EMC Near-field Probes with Wideband Amplifier

Image 1 – from top, H20, H10, H5, E5; wideband amplifier

1 Safety Summary

Do not use the EMC probes to measure devices containing DC voltages higher than 75V or AC voltages higher than 50V. Though the probes are insulated with solder mask, conformal coating and rubber coating, sharp metal edges may damage the insulation and cause lethal electrical shocks.

2 Introduction

The H20, H10, H5, and E5 are magnetic field (H) and electric field (E) probes for radiated emissions and EMC pre-compliance measurements. They serve to locate and identify potential sources of interference within the building blocks of electronic assemblies.

The probes act similar to wide bandwidth antennas, picking up radiated emissions from components, PCB traces, and housing openings that could be emitting RF. Scanning the probe over the surface of a PCB assembly or housing quickly identifies locations which emit electromagnetic radiation. By changing to a probe with smaller size, the origination of the emissions can be further narrowed down.

The probes can be used in RF immunity tests by feeding an RF signal into the probe and radiating it into potentially susceptible circuit sections. Frequency, phase noise, and spectral components can be measured in conjunction with a low noise preamplifier. The wideband amplifier is connected between the EMC probe and Spectrum Analyzer to increase the dynamic range of the measurements.

3 Features

Slim design for access between tightly spaced components. Shielded loops to avoid picking up common mode noise; insensitive to the human hand. Frequency range: up to 6GHz, see coupling plots of the respective probes SMB connectors to avoid twisting the RF cable when scanning DUTs

Wideband amplifier with 40dB gain

4 Dimensions

Probe		length	loop	tip
H20	H-Field	170 mm	20 mm	n.a.
H10	H-Field	170 mm	10 mm	n.a.
H5	H-Field	170 mm	5 mm	n.a.
E5	E-Field	170 mm	n.a.	5 mm

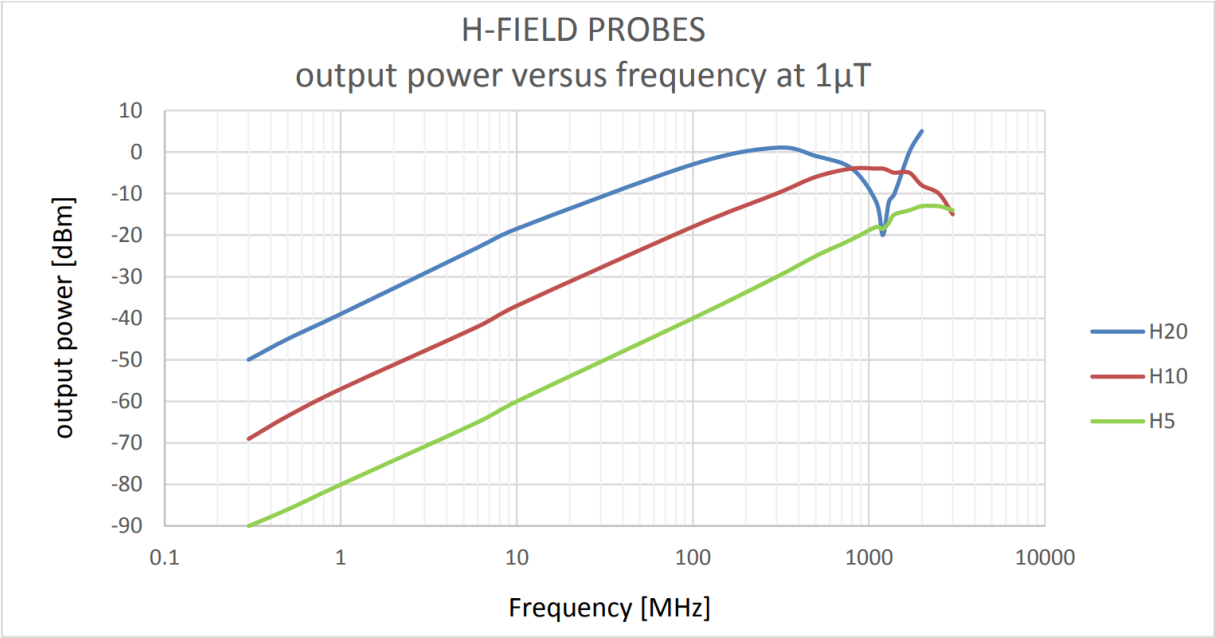

Image 2 - frequency response, H-field probes

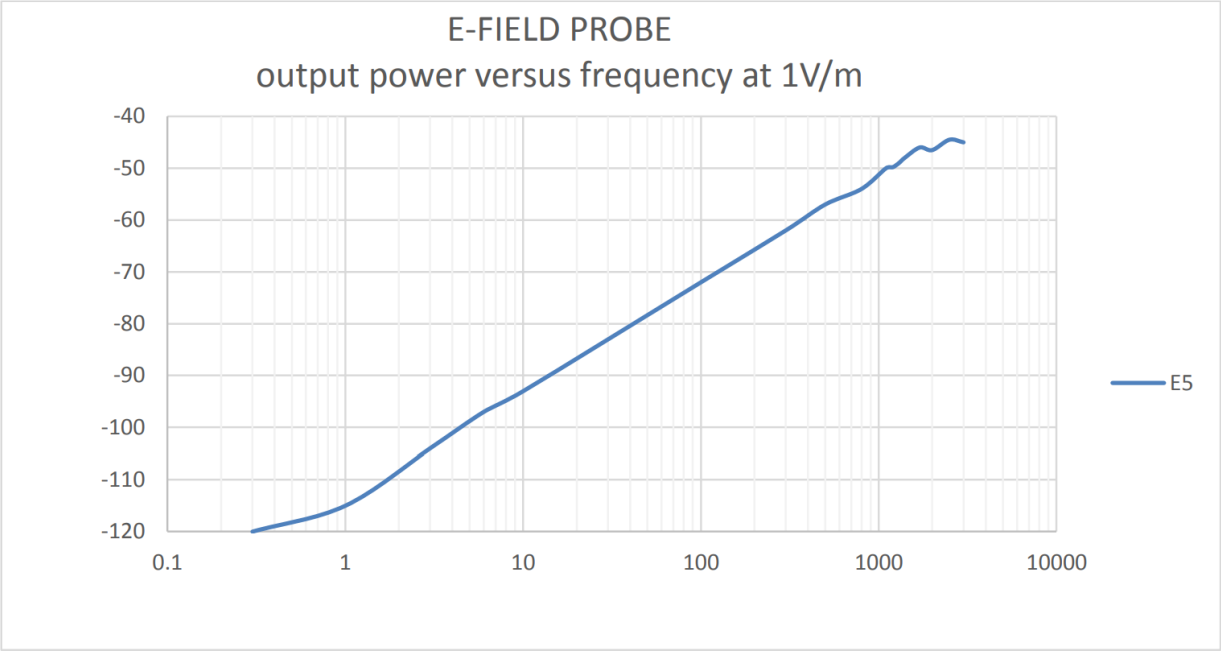

Image 3 - frequency response, E-field probe

5 Coupling loss

Coupling loss was measured on a terminated 50 Ohm stripline on a 1.6 mm thickness FR4 board using a vector network analyzer.

