

NAME OF TEST: Adjacent Channel Coupled Power for digital modulation of Dataradio AET 50W PA module

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 in the receive band	30(swept)	-77
	30(swept)	-100

UNIT UNDER TEST: Pre-production AET 50W PA module in 700 MHz band

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

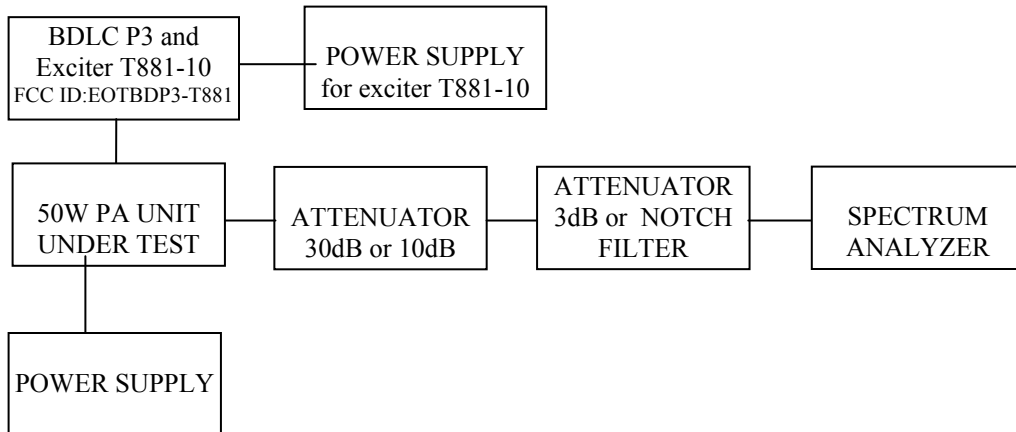
TEST CONDITIONS: 90.543(b) was the standard procedure followed through the test. The instruments have Channel Power over BW measurement built-in software. Input signal from T881 5W transmitter modulated by P3 base station controller modem at 128000 bps 16FSK. Standard Test Conditions, 25 °C.

TEST EQUIPMENT: Notch filter, characteristic supplied
Attenuator, BIRD Models: 150-A-MFN-30, 150-A-FFN-03 and 150-SA-FFN-10 all 150 Watt model,attenuation 30dB, 3dB and respectively, 10dB
DC power source for UUT model TaitT808-10 12.5V/25A
Spectrum Analyzer, Model Agilent E4401B
HP Benchlink -software for plot captures.

Constantin Pintilei

PERFORMED BY: _____ DATE: 12/21/04
Constantin Pintilei

TEST SET-UP:



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

Input RF signal is a 5W 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 $X^23+X5+1$ 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 $a=0.4$. The reference deviation set on 1KHz tone was 8.0kHz, the scaling factor is further applied on data.

Explanations for the 50kHz wideband mobile 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 50W (rated power, 90.534(a)):

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

Settings:150kHz Channel Bandwidth

channel 60, 770.025MHz 12.8 dBm

Total RF power is 50W ⇔ 47dBm, during the test due to the detector in sample mode this can yield a different value. In the set-up there are two attenuation pads of 30+3dB, 34dB 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=3kHz, Video BW=30kHz, Span=0.85MHz, Sweep = Detector mode: sample

