

IEEE 802.11a/b/g High power miniPCI Card benchmark report

V1.3



*UbiquitiR
SuperRange 5 (SR5)*



*EnGenius/SENAO
NMP8602*



*Wistron Neweb
DCMA-82*

1. Candidate Radio cards

Company	Ubiquiti®	EnGenius/SENAO	Wistron Neweb
Model Name	SuperRange 5 (SR5)	NMP8602	DCMA_82
Technology Source	Atheros® MB42, AR5213/AR5112	Atheros® MB62, AR5414	Atheros® MB62, AR5414
IEEE Specification	IEEE 802.11a	IEEE 802.11a/b/g	IEEE 802.11a/b/g
Voltage Acceptance	3.3 Vdc	3.3 Vdc	3.3 Vdc
RF Specialty	High-powered 802.11a	High-powered 802.11 b/g but regular 802.11a	High-powered 802.11a/b/g

2. Test items

item	Test Items
	<i>Transmitter Functional Test</i>
1	Transmit Spectrum Mask
2	Transmit Power
3	EVM
	<i>Receiver Functional Test</i>
4	Receiver Sensitivity
	<i>System</i>
5	Current consumption
6	FCC regulation power level & test result
7	DCMA-82 target power table

3. Test Result

3-1 Transmit spectrum mask:

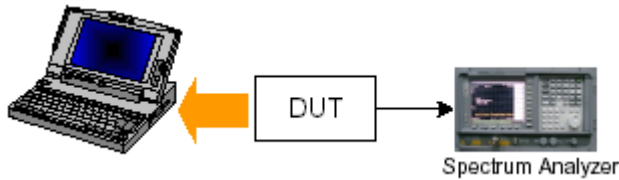
■ **Purpose:**

To verify the transmitter spectrum of the Device Under Test (DUT) is below conformance limit.

■ **Equipment:**

Spectrum Analyzer

■ **Test Environment:**



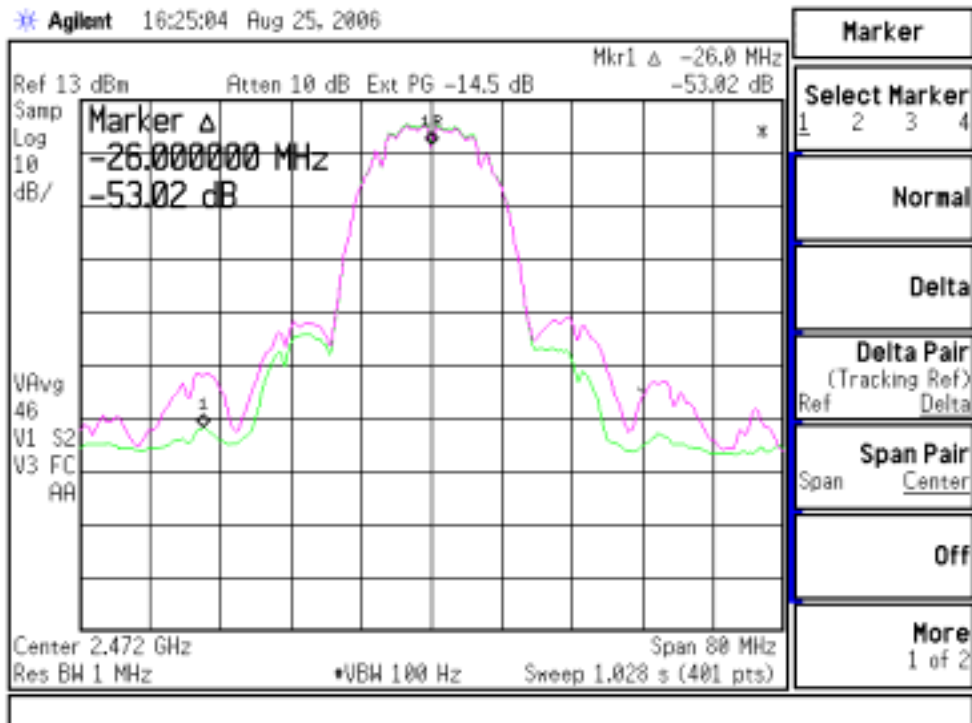
■ **Procedure:**

1. DUT generate continuity frame (TX99) by test utility, ART.
2. Adjust the RF power to be 19dBm.
3. Measurement the spectrum mask.

