



TIFR-NCRA-GMRT

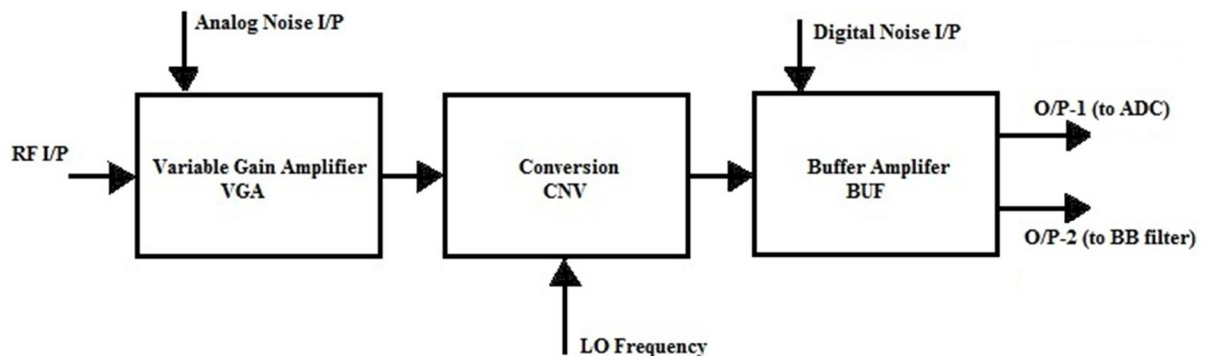
Internal Technical Report on GAB attenuator test

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Sudhir Phakatkar

Introduction: In the upgraded GMRT; GAB (GMRT Analog Backend) system; Analog Receiver PIU (plug-in-unit) is having the facility of controlling the power of RF signal by using variable attenuation. Controlling is required as, RF signal from each antenna may have variation in power level, and hence for delivering the unique output power level by GAB receiver to ADC system, equalization is done by the same unit. For this purpose an IC, HMC 472 LP4 (Hittite make) is used, by which RF power can be controlled from 0 to 31.5 dB ranges with 0.5 dB step size in the VGA (Variable Gain Amplifier) chassis. The IC is operated by six bit TTL controls.

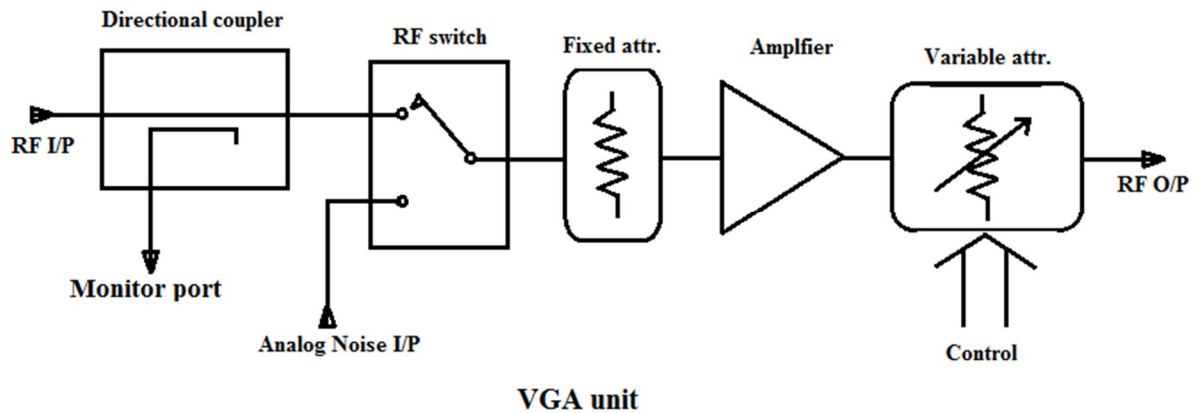
Following block diagram explains about GAB receiver PIU.



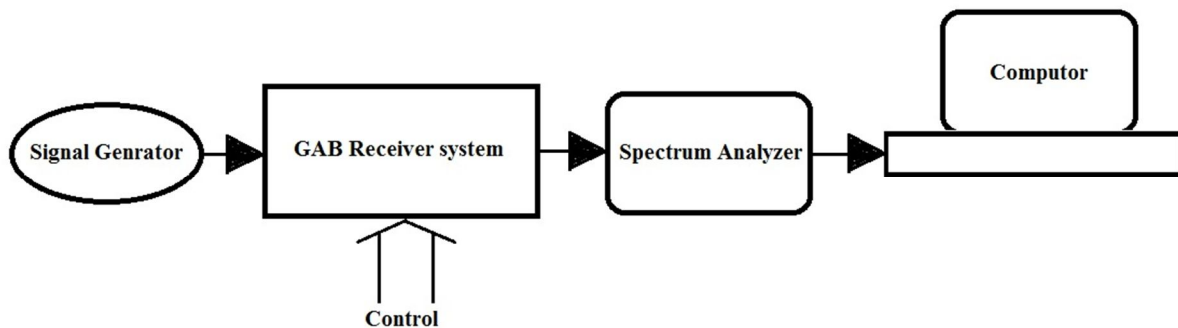
Block diagram of GAB Analog receiver PIU

