Title: CRYOGENIC MEASUREMENTS ISOLATORS CTH1365K10 A151 SN 106, 107, 108, 109, 110

HIFI number	Yebes/FPSS/TN/2003-003		
Issue:	2		
Date:	26/05/2003		
Category:	4		
Prepared by:	Carmen Diez, Juan Daniel Gallego	Date:	26/05/2003
Checked by:		Date:	
Authorised by:		Date:	

Distribution list:

SRON	Joost Adema	**Yebes**	Carmen Díez
	Nick Whyborn		

Document Change Record:

Date	Issue/Revision	Page	Change
26/05/03	1	all	Initial

INTRODUCTION

The purpose of this report is to present the measurements the cryogenic isolators PAMTECH model CTH 1365 K10 SN 106, 107, 108, 109 and 110 made for the DM of HIFI. Their S parameters were measured at 15 K with a HP 8510 Vector Network Analyzer in a test criostat. The first measurements taken did not meet the specifications and the isolators were sent back to PAMTECH for repair. This technical note presents plots of the measurements taken before and after the reparation.

CRYOGENIC S PARAMETERS OF ISOLATORS

Five isolators model CTH 1365 K10 made by PAMTECH were measured. All them are from batch 237. The configuration of the input and output connectors, both on the same side but with a different spacing than the Dewar transitions, made difficult the connection to the cryogenic measuring system. The measurements were made in a Dewar with a CTI 1020 refrigerator. The input and output transitions were stainless steel coaxial air lines with K (2.92 mm) home-made vacuum seals. The input port of the isolator was connected to the female connector of the stainless steel line using a K male-male transition (RADIALL R127 703 001). The output was connected using a 27 cm semi-flexible cable (SUCOFORM 141 by SHUNER) with male SMA connectors (RADIALL R125 055) in both ends (Figure 1). The loss of this cable measured at room temperature was 0.4 dB @ 8 GHz, and it is believed to decrease to 0.08 dB @ 8 GHz when cooled. The measurements were performed with a Vector Network Analyzer HP8510 C. A full two-port calibration was done with reference planes in the interface of the K connectors at the end of the flexible cables of the VNA, outside the Dewar. The stainless steel transitions were measured independently at ambient temperature, and their effect was de-embedded in the post-processing of the data. The de-embedding of the data measured at cryogenic temperature is possible because the S parameters of the transitions change very little with temperature. The S parameters obtained after de-embedding corresponded to the cascade of a K m-m transition, the isolator, and the semi-flexible cable. It was considered unnecessary to de-embed for the K transition and the cable, because their effect at cryogenic temperature is very little, and also because the result will not be too accurate, since the losses of these elements will change with temperature. The output reflection of the isolator (S_{22}) was slightly masked by the effect of the reflection of the semi-flexible cable, and a time domain gate was applied to improve the accuracy. Note that the value of S_{21} (insertion loss) is overestimated, since it includes the cryogenic losses of the K transition and the semi-flexible cable. The precision of S_{11} and S_{22} obtained in this way has been validated comparing measurements of other devices inside and outside of the Dewar at room temperature, and was very good. However, there were some doubts about the accuracy of S_{21} (insertion loss), because its value is very small and difficult to measure, and the contribution of the additional loss due to the transition and the flexible cable (supposed negligible) is uncertain, since its value at cryogenic temperature is unknown. For that reason the value of the insertion loss obtained in this way was compared with the value obtained from noise measurements in a totally different set up. The results of the measurements of the five isolators are presented in figures 2 to 6. The results obtained before and after repair are presented in the same figure for easy comparison. Table I presents a comparison of the measurements obtained at 15 K with the specification at 77 K given by the manufacturer (only for the repaired isolators).

