

TECHNICAL EXHIBIT
APPLICATION FOR LICENSE
AUXILIARY FACILITY
RADIO STATION KISS-FM
SAN ANTONIO, TEXAS
CH 258C 1 KW 433 M

Technical Statement

This Technical Exhibit, of which this statement is part, was prepared on behalf of radio station KISS-FM on Channel 258C at San Antonio, Texas. KISS-FM has authorization to construct a new auxiliary [stand-by] facility.¹ By this instant application, station licensure is requested.

Figure 1 is a tabulation of the RF transmission system.

Within the construction permit, a special condition was specified; requiring spurious emissions measurements to be performed with all the operating stations on this common antenna system and submitted with this herein application for license. This auxiliary system was installed specifically for IBOC (digital) use and cannot be readily employed for analog transmission. Therefore, the applicant is submitting within the Appendix the "Digital Intermodulation Report" prepared by the system manufacturer to fulfill this special condition. As demonstrated within the report, measurements were completed on the frequency response of the combiner system that indicates that "...

¹ See FCC Construction Permit BXPB-20060601A0B.

transmitters will not couple due to the great amount of isolation which prevents intermodulation products between transmitters connected to the common transmission lines and antenna." Therefore, the applicant hereby requests that the enclosed intermodulation report be accepted as fulfilling the spurious emissions measurement special condition.

Charles A. Cooper

June 13, 2006

du Treil, Lundin & Rackley, Inc.
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941.329.6000

TECHNICAL EXHIBIT
 APPLICATION FOR LICENSE
 AUXILIARY FACILITY
 RADIO STATION KISS-FM
 SAN ANTONIO, TEXAS
 CH 258C 1 KW 433 M

KISS-FM RF Transmission System Specifications

| Description | System |
|--|---------|
| Transmitter Power Output (1.3 kW): | 1.1 dBk |
| Combiner: | 0.6 dB |
| <i>Myat</i> Transmission Line Loss (3-1/8" Rigid) 1449 feet: | 1.3 dB |
| <i>Andrew</i> Transmission Line Loss (7/8" foam) 60 feet: | 0.2 dB |
| <i>ERI SHPX-4AC-HW-SP</i> (1.3 Power Gain): | 1.0 dB |
| Effective Radiated Power (1 kW): | 0.0 dBk |

APPENDIX

DIGITAL INTERMODULATION REPORT

ELECTRONICS RESEARCH, INC.

Digital Intermodulation Report KISS, KSMG, KXTN San Antonio, Texas

1.1 Introduction

To augment their preexisting Analog operation in San Antonio, Texas, the radio station group elected to use **In Band On Channel** (IBOC) simultaneous Analog and Digital broadcasting. After considering all other practical approaches the group elected (for its ease of implementation) to install a separate, independent Antenna and Combiner for digital broadcasting. A new SHPX -4AC-HW-SP IBOC antenna was installed on the tower just 12 feet below the existing Analog ERI SHPX-10BC-SP antenna and a separate Digital combiner was constructed.

Having consolidated the station's IBOC and Analog broadcast operations, they now operate from a common tower site using new Digital combining equipment and Antenna provided by ERI. The focus of this report is on maintaining good transmitter-to-transmitter isolation and on reviewing the equipment required to insure FCC compliance. This report concludes with comments on the operating performance of the system while operating at licensed RF power levels.

1.2 Discussion On Intermod Products and Findings

This document presents findings from an investigation into intermodulation emissions associated with the operation of three IBOC transmitters simultaneously broadcasting from a common antenna. When two or more signals of different frequencies are "mixed" in a non-linear transmitter, a large number of new frequencies known as intermod products are generated. These intermod products have become the major source of interference within the radio spectrum in the past few years and are regulated by the FCC. The source of the "Intermod Products" usually is found in the front-end of the final amplifier of a transmitter that has been coupled with other transmitters. Electronics Research Inc. (ERI) provides a solution to the problem of transmitter coupling and intermodulation generation through the use of selectively tuned bandpass filters.

The following is a list of equipment that has been added to the San Antonio facility for IBOC broadcasting this material is in addition to the already in place Analog equipment.

- 1) IBOC Antenna Type : ERI SHPX-4AC-HW-SP
- 2) IBOC Transmission Feed Line Type : Rigid $3\frac{1}{8}$ Coax
- 3) IBOC Combiner Type : Irte Stare tuned to 99.5 MHz, 105.3 MHz, and 107.5 MHz.

1.3 Bandpass Filters, Used To Optimize Transmitter Isolation

Station combining methods have become highly dependent on band-pass cavity resonators. Band-pass filters have been used with great success in all types of station multiplexing applications involving closely spaced frequencies. The ability to meet FCC requirements for spurious emissions is inherent in a well thought out filter design that includes combining stations with **Starpoint** as well as **T-Type** combiners and **Constant-Z** combiner modules.

A bank of bandpass filters is comprised of individual high Q resonant cavities designed to pass a narrow band of frequencies with low insertion loss while at the same time attenuating frequencies outside of this narrow band. As frequencies become further removed from the resonant frequency of the cavity, they become more attenuated. Therefore, one can achieve greater selectivity with little increase in insertion loss by coupling several bandpass filter cavities together. The total insertion loss at resonance will be nearly the loss of one cavity times the number of cavities that are ganged together. However, the attenuation of resonance will be greater than the additive attenuation of a single cavity. Four cavities form a bank of filters that are used on each station. Measurements indicate that each filter bank has a pass-band loss of -0.6 dB @ F_o (though at a frequency shifted 0.8 MHz from F_o the filter provides approximately -21 dB attenuation). Note that 2.2 MHz. is the frequency separation between the three user frequencies of this combiner and the input port to input port isolation is no less that -65 dB.

A filter bank (series of four interconnected high Q cavities) form a pass-band with a frequency response that is broad and flat, making it ideal for passing an **IBOC** channel. The same filter bank, while providing for IBOC, must have a frequency response that will reduce interference from undesired frequencies that are above and below the IBOC bandpass frequency spectrum. Primarily, the steep-sloped rejection characteristic of the filters prevent intermodulation that might be caused by the interference of transmitters sharing the Combiner. Also, the filter-bank will isolate all out-of-band frequencies that may be generated from within the transmitter such as fundamental harmonics. Furthermore, the filter-bank will provide protection from stations that coexist within a congested, overloaded broadcast site.

1.4 Combiner, Theory of Operation

The combining hardware consists primarily of tuned, interconnected banks of Band-Pass filters. At the multiplexed output is placed a Directional Coupler that provided forward and reverse signal samples. The samples supply carrier reference levels, investigated emission levels and information pertaining to each station's Analog carrier that also broadcasts from the same antenna. Consequently, analysis (rationalization of measured levels using a spectrum analyzer) of all the collected data shows that while stations are operating at their licensed power levels, NO spurious emissions were present.

In the San Antonio system three transmitters with various frequencies operate into a single antenna. The ERI type SHPX-4AC-HW-SP antenna was selected due to its wide-band-width and ability to handle the combined power of three IBOC transmitters. The transmitters are connected to the common antenna by means of a Starpoint Combiner unit, all built with Band-Pass filters. The filters mainly provide for isolation between the individual IBOC transmitters while guiding the signals from transmitters to the antenna.

A Starpoint IBOC combiner can combine three IBOC transmitters and exhibits low passband losses and high transmitter isolation provided that a minimum spacing of 2 Mhz between transmitter frequencies is maintained. At the San Antonio broadcast facility frequencies F1, F2, and F3 are within this spacing and the Starpoint is therefor used in the following manner:

The signal from IBOC transmitter F1 is taken via the bandpass filter bank B1, which is tuned to frequency F1, to the Starpoint . The input impedance (seen from the Starpoint) of the bandpass filters B2 and B3, which are tuned to the frequencies F2 and F3 must now be transformed to the Starpoint via the line lengths L2 and L3 such that parallel resonance is obtained for the frequency F1 and the power of transmitter 1 transfers fully to the antenna. The same consideration holds true for the connection of IBOC transmitter 2 and 3.

1.5 Conclusion

This report has attempted to convey that through the use of band-pass filters used in station combining schemes it is possible to reduce station coupling and eliminate spurious emission problems. By providing measured graphs and system schematics it can be seen how the high Q frequency response of banks of cavity resonators are used to isolate two or more transmitters of different frequencies sharing the same antenna.

The report's contention is that the measured frequency response (graphs) of Band-Pass Filters used provides, in itself, mathematical proof that a given number of transmitters will not couple due to the great amount of isolation which prevents intermodulation products between transmitters connected to common transmission lines and antenna.

Listed below is a summary of the data and attached are the plots collected of the antenna and installation of the Combiner System April, 2006.

| | |
|---------------------------------|---------------|
| Drawings included: | Page # |
| SHP-4AC-HW-SP Antenna | 5 |
| IRTE 3x2KW4 Star Combiner | 6 |
| TPO Calculations | 7 |
| Antenna Tuning Sheet | 8 |

FILTER MEASUREMENTS
99.5 MHz. Input Port

| | | |
|--|-------------|----|
| Description of measurements | Return Loss | |
| Match..... | -39 dB | 10 |
| Insertion Loss..... | -.638 dB | 10 |
| Group Delay +/- 150 KHz..... | <125 ns | 11 |
| Isolation to the Output +/- 800 KHz..... | -27 dB | 12 |
| Port to Port Isolation from 99.5 MHz. to 105.3 MHz. | -83 dB | 13 |
| Port to Port Isolation from 99.5 MHz. to 107.5 MHz. | -81 dB | 14 |
| Antenna Match at Output of Filter System | -39 dB | 15 |

FILTER MEASUREMENTS
105.3 MHz. Input Port

| | | |
|---|----------|----|
| Match..... | -38 dB | 17 |
| Insertion Loss..... | -.622 dB | 17 |
| Group Delay +/- 150 KHz..... | <75 ns | 18 |
| Isolation to the Output +/- 800 KHz..... | -23 dB | 19 |
| Port to Port Isolation from 105.3 MHz. to 99.5 MHz. | -87 dB | 20 |
| Port to Port Isolation from 105.3 MHz. to 107.5 MHz. | -65 dB | 21 |
| Antenna Match at Output of Filter System | -37 dB | 22 |

FILTER MEASUREMENTS
107.5 MHz. Input Port

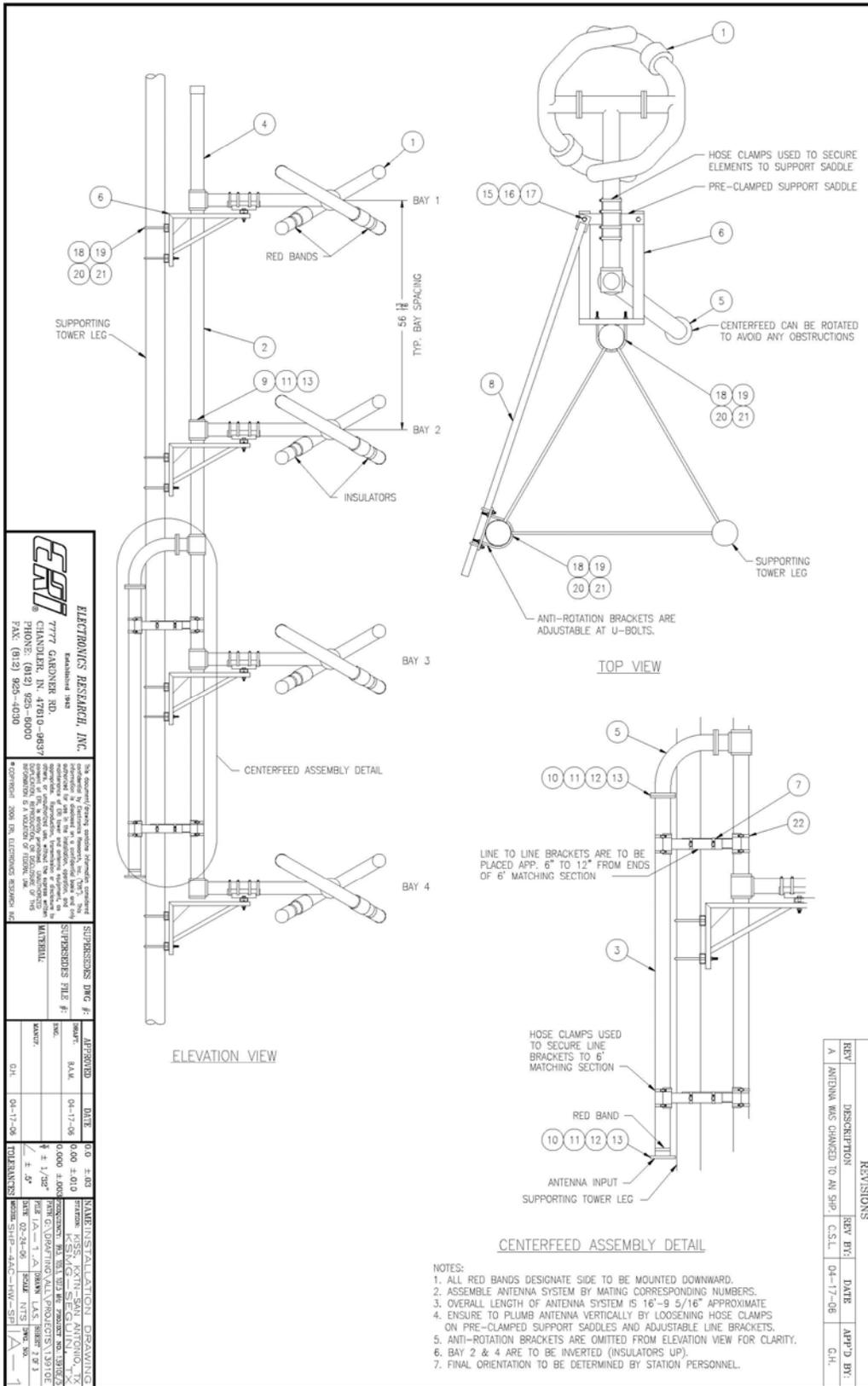
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|---|----------|----|
| Match..... | -34 dB | 24 |
| Insertion Loss..... | -.587 dB | 24 |
| Group Delay +/- 150 KHz..... | <75 ns | 25 |
| Isolation to the Output +/- 800 KHz..... | -21 dB | 26 |
| Port to Port Isolation from 107.5 MHz. to 99.5 MHz. | -87 dB | 27 |
| Port to Port Isolation from 107.5 MHz. to 105.3 MHz. | -66 dB | 28 |
| Antenna Match at Output of Filter System | -31 dB | 29 |

