

ANNEX A3 : Emission Limitations (ACCP)

NAME OF TEST: Adjacent Channel Coupled Power for digital modulation of the Dataradio AMP 70W PA.

RULE PART NUMBER: 90.543(a) and (b), 27.53(d)(1)(2)

MINIMUM STANDARD: Wideband 150kHz base transmitter ACCP requirements:

Offset from Center frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACCP Relative (dBc)
100....	50	-40
200...	50	-50
300...	50	-55
400...	50	-60
600 to 1000.....	30 (swept)	-65
1000 to receive band	30 (swept)	-77
in the receive band	30 (swept)	-100

UNIT UNDER TEST Pre-production AMP 70W PA module in 700 MHz band

TEST RESULTS: Meets minimum standard (see test data on the following pages)

TEST CONDITIONS: 90.543(b) was the standard procedure followed through the test. The instruments have Channel Power over BW measurement built-in software. Input signal from T881 4W transmitter modulated by P3 base station controller modem at 128000 bps 16FSK. Standard Test Conditions, 25 °C.

TEST EQUIPMENT: Notch filter, characteristic supplied
Attenuator, BIRD Models: 150-A-MFN-30, and 150-SA-FFN-10 all 150 Watt
attenuation 30dB, 10dB
Attenuator Pasternak model PE7015-6, 5W 6dB
Splitter Mini Circuits model ZFSC-2-4
DC power source for UUT model TaitT809-10 13.8V/30A
Spectrum Analyzer, Model Agilent E4401B
Communication analyzer IFR COM 120B - power meter function with IF filter
set to 300kHz BW.
HP Benchlink -software for plot captures.

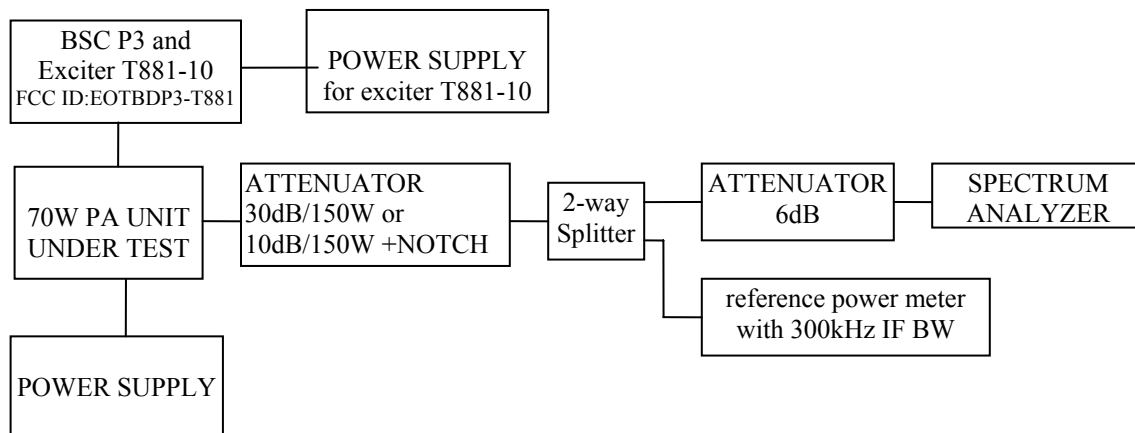
PERFORMED BY:

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DATE: 03/02/05

TEST SET-UP:



NAME OF TEST: Adjacent Channel Coupled Power (Continued)
Dataradio AET 50W PA.

Input RF signal is a 4W 16-level digital FM modulated carrier.

The transmit “test data” pattern command produces a 8,388,607 bit pseudo- random pattern. This pattern is generated by the DSP using the polynomial $X^{23}+X^5+1$ form and a 23-bit shift register. Initial value of the register is 1 (1 hex). The 8,388,607 bit sequence is repeated thereafter as long is necessary to complete the test duration, the initial sequence lasts about 66 seconds at 128 kbps.

This pattern is applied to the DSP modulator for mapping to 16-FSK and pulse shaping with SRRC $\alpha=0.4$. The reference deviation set on 1KHz tone was 8.0kHz, the scaling factor is further applied on data.

Explanations for the 50kHz wideband base station transmitter

As per 90.531(c) there are two band segments that are designated for use with wideband emissions. Each of these wideband segments is divided into 120 channels having a channel size of 50 kHz. Further down in the part 90.531(d)(2) is stated that two or three contiguous wideband (50 kHz) channels may be used in combination as 100 kHz or 150 kHz channels, respectively. Meantime, the specifications for ACCP directly address only the 150kHz base transmitter ACCP requirements with no explicit reference to 50kHz or 100kHz base transmitter ACCP requirements.

For the test purposes the specifications available were interpreted such that the 150 kHz transmitter specifications were considered as applicable to 3 contiguous 50kHz channels which of which has each its own 50 kHz transmitter. Subsequently the rule was applied for the 50kHz transmitter when transmitting on any of the 3-combined channels. Adjacent channel coupled power has also been measured is each of the 50kHz channels immediately adjacent to the non-aggregated 50k in use.

Test results 70W (nominal power, 90.534(a)):

Reference power in the main channel, (90.534(b)(1))

Settings: 150kHz Channel Bandwidth

Test channel, 768.5MHz power read 8.7 dBm

Total RF power is 70W $\Leftrightarrow$ 48.5 dBm, during the test due to the detector in sample mode this can yield a different value. In the set-up there are a 3dB splitter and two attenuation pads of 30+6dB, 40dB is added to the reading of the display to get the absolute value.