■ **Test Result:**

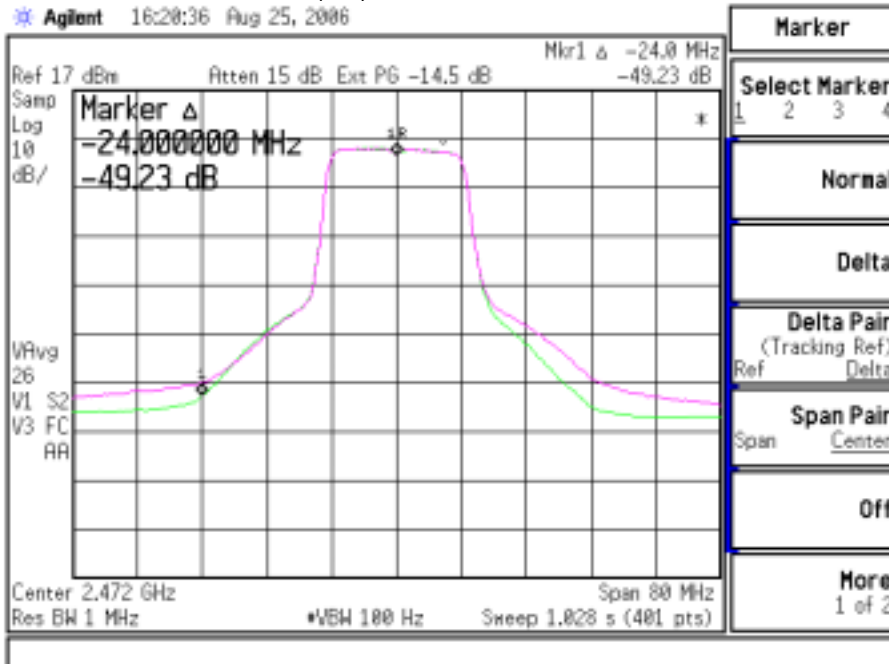
1. 11b:

- NMP-8602
- DCMA-82
- SR5 (NA)



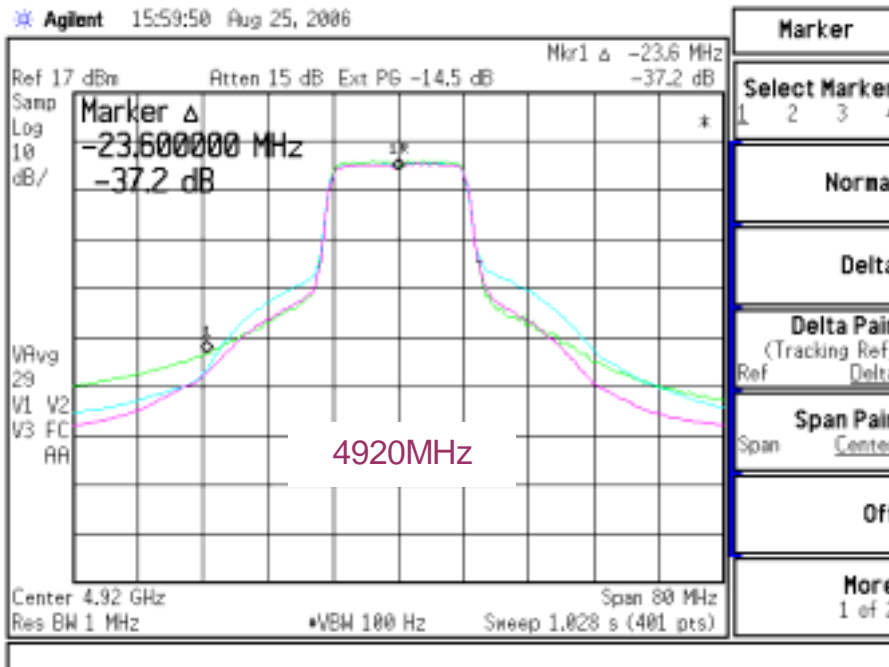
2. 11g:

- NMP-8602
- DCMA-82
- SR5 (NA)

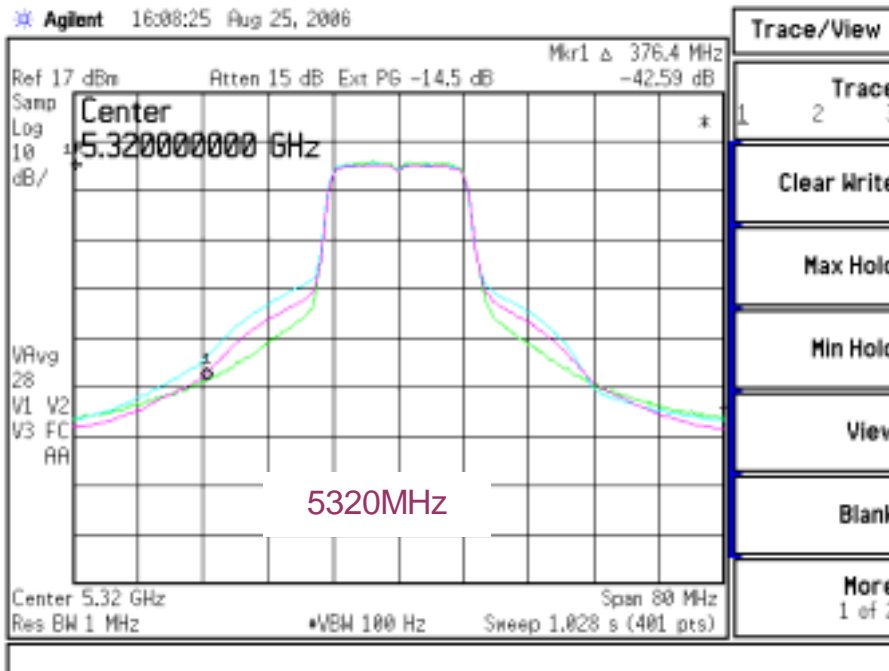


3. 11a:

