TECHNICAL NOTE

Subject : Effect of LO Power variation on the performance of GMRT Receiver system

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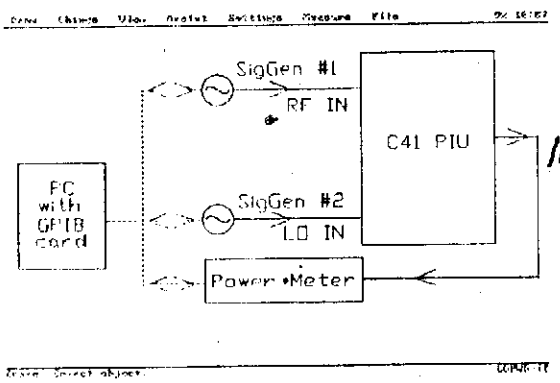
1.0 Introduction:

The GMRT Local Oscillator Synthesiser system produces phase-coherent local oscillator signals at each antenna base in the frequency range of 100 to 1750 Mhz. The block diagram of LO Synthesiser for SYN1 did not include any special circuitry for levelling the power. This was because it was found that the power output of VCOs 1, 2 and 3 as well as gain of various sub-modules used was more or less constant in the frequency range covered. However, in the First prototype of SYN2 released during 1995, the power level was found to have considerable variation, especially beyond 1400 MHz. To solve the problem, a 2-bit RF attenuator was included in an open-loop mode in the Second prototype of SYN2.

This note examines the adequacy of the solution by describing the performance of the C41 PIU of the IF system (which converts the RF signal to a First IF centred at 70 Mhz), when the LO power is varied.

2.0 Set-up to measure performance of C41 PIU of the IF system:

The experimental set-up is as shown. The C41 PIU under test is set to 16 Mhz IF bandwidth and 16 dB pre-attenuation. Marconi SigGen #1, SigGen #2 and Power Meter (≡ Channel A of HP Vector Voltmeter) are controlled through GPIB by a PC. SigGen #1, acting as an RF source is set in CW mode with a constant power of -30 dBm at frequency $F_{RF} = F_{LO} - 70$ Mhz. F_{LO} is varied in steps of 100 Mhz, from 100 to 1800 Mhz using SigGen #2. At each LO frequency step, the LO power is varied from +5 dBm to +13 dBm in steps of 1 dB. The power meter reading at IF frequency of 70 Mhz is recorded.



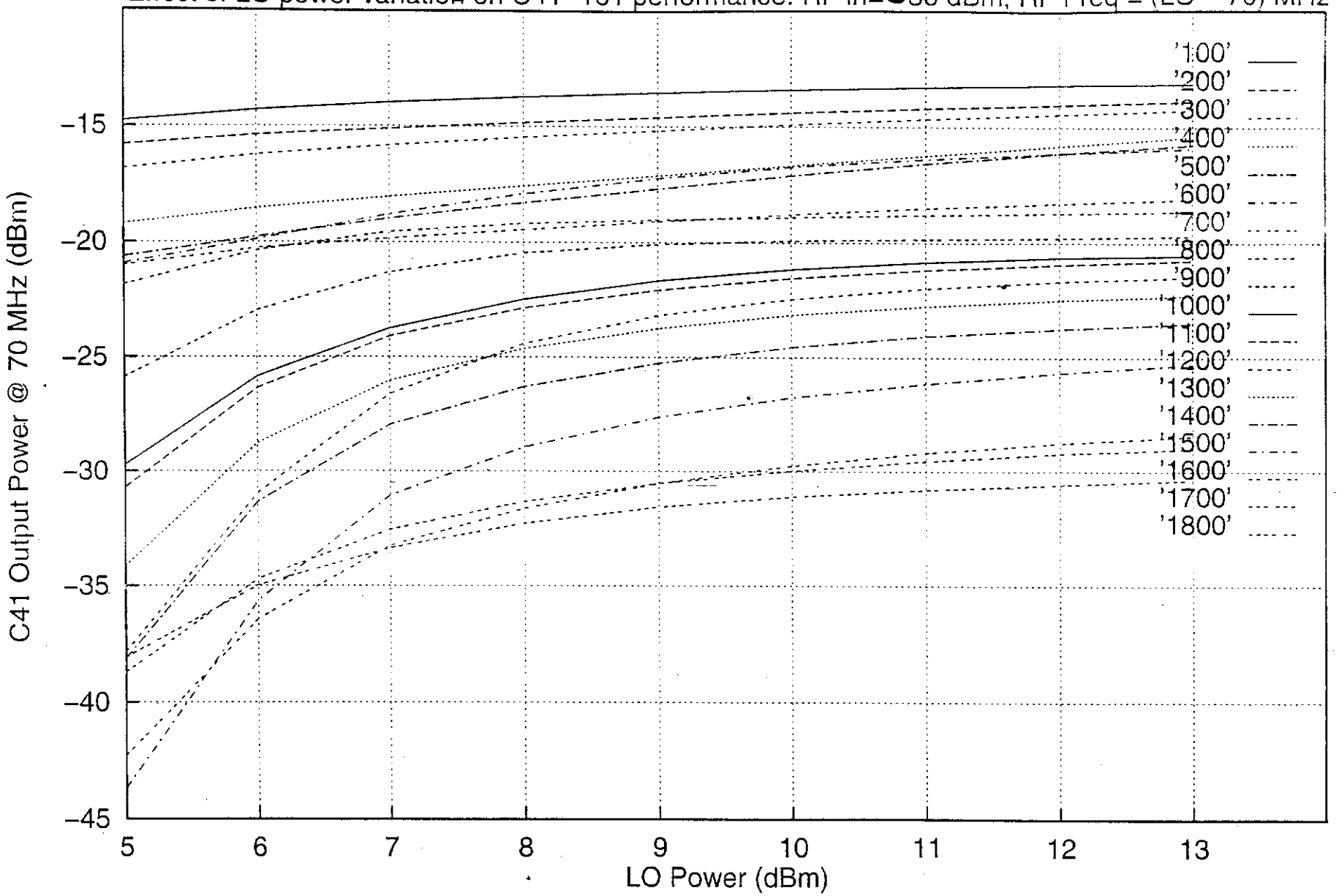
The results for a typical PIU C41-161 has been plotted and is enclosed as Figure 1.