H20

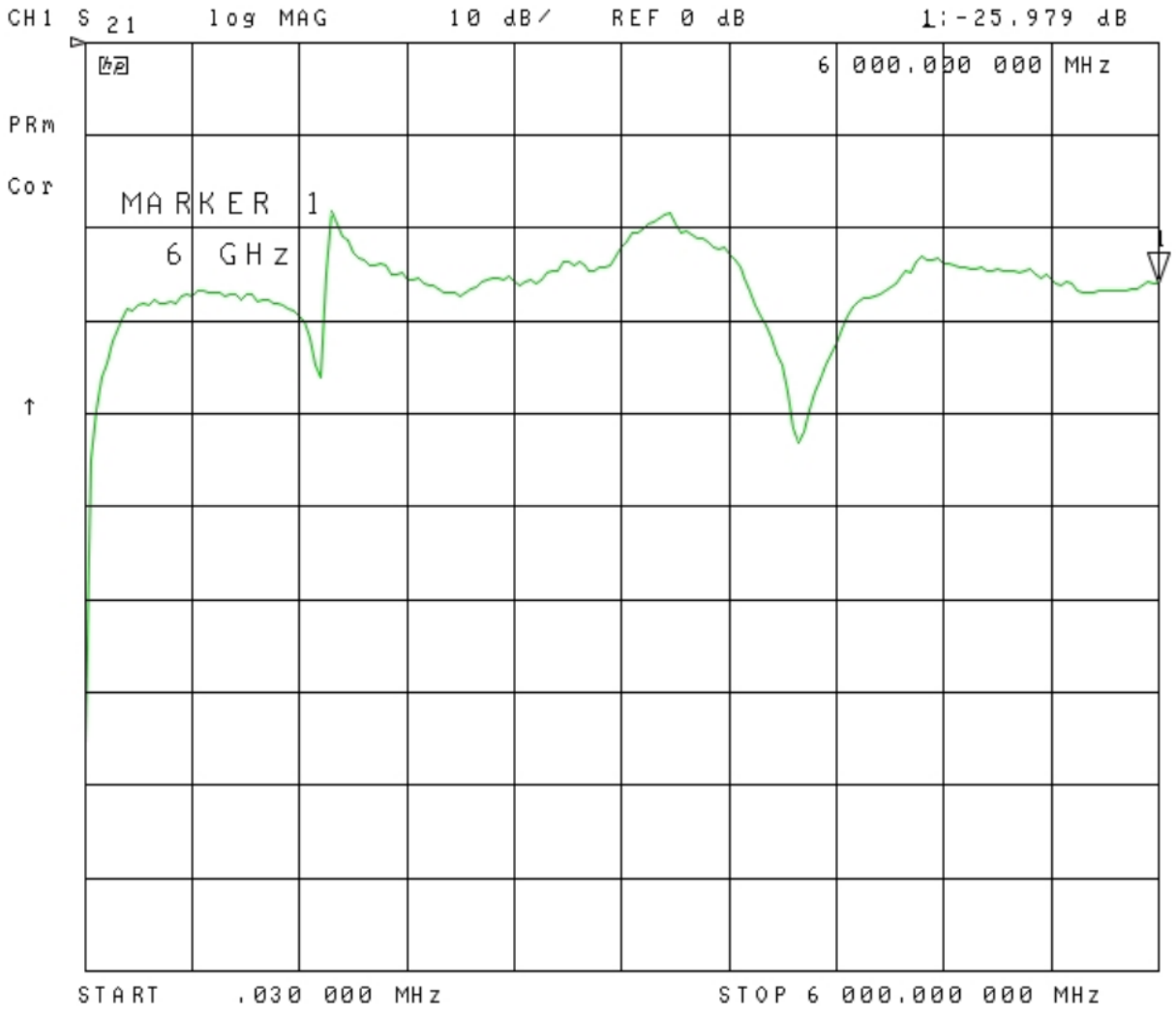

Image 4 - H20 coupling loss, 30 kHz to 6 GHz, lin.

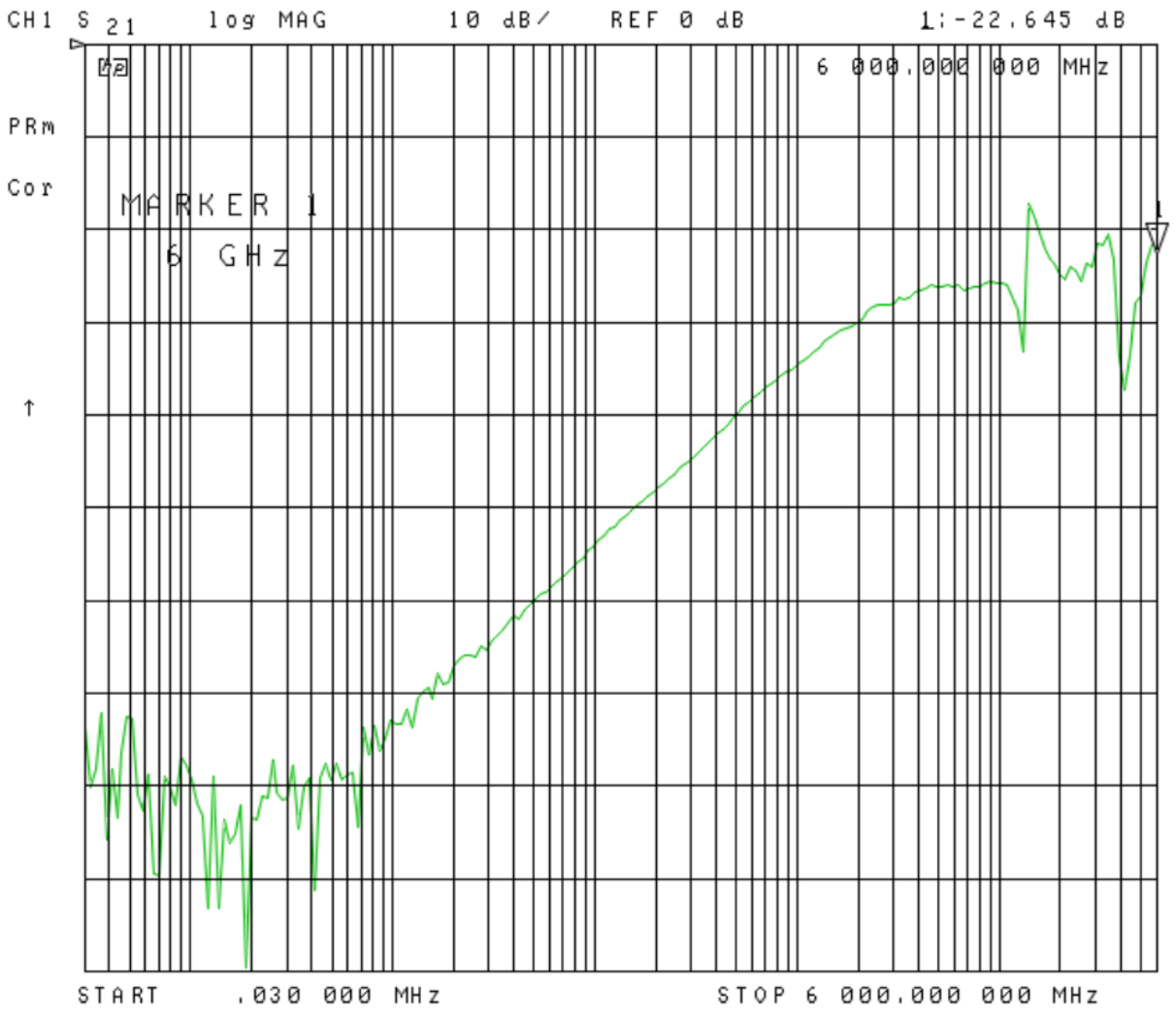

Image 5 - H20 coupling loss, 30 kHz to 6 GHz, log.