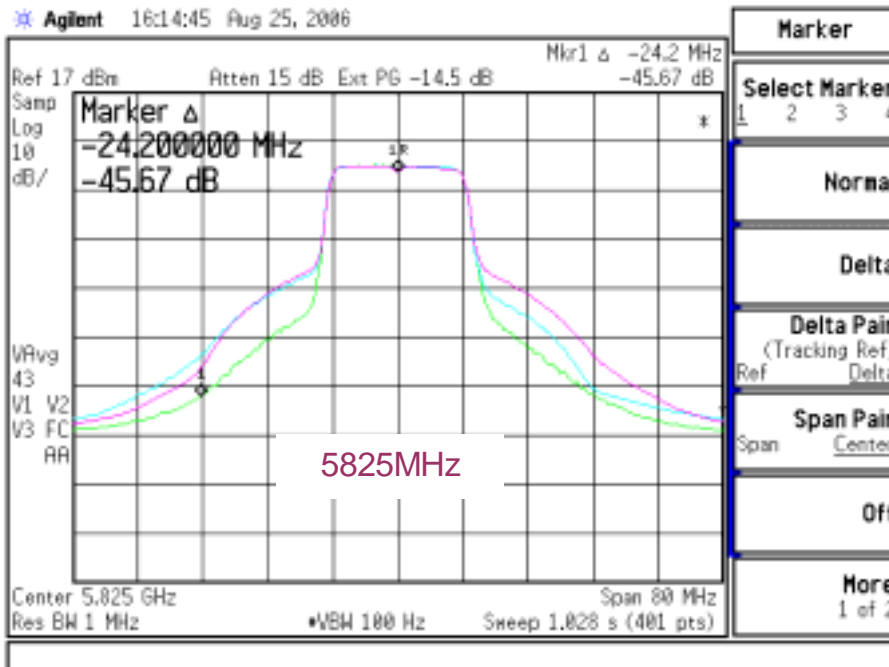
- NMP-8602
- DCMA-82
- SR5



- NMP-8602
- DCMA-82
- SR5



- NMP-8602
- DCMA-82
- SR5

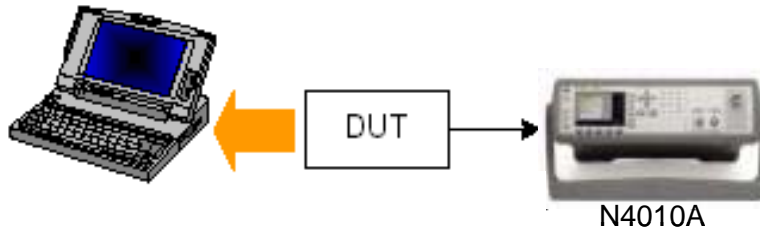


3-2 Transmitter Power & EVM:

- **Equipment**

1. Agilent N4010A

- **Test Environment:**



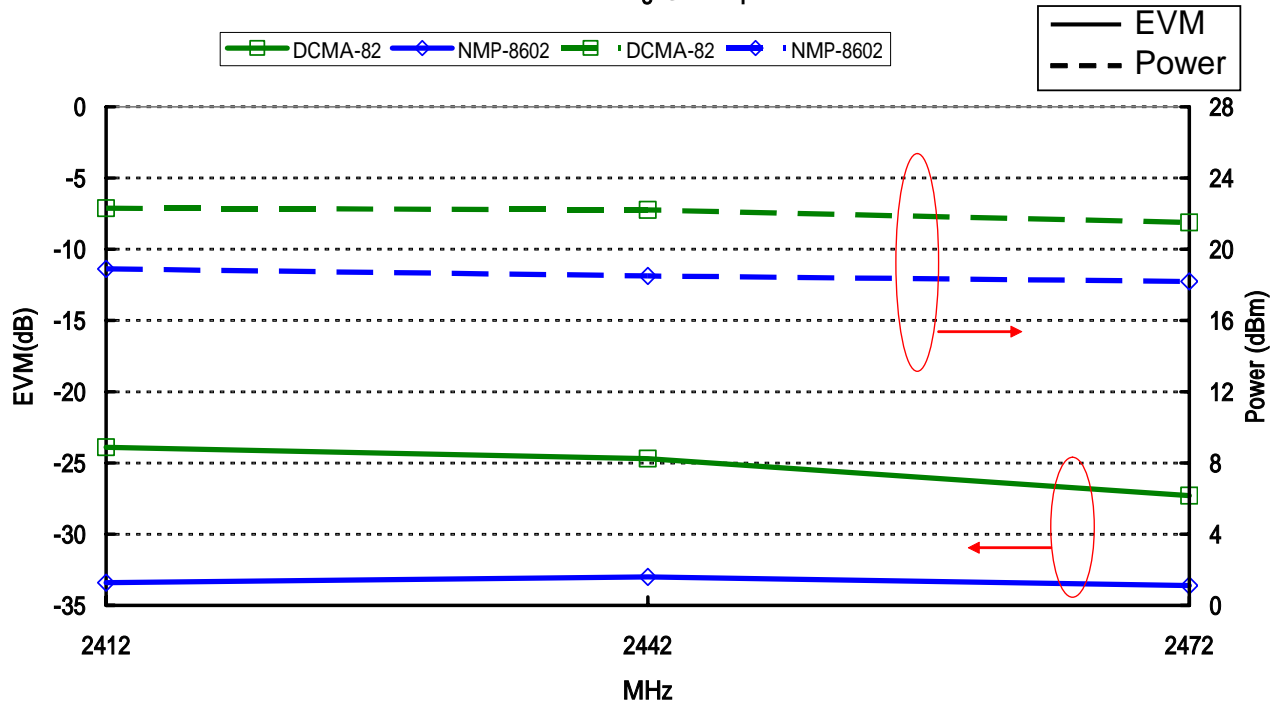
- **Procedure**

1. By using ART (Atheros radio test program) to generate the **target power** which were already loaded in **EEPROM**.
2. Measure the output power at the antenna connector by Agilent N4010.