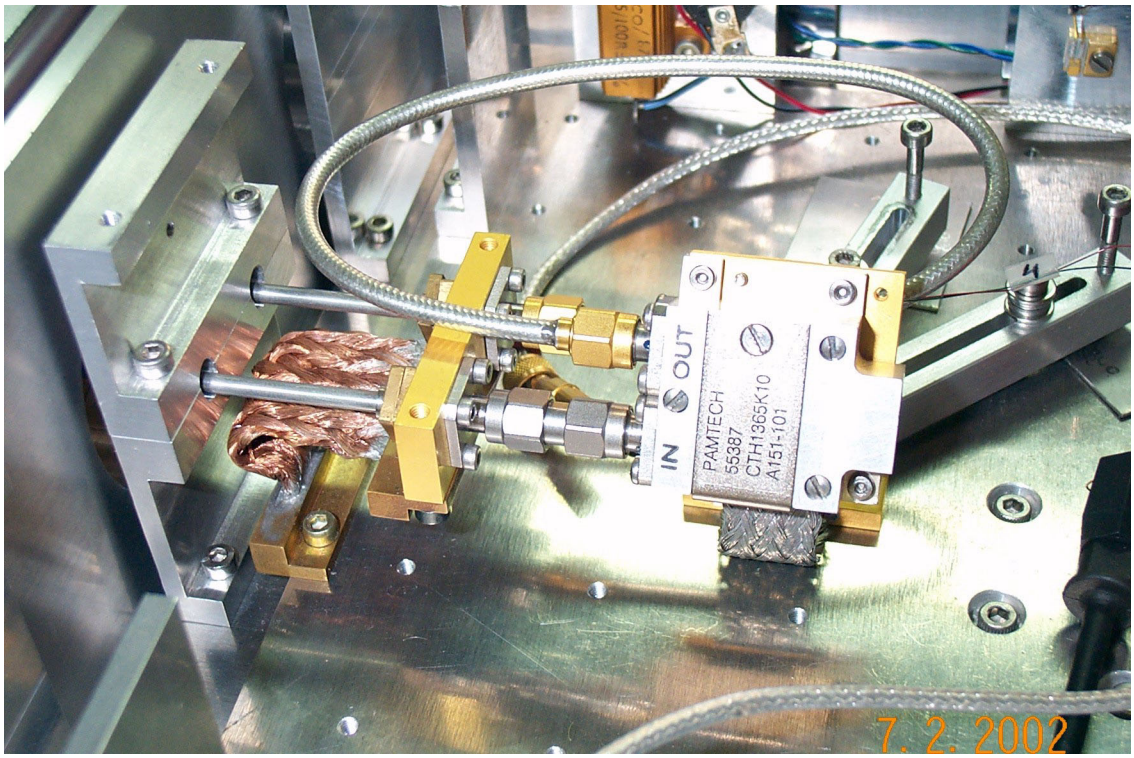

Figure 1: Isolator PAMTECH Inside the test Dewar.

TABLE I

Results of measured S parameters compared with data from PAMTECH

	MEASURED @ 15 K				PAMTECH DATA @ 77 K			
S/N	S_{11} (dB)<	S_{12} (dB)<	S_{21} (dB)>	S_{22} (dB)<	S_{11} (dB)<	S_{12} (dB)<	S_{21} (dB)>	S_{22} (dB)<
106	-15.5	-21.2	-0.56	-13.8	-18.2	-18.2	-0.28	-18.8
107	-17.4	-18.2	-0.56	-16.1	-17.9	-17.7	-0.28	-19.4
108	-16.4	-20.4	-0.49	-16.6	-18.5	18.7	-0.28	-18.5
109	-15.4	-23.3	-0.48	-15.7	-17.7	-18-3	-0.28	-17.2
110	-17.3	-20.3	-0.76	-16.3	-17.9	-19.1	-0.28	-18.2
SPEC.					-18.2	-17.0	-0.30	-18.2