Description: GAB receiver is designed to deliver -15 dBm power levels (maximum -12 dBm) to input for ADC of co-relator system. Expected Front End RF signal power level from each antenna is -25 dBm. But as per expectation there may be the variation or exact output is not possible due different antenna/units characteristics or with respect to time, temperature or frequency. Even though, there is variation in the antenna output, ADC requires steady power level (i.e. -15 dBm.) as input. Hence the provision is made in the GAB system's Analog Receiver PIU by providing the variable attenuation module in the VGA chassis. This module will play the role for power equalization for GAB system. By the process of power equalization, understanding the variation in the receiver of GAB and doing the study of each antenna performance becomes easy.

Following schematic explains about the VGA unit.



Aim of the test: A test has been carried out to study the variation of attenuation values for different status as follows; 1) Four different input single tone frequencies (200 MHz, 600 MHz, 1000 MHz & 1400 MHz considering as RF band freq.) at three different power levels (-20 dBm, -25 dBm & -30 dBm) 2) A Single PIU performance at same settings in different time span.



By conducting such a various tests, it will be easy to understand the measured attenuation and error in the set values for different; input RF signals as well as input power levels and and time period.

Test Set-up:

Test set up used for attenuator test is existing GAB system with separate GPIB control by feeding single tone frequency as RF input and data recording is done in the PC. RF input was provided by signal generator (Model Rodhe & Schwarz SMA100) and output was recorded at spectrum analyzer (Model Rodhe & Schwarz FSV) Local Oscillator frequencies were used of LO synthesizer PIU connected to GAB receiver as default system.

The test procedure is done using programmed controlling which is usually used for characterization of the system.

Test details:

Conducted tests are as following ways.

- 1) Different input single tone frequencies as RF (200 MHz, 600 MHz, 1000 MHz & 1400 MHz at different power level values i.e. -25.0 dBm, -25.0 dBm & -30.0 dBm.
- 2) One PIU at above settings in different time slot.

Results:

- 1: For the all input RF frequencies performance is linear for -20 dBm & -25 dBm power level in full attn. stepping.
- 2: For 1.4 GHz input RF frequency performance becomes nonlinear from around 26 dB step onwards for -30 dBm power level.
- 3: Performance of individual PIU for different input RF frequencies is having same difference throughout attn. step range.
- 4: Performance of individual PIU in difference time slot (at different days i.e. 03/10/16, 18/10/16 & 27 /10/16) is maintained stable.

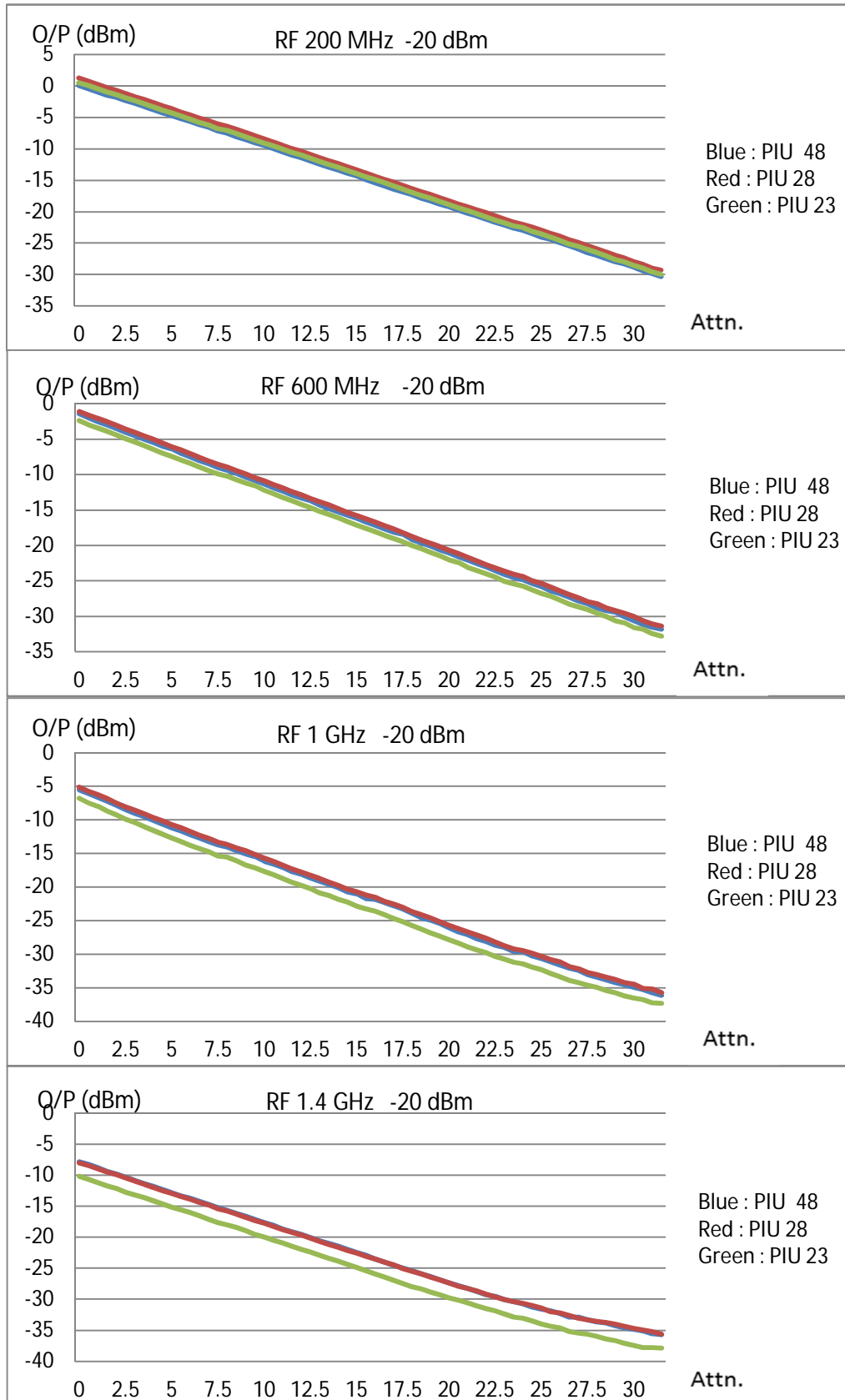
Summary: Performance becomes nonlinear only from 26 dB step onwards for 1.4 GHz frequency at -30 dBm power level.