H10

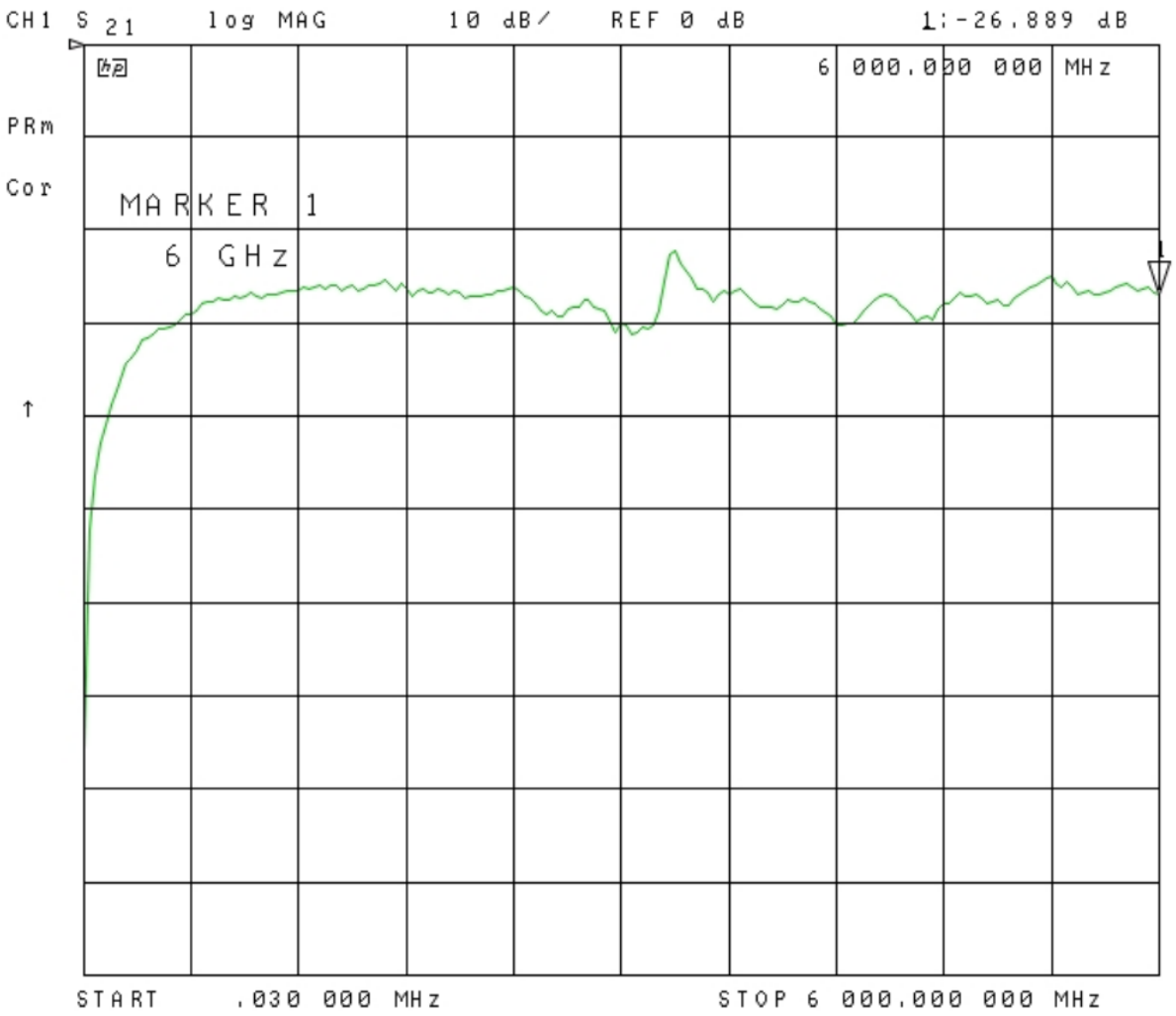

Image 6 - H10 coupling loss, 30 kHz to 6 GHz, lin.