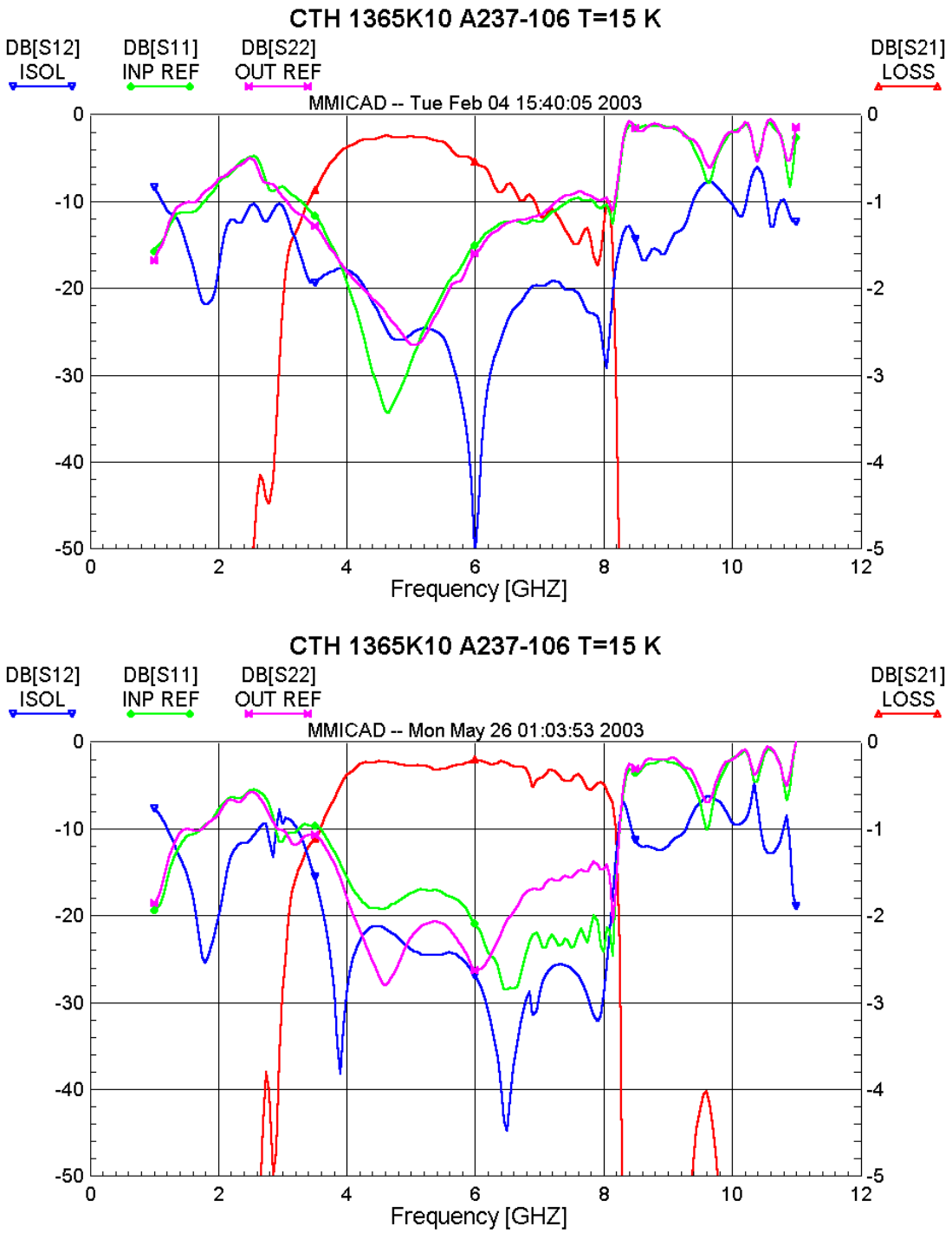

Figure 2: Isolator PAMTECH CTH 1365 K10 S/N 106 before reparation (up) and after reparation (down).