Future scope: The similar tests can be carried out periodically for same parameters to check reliability performance of the system.

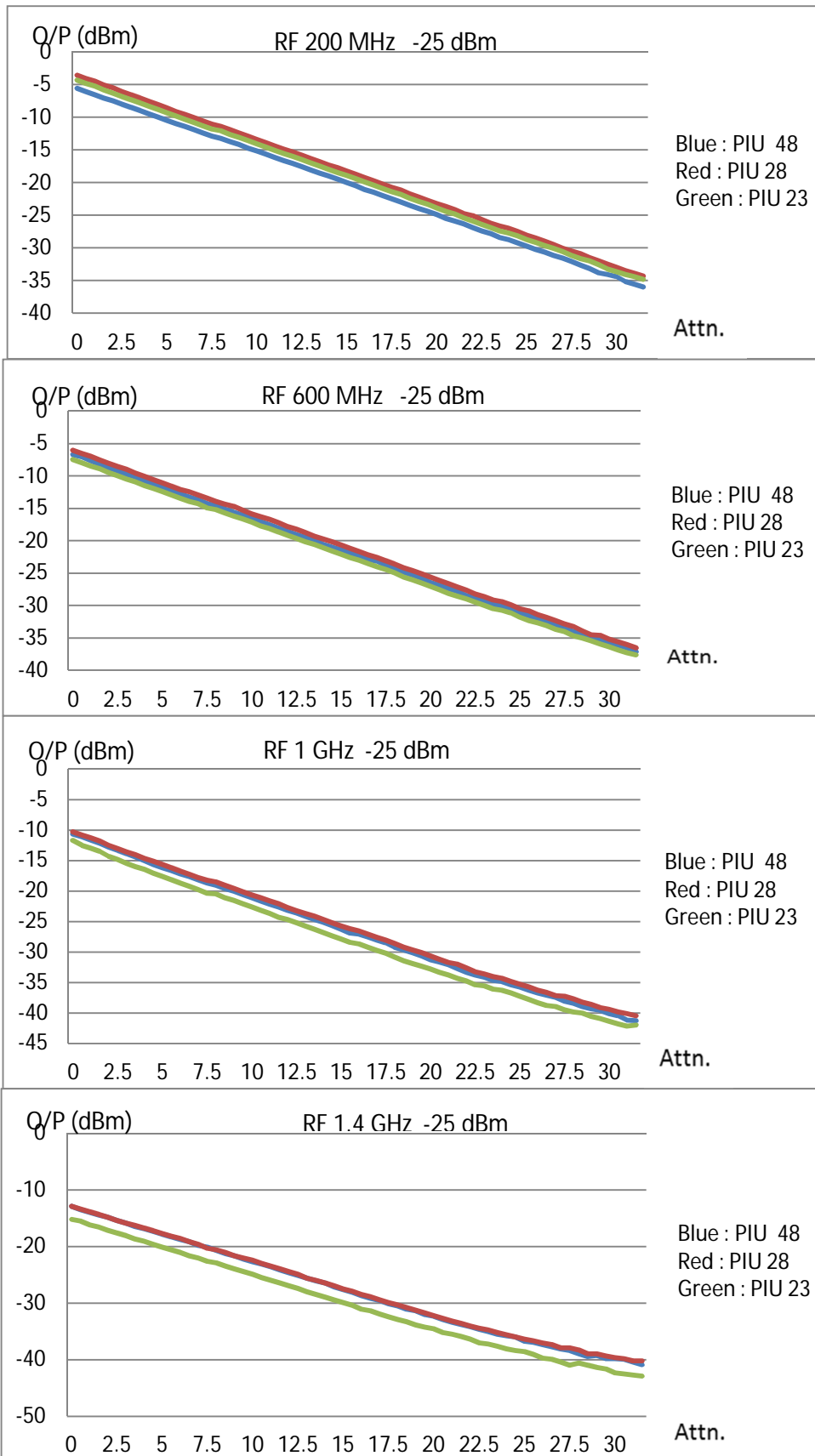
Note: Following pages are containing the plots of