OCCUPIED BANDWIDTH MEASUREMENTS

| | |
|-------------------------|----|
| OCBW of 99.5 MHz. | 30 |
| OCBW of 99.5 MHz. | 31 |
| OCBW of 105.3 MHz. | 32 |
| OCBW of 105.3 MHz. | 33 |
| OCBW of 107.5 MHz. | 34 |
| OCBW of 107.5 MHz. | 35 |

All measurements were taken by Jon Adams and Jeff Taylor of Electronics Research Inc. April, 2006
Sincerely _____

Jeff Taylor



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ELECTRONICS RESEARCH, INC.
 ESTABLISHED 1948
 7777 GARDNER RD.
 CHANDLER, IN. 47910-9837
 PHONE: (812) 925-0000
 FAX: (812) 925-4000

| REV# | DESCRIPTION | REV# | DATE | APP'D BY |
|------|-------------------------------|--------|----------|----------|
| 1 | ANTENNA WAS CHANGED TO AN SPO | C.S.L. | 04-17-06 | G.H. |

The Elevation/Top View drawings were prepared using AutoCAD software by Electronics Research, Inc. ("ERI", "we" or "us") and are intended for use by the customer for the construction, operation and maintenance of the antenna system. ERI warrants that the drawings were prepared in accordance with the requirements of the customer and that the drawings are a true and accurate representation of the design of the antenna system. ERI does not warrant that the drawings are suitable for any other purpose. ERI shall not be responsible for any errors or omissions in the drawings or for any consequences arising from the use of the drawings. ERI shall not be responsible for any damage to property or injury to persons resulting from the use of the drawings. ERI shall not be responsible for any costs or expenses incurred by the customer in connection with the use of the drawings. ERI shall not be responsible for any claims or damages of any kind arising from the use of the drawings. ERI shall not be responsible for any claims or damages of any kind arising from the use of the drawings.

| APPROVED | DATE | DWG # | DESCRIPTION |
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| BALE | 04-17-06 | 04-00-010 | SUPPLEMENTARY FILE #1 |
| MAKIZ | | | ATMOSPHERIC |

| TOLERANCES | UNLESS OTHERWISE SPECIFIED |
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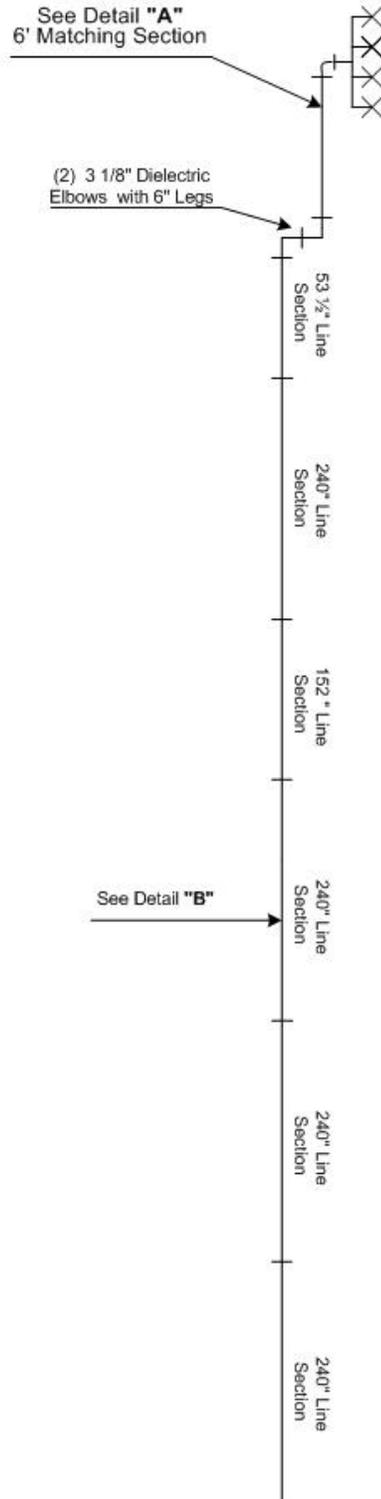
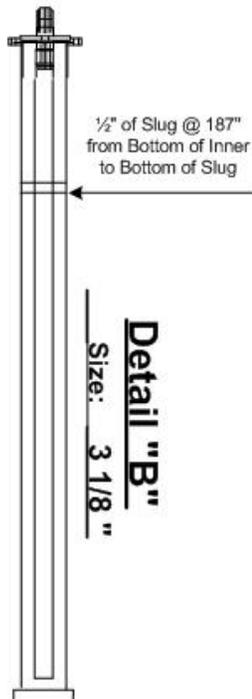
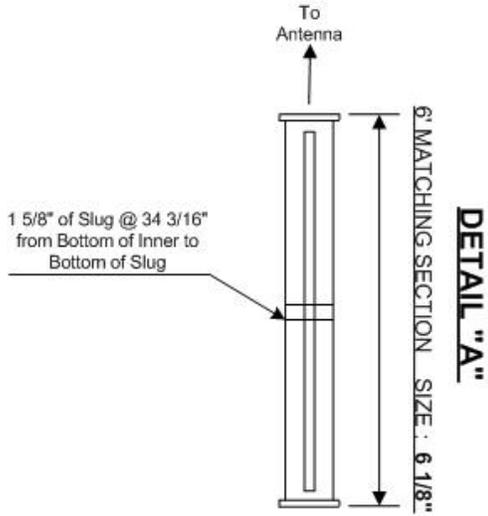
| | | | | | |
|--------------------------|-------------|--------------|--------------|--------------|--|
| City | Project # | Date | | | |
| San Antonio, TX | 13910E | 3/28/2006 | | | |
| Freq. | MHz. | 99.5 | 105.3 | 107.5 | |
| ERP | Watts | 1,000 | 1,000 | 1,000 | |
| Antenna Gain | | 1.261 | 1.326 | 1.347 | |
| Antenna Input | Watts | 793 | 754 | 742 | |
| Losses | | | | | |
| Feed Line Length | Feet | 1449 | 1449 | 1449 | |
| Loss / 100' | dB | 0.092 | 0.095 | 0.096 | |
| Outside Line Loss | | 1.3331 | 1.3766 | 1.3910 | |
| | | | | | |
| Inside Line Length | Feet | 60 | 29 | 75 | |
| Loss / 100' | dB | 0.376 | 0.365 | 0.096 | |
| Inside Line Loss | dB | 0.2256 | 0.1059 | 0.0720 | |
| | | | | | |
| Circulators | .2 Each | 0 | 0 | 0 | |
| | | | | | |
| TOTAL LINE LOSS | dB | 1.559 | 1.483 | 1.463 | |
| COMBINER LOSS | dB | 0.638 | 0.622 | 0.587 | |
| | | | | | |
| TOTAL LOSS | dB | 2.197 | 2.105 | 2.050 | |
| | dBK | 31.1897319 | 30.8787135 | 30.7540391 | |
| | | | | | |
| TPO | | 1,315 | 1,224 | 1,190 | |

Digital Antenna

Tuning Slug Location for San Antonio, TX.

KISS - 99.5 MHz. / KSMG - 105.3 MHz.
KXTN - 107.5 MHz.

SHP-4AC-HW-SP



PROJECT # : 13910 DATE: 4/10/06 LINE SIZE: 3 1/8" MYAT SECTION LENGTHS: 20'