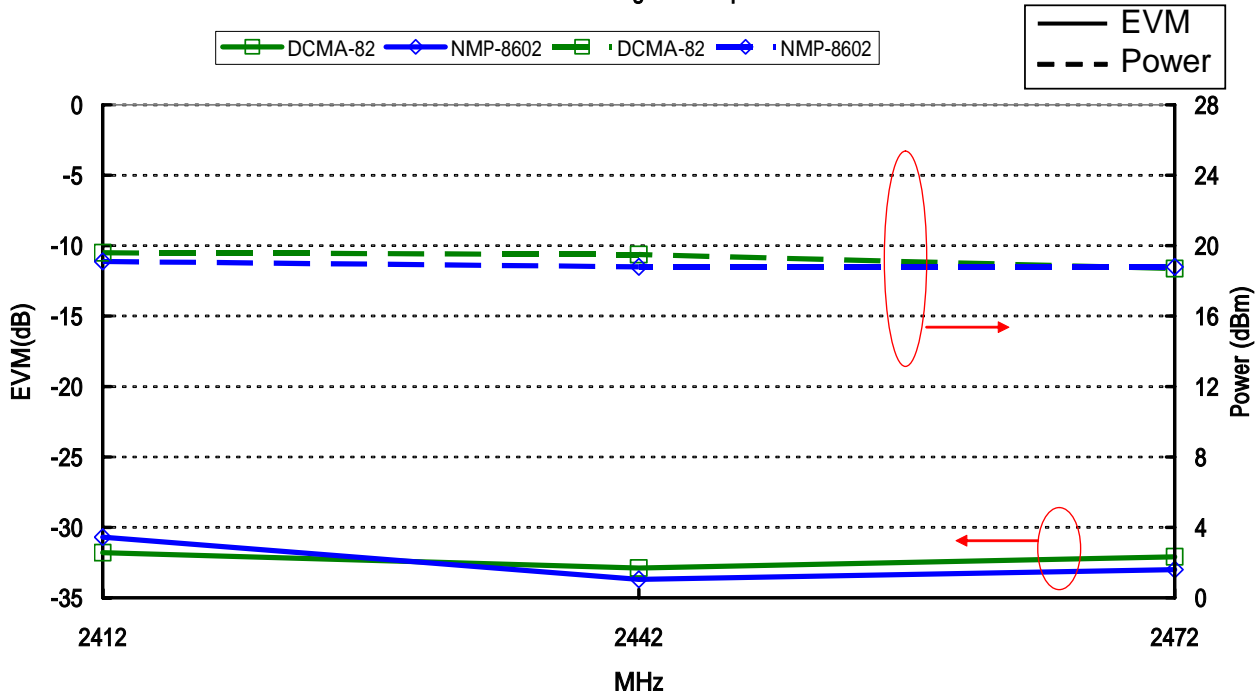
- **Test Result.**

		EVM			Power		
Freq (MHz)	Datarate	SR5	DCMA-82	NMP-8602	SR5	DCMA-82	NMP-8602
4920	24M	-26	-22.1	-27.4	12	19.7	18
4920	36M	-24	-24.1	-29	9.6	19.2	17.1
4920	48M	-27.4	-32.5	-30.1	7.8	16.8	14.5
4920	54M	-24.2	-32.3	-27.3	7	15.7	13.5
4960	24M	-25.5	-27.3	-29	12.1	19.9	18.1
4960	36M	-27.4	-28.1	-29.6	10.2	19.9	16.3
4960	48M	-25	-30	-29.3	8.3	17.3	14.4
4960	54M	-24.5	-32.2	-31.9	7.3	16.5	12.8
5040	24M	-27.5	-23.4	-27.5	12.7	21.3	17.4
5040	36M	-27.2	-26.8	-28.4	10.5	19.9	16.1
5040	48M	-27.4	-29.3	-28.7	8.8	17.6	13.4
5040	54M	-27.2	-29.8	-30.1	7.7	17.1	12.8
5220	24M	-28.2	-23.4	-28.8	13.9	22.5	18.1
5220	36M	-29.4	-26.7	-30.2	11.4	21.2	16
5220	48M	-28.5	-30	-30.1	9.1	16.9	13.3
5220	54M	-26	-29.1	-29	7.3	15.8	13.1
5300	24M	-28.8	-24.9	-27	14.3	22.1	18
5300	36M	-29.1	-26.1	-30.6	11.8	20.8	16.3
5300	48M	-29.4	-31	-30.1	9.8	17.3	14.2
5300	54M	-26.5	-31	-30	7.7	15.9	13.2