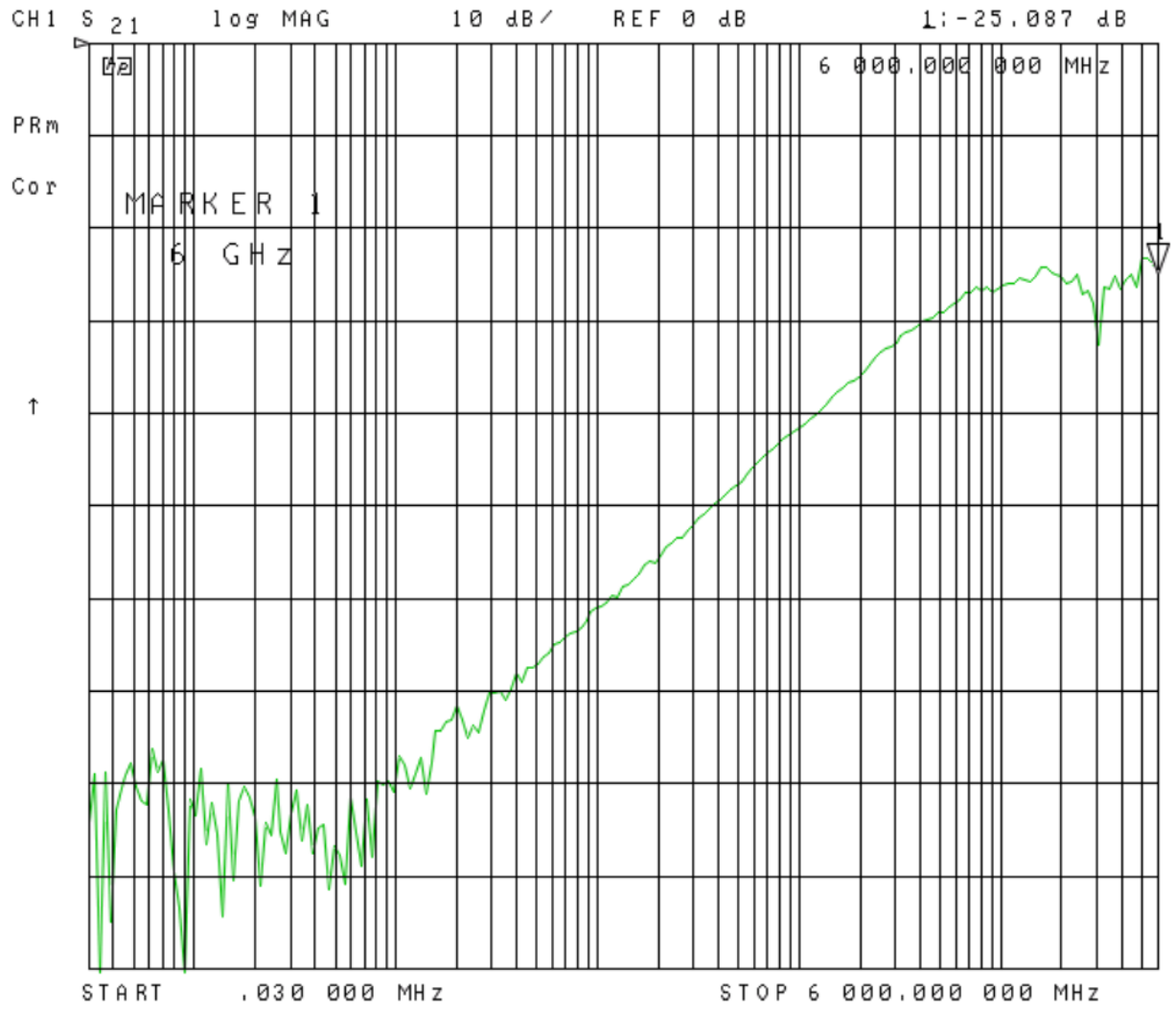

Image 7 - H10 coupling loss, 30 kHz to 6 GHz, log.

H5

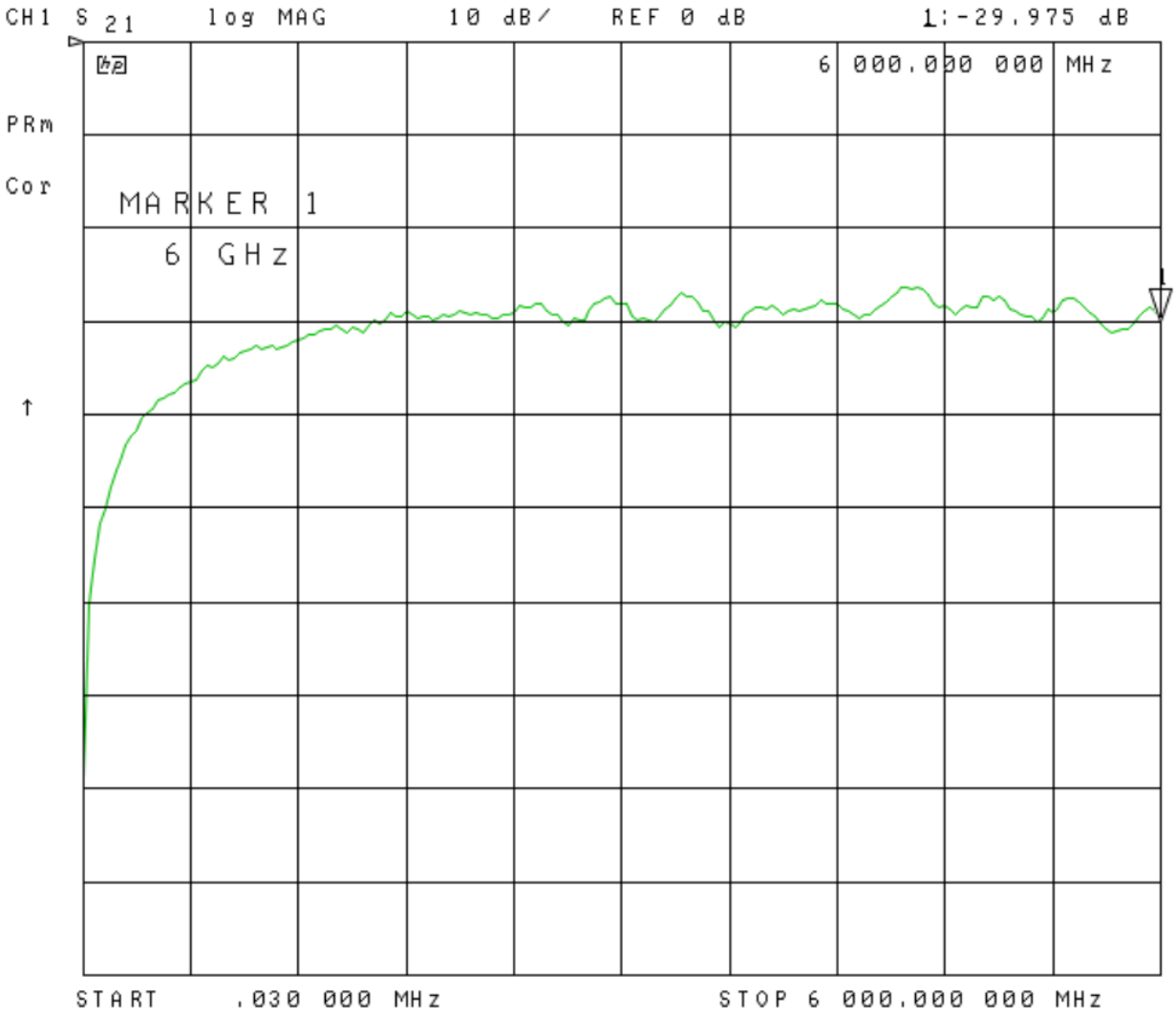

Image 8 - H5 coupling loss, 30 kHz to 6 GHz, lin.