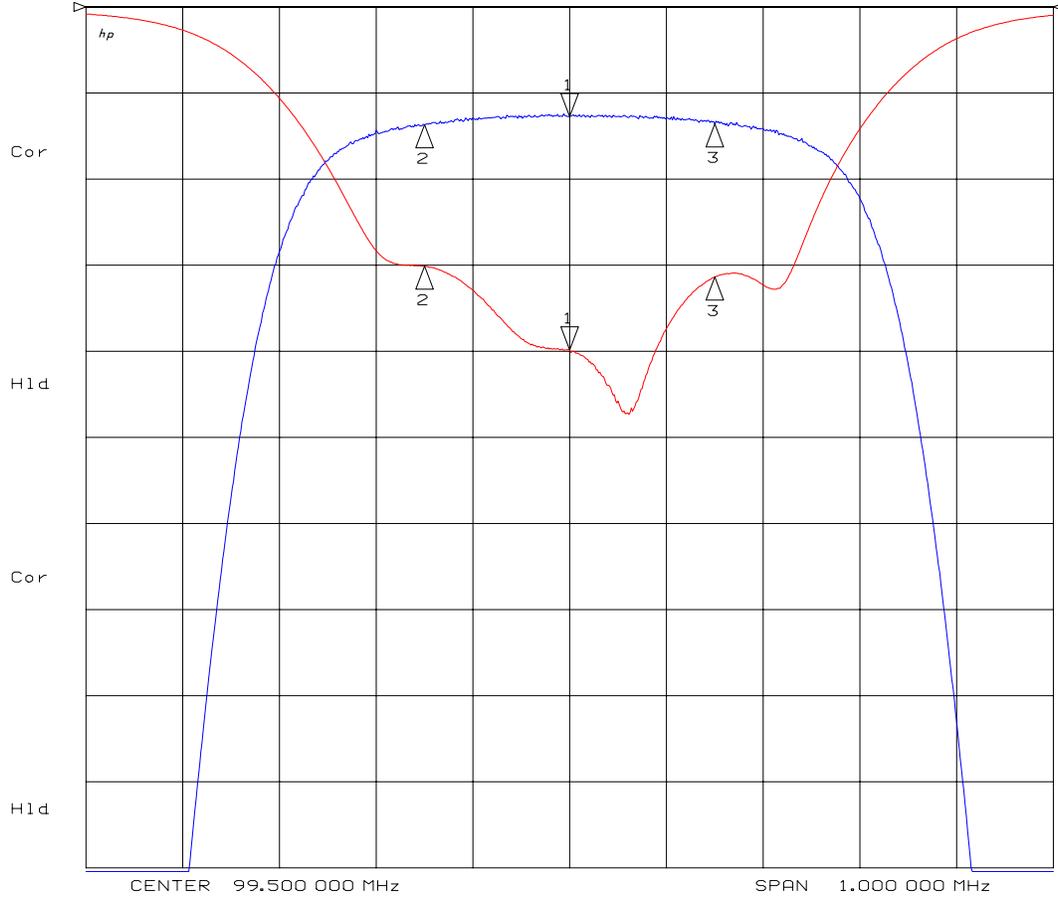
KISS 99.5 MHz Data

Red trace is Return Loss and the blue is measured Insertion Loss

25 Mar 2006 14:34:37

CH1 S11 LOG 10 dB/REF 0 dB
 CH2 S21 LOG .5 dB/REF 0 dB

1:-39.831 dB 99.500 000 MHz
 1:-.63820 dB



CH1 Markers

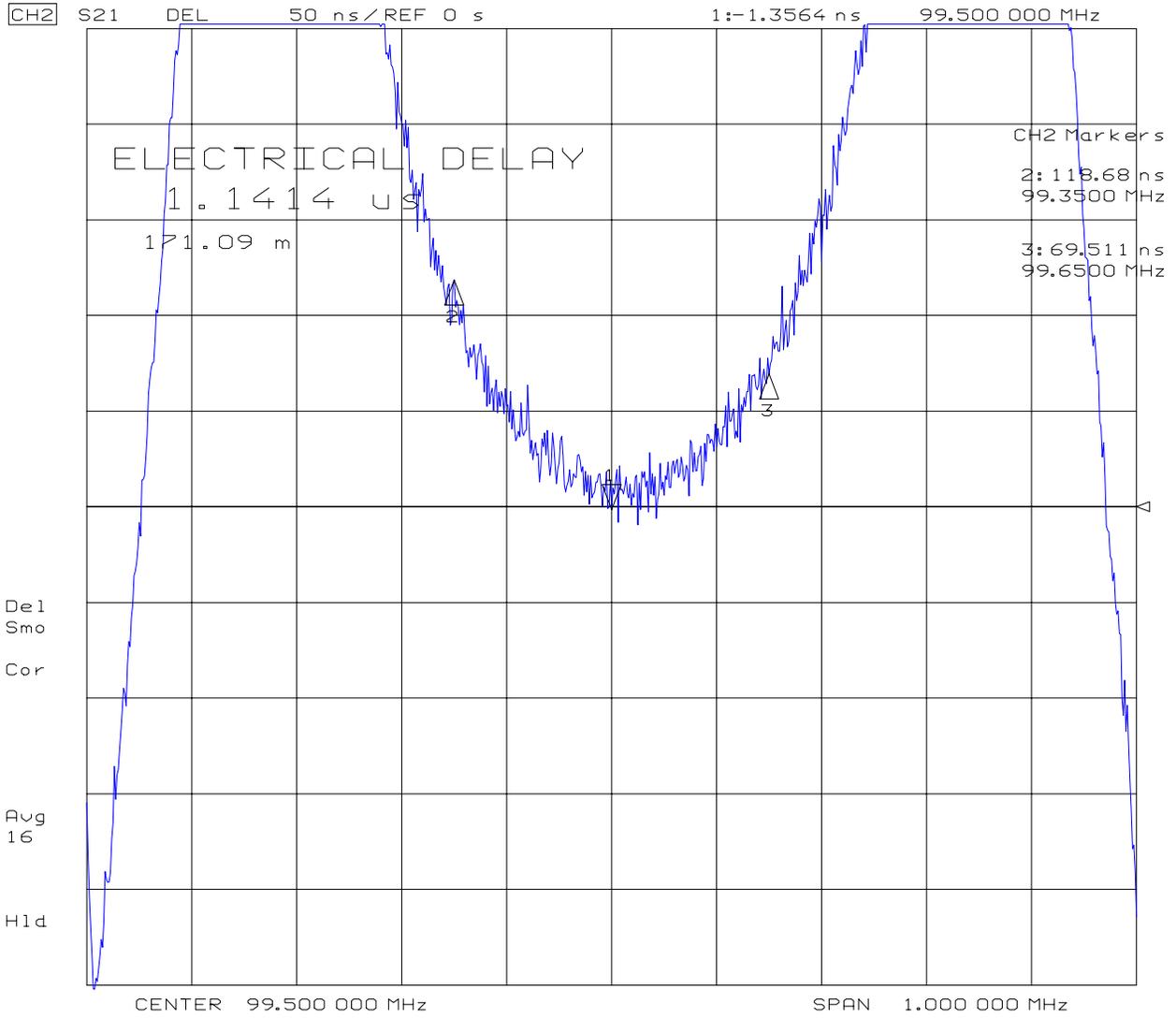
2:-30.128 dB
 99.3500 MHz
 3:-31.393 dB
 99.6500 MHz