Power Level at frequency offsets <600kHz (90.534(b)(2))

Settings: 50kHz Channel bandwidth

RBW=300Hz, Video BW=3kHz, Span=0.85MHz, Sweep = Detector mode: sample

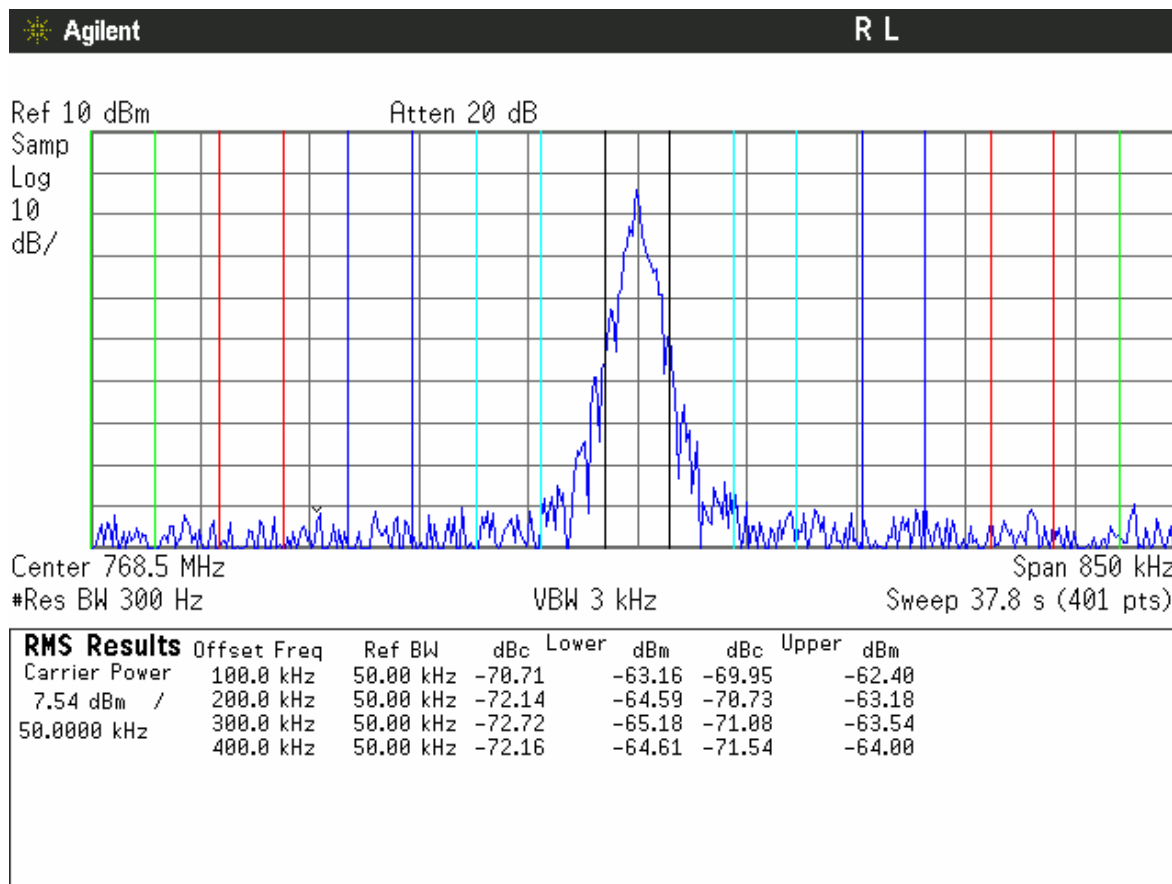
Display resolution (401 display buckets)= 2125Hz,

Reference level +10dBm, 50kHz channel noise=-64.5dBm/50kHz

UUT in center channel of the 150kHz 3-contiguous 50 kHz channels.