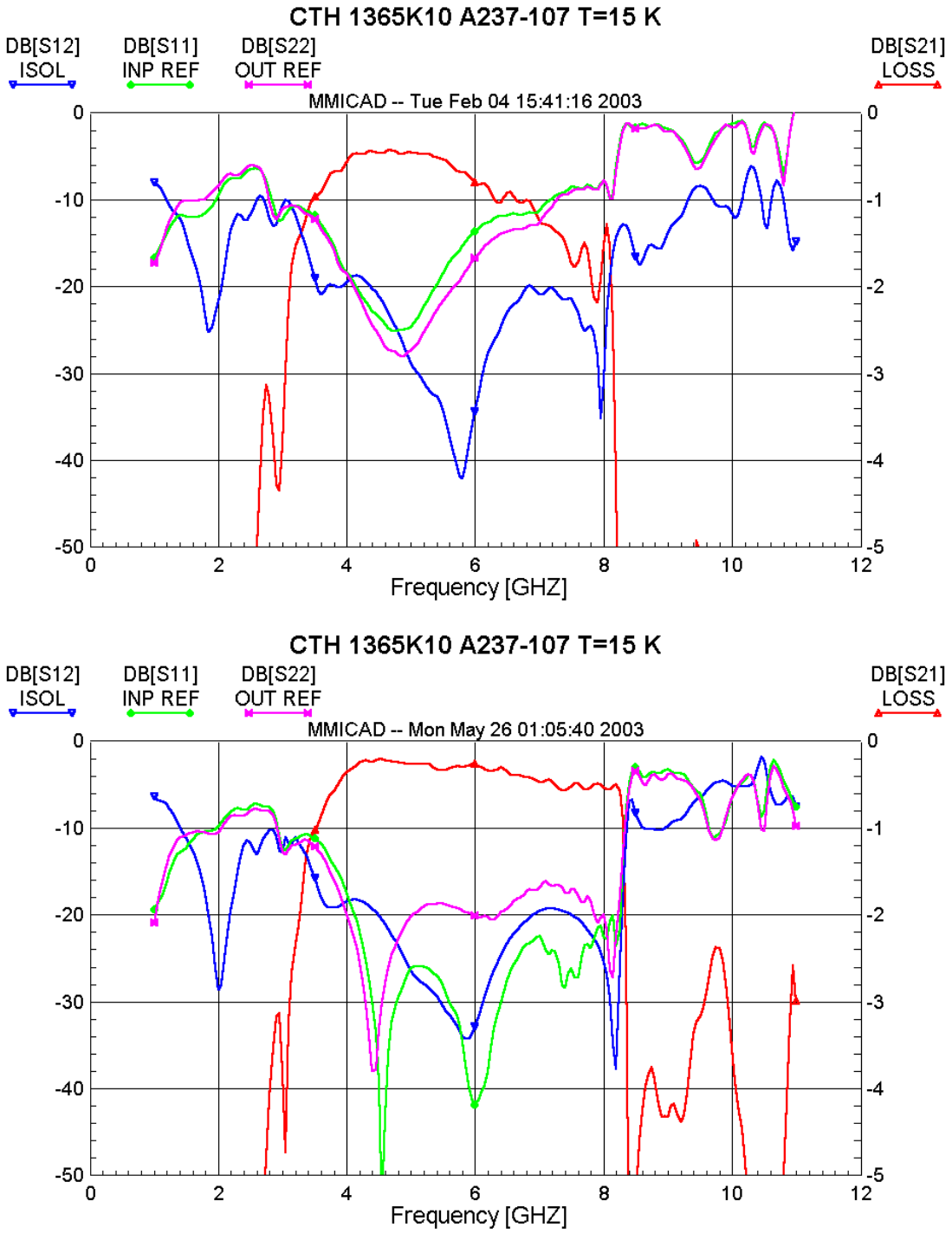

Figure 3: Isolator PAMTECH CTH 1365 K10 S/N 107 before reparation (up) and after reparation (down).