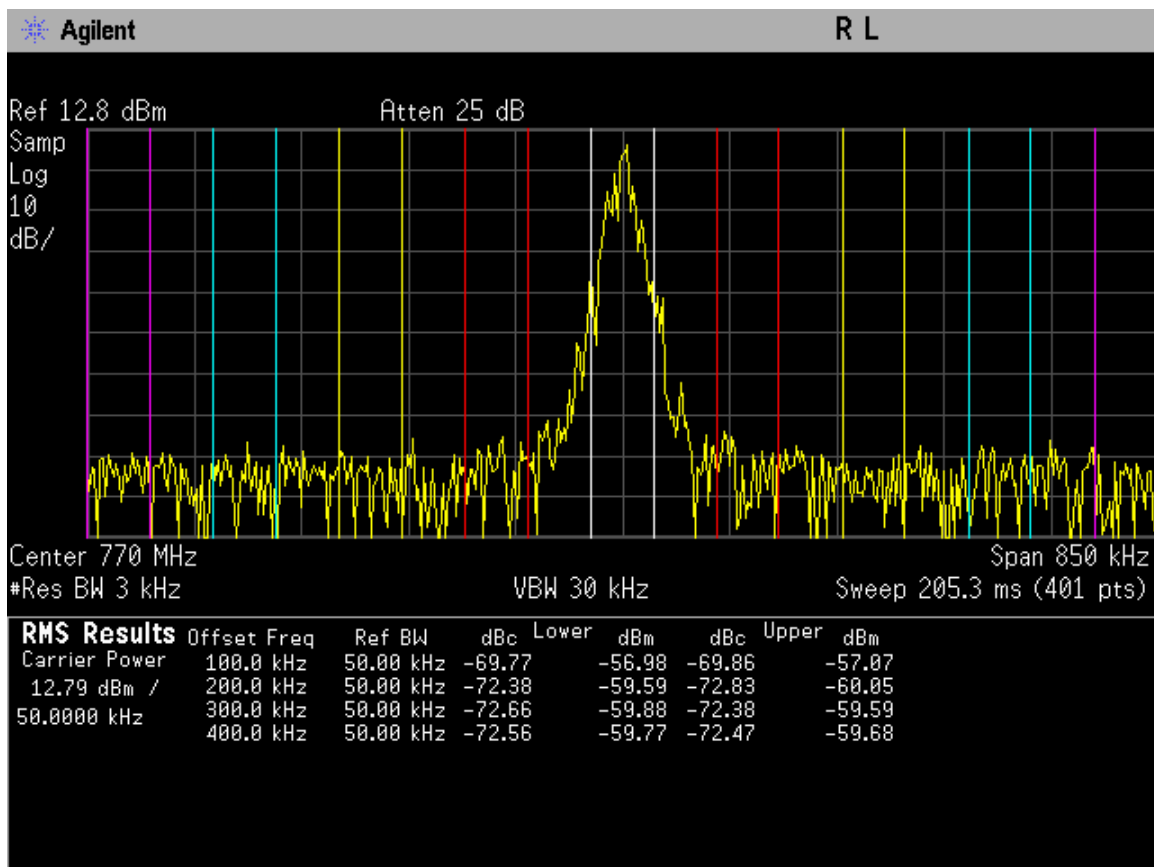
Display resolution (400 display buckets)= 2125Hz,

Reference level +12.8dBm, 50kHz channel noise=-64.5dBm/50kHz

UUT in center channel of the 150kHz 3-contiguous 50 kHz channels 59, 60, and 61.