3.0 Inference:

At a given LO frequency, the 'Conversion Gain' varies by around ±1 dB as the LO level is varied by 11 ± 3 dBm. A variation of this order is expected from the First mixer. *Hence, the LO synthesiser power levelling specification is proposed as* ***"BETTER THAN ± 3 dB, AROUND +11 dBm".*** A preview of the measured output power level in a prototype SYN1 + SYN2 system, from 100 to 1750 Mhz, is given in Page 3, which shows that this specification may be achievable.

Note:

From Figure 1, it may be also seen that at a typical LO power level of +11 dBm, the 'Conversion Gain' of C41 PIU decreases by ~16 dB, as the LO frequency increases from 100 to 1800 Mhz. This is due to the increased conversion loss of the First mixer (SRA 2010MH) and the decreasing gain of amplifier stages preceding it (MAR 3), as frequency is increased. *This variation must be appropriately compensated by choosing proper values for pre- and post- attenuator, so as to get the same power output from the ABR system independant of the observing RF frequency.*



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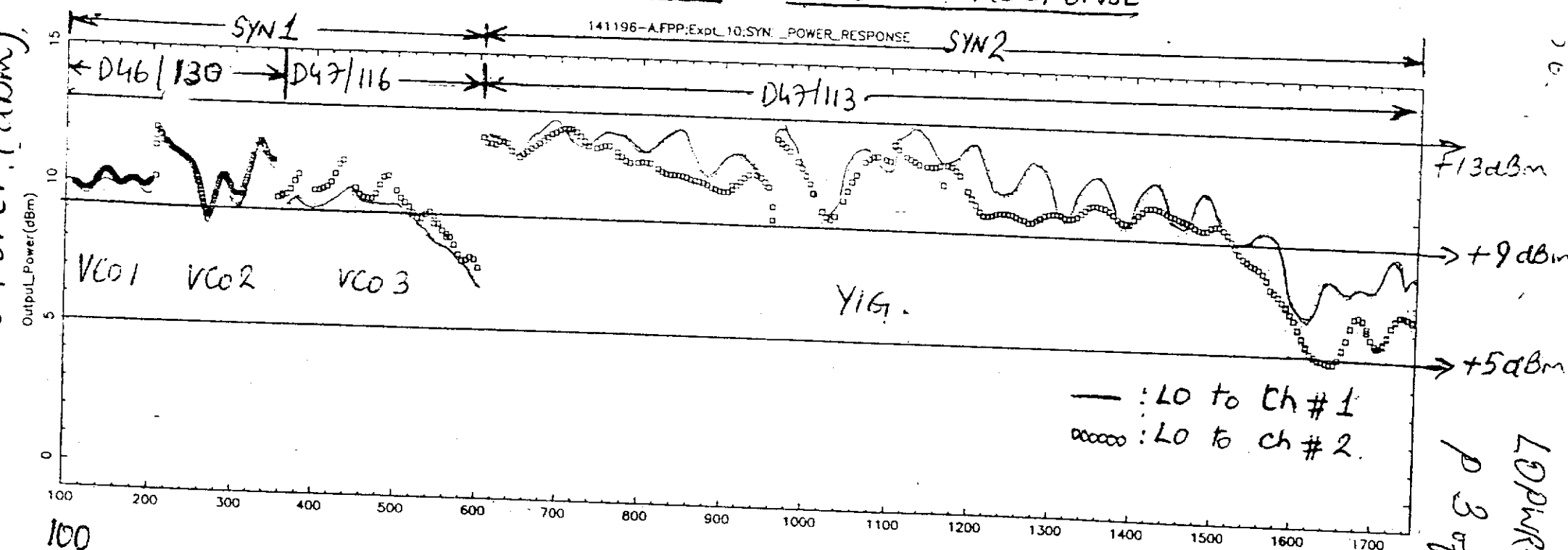
LO SYNTHESISER POWER RESPONSE



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