CH2 Markers

2:-.68510 dB
 99.3500 MHz
 3:-.68010 dB
 99.6500 MHz

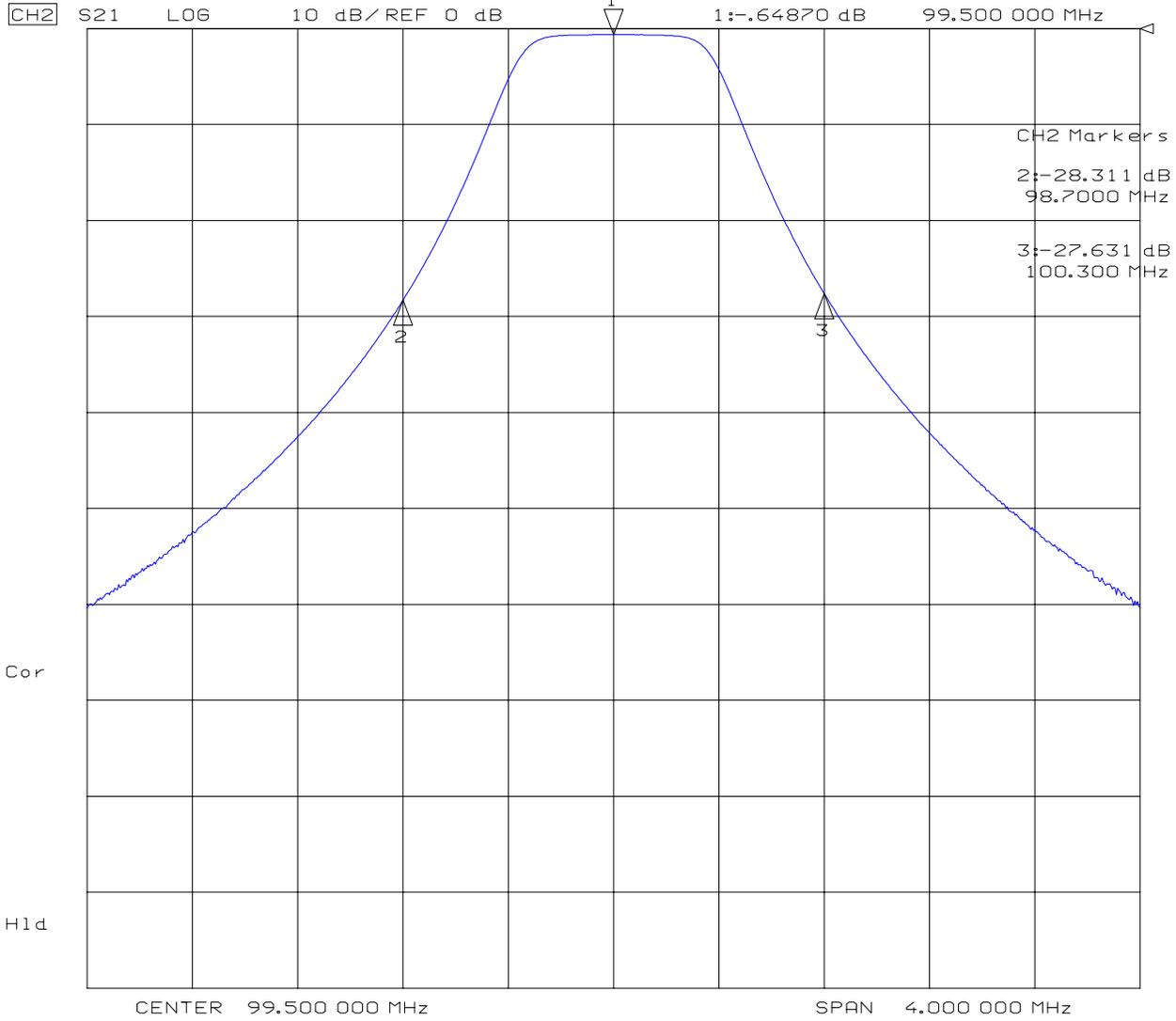
Group Delay

25 Mar 2006 14:35:29



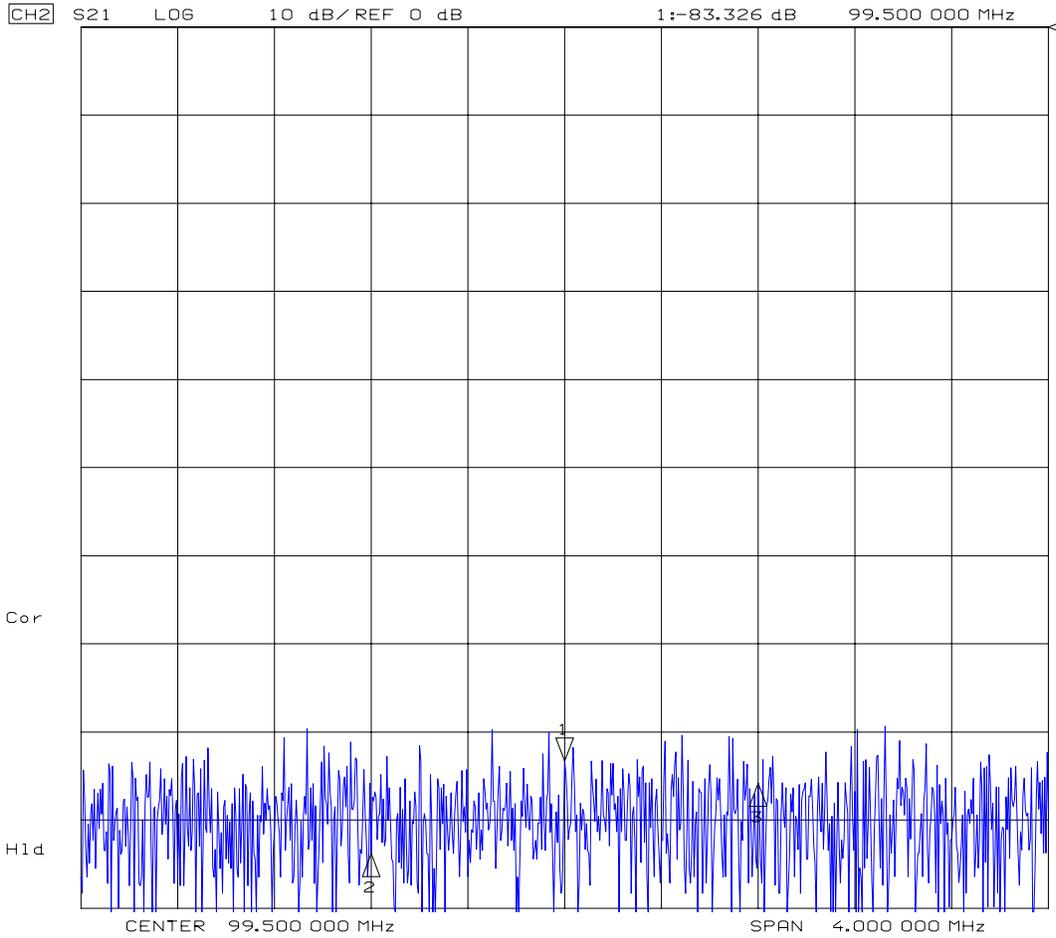
Filter rejection

25 Mar 2006 14:35:50



Isolation from 99.5 MHz to 105.3 MHz

25 Mar 2006 14:49:03

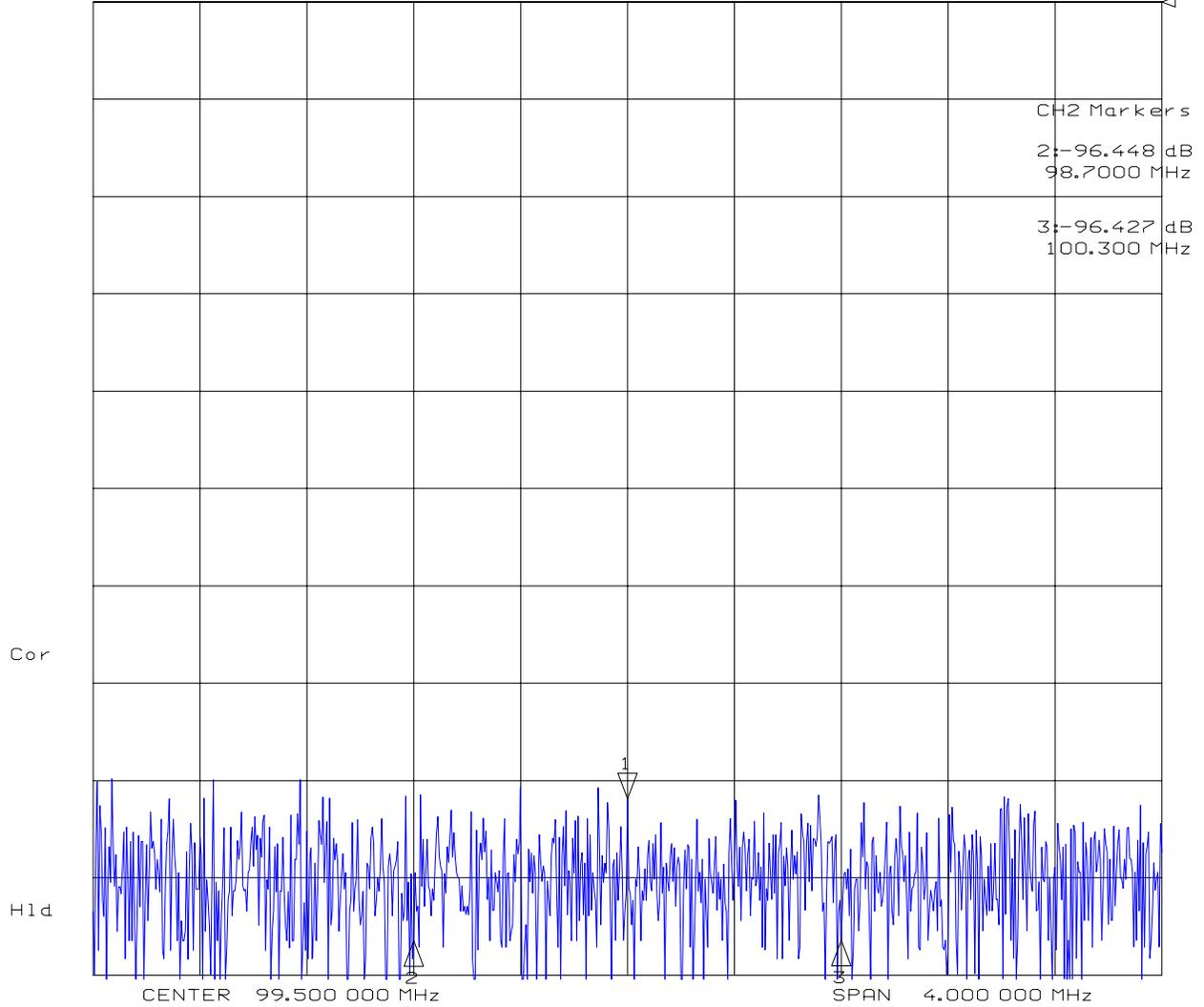


CH2 Markers
2:-93.772 dB
98.7000 MHz
3:-85.843 dB