Test Channel Frequency 768.500 MHz

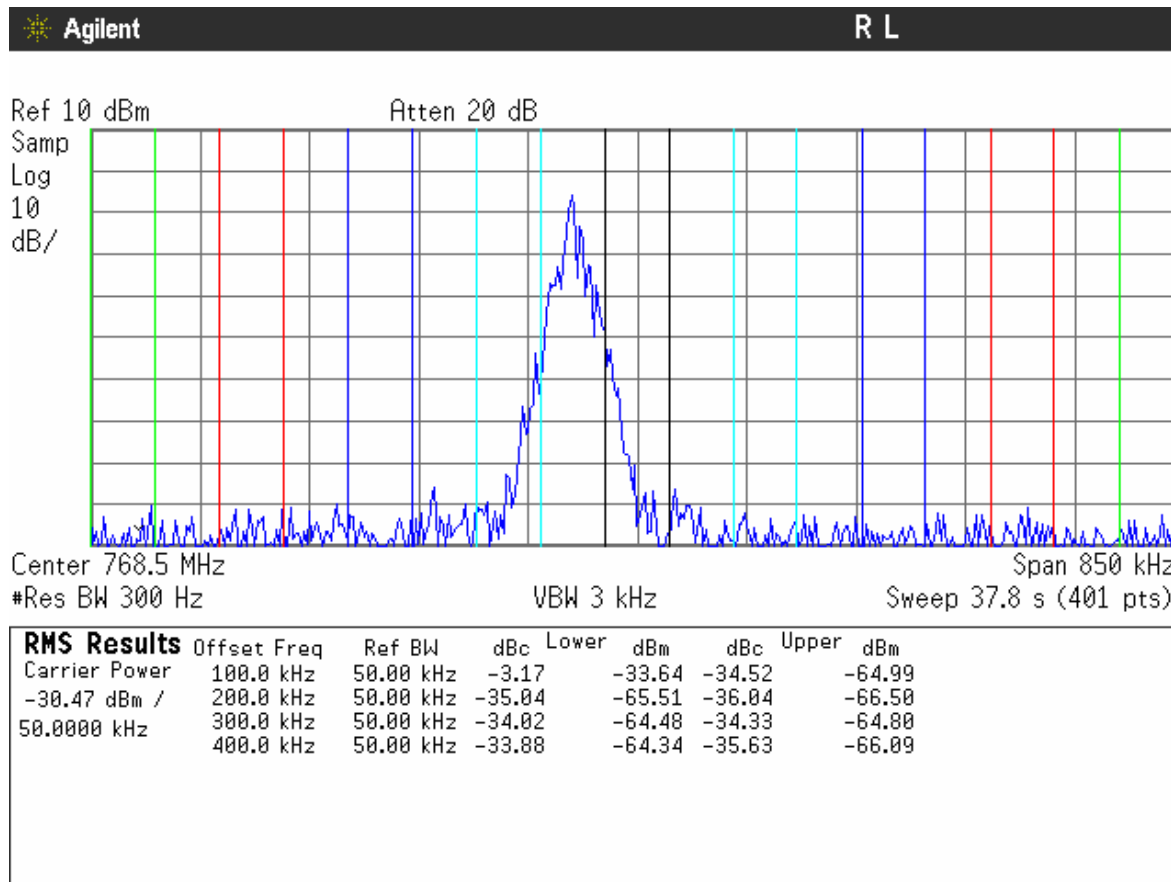
frequency Offset	-400	-300	-200	-100	0	100	200	300	400
Channel Power read (dBm)	-64.6	-65.1	-64.5	-63.1	8.7	-62.4	-63.1	-63.5	-64.0
Absolute channel power (dBm) (read value +40 dB attenuator)	-24.6	-25.1	-24.5	-23.1	48.7	-22.4	-23.1	-23.5	-24.0
ACCP (difference)	-73.3	-73.8	-73.2	-71.8	NA	-71.1	-71.8	-72.2	-72.7



UUT in left channel (-50kHz) of the 150kHz 3-contiguous 50 kHz channels .

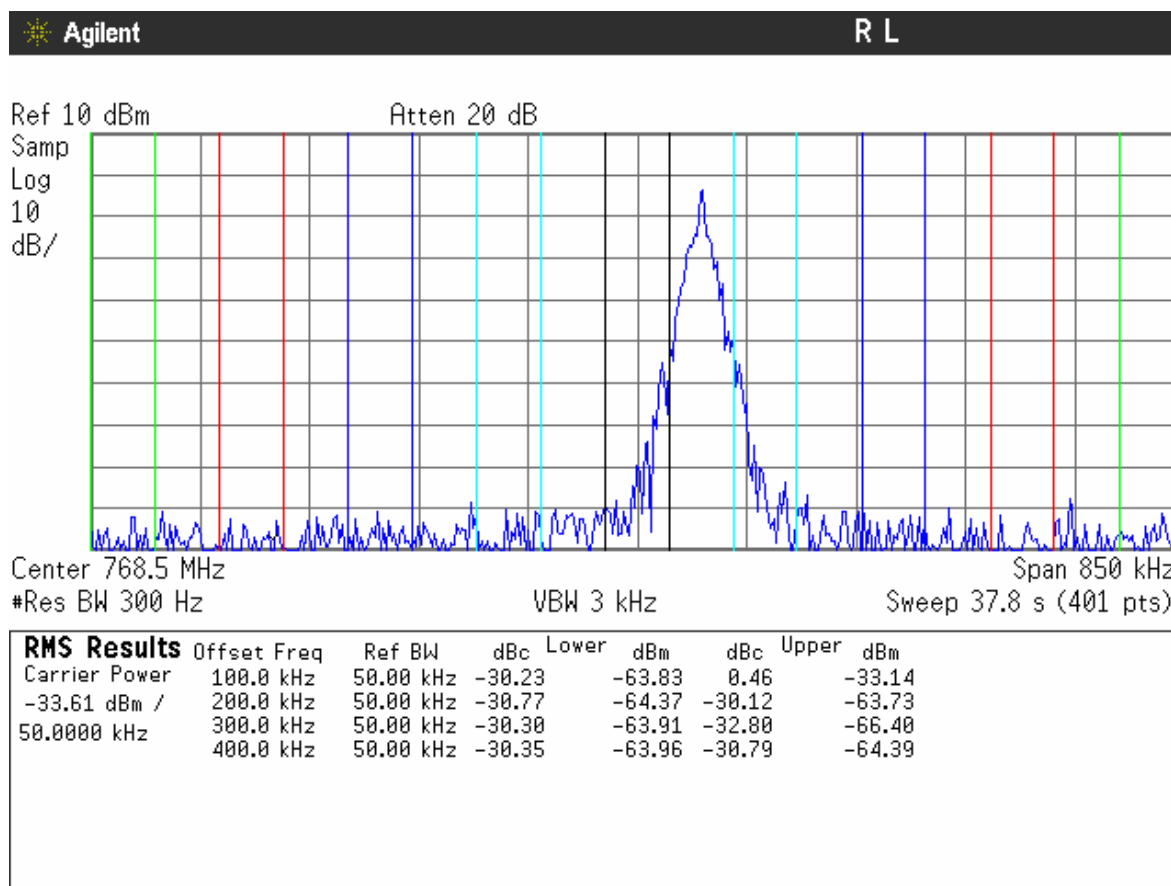
Test Channel -50kHz, frequency 768.450 MHz

frequency Offset to the center channel	-400	-300	-200	-100	0	100	200	300	400
frequency Offset to the unit channel	-350	-250	-150	-50	+50	+150	+250	+350	+450
Channel Power read (dBm)	-64.3	-64.4	-65.5	-33.6	8.7	-64.9	-66.5	-64.8	-66.0
Absolute channel power (dBm) (read value +40 dB attenuator)	-24.3	-24.7	-25.5	6.4	48.7	-24.9	-26.5	-24.8	-26.0
ACCP (difference)	-73.0	-73.4	-74.2	-42.3	NA	-73.6	-75.2	-73.5	-74.7