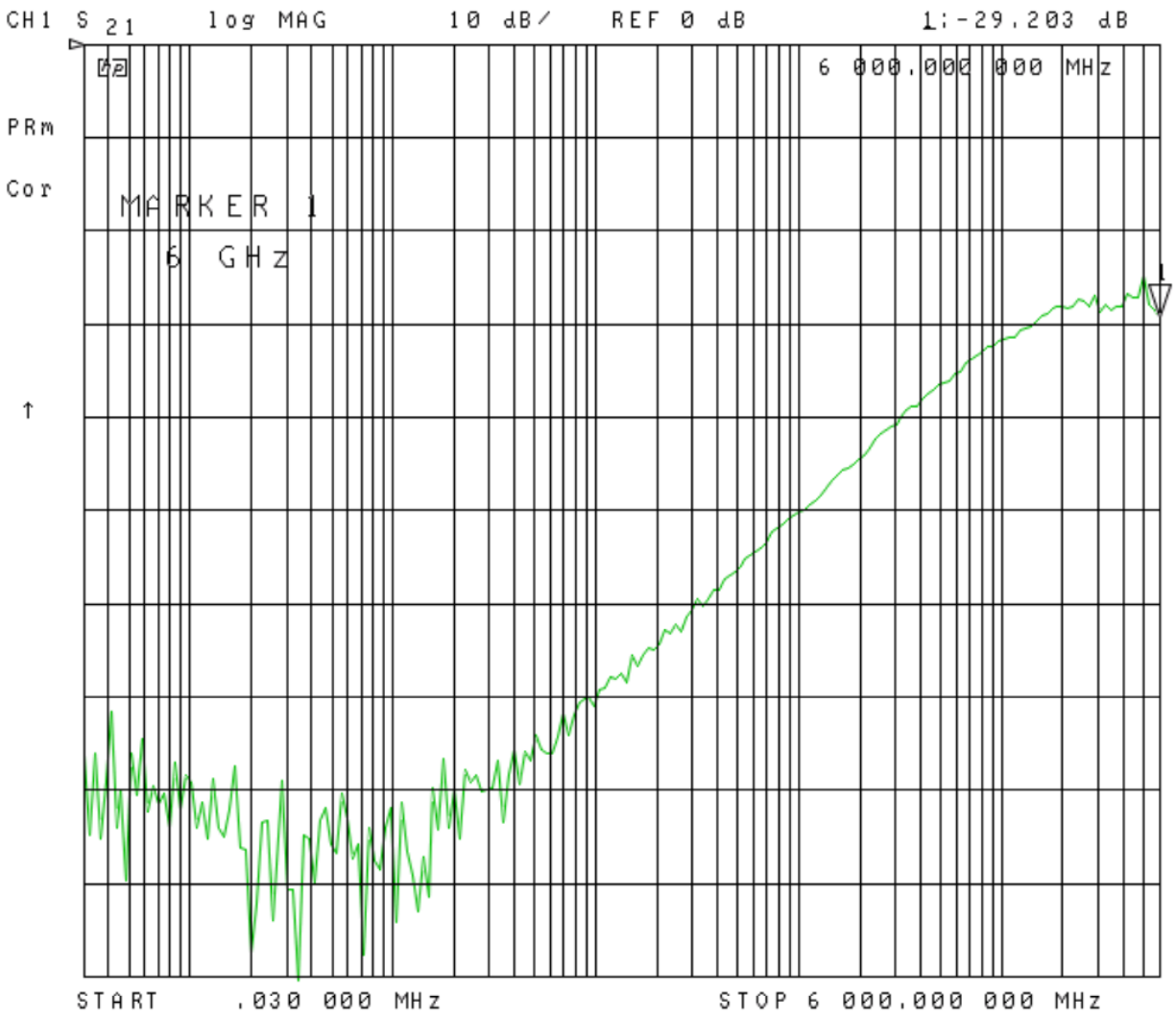

Image 9 - H5 coupling loss, 30 kHz to 6 GHz, log.

E5

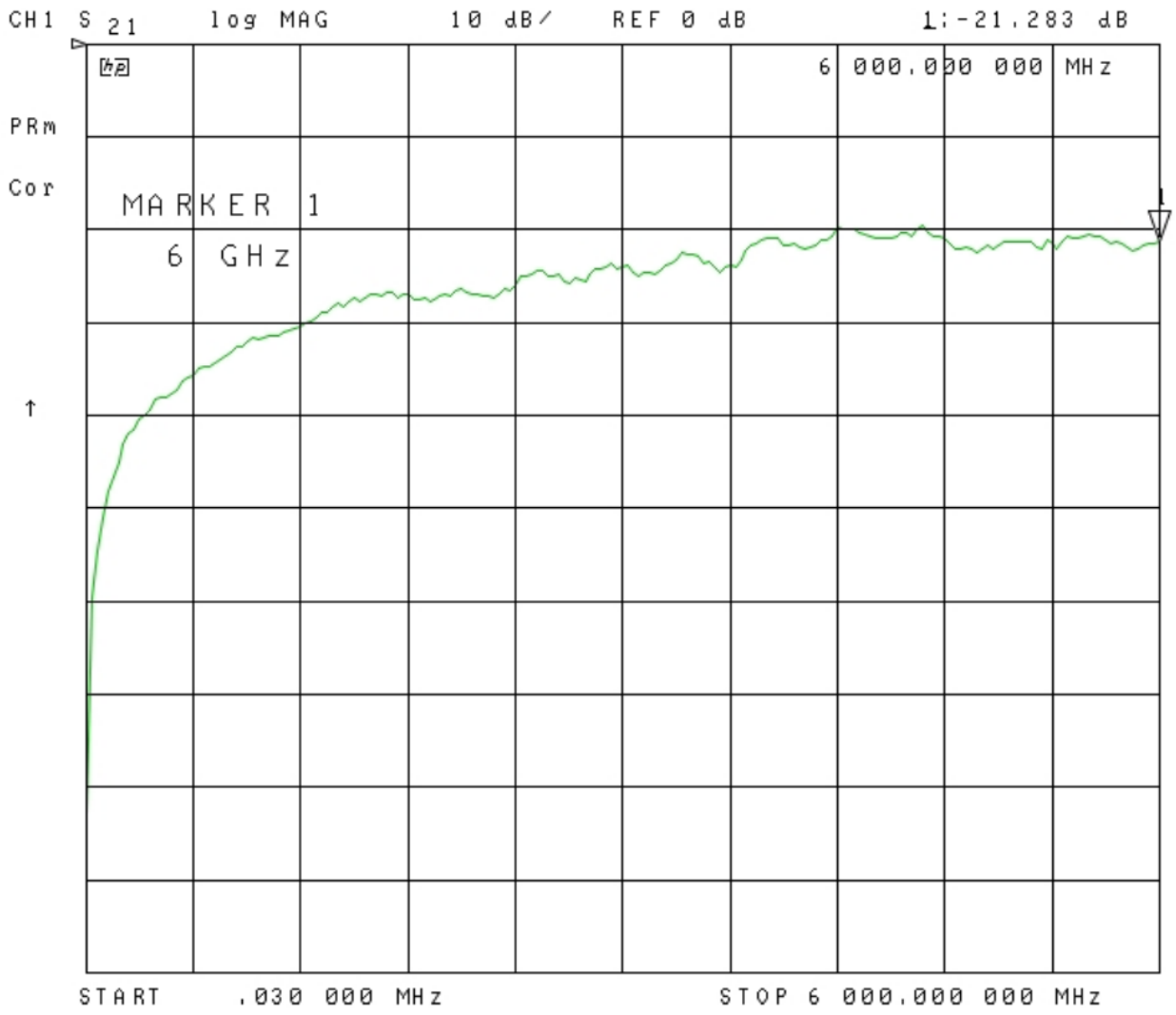

Image 10 - E5 coupling loss, 30 kHz to 6 GHz, lin.