100.300 MHz

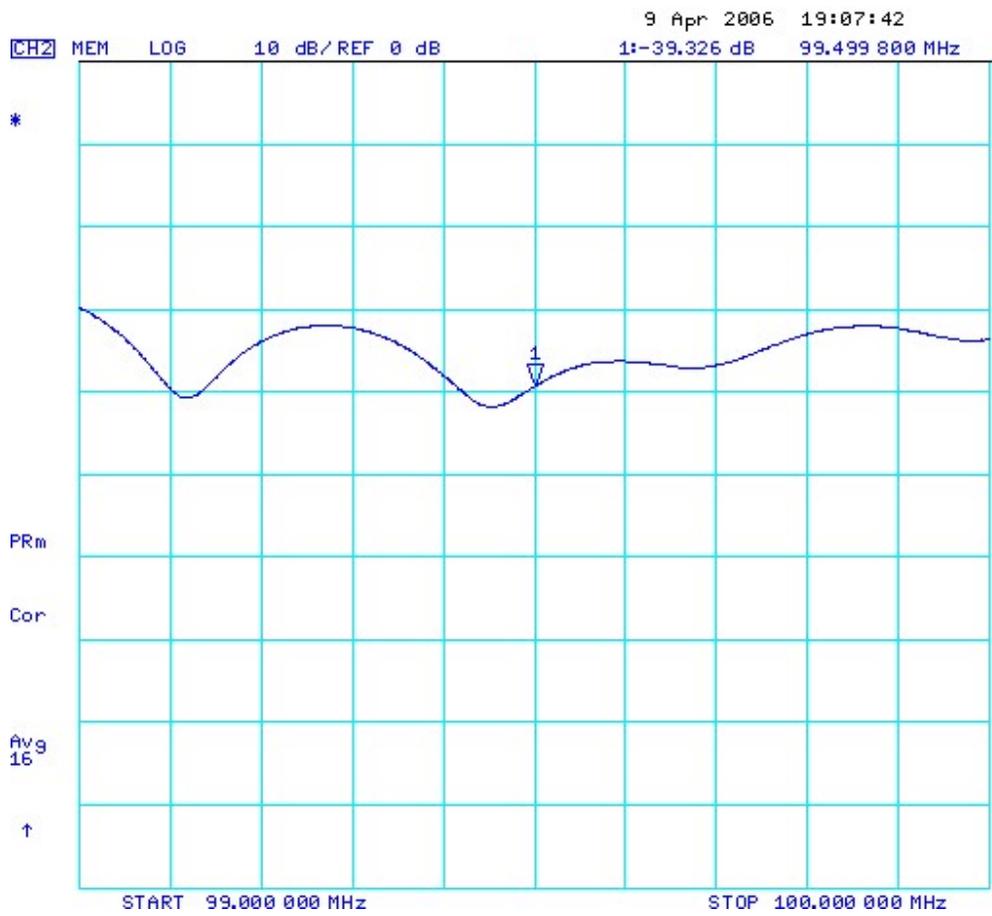
Isolation from 99.5 MHz to 107.5 MHz

25 Mar 2006 14:48:11

CH2 S21 LOG 10 dB/REF 0 dB 1:-81.845 dB 99.500 000 MHz



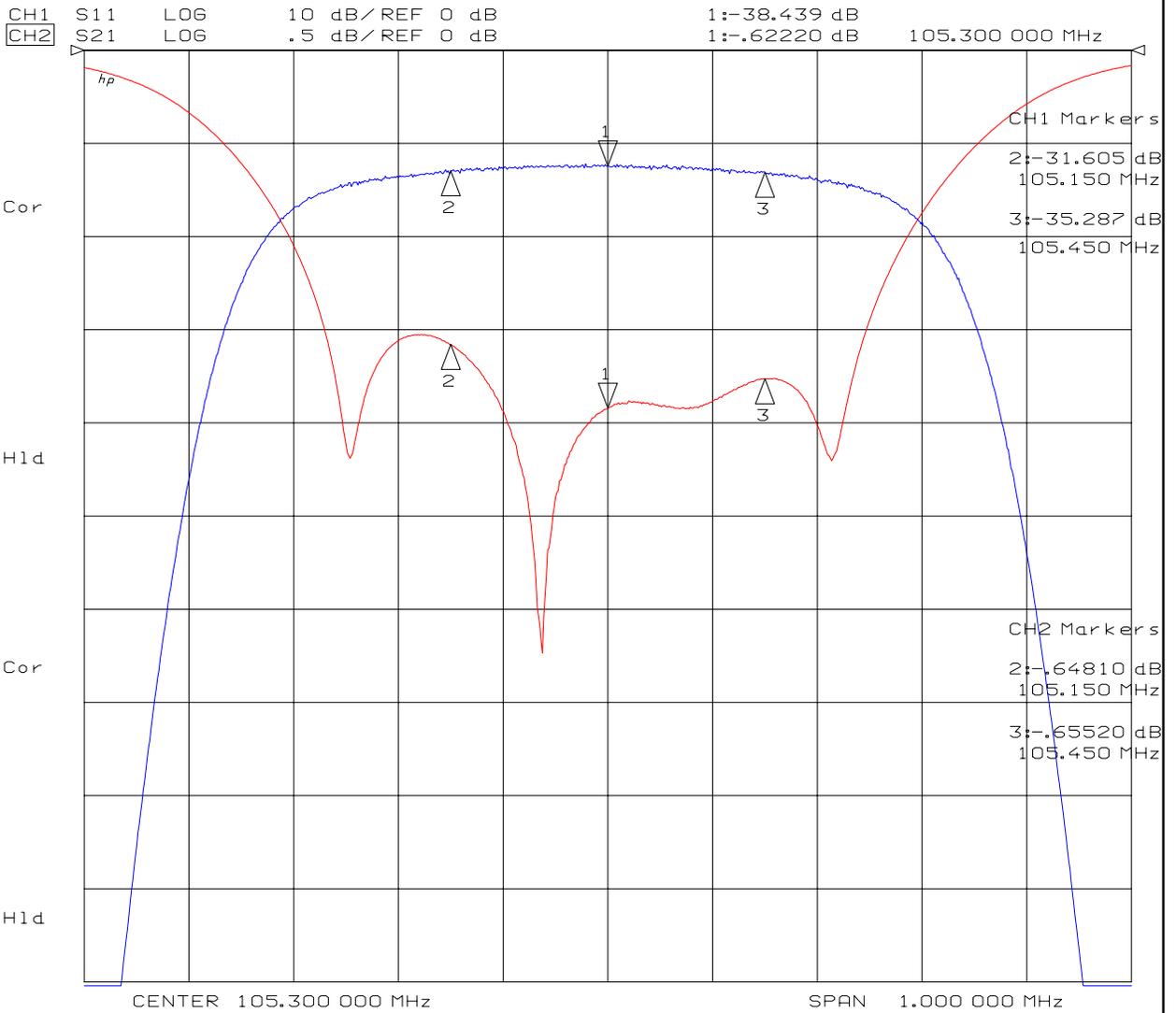
Digital Antenna Match at Output of Filter System



KSMG 105.3 MHz Data

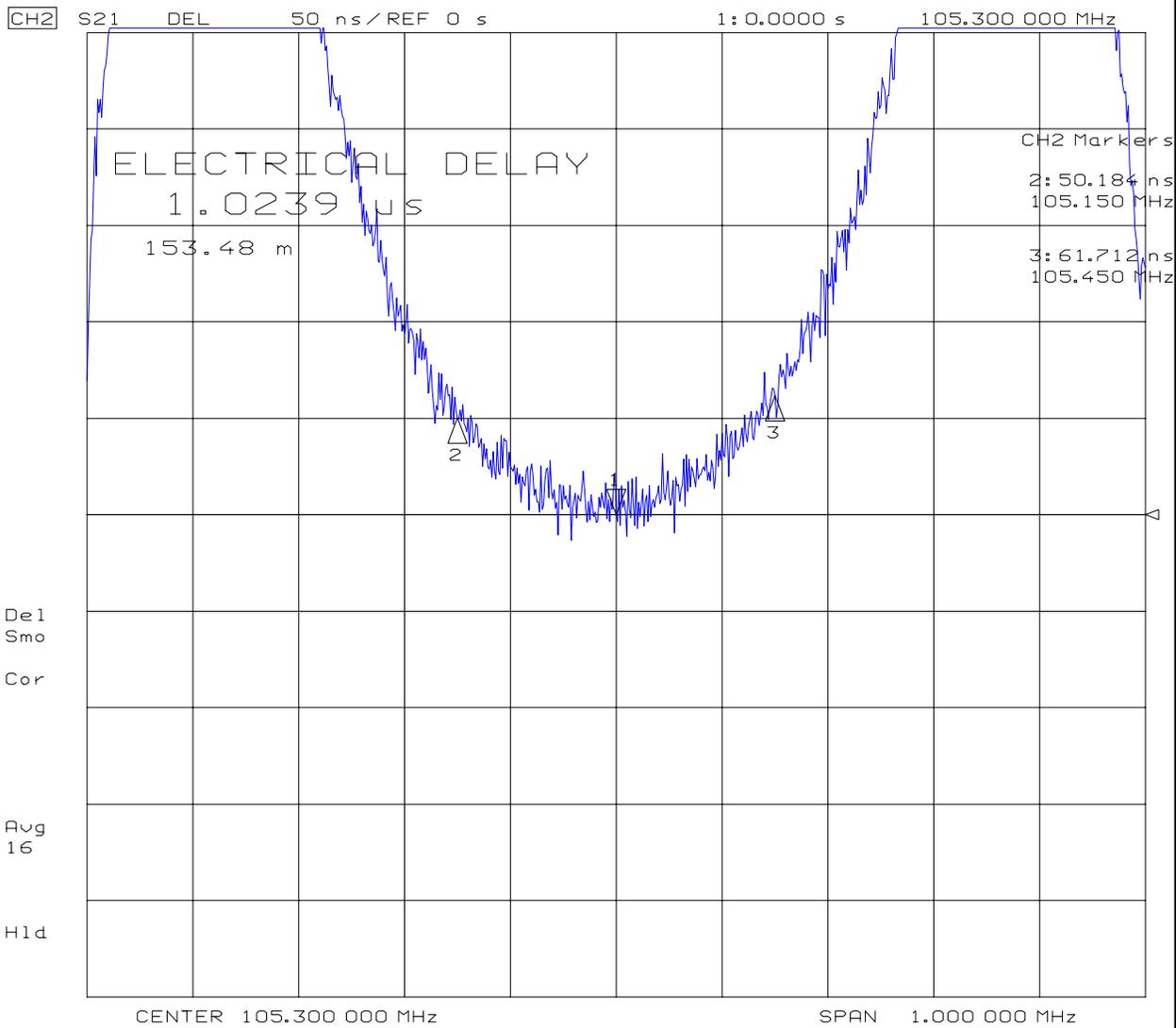
Red trace is Return Loss and the blue is measured Insertion Loss