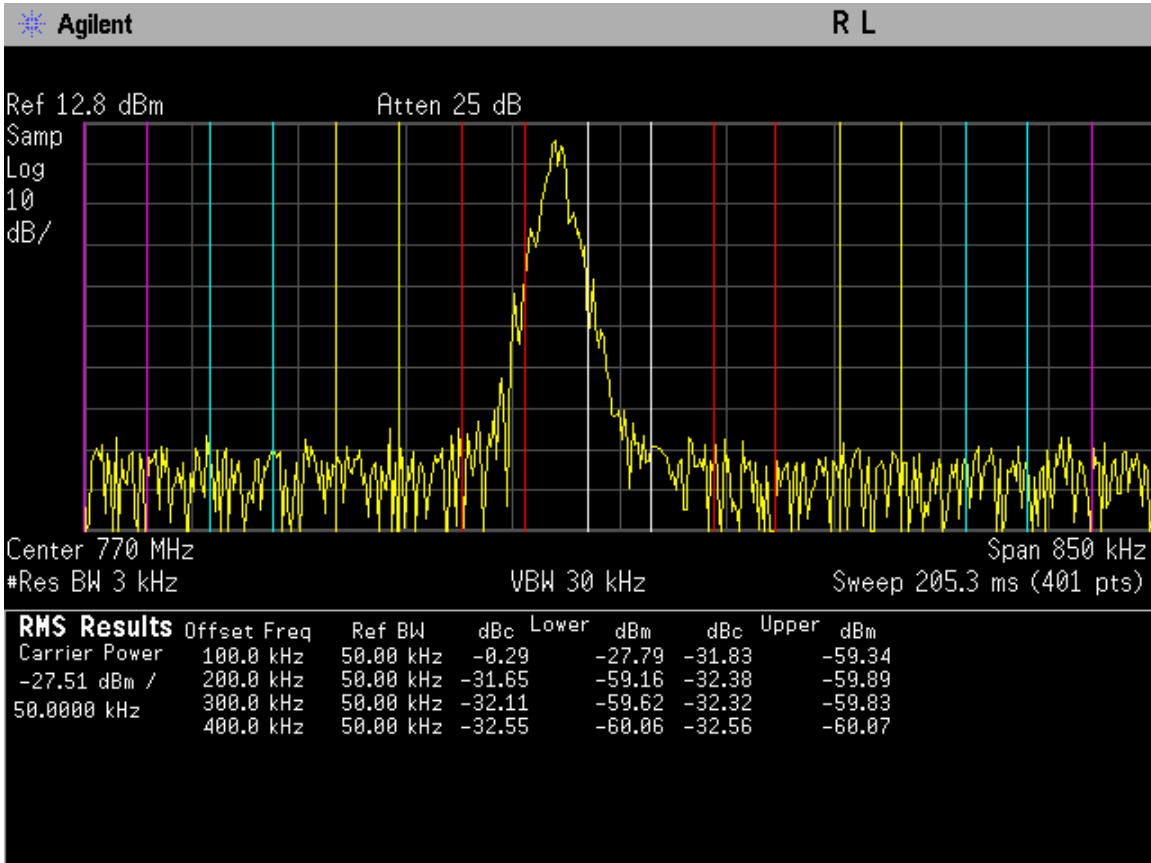
Channel 60, frequency 770.02500 MHz

frequency Offset	-400	-300	-200	-100	0	100	200	300	400
Channel Power read (dBm)	-59.8	-59.9	-59.6	-57.0	12.8	-57.1	-60.1	-59.6	-59.7
Absolute channel power (dBm) (read value +34 dB attenuator)	-25.8	-25.9	-25.6	-22.0	46.8	-23.1	-26.1	-25.6	-25.7
ACCP (difference)	-72.6	-72.7	-72.4	-69.8	NA	-69.9	-72.9	-72.4	-72.5