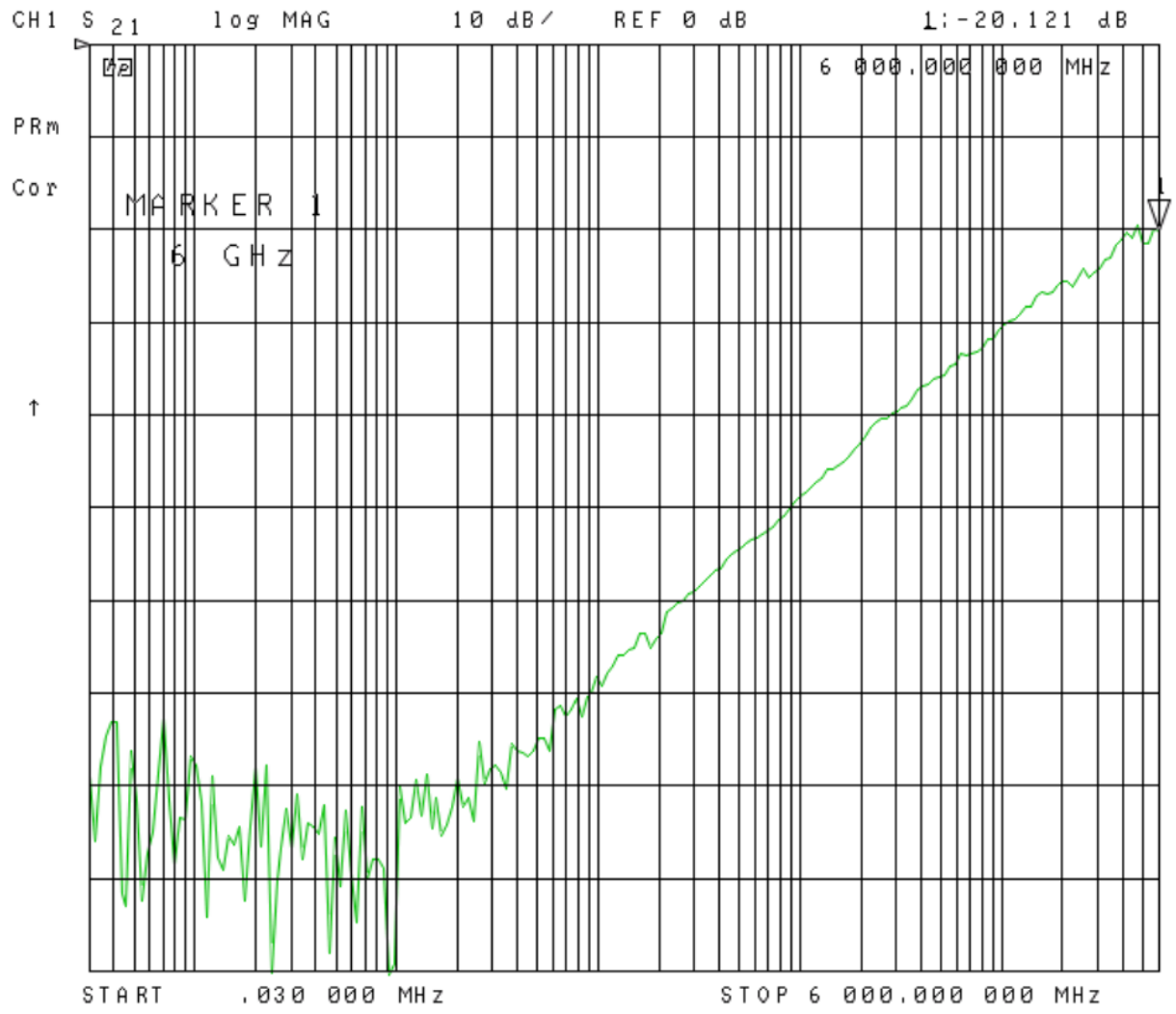

Image 11 - E5 coupling loss, 30 kHz to 6 GHz, log.

5.1 Summary

The larger the tip diameter, the lower the coupling loss at frequencies below 1GHz. At frequencies above 1GHz, the performance in terms of coupling loss of all probes is similar. The H20 has resonances in the range of 1.3GHz and 4GHz. The H10 has a resonance at 3.1GHz. The smaller the loop, the better the spatial response.

6 Wideband Amplifier

6.1 Technical Data

Input: 50 Ohm, SMA

Output: 50 Ohm, SMA

Nominal supply Voltage: 4.5 - 5V, typ. 210mA, Mini-USB-B connector

Maximum supply voltage: 5.5V

Maximum input power: -10dBm

1dB output compression point @ 2GHz: +20dBm

Reverse isolation S12, 0.1 …6GHz: 40dB

Noise Figure @ 2GHz: 5 dB

Gain:

1 MHz	10 MHz	100 MHz	500 MHz	1 GHz	2 GHz	3 GHz	4.5 GHz	6 GHz
30 dB	40.2 dB	40.2 dB	40 dB	39.5 dB	37.6 dB	36.4 dB	34.6 dB	34.7 dB