25 Mar 2006 14:37:32



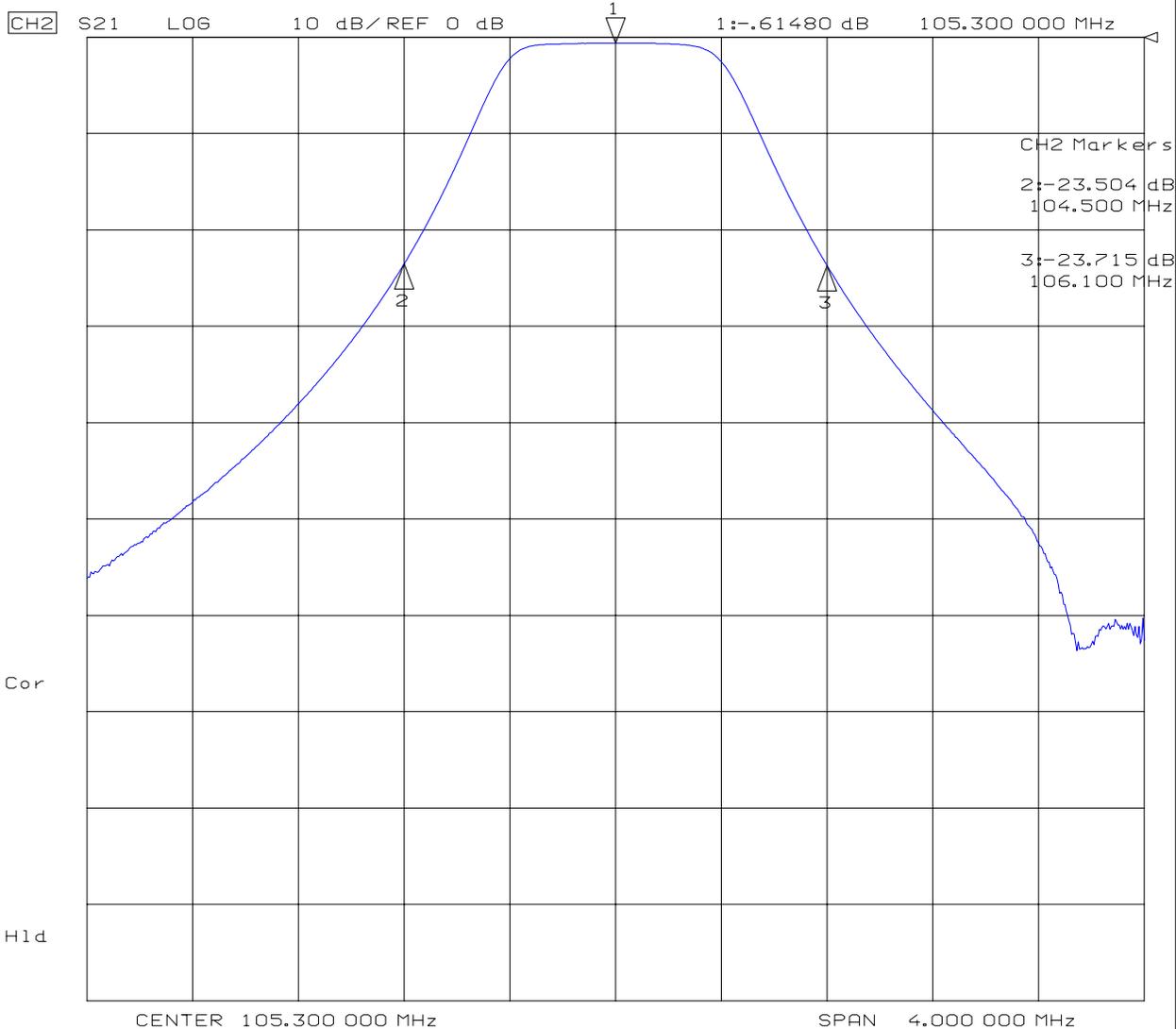
Group Delay

25 Mar 2006 14:38:14



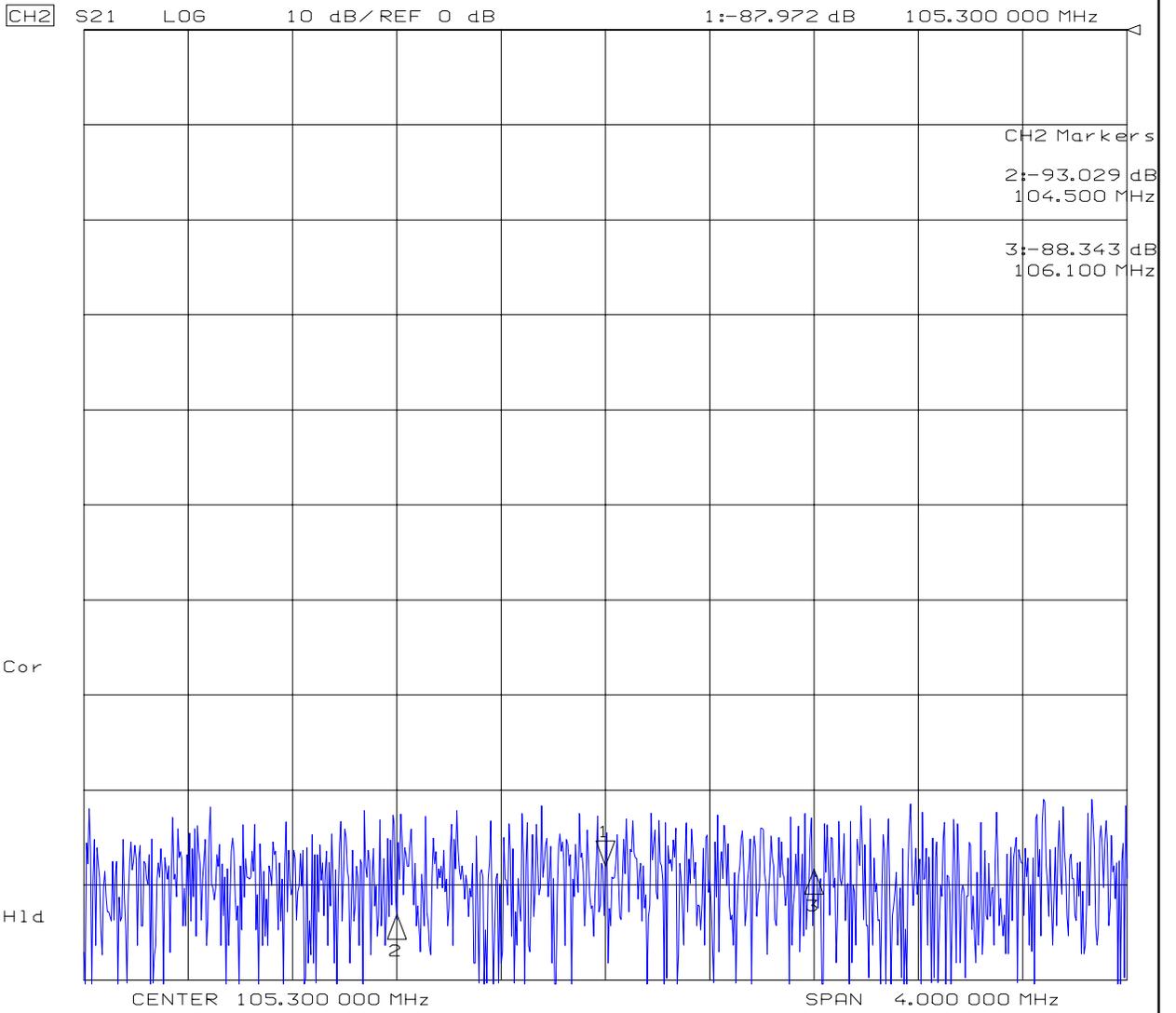
Filter Rejection

25 Mar 2006 14:38:36



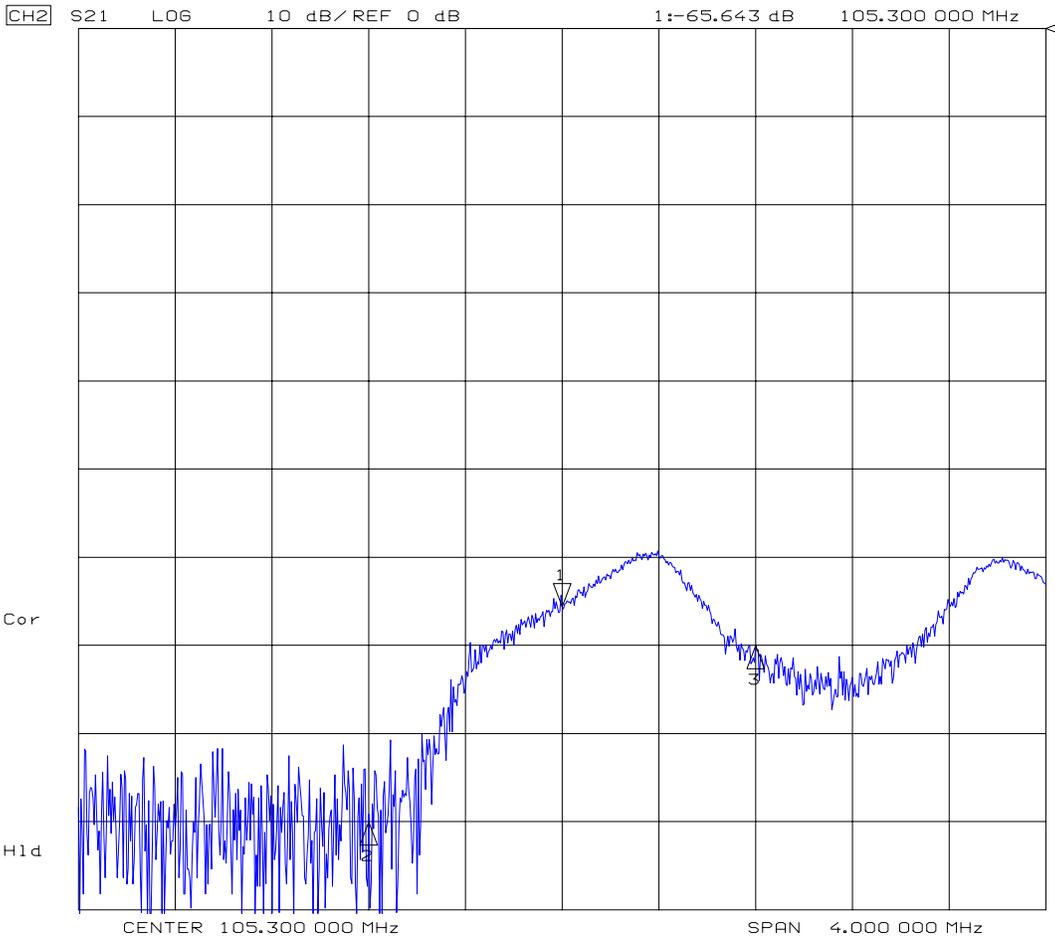
Isolation from 105.3 MHz to 99.5 MHz

25 Mar 2006 14:46:22

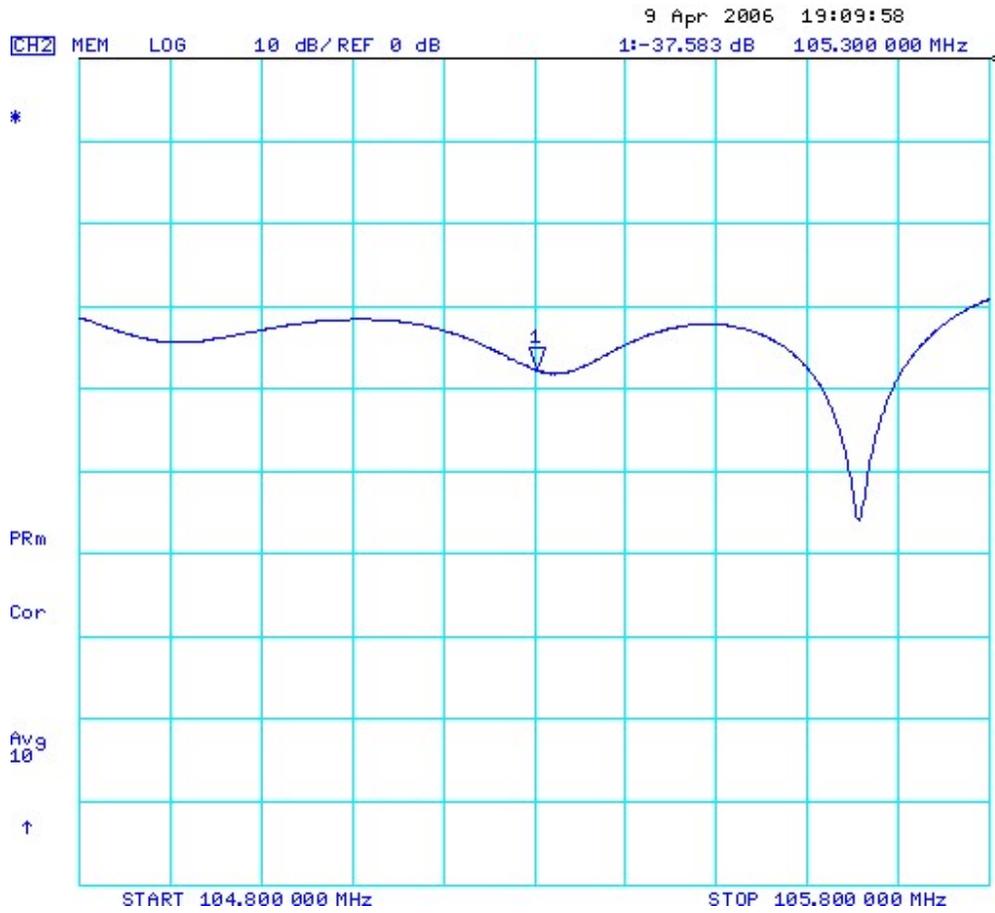


Isolation from 105.3 MHz to 107.5 MHz

25 Mar 2006 14:47:19



Digital Antenna Match at Output of Filter System



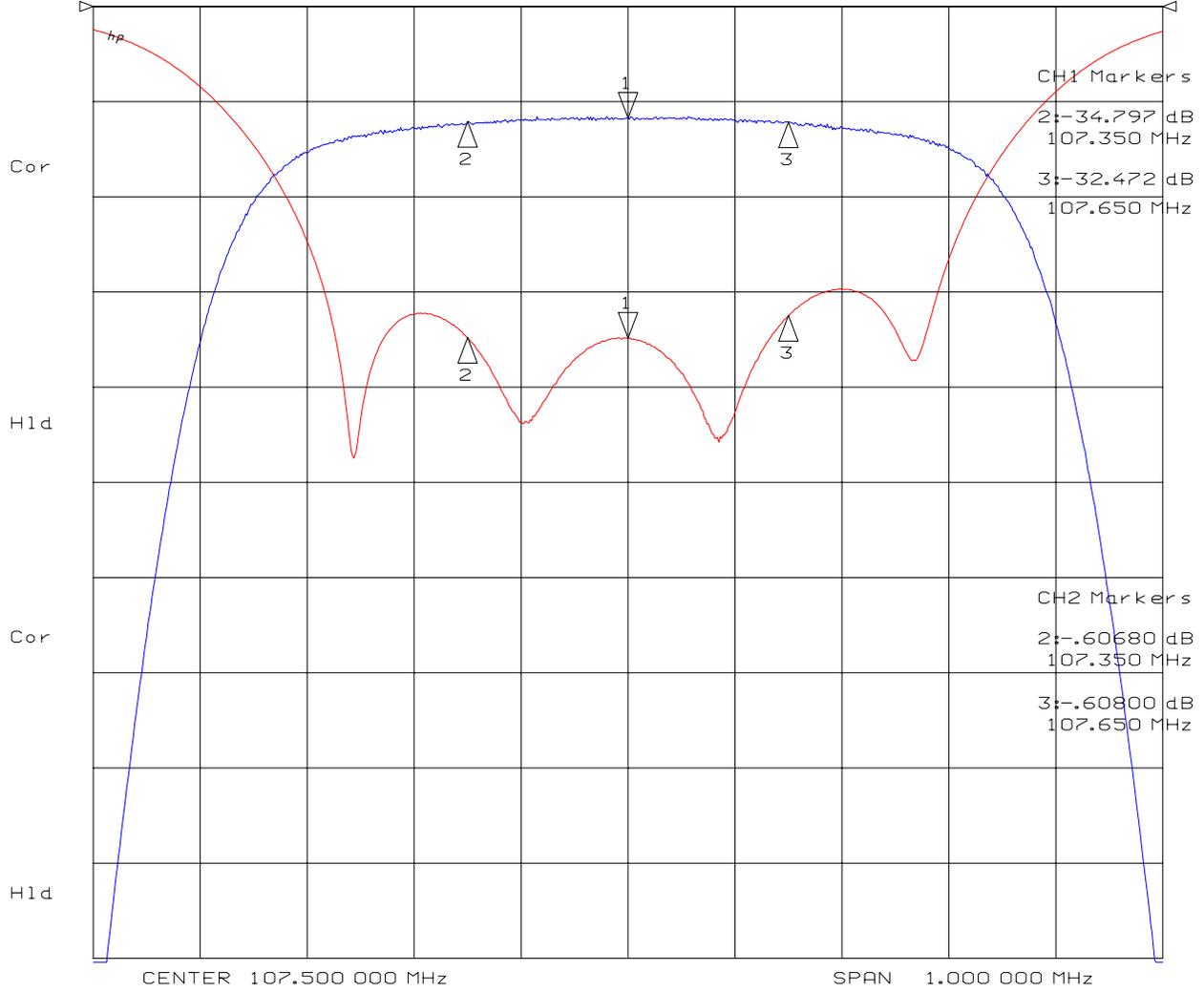
KXTN 107.5 MHz Data

Red trace is Return Loss and the blue is measured Insertion Loss

25 Mar 2006 14:41:25

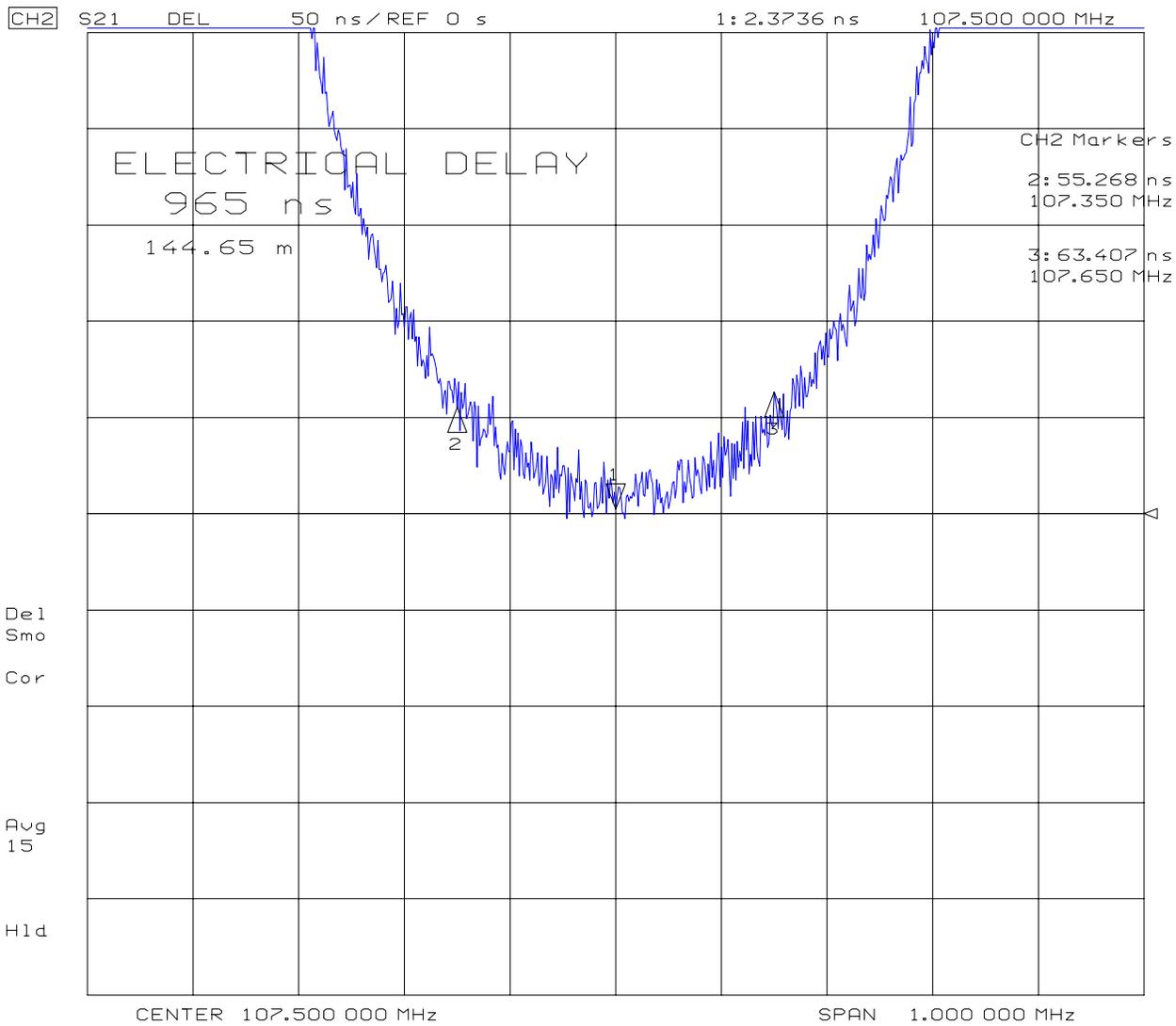
CH1 S11 LOG 10 dB/REF 0 dB
CH2 S21 LOG .5 dB/REF 0 dB