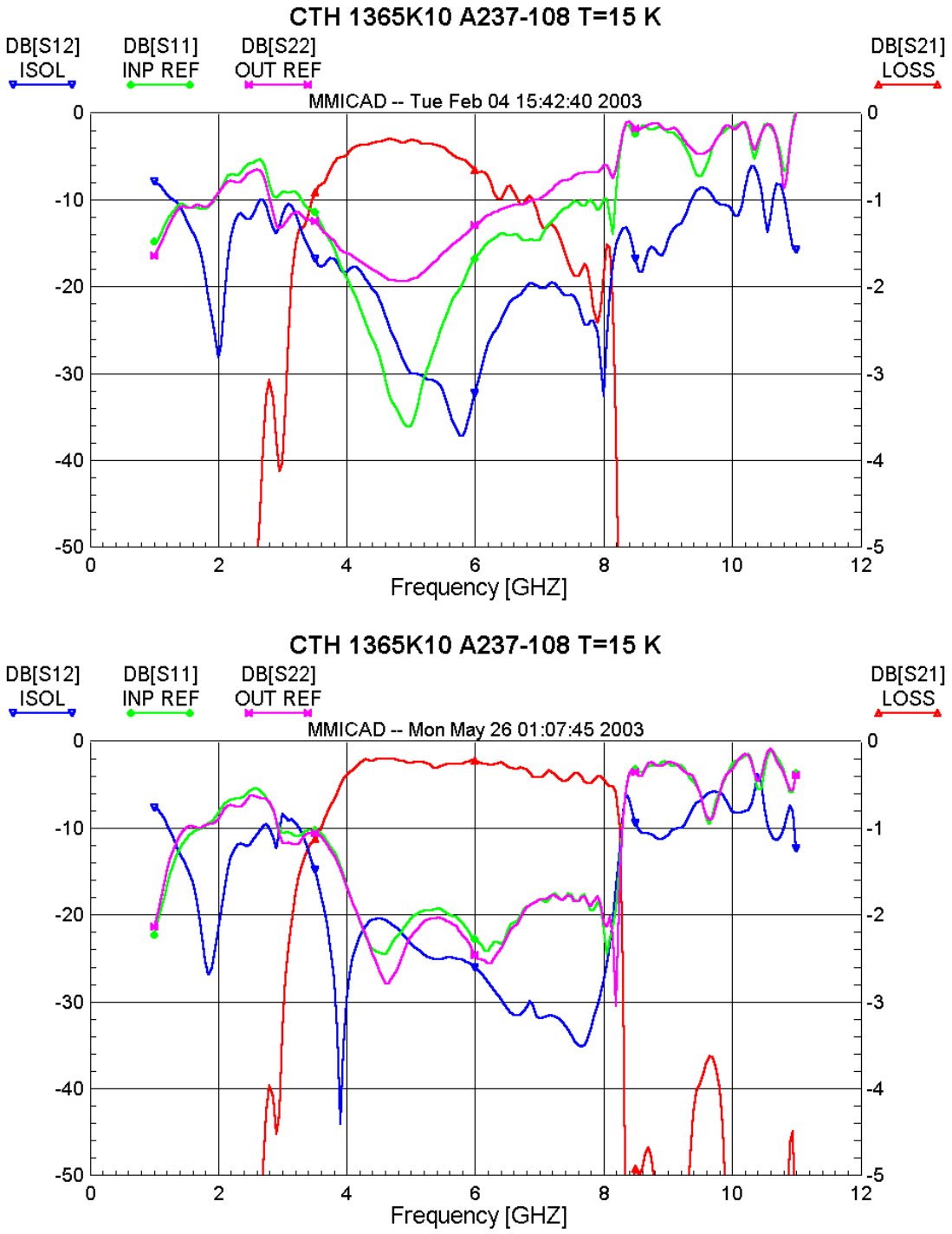

Figure 4: Isolator PAMTECH CTH 1365 K10 S/N 108 before reparation (up) and after reparation (down).