- 1: Different PIUs at -20, -25 & -30 dBm input RF power levels for same frequencies.
- 2: Individual PIUs at -20, -25 & -30 dBm input RF power levels for all frequencies.
- 3: PIU 23 at different days for all frequencies at -20, -25 & -30 dBm input RF power levels

Different PIUs at -20 dBm

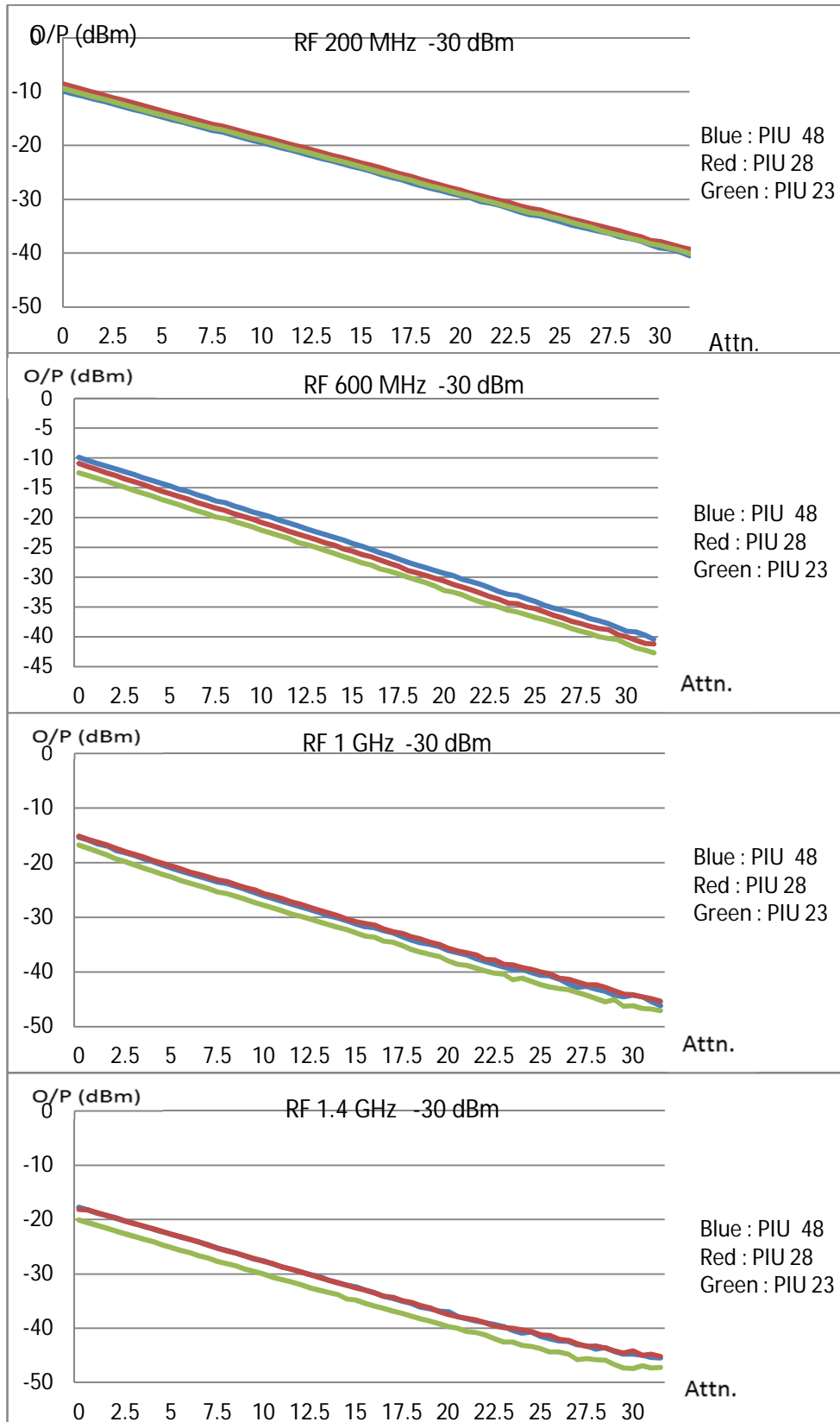


Different PIUs at -25 dBm



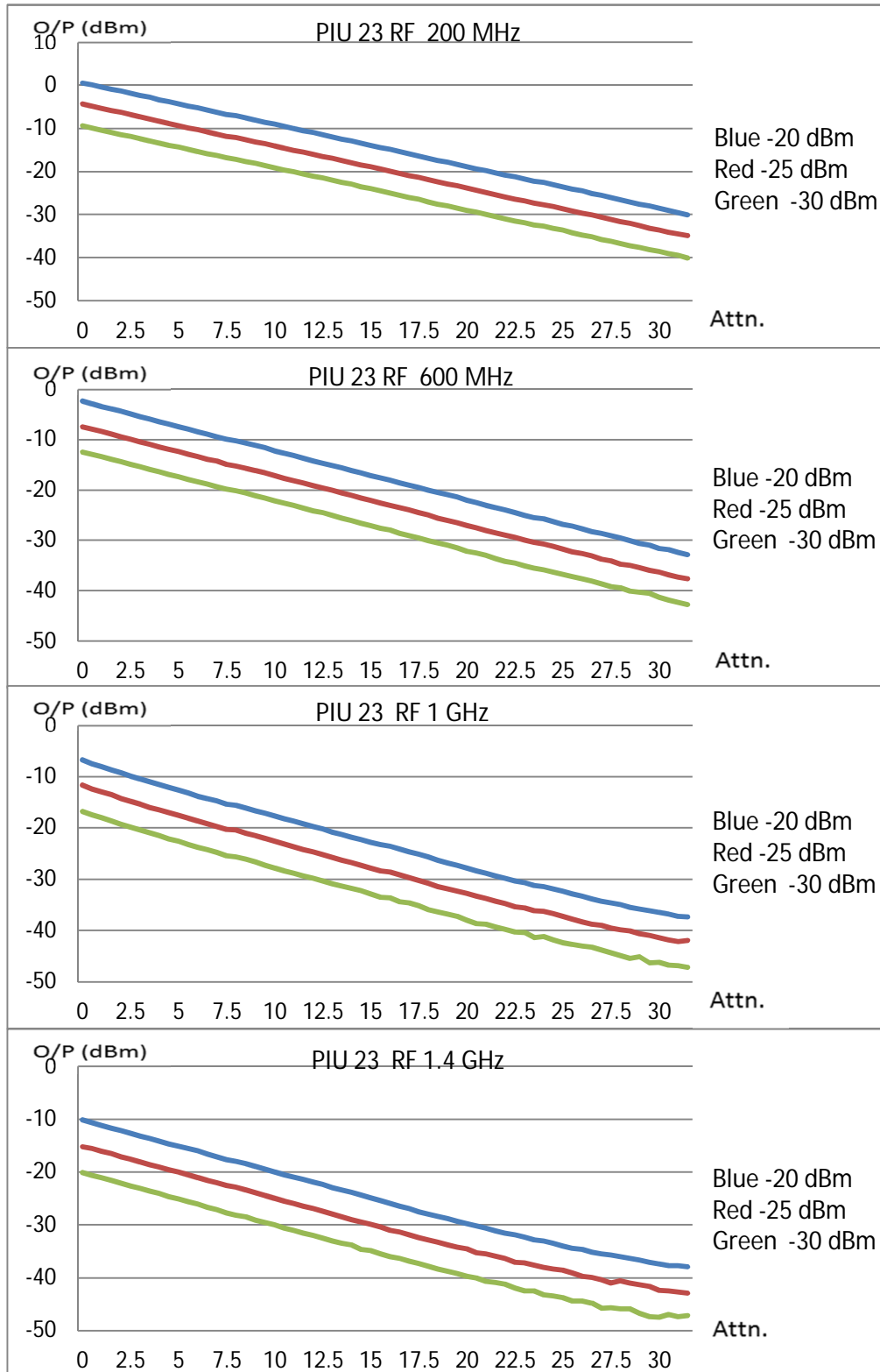
Different PIUs at -30 dBm

(Performance is linear except for RF 1.4 GHz from 26 dB step onwards)