1:-34.857 dB 107.500 000 MHz
1:-.58740 dB



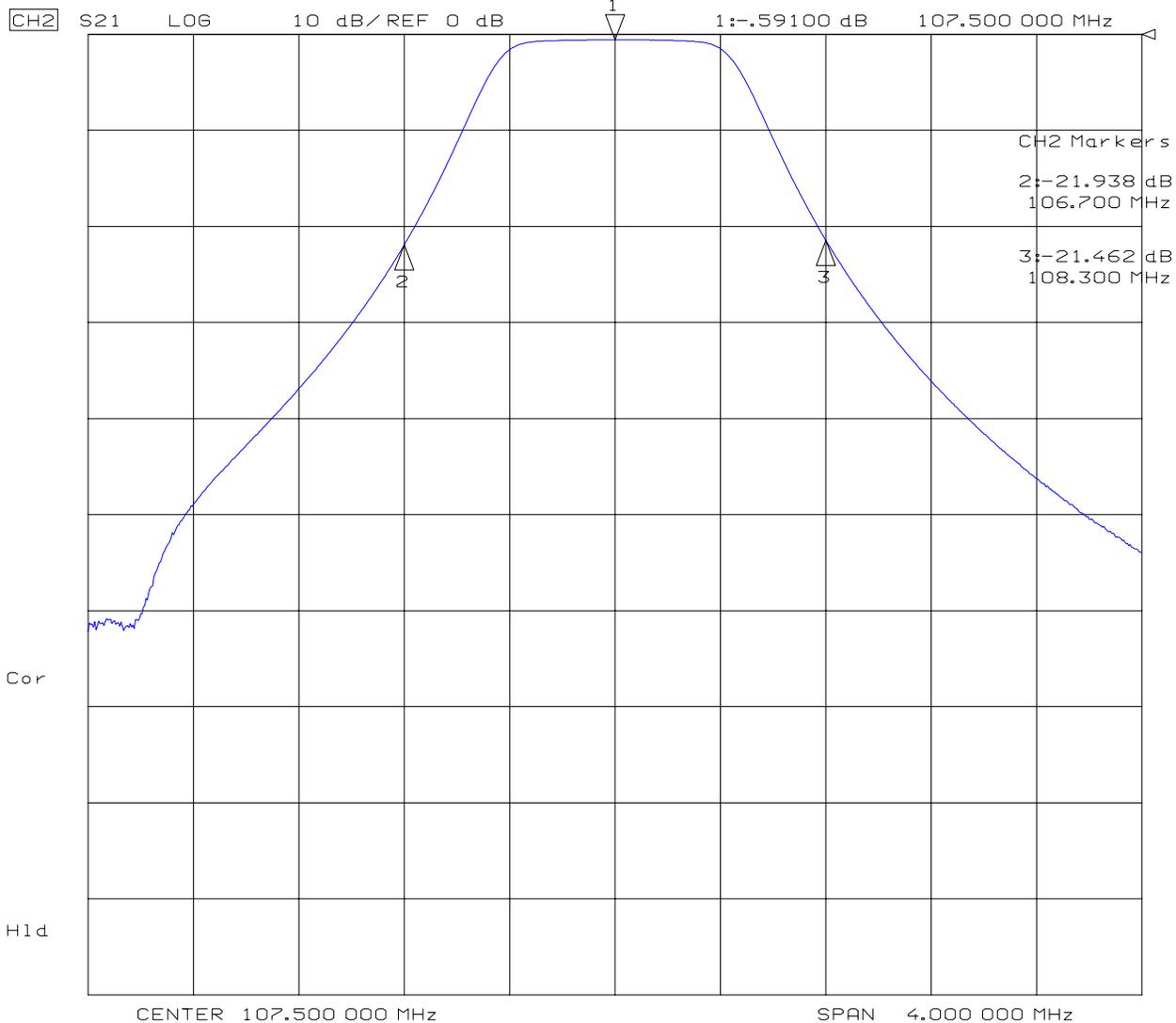
Group Delay

25 Mar 2006 14:42:01



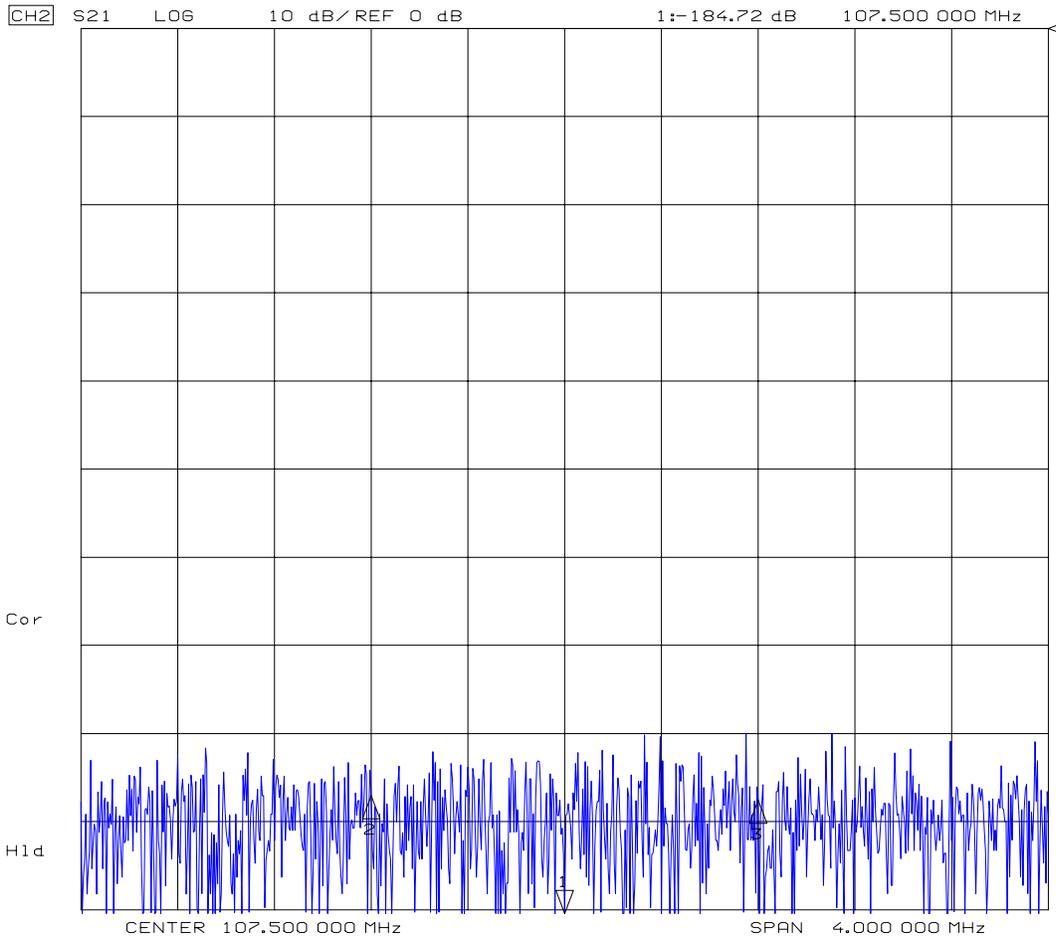
Filter Rejection

25 Mar 2006 14:42:13



Isolation from 107.5 MHz to 99.5 MHz

25 Mar 2006 14:43:39



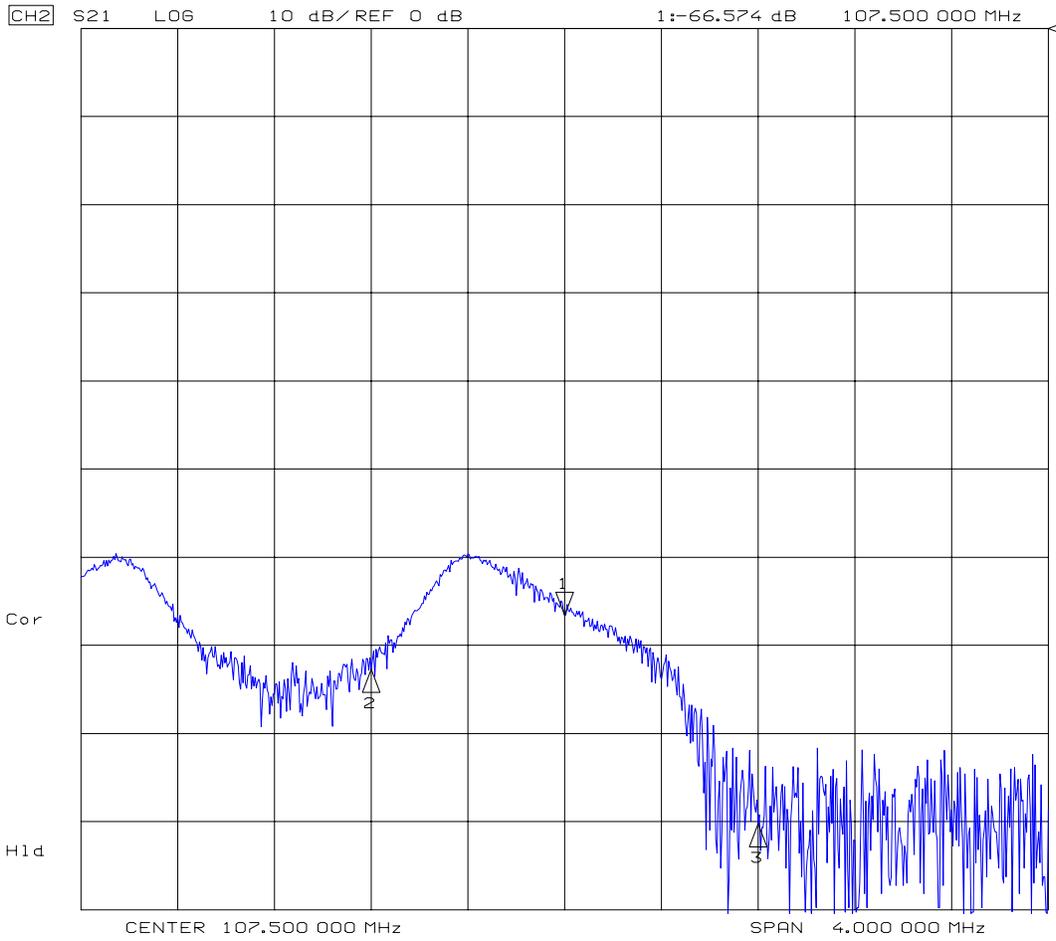
CH2 Marker s

2:-87.050 dB
106.700 MHz

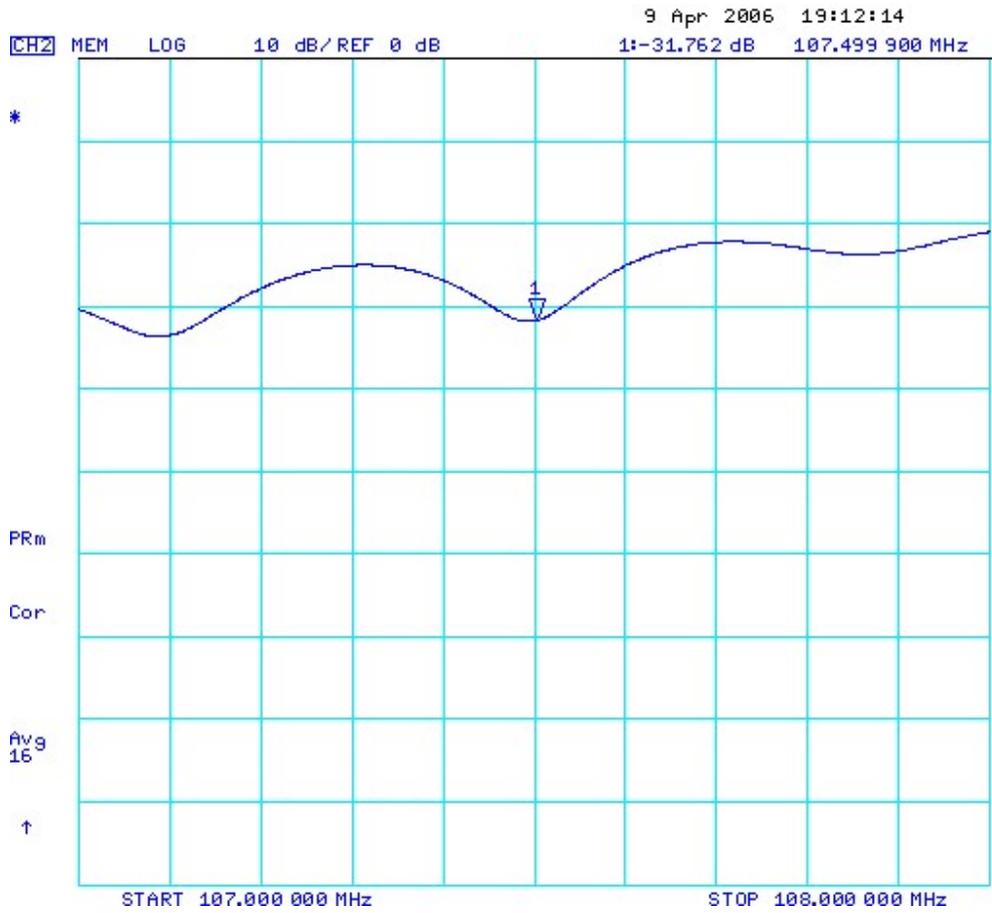
3:-87.575 dB
108.300 MHz

Isolation from 107.5 MHz to 105.3 MHz

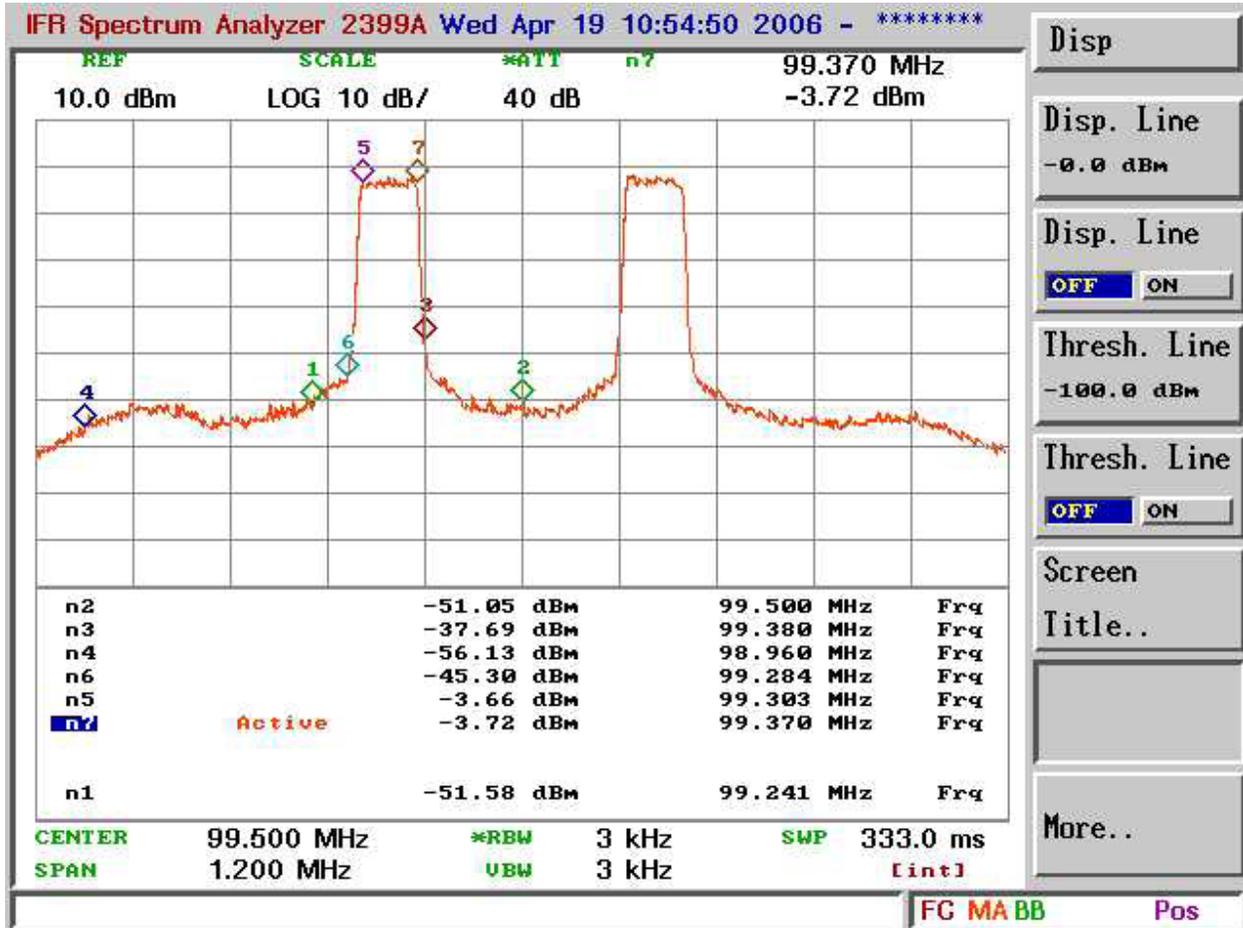
25 Mar 2006 14:43:03



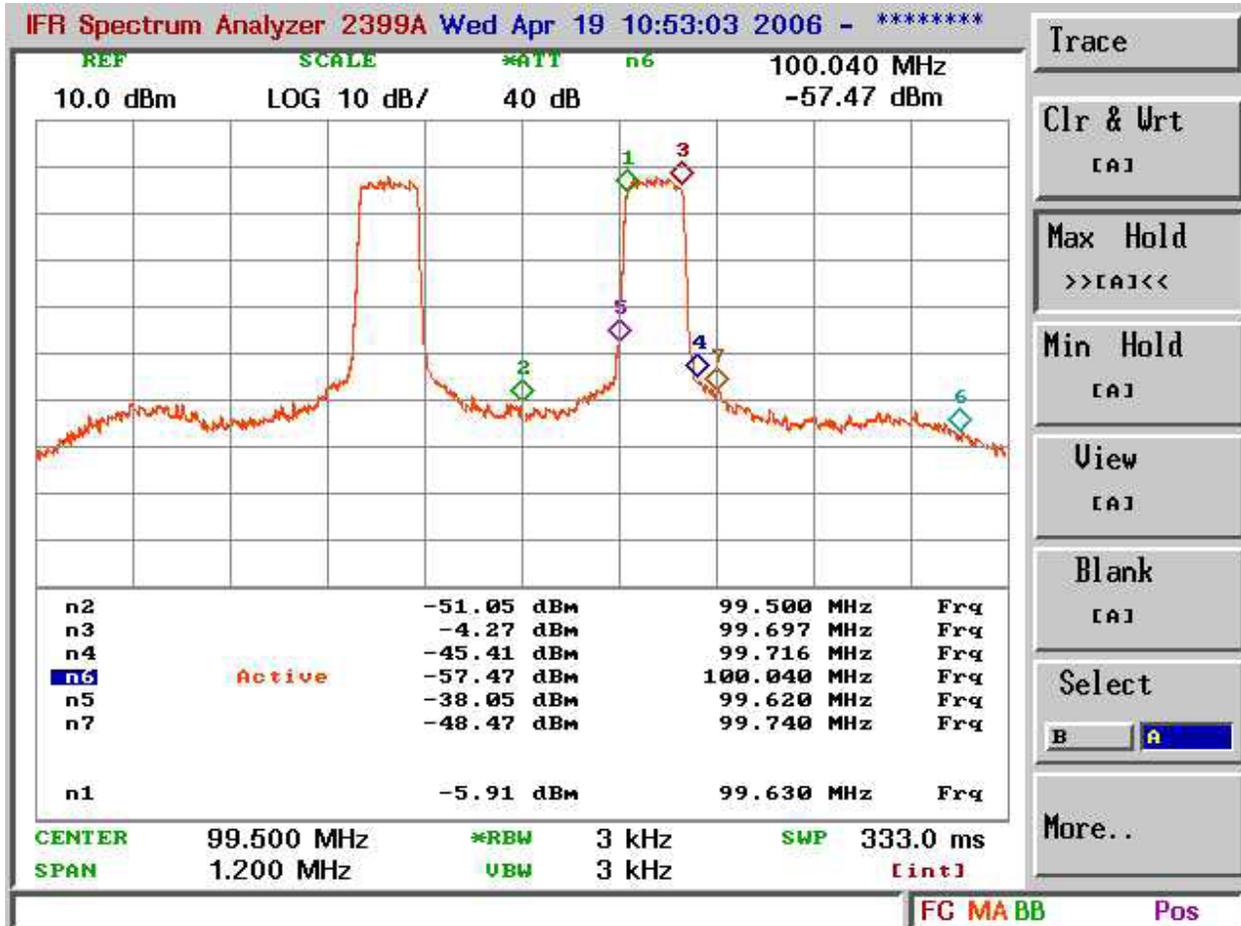
Digital Antenna Match at Output of Filter System