Wideband amplifier gain

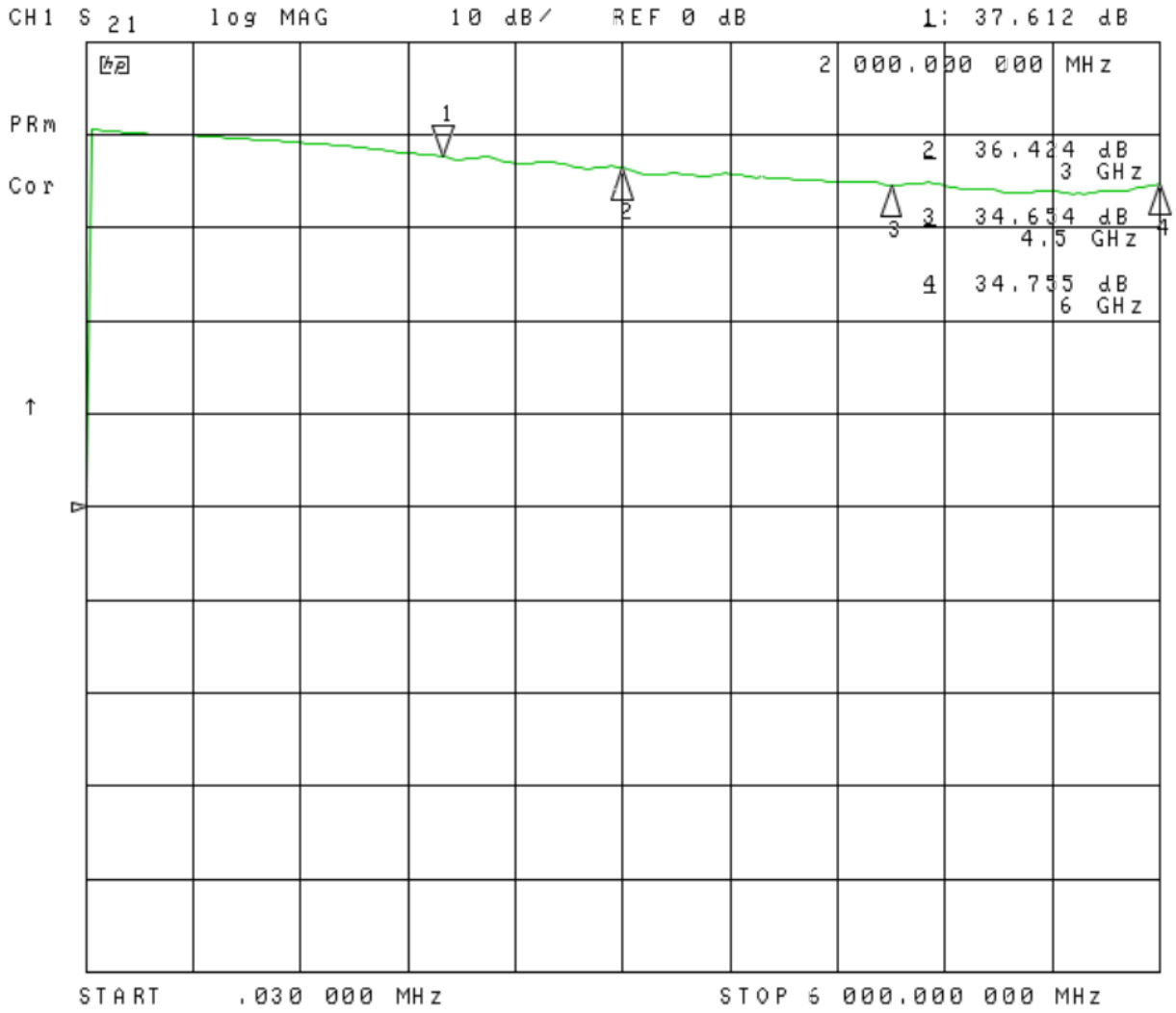

Image 12 - Wideband amplifier gain, 30 kHz to 6 GHz, lin.

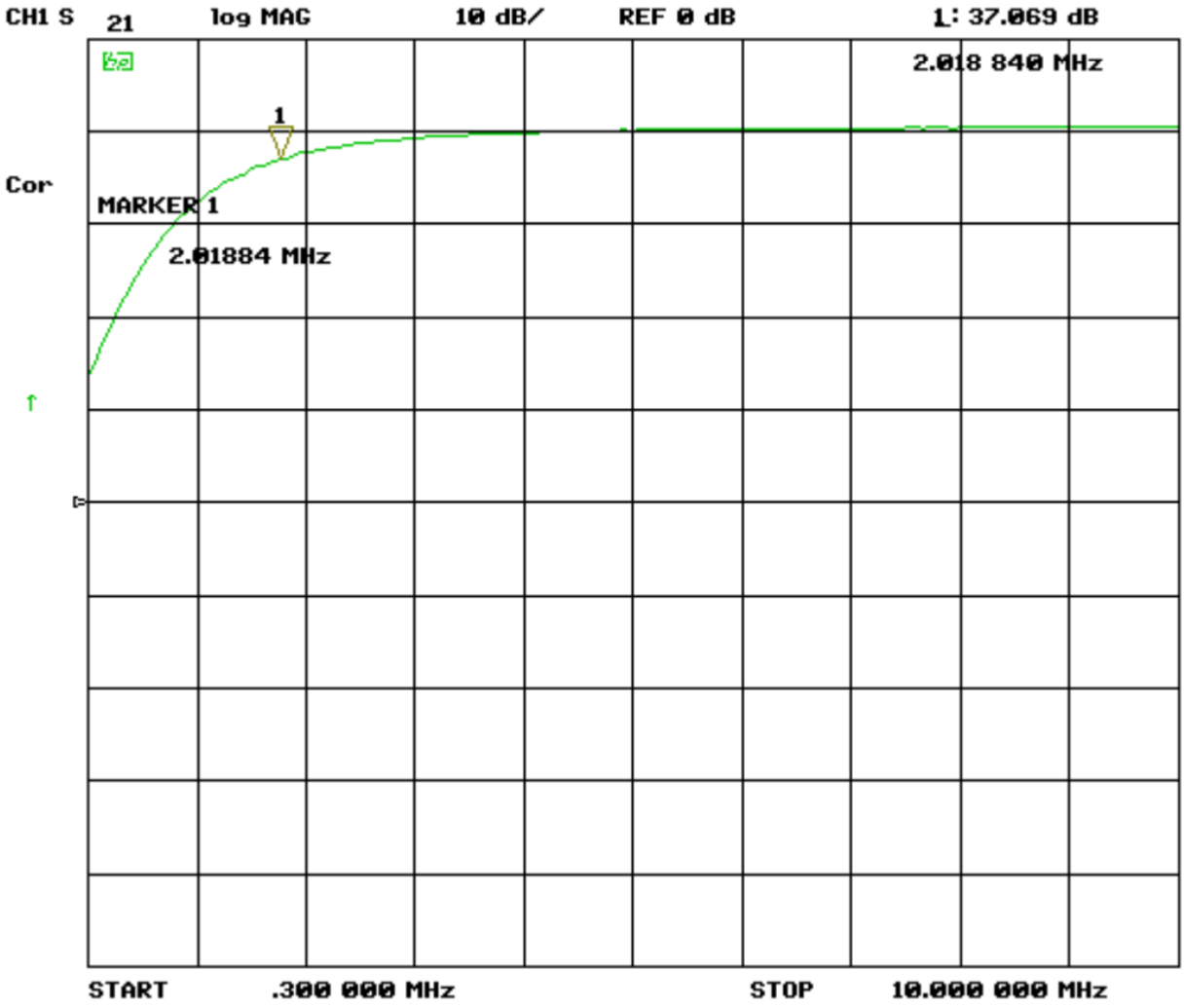

Image 13 - Wideband amplifier gain, 300 kHz to 10 MHz, lin.