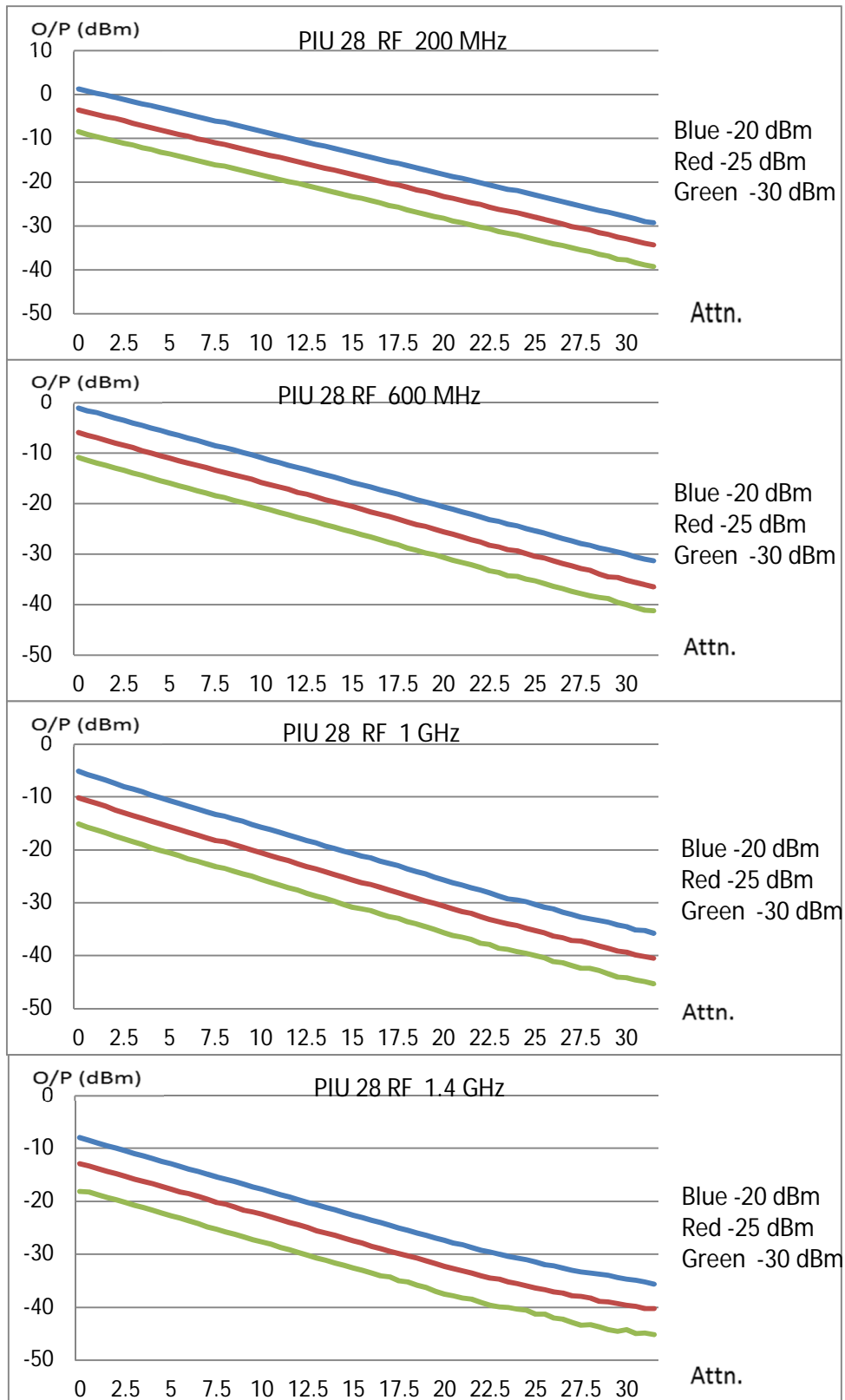
PIU 23 at different I/P RF power levels

(Performance is linear except for RF 1.4 GHz from 26 dB step onwards)