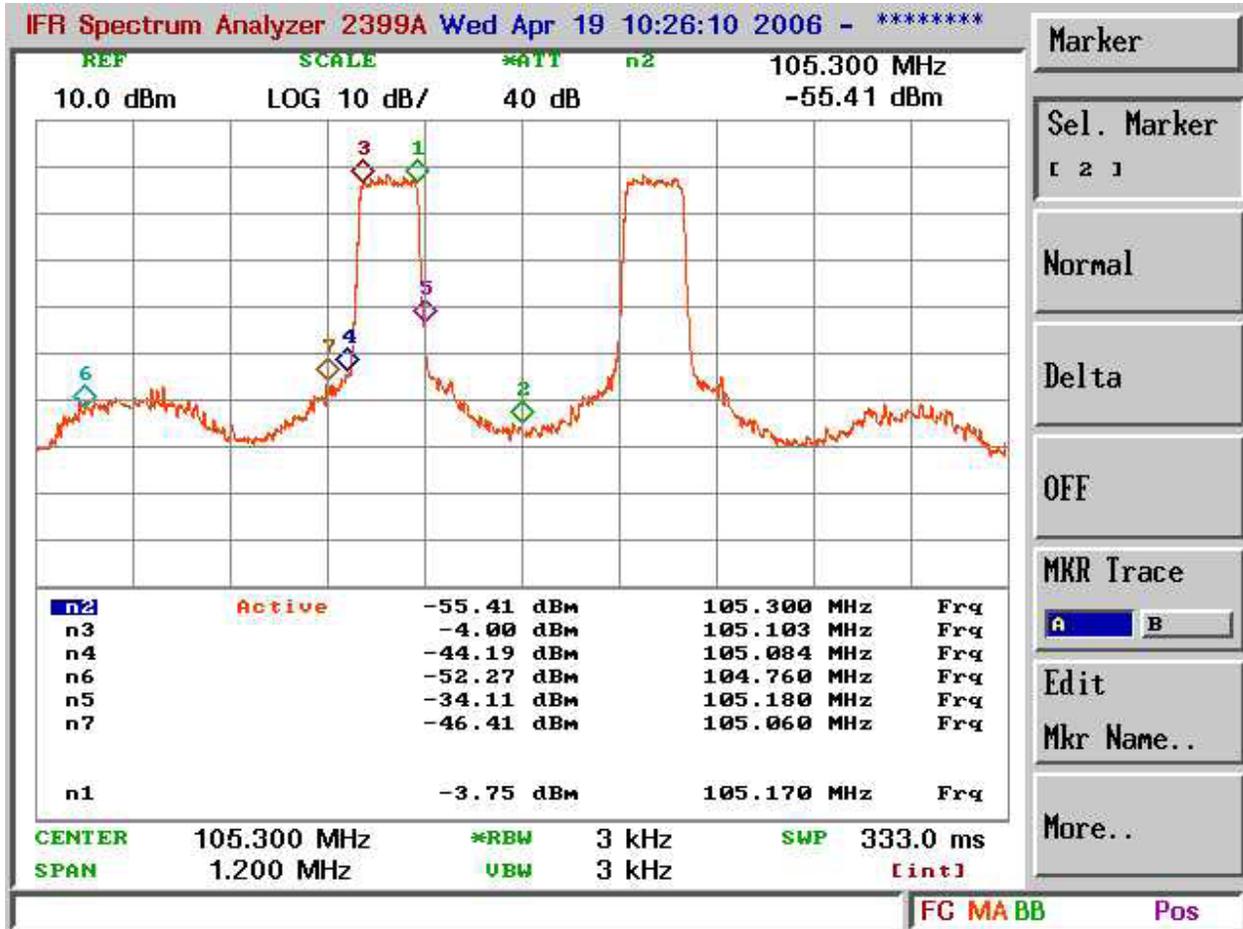
OCBW OF 99.5 MHz.



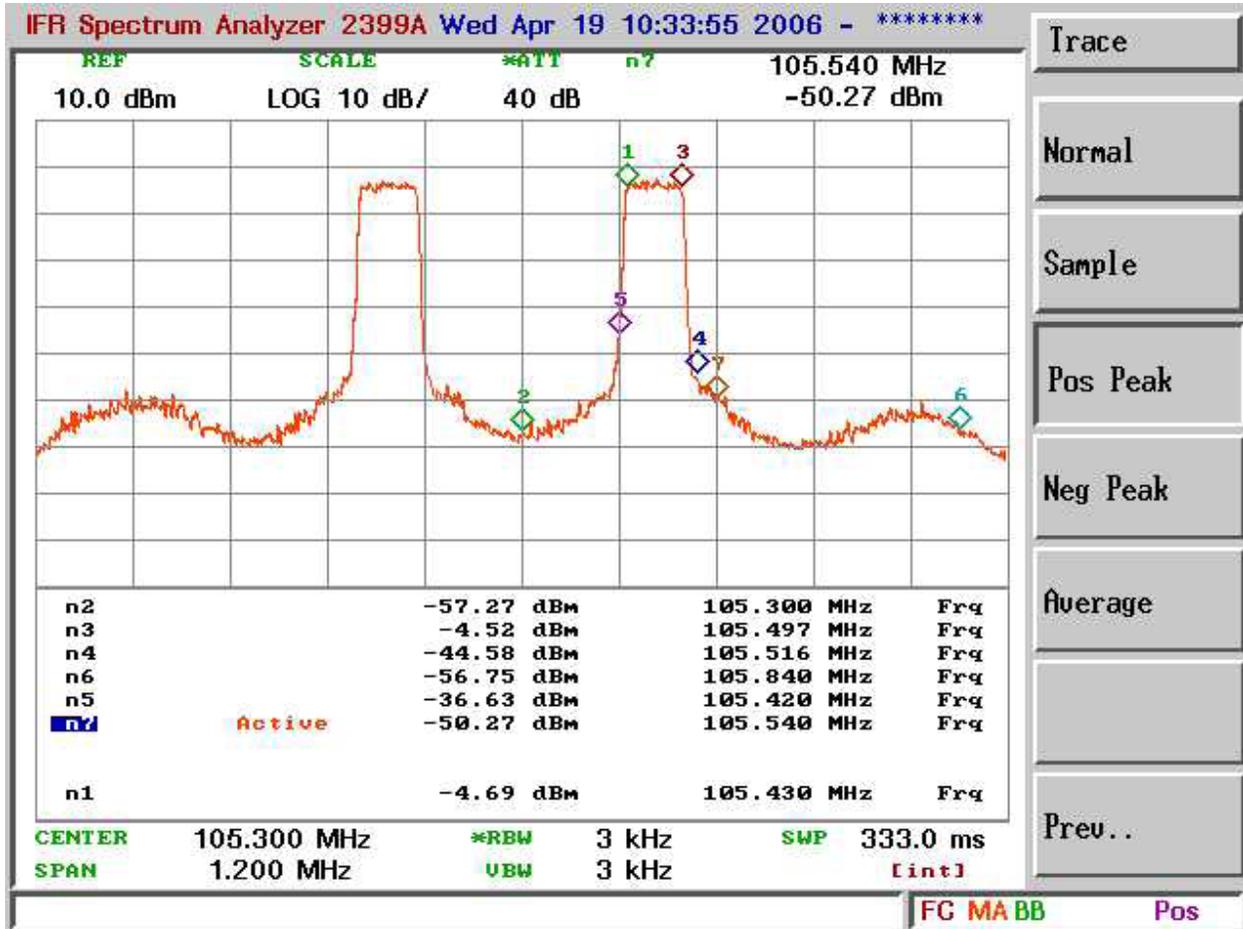
OCBW OF 99.5 MHz.



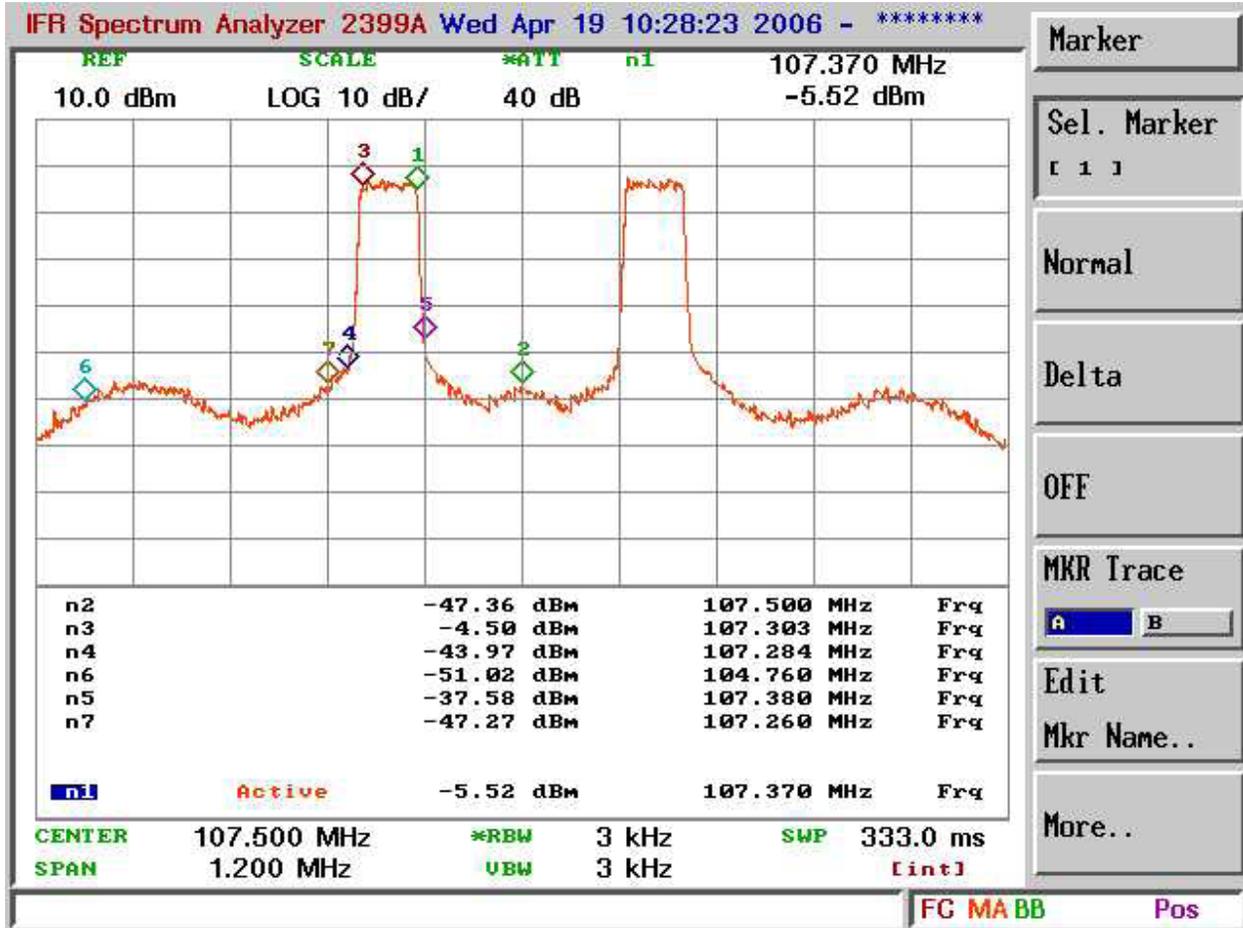
OCBW OF 105.3 MHz.



OCBW OF 105.3 MHz.



OCBW OF 107.5 MHz.



Marker

Sel. Marker [1]

Normal

Delta

OFF

MKR Trace

A B

Edit

Mkr Name..

More..

OCBW OF 107.5 MHz.