5520	24M	-19.4	-26.2	-27.9	21.2	21.7	18.3
5520	36M	-22.4	-28.1	-29.3	20.3	21.3	16
5520	48M	-23.3	-29.8	-31	19.6	18.5	14
5520	54M	-27.3	-29.8	-30.4	17.8	18.1	13
5825	24M	-17.7	-26.3	-26.7	22.3	21.5	17.1
5825	36M	-19.8	-25.6	-29.3	21.4	21	15.1
5825	48M	-23.9	-28.9	-29.6	19.4	18.3	13.3
5825	54M	-23.3	-31	-28.9	18.6	17.5	12.4
2412	54M	NA	-31.8	-30.7	NA	19.6	19.1
2412	48M	NA	-29.4	-34.6	NA	20.7	18.8
2412	36M	NA	-24.1	-34.5	NA	22.2	18.8
2412	24M	NA	-23.9	-33.4	NA	22.3	18.9
2442	54M	NA	-32.9	-33.7	NA	19.5	18.8
2442	48M	NA	-29.4	-32.5	NA	20.4	18.9
2442	36M	NA	-24.8	-34.7	NA	22.3	18.4
2442	24M	NA	-24.7	-33	NA	22.2	18.5
2472	54M	NA	-32.1	-33	NA	18.7	18.8
2472	48M	NA	-30.8	-32.5	NA	20.1	18
2472	36M	NA	-26	-33	NA	21.3	18.6
2472	24M	NA	-27.3	-33.6	NA	21.5	18.2
2412	11M_peak	NA	11%	18%	NA	21.7	18.9
2412	11M_rms	NA	9%	9%	NA	21.7	18.9
2472	11M_peak	NA	19%	23%	NA	22	19.1
2472	11M_rms	NA	9.50%	10.00%	NA	22	19.1