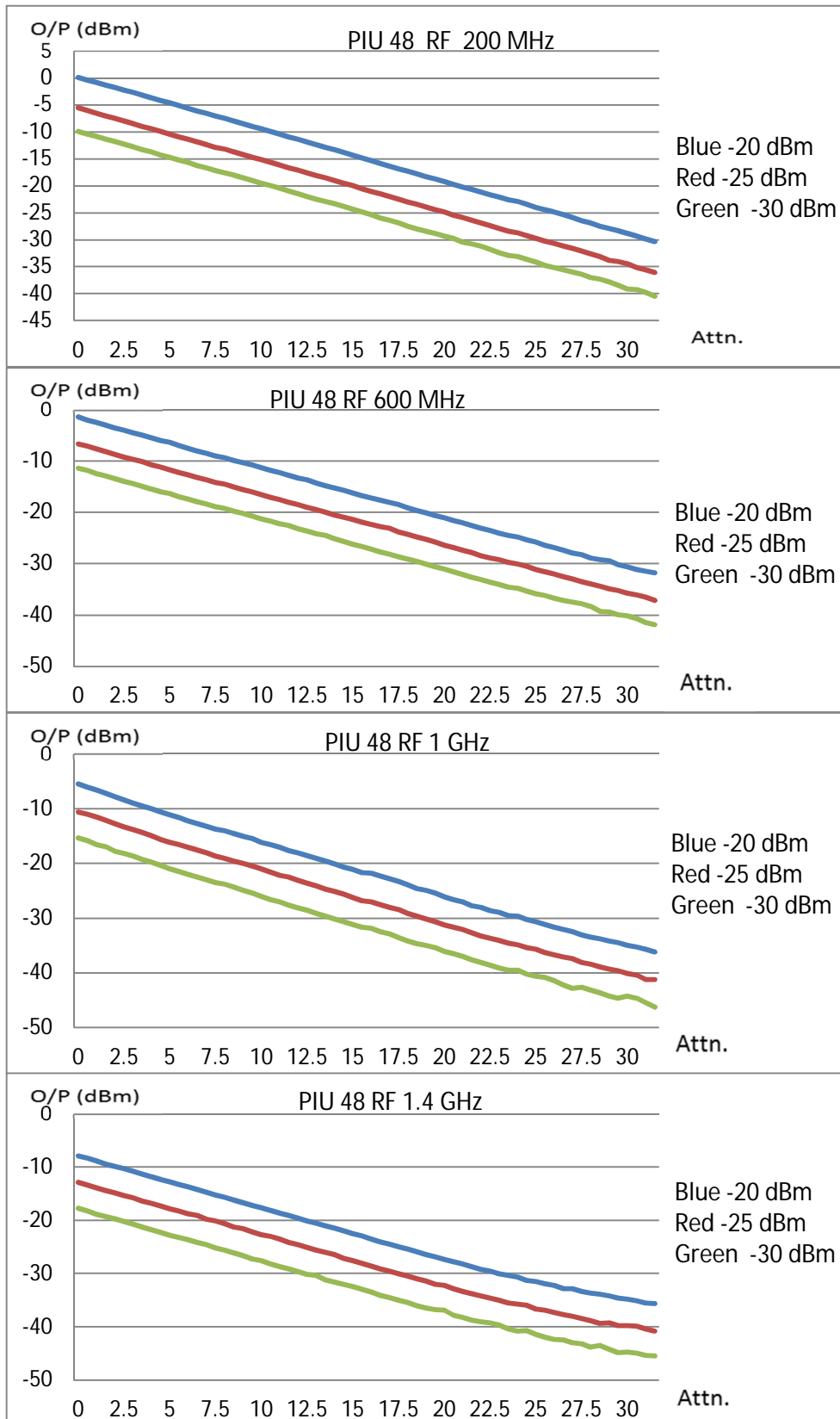
PIU 28 at different I/P RF power levels

(Performance is linear except for RF 1.4 GHz from 26 dB step onwards)