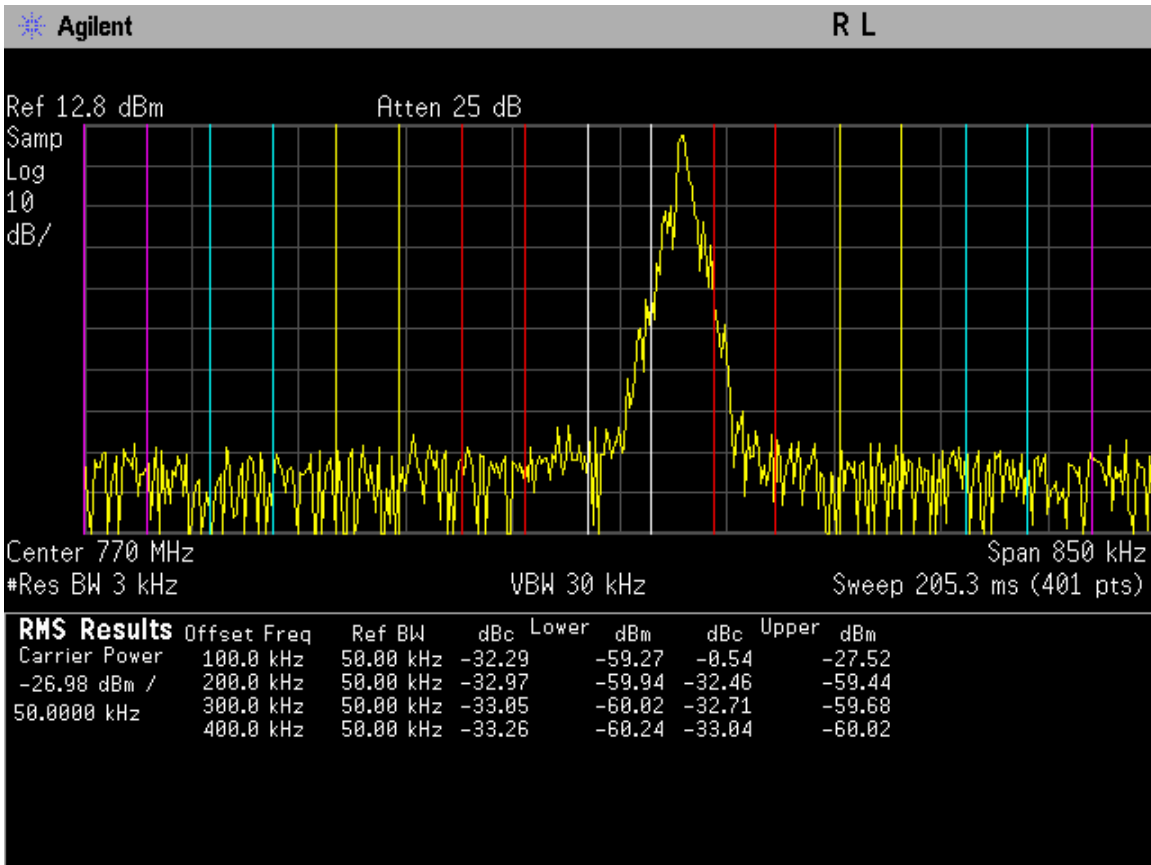
UUT in left channel (59) of the 150kHz 3-contiguous 50 kHz channels 59, 60, 61.
 Channel 69, frequency 769.975000 MHz

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)	-60.0	-59.7	-59.2	-27.8	12.8	-59.4	-59.9	-59.9	-60.1
Absolute channel power (dBm) (read value +34 dB attenuator)	-26.0	-25.7	-25.2	6.2	46.8	-25.4	-25.9	-25.9	-26.1
ACCP (difference)	-72.8	-72.5	-72.0	-40.6	NA	-72.4	-72.7	-72.7	-72.9



