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ABC Company	Doc T/ 2345	Revision 1	Date 5/3/2016
EMC Test System Power Amplifier Checks			
Originator:		Last Revision Date:	5/3/2016

NB: The following actions are suggestions only. All information is given in good faith. The decision to act and any resulting consequential damage howsoever caused is down to you.

Appendices

Appendix A: Staying below the 'No Damage Level' input power of the Analyzer
Appendix B: Measured Data Fill-in Sheet
Appendix C: Previously Recorded Power Amplifier Performance Data

Introduction

This test procedure describes how the small signal performance data of an amplifier is gathered and checked against previously recorded data. This is a fault finding step that establishes the health of the preamplifier. Data is gathered over 5 predetermined spot frequencies. The data is compared with the data in Appendix C.
NOTE: The antenna in the chamber is used as the high power termination. The spot frequencies chosen should be where the antenna / chamber termination is a good match (generally away from the start of the antenna band).

Definitions

Small-Signal Input Level: The small signal level is defined here as the input power level required to achieve 1dB amplifier gain compression **minus** 10dB. For example, if from the amplifier data sheet the input power to achieve 1dB gain compression is established as -5dBm, this level is backed off by a further 10 dB (to -15dBm) to ensure the amplifier is within it's small signal range.

Small-Signal Range: An amplifier is operating within it's small signal range when it is operating in a backed off condition far away from the onset of gain compression.

P1dB Gain Compression: The P1dB gain compression point of an amplifier is a figure of merit stated on the amplifier data sheet. It is the measured output power when the small-signal gain has compressed by 1dB.

No Damage Input Power Level: This is the maximum input power an analyzer should be exposed to. The analyzer will be damaged if this power is exceeded.

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Required Equipment

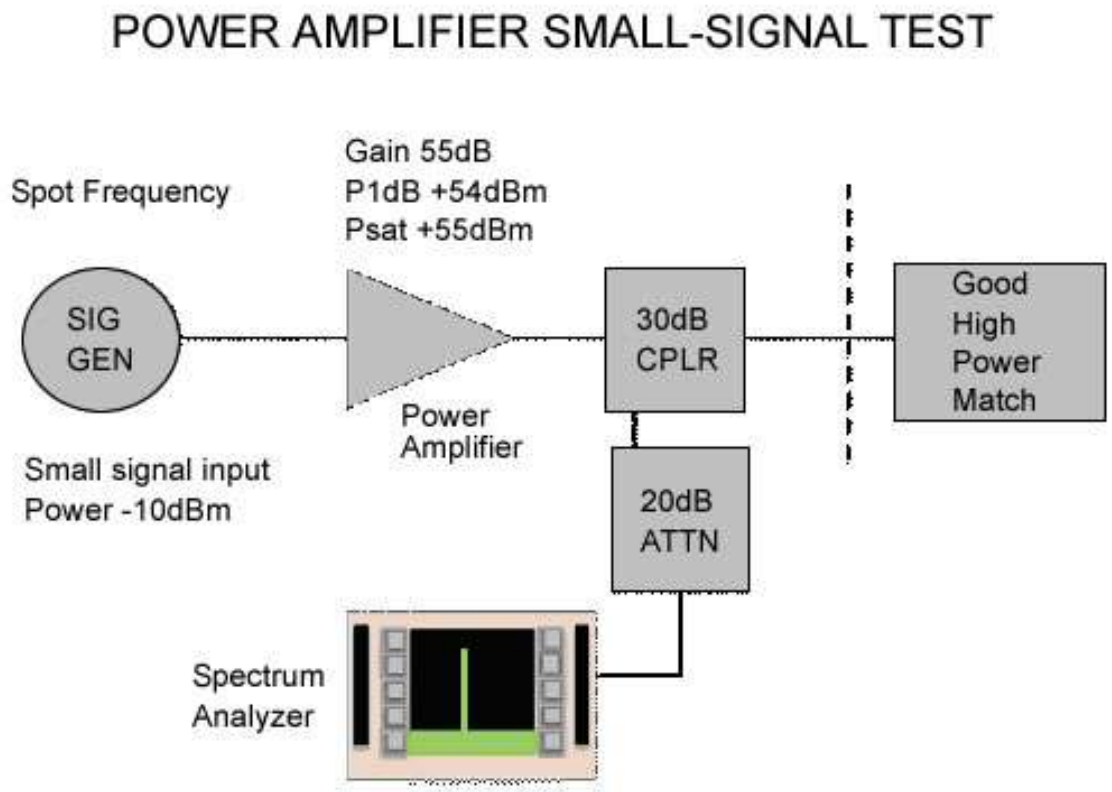
The test set-up is shown at Figure A.