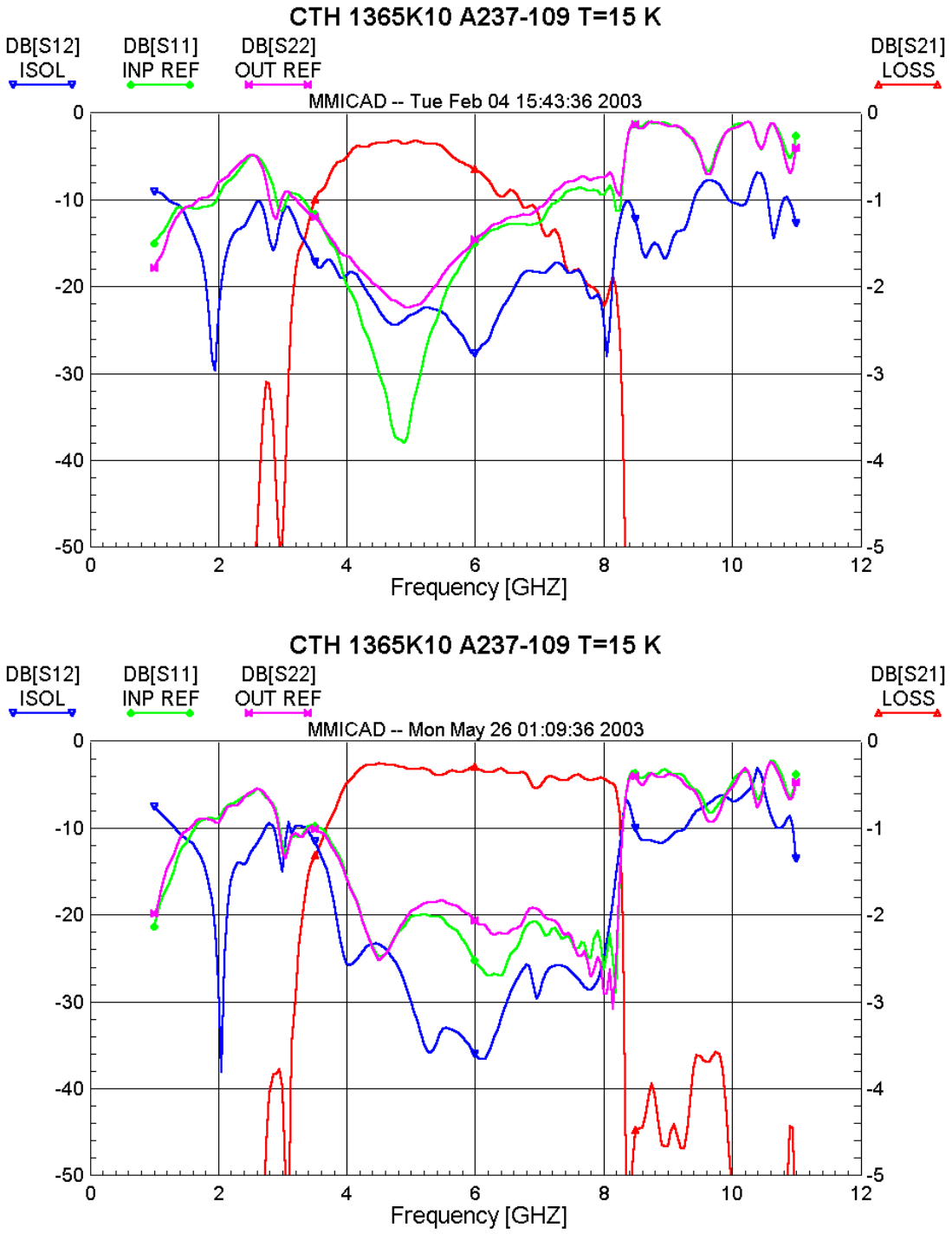

Figure 5: Isolator PAMTECH CTH 1365 K10 S/N 109 before reparation (up) and after reparation (down).