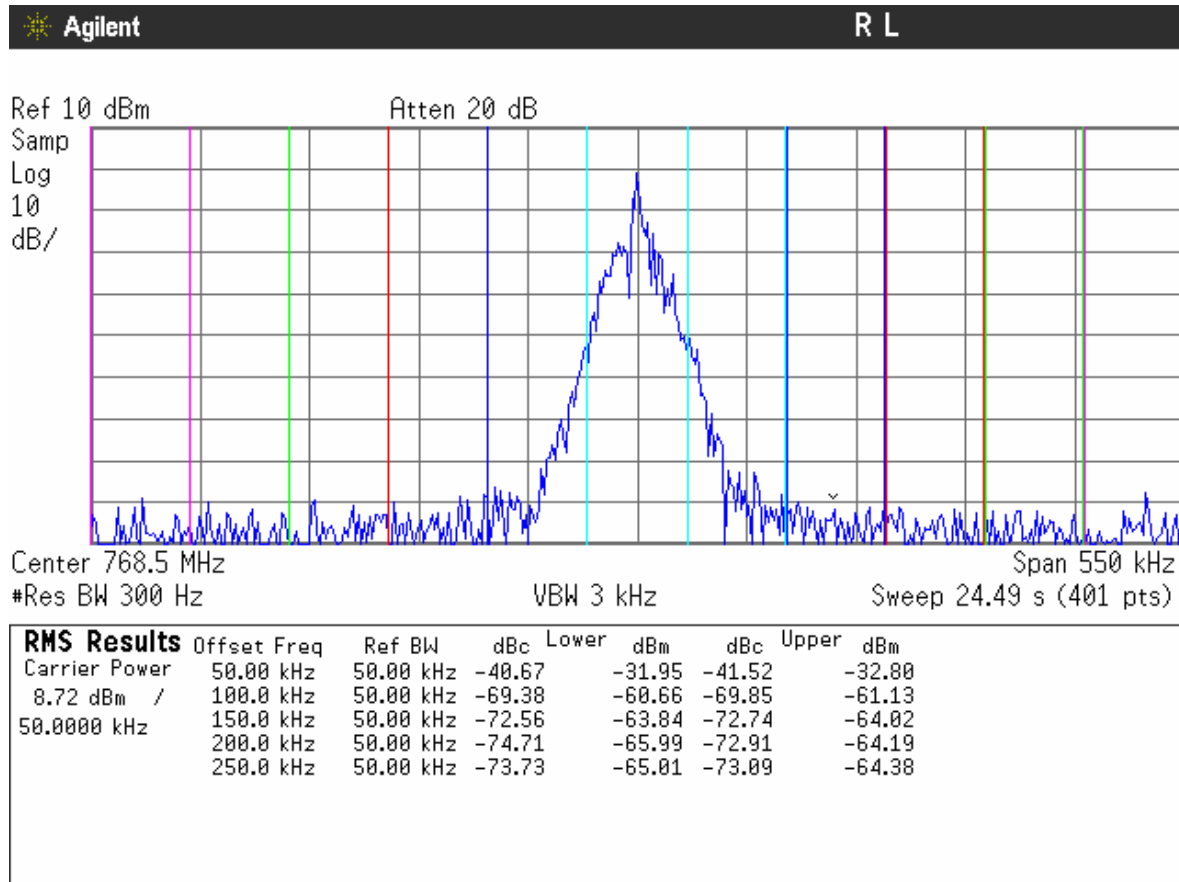
UUT in right channel (+50kHz) of the 150kHz 3-contiguous 50 kHz channels .
Test Channel +50kHz, frequency 768.550 MHz

frequency Offset to the center channel	-400	-300	-200	-100	0	100	200	300	400
frequency Offset to the unit channel	-450	-350	-250	-150	-50	+50	+150	+250	+350
Channel Power read	-63.9	-63.9	-64.3	-63.8	8.7	-33.1	-63.7	-66.4	-64.3
Absolute channel power (dBm) (read value +40 dB attenuator)	-23.9	-23.9	-24.3	-23.8	48.7	6.9	-23.7	-26.4	-24.3
ACCP (difference)	-72.6	-72.6	-73.0	-72.5	NA	-41.8	-72.4	-75.1	-73.0



50 kHz channel (non-aggregated) adjacent channel coupled power.
Test channel , frequency 768.500 MHz .All power readings on 50kHz channel

frequency Offset to the center channel	-250	-200	-150	-100	-50	0	+50	+100	+150	+200	+250
Channel Power read (dBm)	-65.0	-65.9	-63.8	-60.6	-31.9	8.7	-32.8	-61.1	-64.0	-64.1	-64.3
Absolute (dBm) channel power	-25.0	-25.9	-23.8	-20.6	8.1	48.7	7.3	-21.1	-24.0	-24.1	-24.3
ACCP (dBc) (difference)	-73.7	-74.6	-72.5	-69.3	-40.6	NA	-41.4	-69.8	-72.7	-72.8	-73.0



Power Levels at frequency offsets >600kHz (90.534(b)(3))

- **frequency offsets between 600kHz and 1000 kHz**

Settings

Set-up attenuation: 2 attenuators 30dB+6dB and 1 splitter, 2MHz span picture, attenuation for 600kHz-1MHz offsets between 39.9 dB and 40.3 dB(worst case).