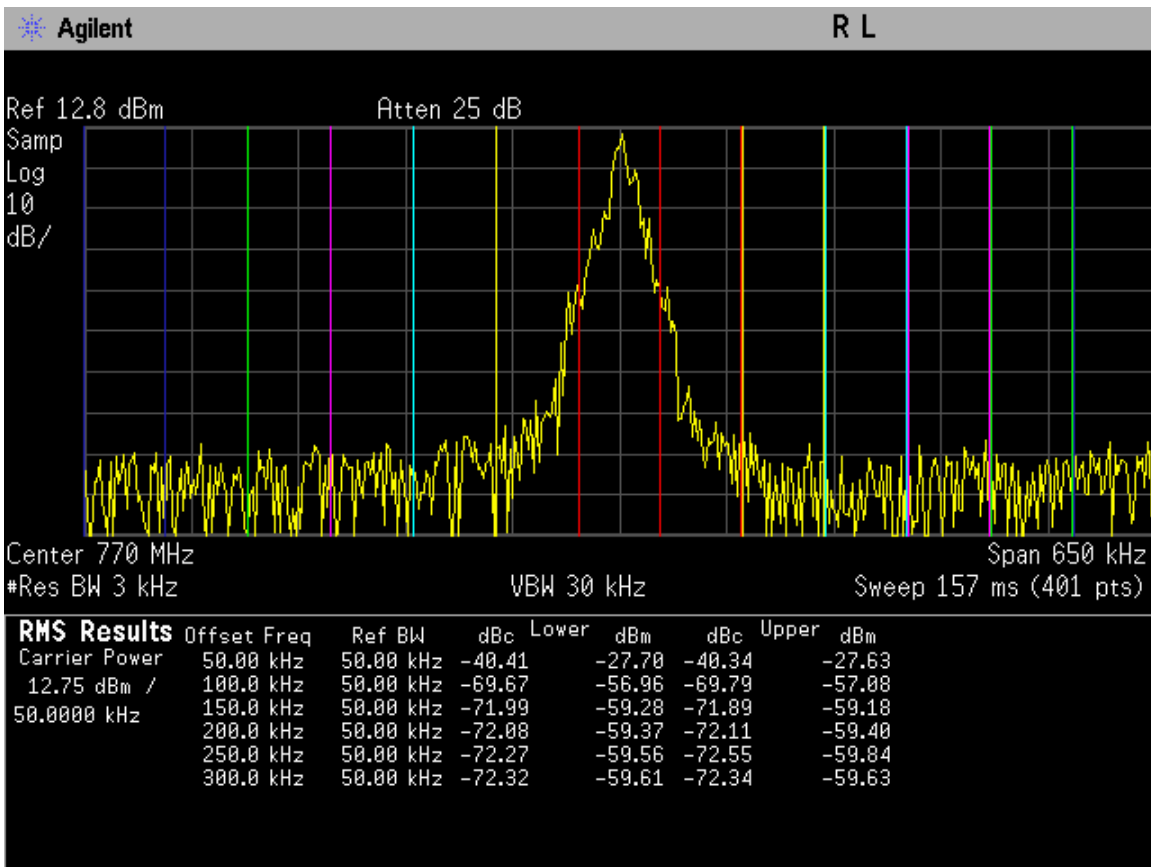
UUT in right channel (61) of the 150kHz 3-contiguous 50 kHz channels 59, 60, 61.
 Channel 61, frequency 770.075000 MHz

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	-60.3	-60.0	-60.0	-59.3	12.8	-27.6	-59.5	-59.7	-60.0
Absolute channel power (dBm) (read value +34 dB attenuator)	-26.3	-26.0	-26.0	-25.3	46.8	6.4	-25.5	-25.7	-26.0
ACCP (difference)	-73.1	-72.8	-72.8	-72.3	NA	-40.4	-72.3	-72.5	-72.8



50 kHz channel (non-aggregated) adjacent channel coupled power.
 Channel 60, frequency 770.025000 MHz .All power readings on 50kHz channel

frequency Offset to the center channel	-300	-250	-200	-150	-100	-50	0	+50	+100	+150	+200	+250	+300
Channel Power read (dBm)	-59.7	-59.6	-59.4	-59.3	-57.0	-27.7	12.8	-27.7	-57.1	-59.2	-59.4	-59.9	-59.7
Absolute (dBm) channel power	-25.7	-25.6	-25.4	-25.3	-23.0	6.3	46.8	6.3	-23.1	-25.2	-25.4	-25.9	-25.7
ACCP (dBc) (difference)	-72.5	-72.4	-72.2	-72.1	-69.8	-40.5	NA	-40.5	-69.9	-72.0	-72.2	-72.7	-72.5