Power Amplifier being tested
Signal Generator
Directional Coupler
Attenuator Type N (20dB, 5 watts)*
Connecting cables
Spectrum Analyzer

*The attenuator value is established as described in Appendix A 'Staying below the 'No Damage Level' input power of the Analyzer'

NOTE: Set signal generator output level to -30dBm BEFORE connecting it to the input of the power amplifier.

FIGURE A



Procedure

For an 80-1000MHz 250W amplifier, the five spot frequencies are 200MHz, 300MHz, 500MHz, 700MHz and 900MHz

Note: In all cases, the input signal is unmodulated, that is, the 80% AM modulation is OFF.

With the signal generator output set at -30dBm and the output set to OFF, set up the test equipment as shown in Figure A.

Set the frequency to the first spot frequency on the fill-in sheet (Appendix B)
Adjust the signal generator output to -10dBm
Set the signal generator output to ON
Measure and record the preamplifier output power on the spectrum analyzer (in dBm) (allow for the attenuation in the signal path by putting in the necessary offset)
Repeat the test for all spot frequencies

Compare the data to the previously recorded data (Appendix B). If the data is within +/- 1dB, the preamplifier is healthy.

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APPENDIX A

Staying below the 'No Damage Level' input power of the Analyzer

Introduction

This appendix gives examples in how to select the test system attenuation so the spectrum analyzer is not damaged, and how to establish the input power to the amplifier for small signal operation.

In these examples an amplifier with the following specifications is being tested (the data is taken from the amplifier data sheet)

Frequency Range	80-1000MHz
Output Power [1]	250W
Gain [2]	55dB
P1dB [3]	54dBm (approx 250W)
Psat [4]	55dBm (approx 320W)

Note 1: This is a nominal value
Note 2: This is the small signal gain
Note 3: This is used as a reference point (back off 10dB from P1dB level for small signal operation)
Note 4: This is the minimum saturated power the amplifier produces

Establishing the 'No Damage' Attenuation

Please refer to Figure 1. Note that in the absence of a suitable high power termination, the 'good match' can be the antenna / empty chamber combo. If the combo at a proposed spot frequency does not present a good match, replace the frequency with a nearby one that does. The power at the reflected power connector of the coupler should be measured to ensure a good match exists. A good match for these health check purposes is a VSWR of 3:1 or less (25% reflected power or less).

To protect the input of the spectrum analyzer the total attenuation must permit no more than +10dBm through (or whatever maximum limit a particular analyzer / instrument specifies) when the amplifier is producing maximum power.

So basically, the coupling factor of the coupler and the attenuator between the coupler and the analyzer input must reduce +55dBm (amplifier maximum power) to no more than +10dBm. Therefore the combined attenuation must be +55dBm minus +10dB = 45dB. In the case of a coupler with 30dB coupling factor, a further 15dB of attenuation must be provided by the attenuator in Figure 1. The specified saturated power is a minimum, so as a safety factor a 20dB attenuator is used.

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Establishing the Small Signal Operation Input Level

A rule of thumb is that the amplifier should be running at it's P1dB level minus 10dB. To establish the approximate signal generator output power that achieves this, we subtract the specified small signal gain from the P1dB level in the data sheet. That is we subtract 55dB [1] from +54dBm and get a signal generator level of -1dBm. We now subtract the rule of thumb 10dB to get -11dBm. This is used as the test level for all 5 spot frequencies.

Note 1: Strictly speaking the small signal gain has compressed to 54dB at the P1dB level, but this is a minor matter, so for our purposes we will just use the stated 55dB.

-END-

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APPENDIX B

Measured Data Fill-in Sheet