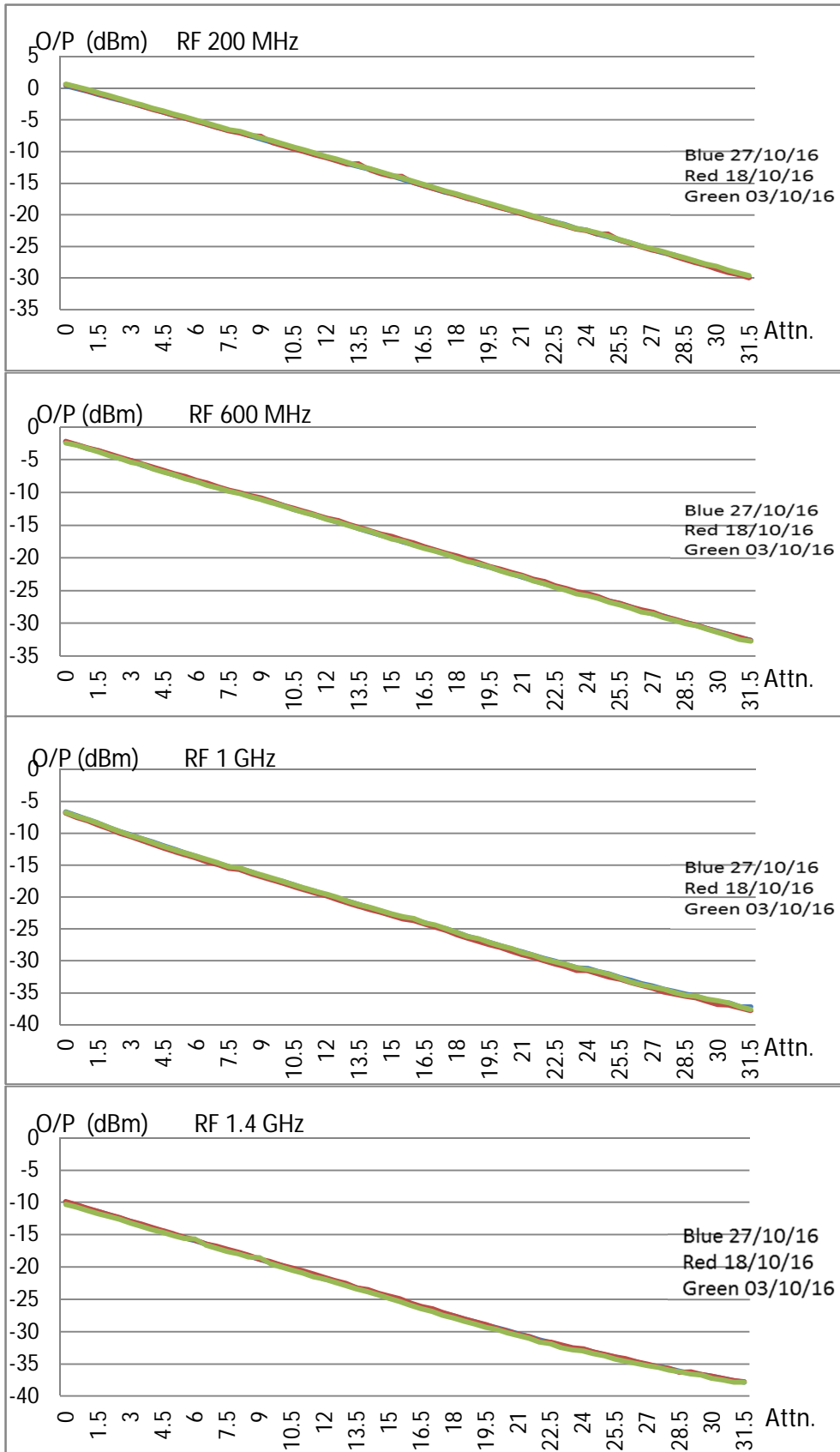


PIU 48 at different I/P RF power levels

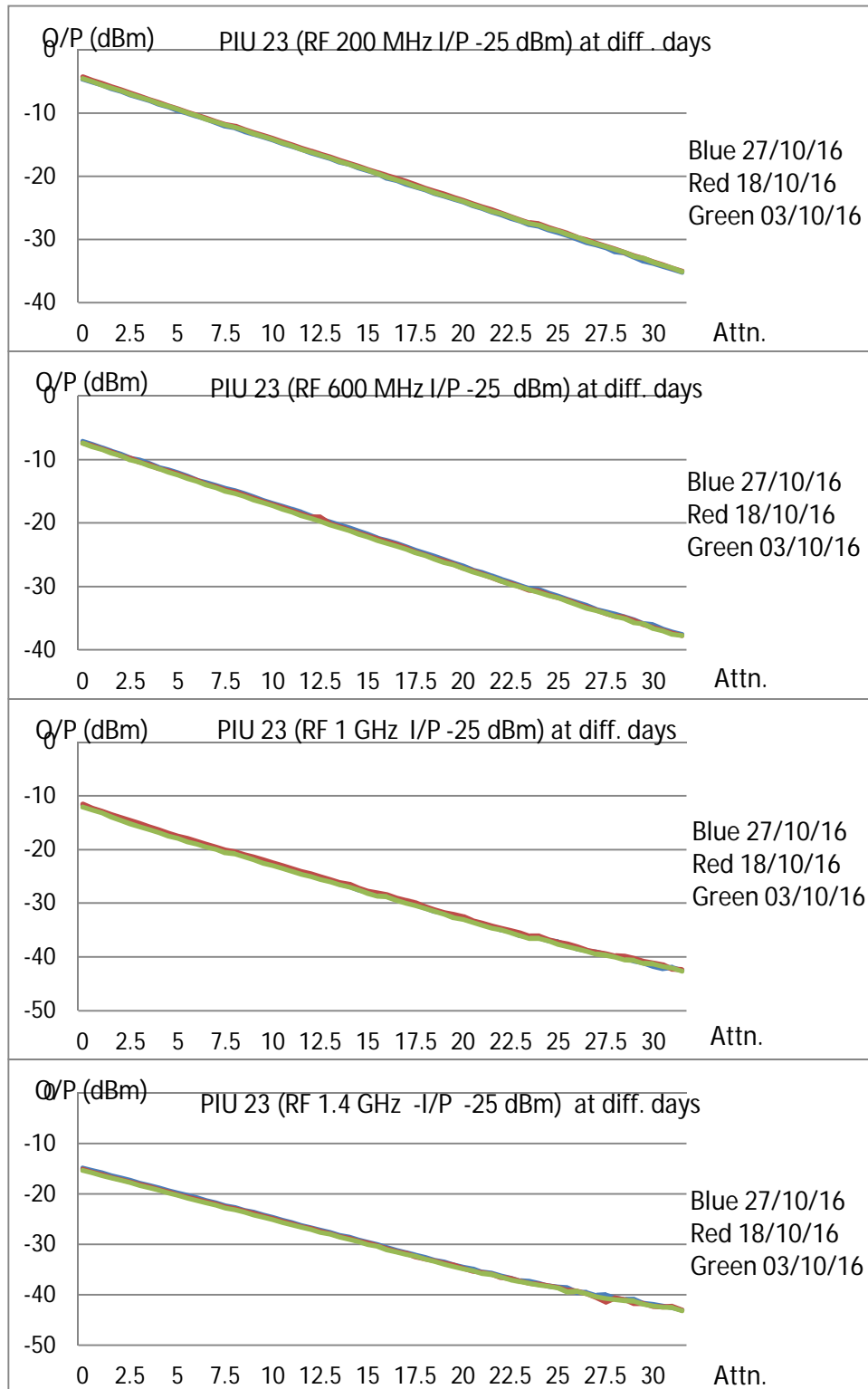
(Performance is linear except for RF 1.4 GHz from 26 dB step onwards)



PIU 23 at different days at I/P -20 dBm



PIU 23 at different days at I/P -25 dBm



PIU 23 at different days at I/P -30 dBm

(Performance is linear except for RF 1.4 GHz from 26 dB step onwards)