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

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

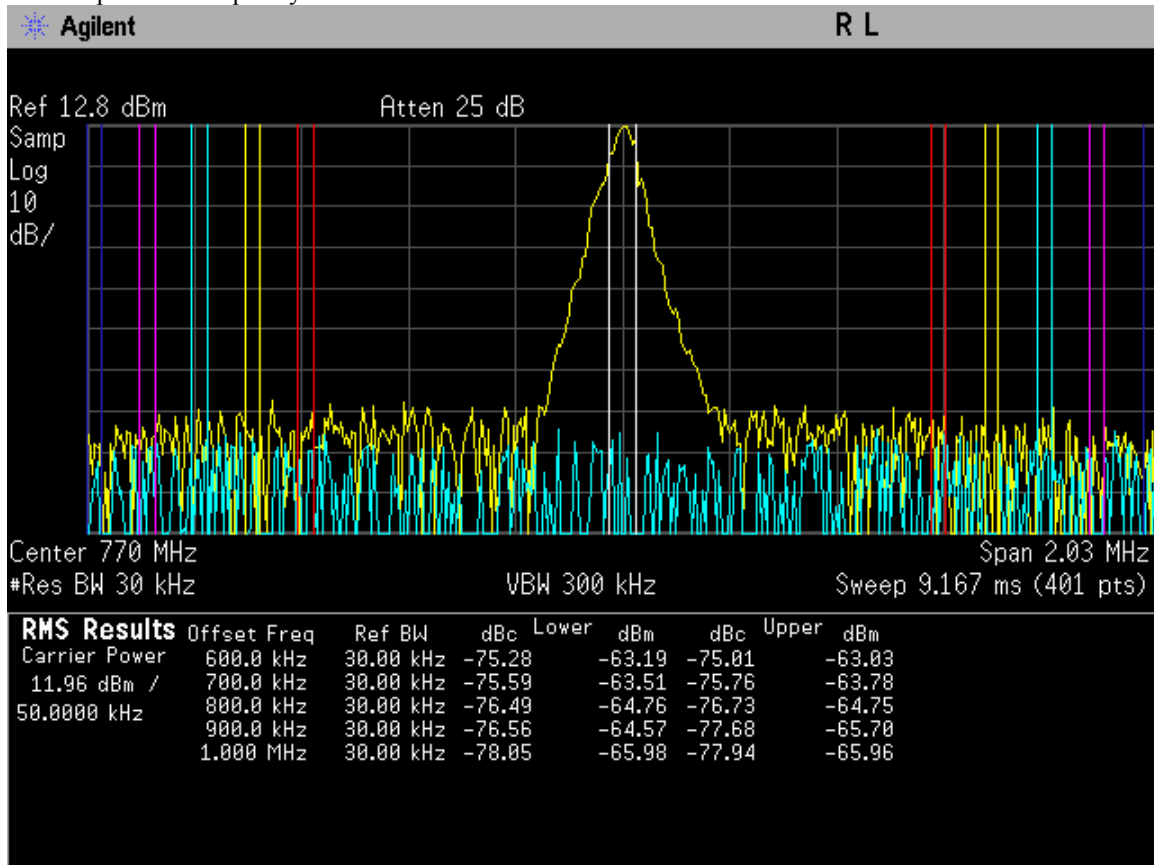
Settings

Set-up attenuation: 2 attenuators 30dB+3dB, 2MHz span picture, attenuation for 600kHz-1MHz offsets between 33.9 dB and 34.3 dB(worst case).

Spectrum analyzer: RBW=30kHz, Span=2MHz, Display resolution (401 display buckets)= 50kHz Detector mode: RMS; Instrument’s noise floor for 12.8dBm reference level -71.8dBm/30kHz (density noise =116.4dBm/Hz), instrument’s noise floor including the setup attenuation: -36.8dBm/30kHz

Test data:

The capture below has data trace (yellow) vs noise trace (blue). 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 35dB (worst case across the span) inserted by the attenuators, the absolute channel coupled power was found lower than -28dBm for a CW power of 47dBm.

The value required for maximum relative ACCP = -65dBc >-75dBc readings

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

Notch filter: 2 cavities, notch attenuation for 1MHz-27MHz offsets (771MHz to 797MHz) decreases between 30dB and 0.5dB. Setup attenuation adds 10dB attenuator after the notch filter, overall set-up attenuation decreases between 40db and 10.5db.