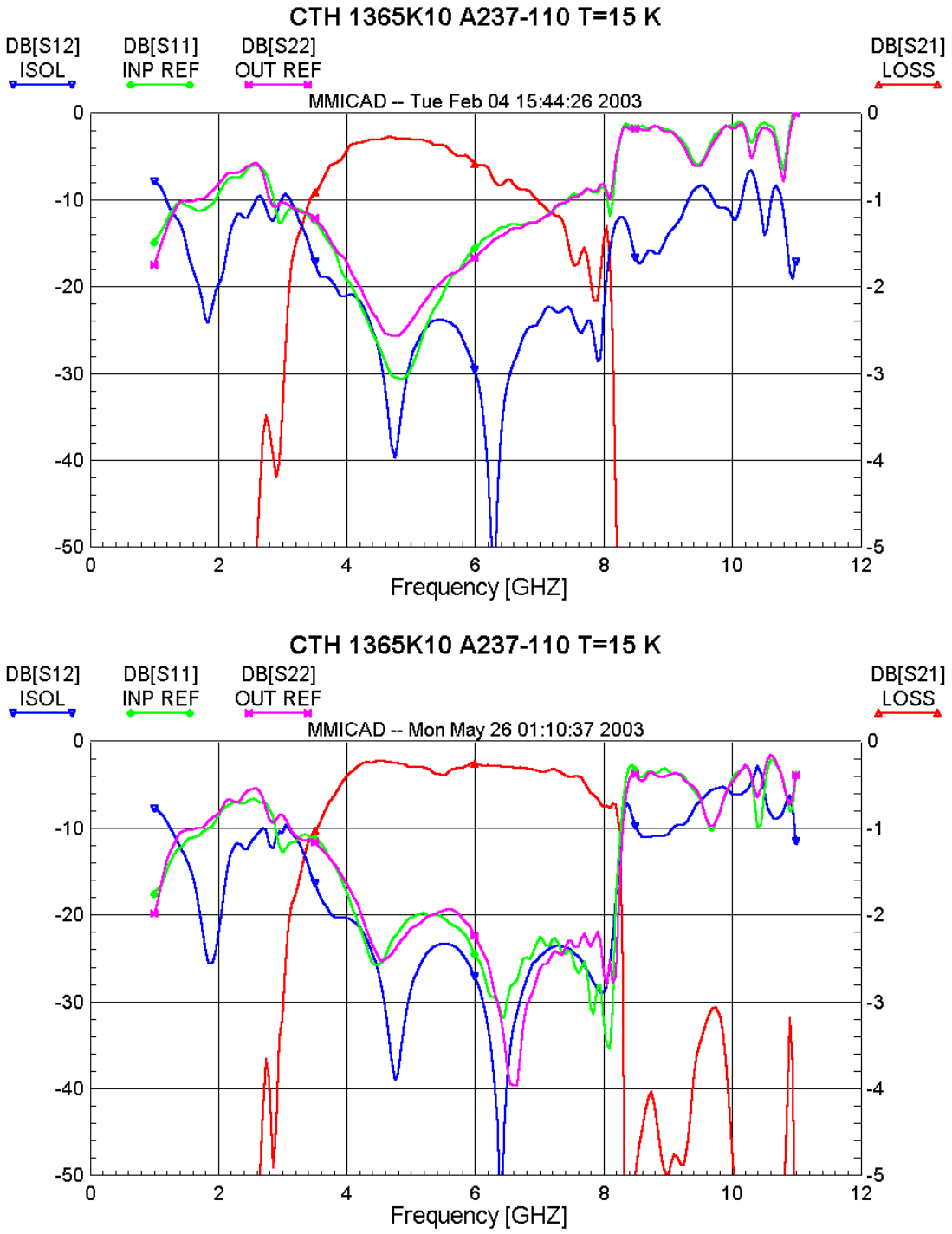

Figure 6: Isolator PAMTECH CTH 1365 K10 S/N 110 before reparation (up) and after reparation (down).

CONCLUSION

The measured performance of isolators SN 106-110 repaired is similar to the previous set received (SN 101-105) described in Yebes/FPSS/TN/2002-003. No resonances are observed in present set. In general, the band is well centered.