Spectrum analyzer: RBW=30kHz, Span=2.03MHz, Display resolution (401 display buckets)= 50kHz

Detector mode: RMS; Instrument's noise floor for 10dBm reference level -71.8dBm/30kHz (density noise =116.4dBm/Hz), instrument's noise floor including the setup attenuation: -34.5dBm/30kHz

Test data:

Data spectrum was swept for the 30kHz channel power at frequency offsets between 600kHz and 1MHz. All the power channel read was below -63dBm/30kHz, after the correction of the 41dB (worst case across the span) inserted by the attenuators in the set-up, the absolute channel coupled power was found lower than -22dBm for a CW power of 48.5dBm.

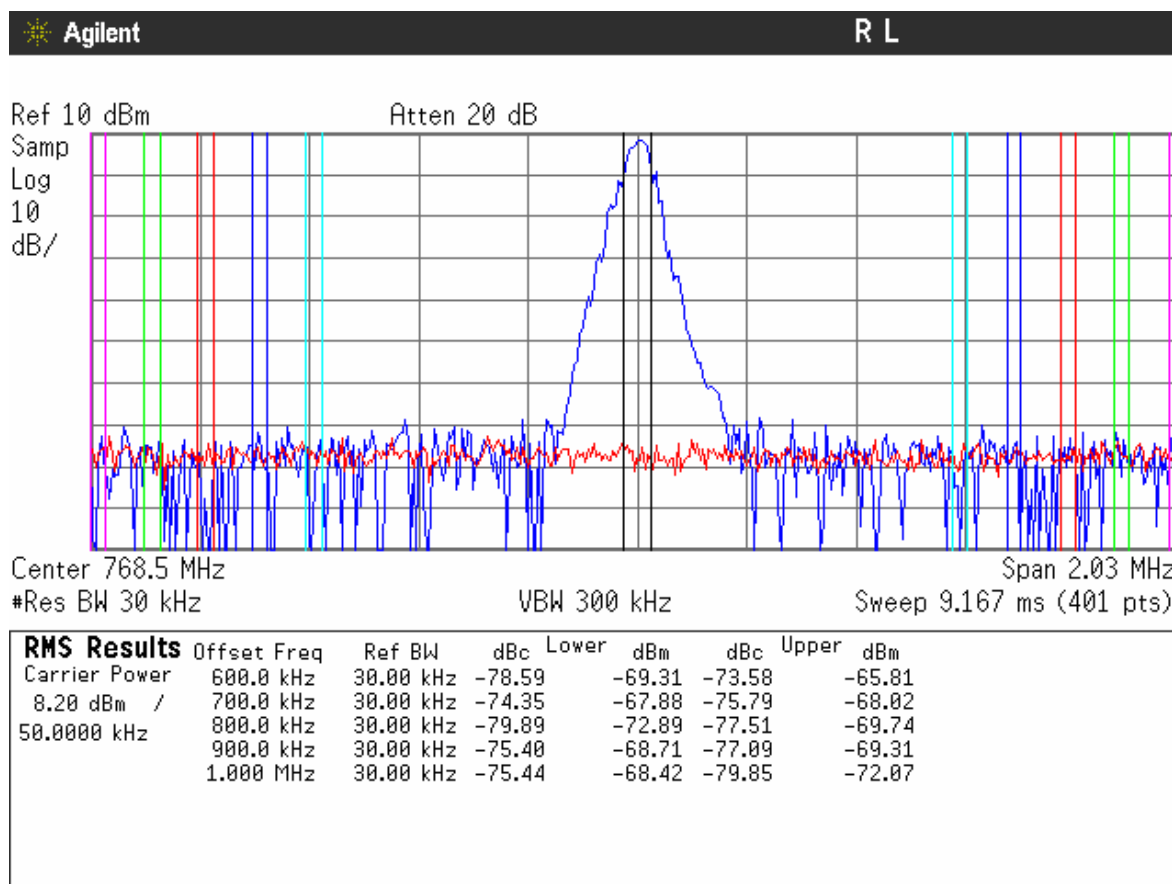
Relative channel power is -22.0-48.5=-70.5dBc

The value required for maximum relative ACCP = -65dBc >-70.5dBc readings

On the plot capture below:

blue: normal mode of UUT's data

red: peak hold mode of instrument's noise



- frequency offsets between 1MHz and the lowermost receive frequency**

Notch filter: 2 cavities, notch attenuation for 1MHz-29.5 MHz offsets (769.5MHz to 797MHz) decreases between 30dB and 0.8dB. Setup attenuation adds 17dB attenuation before and after the notch filter, overall set-up attenuation decreases between 47db and 17.8db.

Spectrum analyzer: RBW=30kHz, Span=600kHz, Display resolution (401 display buckets)= 1.5kHz Detector mode: sample; Instrument's noise floor for -30dBm reference level -101.0dBm/30kHz (density noise =145dBm/Hz)

For frequencies between 769.5MHz and 770.5MHz the value of the couples power over 30kHz channel read was below -80dBm/30kHz, its absolute value corrected with the set-up attenuation (worst case 47.5dB) is below -32.5dBm/30kHz.