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)

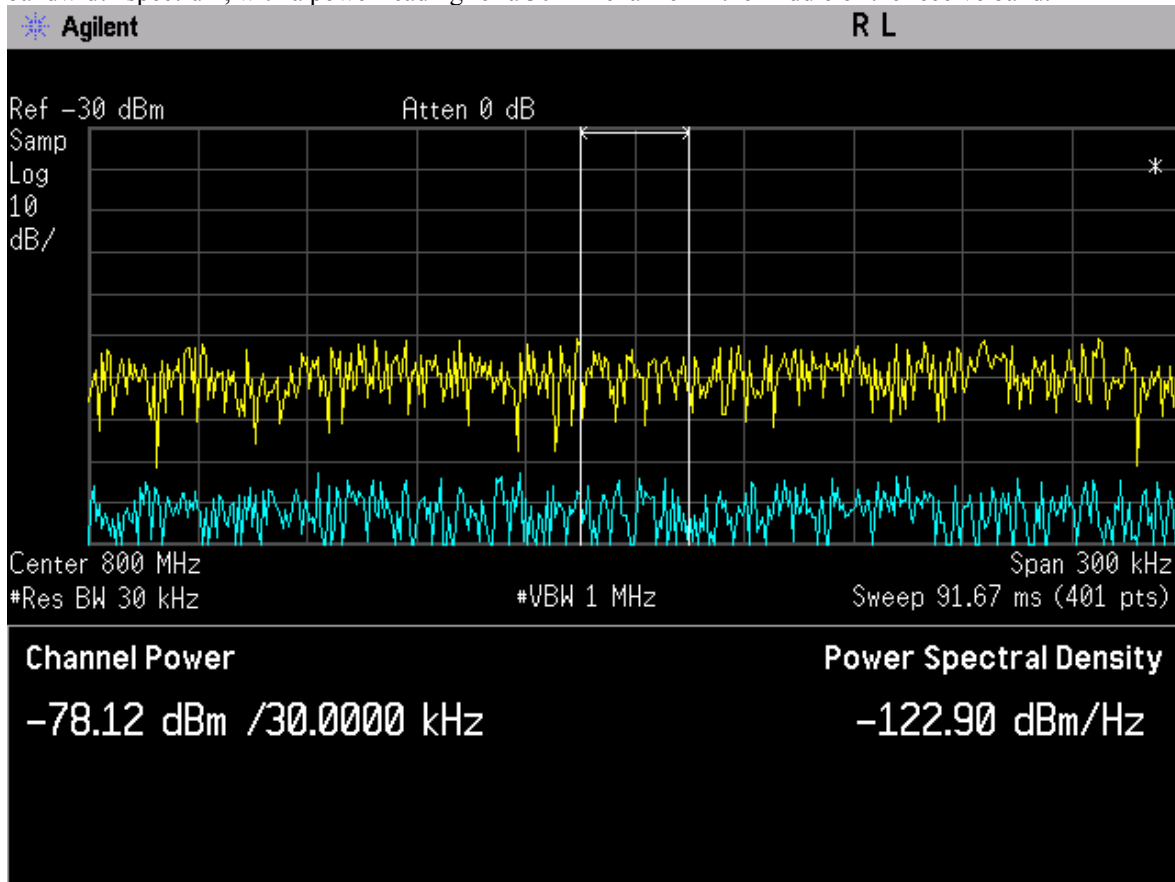
For the frequencies between 771.0MHz and 797MHz the value of the couples power over 30kHz channel read was below -75dBm/30kHz, its absolute value corrected with the set-up attenuation (worst case 40dB) is below -35dBm/30kHz.

The value of maximum absolute ACCP = -35dBm/30kHz bandwidth.
 The relative ACCP is -35dBm-47dBm = -82dBc
 The value required for maximum relative ACCP = -77dBc > -82dBc (+47dBm carrier)