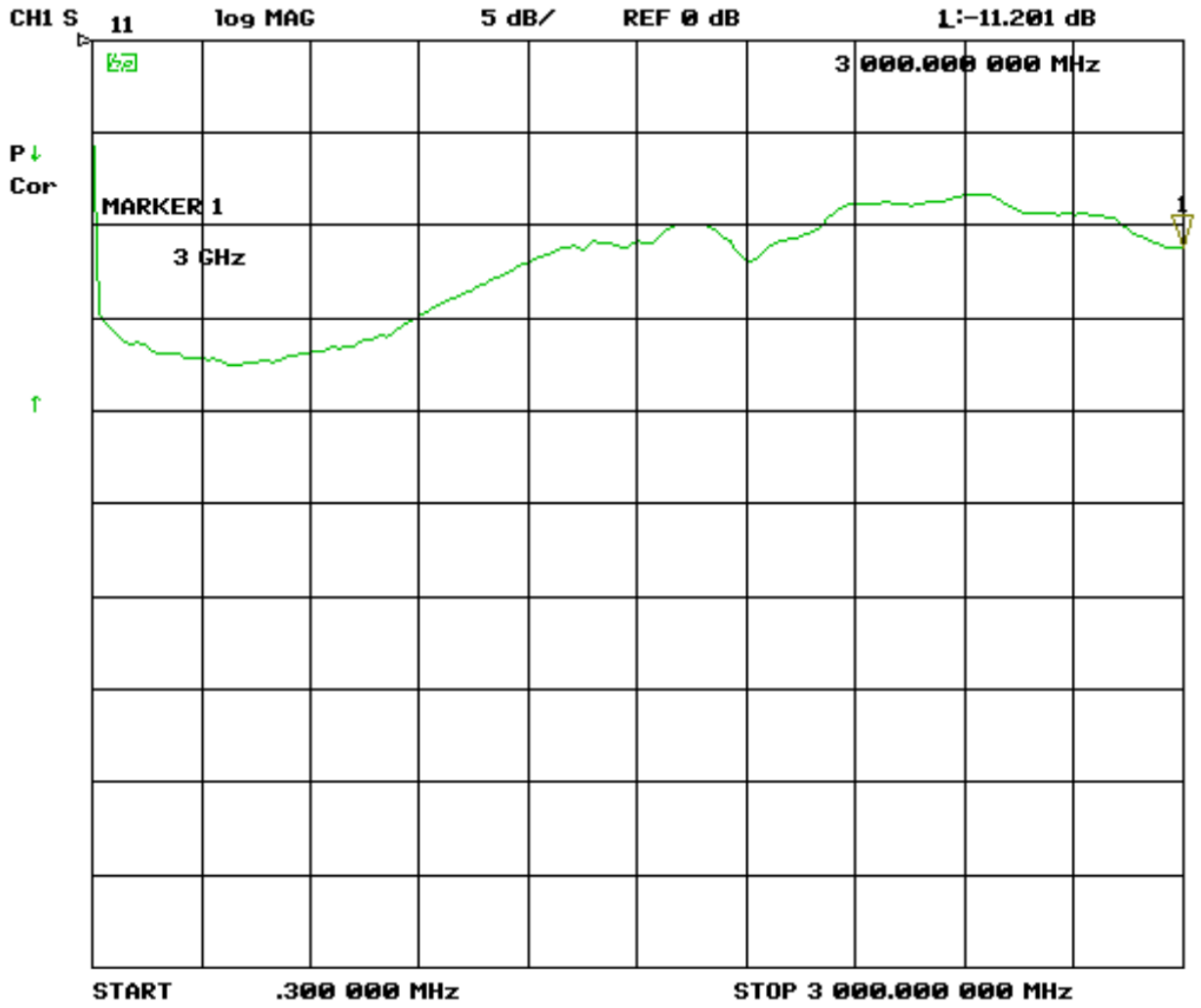

Image 14 - Wideband amplifier input return loss, IS11I, 300 kHz to 3 GHz, lin.

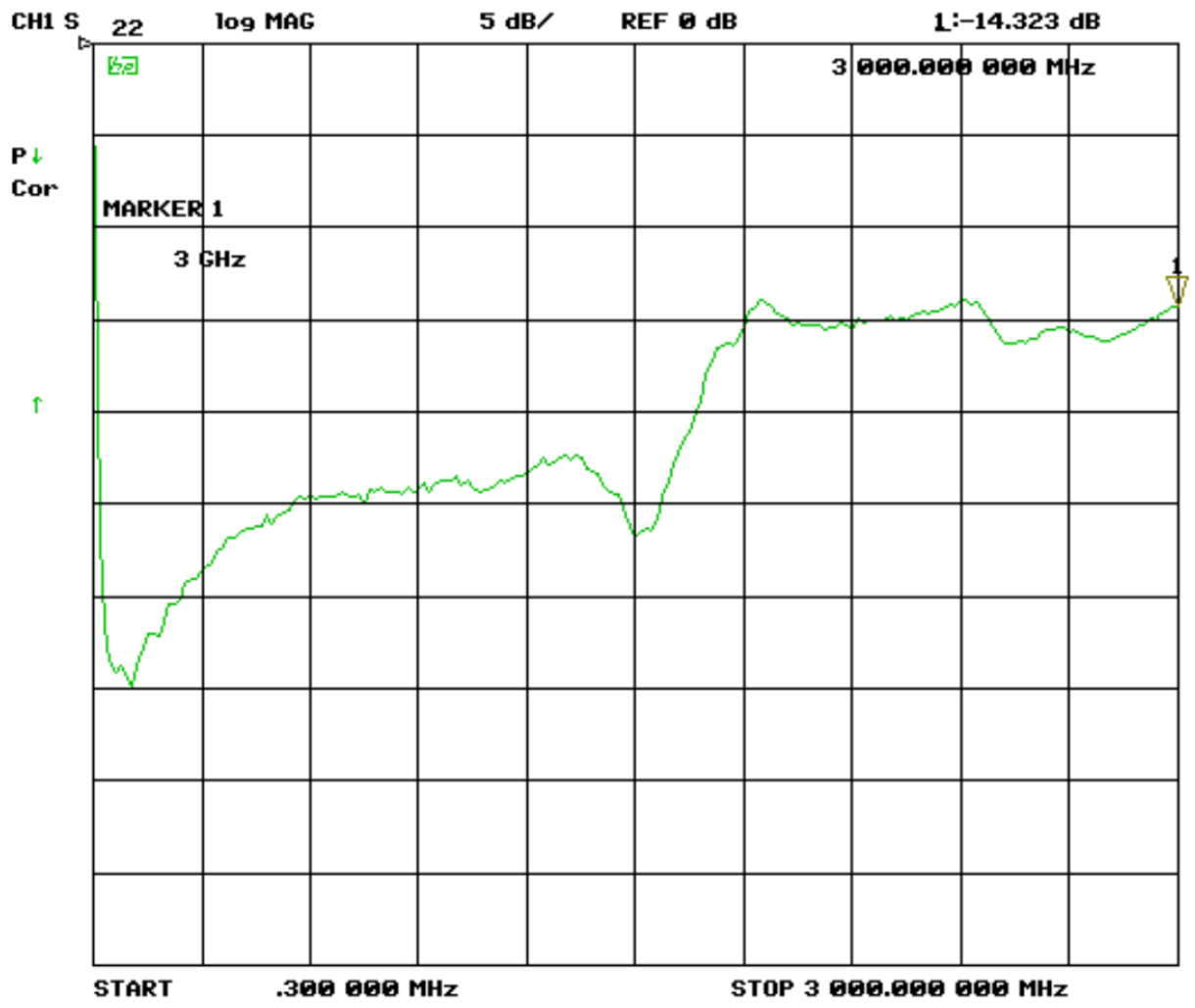

Image 15 - Wideband amplifier output return loss, IS22I 300 kHz to 3 GHz lin.

7 Application

Radiated EMC measurement

RF immunity testing

Contactless (load free) relative measurement of RF signal chains

Contactless (load free) relative measurement of oscillators, modulators, etc.

8 Spectrum analyzer settings

If the probes are used without a wideband preamplifier, set the input attenuation to 0dB and turn on the internal preamplifier, if available on your spectrum analyzer. Furthermore, you can increase the dynamic range and sensitivity by reducing frequency span, resolution bandwidth, and video bandwidth.

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