For frequencies between 770.5MHz and 771.5MHz the value of the couples power over 30kHz channel read was below -74dBm/30kHz, its absolute value corrected with the set-up attenuation (worst case 38.0dB) is below -36.0dBm/30kHz.

For frequencies between 771.5 MHz and 797.0 MHz the value of the couples power over 30kHz channel read was below -63 dBm/30kHz, its absolute value corrected with the set-up attenuation (worst case 31.0dB) is below -32.0dBm/30kHz.

Across the band the value of maximum absolute ACCP = -32.0dBm/30kHz bandwidth.

The relative ACCP is -32.0dBm-48.5dBm = -80.5dBc

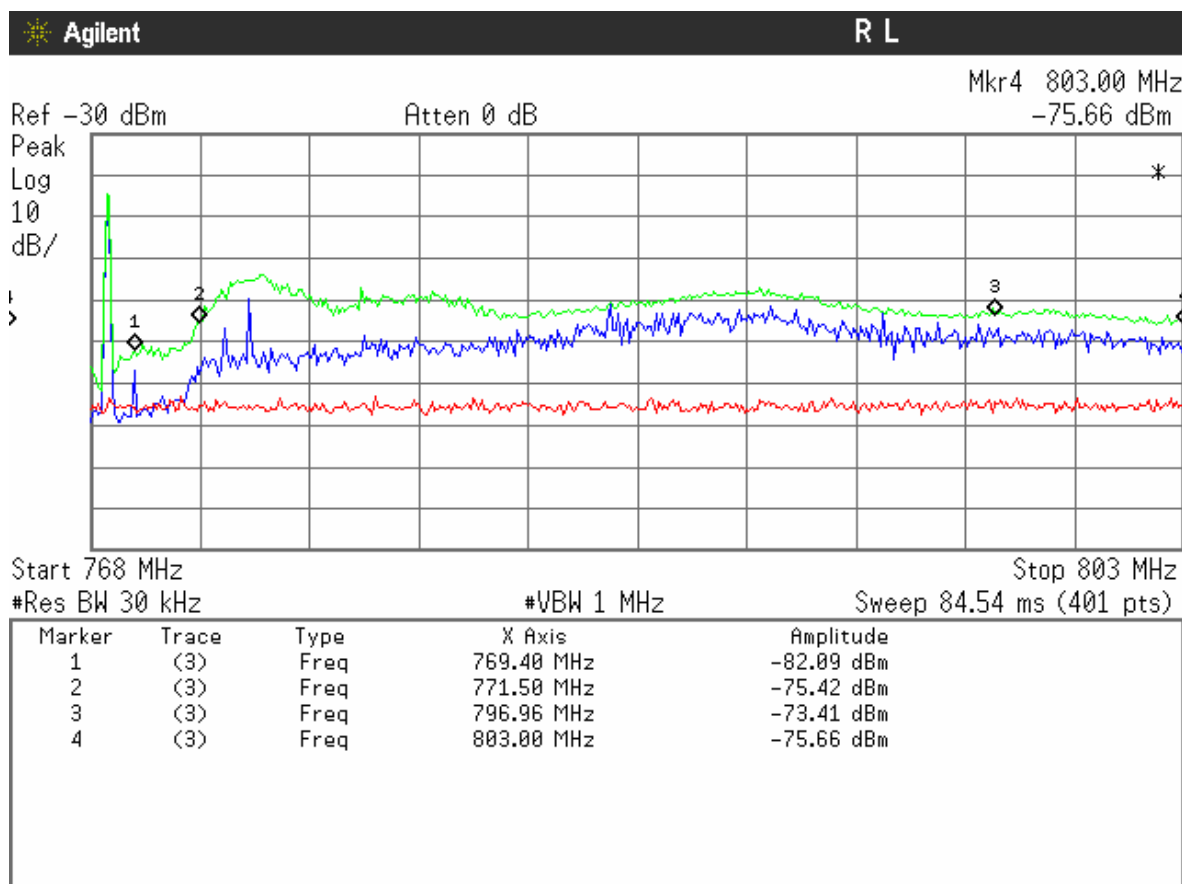
The value required for maximum relative ACCP = -77dBc > -80.5dBc (vs +48.5dBm carrier)

On the plot capture below:

red – peak hold of the noise floor of the instrument for the set-up

blue – normal mode trace of the UUT

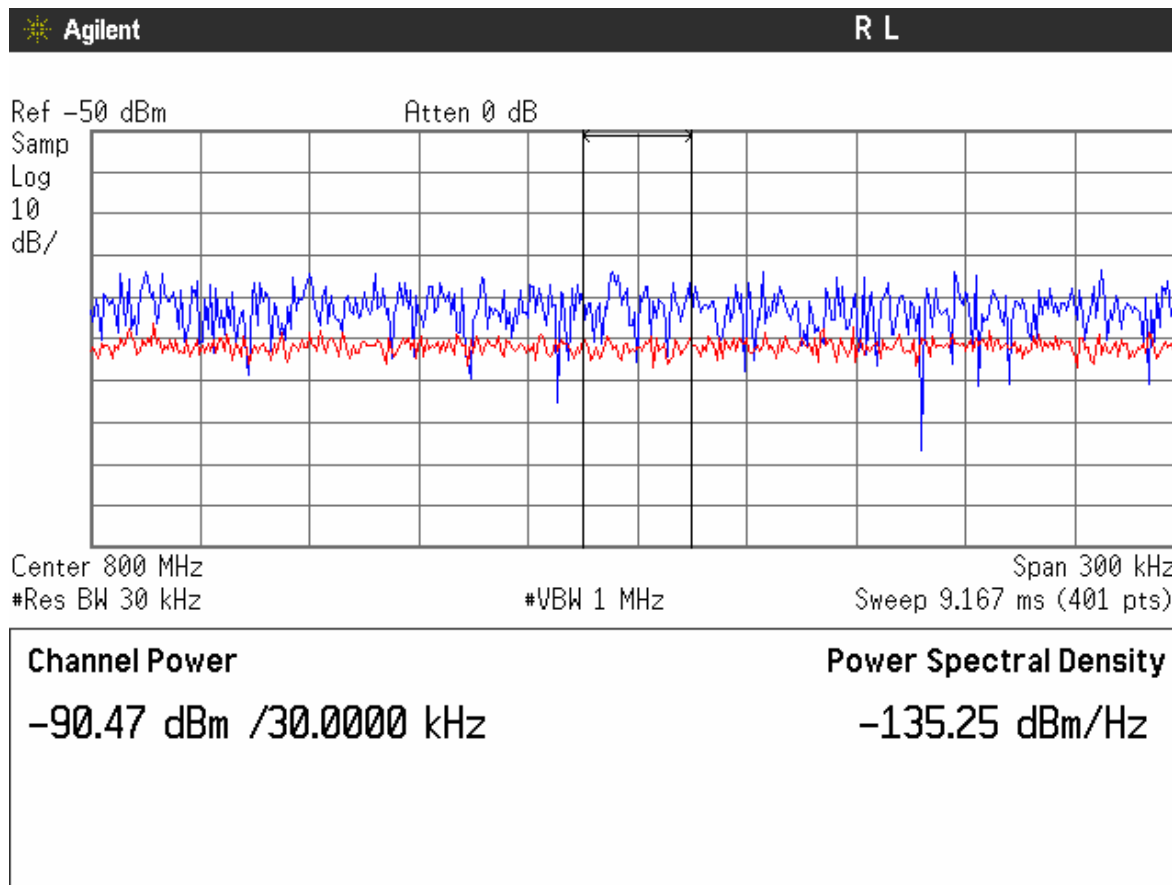
green – peak hold mode of the trace of the UUT



- **Coupled Power in receiver channels (797-803 MHz)**

Notch filter: 2cavities,; attenuation in receive band 797MHz –803MHz is 0.8dB. The set-up adds 17dB attenuator to the notch, the attenuation between 793MHz (lowermost receive band) and 806MHz is 17.8dB. Spectrum analyzer: RBW=30kHz, Span=300kHz, Display resolution (401 display buckets)= 0.75kHz
 Detector mode: sample; Instrument's noise floor for -50dBm reference level –101dBm/30kHz (density noise =145dBm/Hz), instrument's noise floor including the set-up attenuation: -84dBm/30kHz

The sample capture below shows data trace (blue) vs reference noise trace (red), for 300kHz in the receive bandwidth spectrum, with a power reading for a 30kHz channel in the middle of the receive band.