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

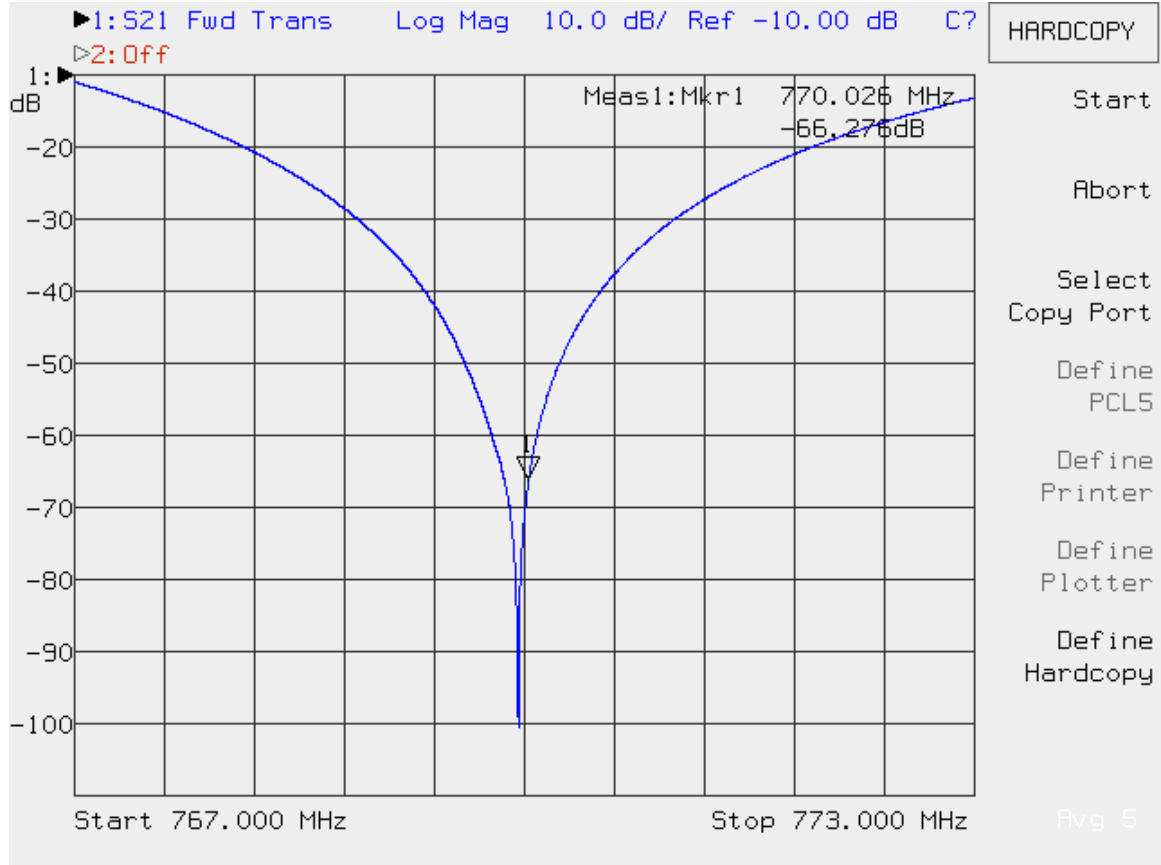
Notch filter: 2cavities,; attenuation in receive band 797MHz –803MHz is 0.5dB. The set-up adds 10dB attenuator to the notch, the attenuation between 793MHz (lowermost receive band) and 806MHz is 10.5dB. Spectrum analyzer: RBW=30kHz, Span=300kHz, Display resolution (400 display buckets)= 0.75kHz
 Detector mode: sample; Instrument’s noise floor for -30dBm reference level —101dBm/30kHz (density noise =145dBm/Hz), instrument’s noise floor including the set-up attenuation: -89dBm/30kHz

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



All the power channel read was below -76.0dBm/30kHz , after the correction of the 10.5dB inserted by the set-up (notch filter plus attenuator) the absolute channel coupled power was found lower than -65.5dBm
 The relative ACCP is -47dBm-65.5dBm=-112.5dBc
 The value required for maximum relative ACCP = -100dBc > -112dBc

Notch filter characteristic. Attenuation between -45dB <a<-30dB for frequency offset 600kHz to 1MHz two cavity notch (6MHz span plot, 600kHz/div)



Two cavities notch (1000kHz frequency offset and in the receive band)

44MHz sweep, 4.4MHz/div

Attenuation between -45dB <a<-30dB for frequency offset 600kHz to 1MHz

Attenuation -30dB <a<-0.5 dB for frequency offset 1MHz to 27 MHz (771MHz to 797MHz)

Attenuation a=0.5dB for frequencies in receive band (797MHz to 803MHz)