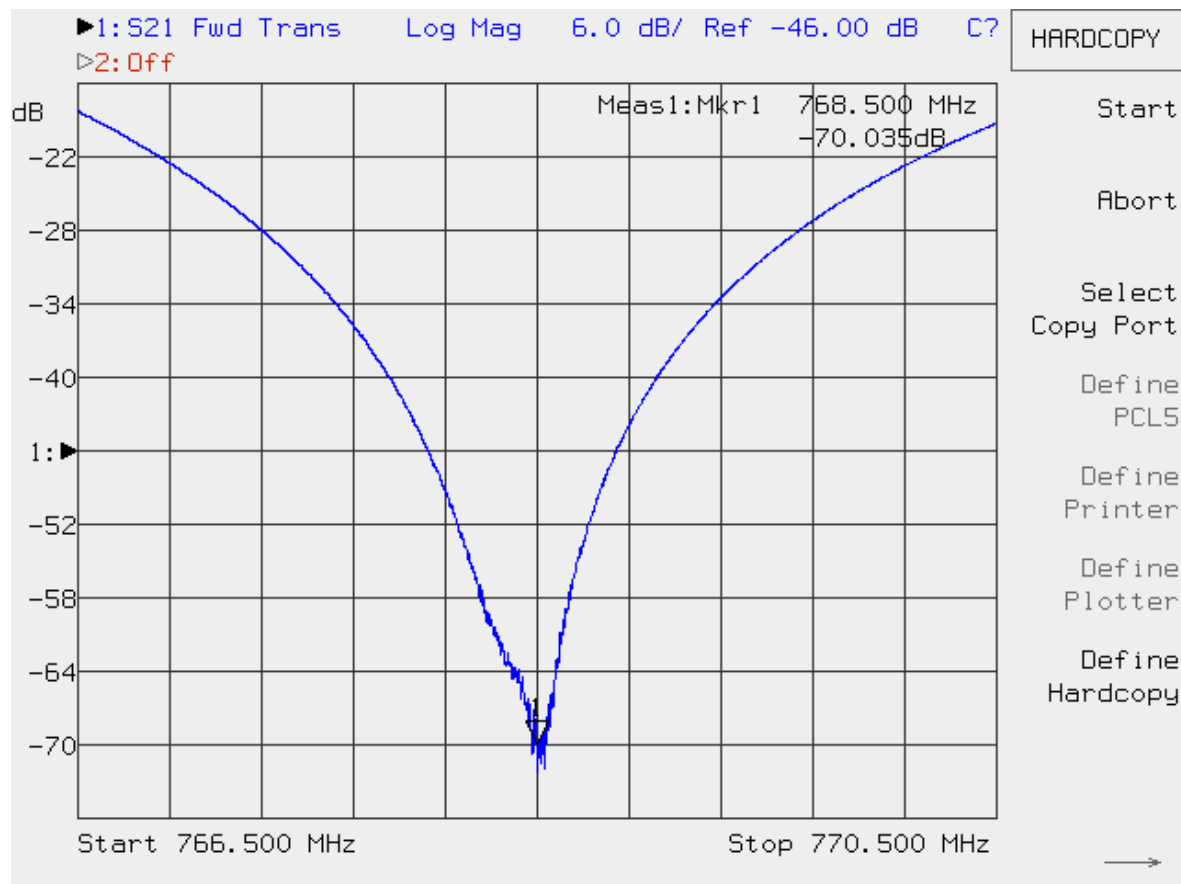


Across all the channel, maximum power read was below –80.0dBm/30kHz , after the correction of the 17.8dB inserted by the set-up (notch filter plus attenuators) the absolute channel coupled power was found lower than –62.2dBm

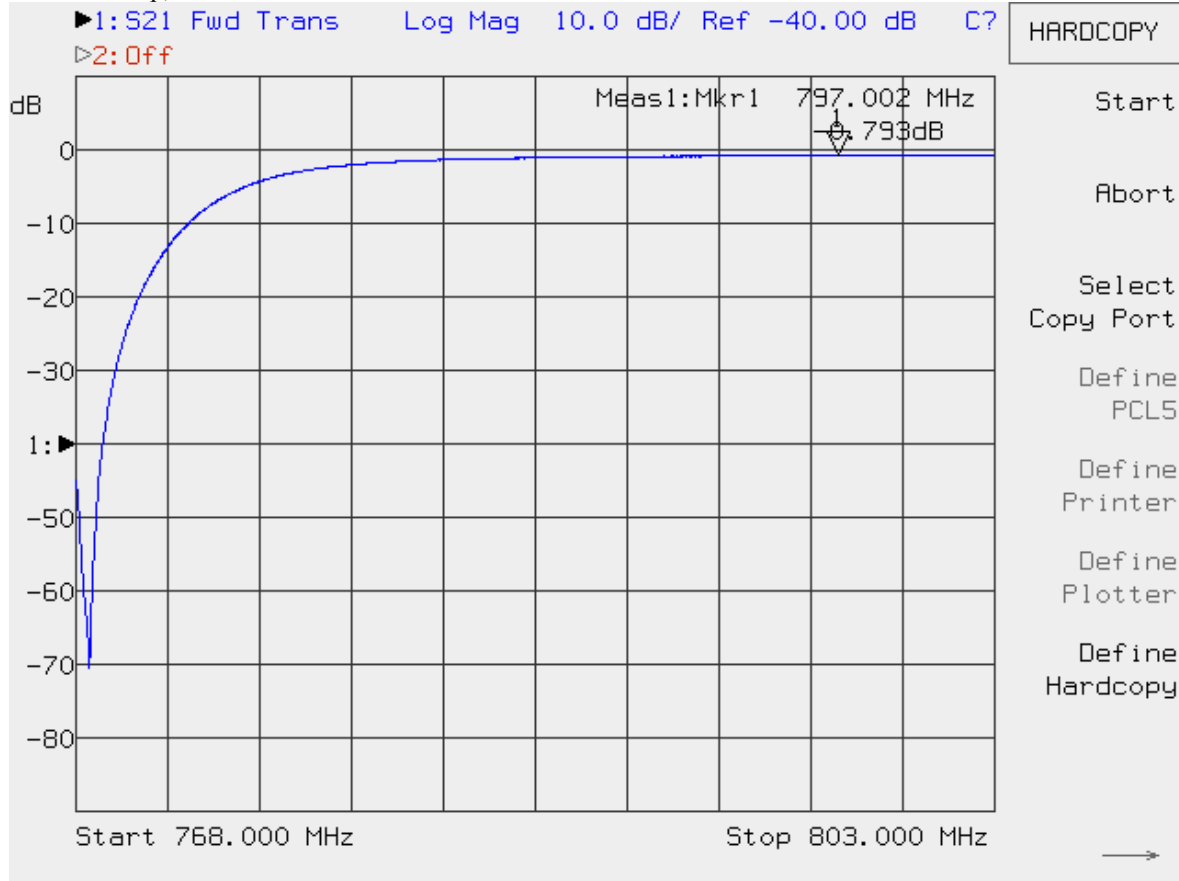
The relative ACCP is -62.2dBm –48.5dBm=-110.7dBc

The value required for maximum relative ACCP = -100dBc >-110.7dBc

Notch filter characteristic, two cavity notch (4MHz span plot, 400kHz/div)



Two cavities notch (1000kHz frequency offset and in the receive band)
35MHz sweep, 3.5MHz/div



Attenuation table:

frequency range	frequency offset from 768.5 MHz	Notch attenuation	worst case set-up attenuation max(-(a_N -17dB attenuators))
769.5-770.5	1MHz-2MHz	$-30.5 < a_N < -20.0$	<47.5dB
770.5-771.5	2MHz-3MHz	$-21.0 < a_N < -13.0$	<38.0dB
771.5-797.0	3MHz- 28.5MHz	$-14 < a_N < -0.8$	<31
797.0-803.0	28.5MHz-34.5MHz	-0.8	<17.8