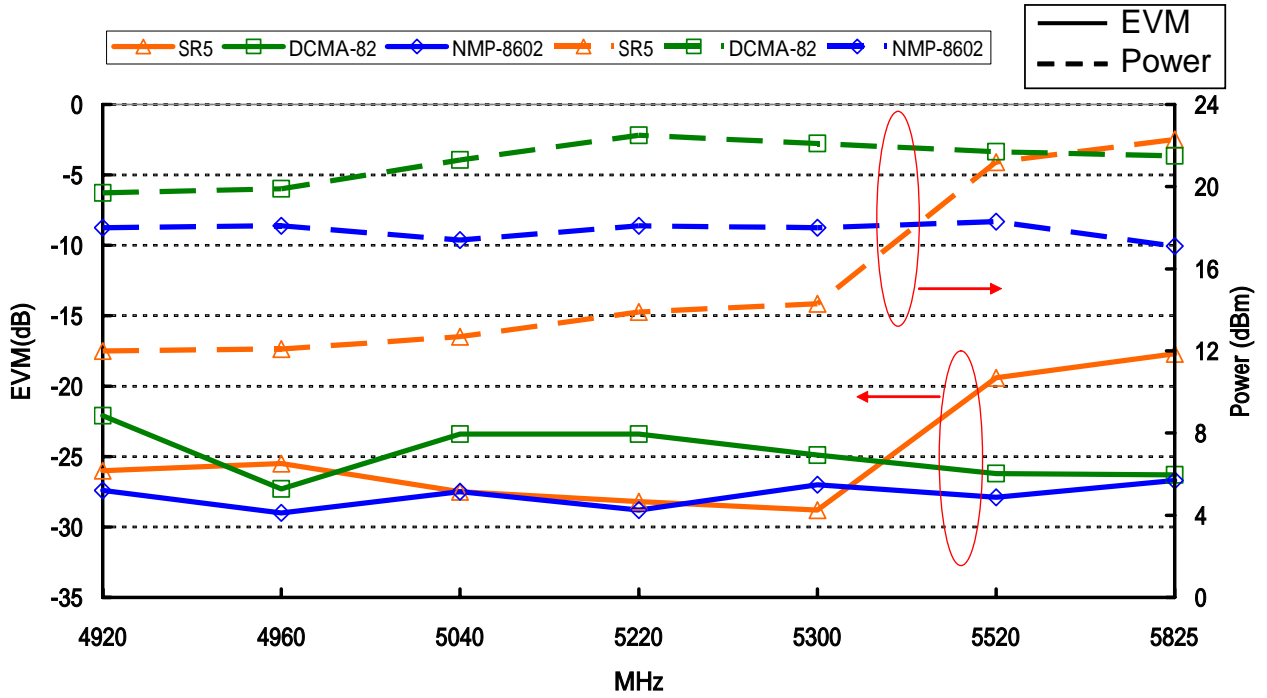
EVM & Power for 11g @24Mbps



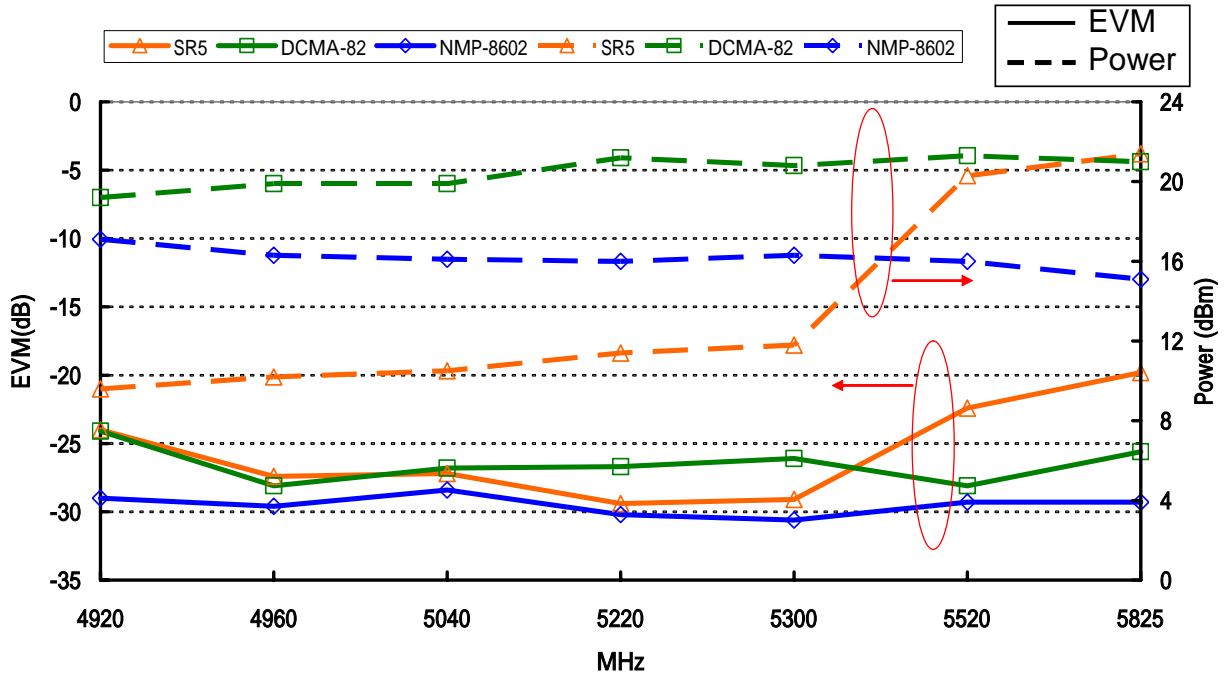
EVM & Power for 11g @54Mbps

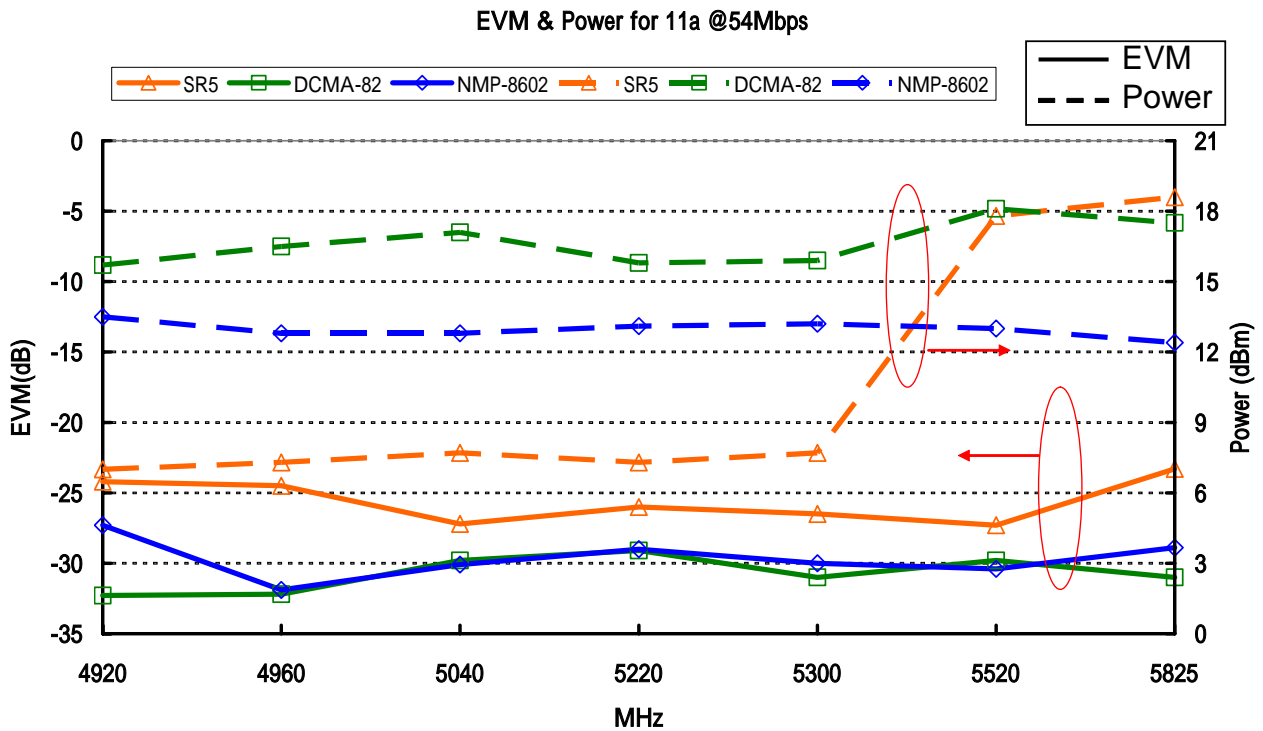


EVM & Power for 11a @24Mbps



EVM & Power for 11a @36Mbps





Remarks: DCMA-82 got the best linearity for TX mode, higher power but lower EVM.

3-3 Receiver sensitivity

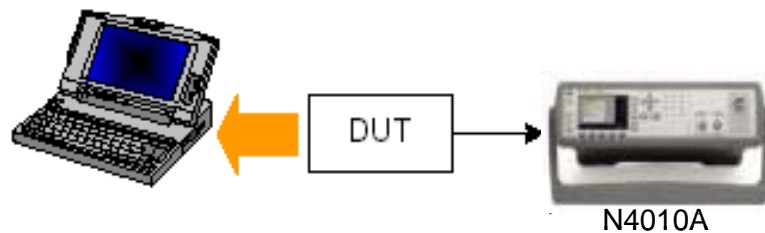
■ **Purpose:**

To verify Receiver minimum input level sensitivity

■ **Test Equipment:**

1. Agilent N4010A

■ **Test Environment:**



■ **Procedure**

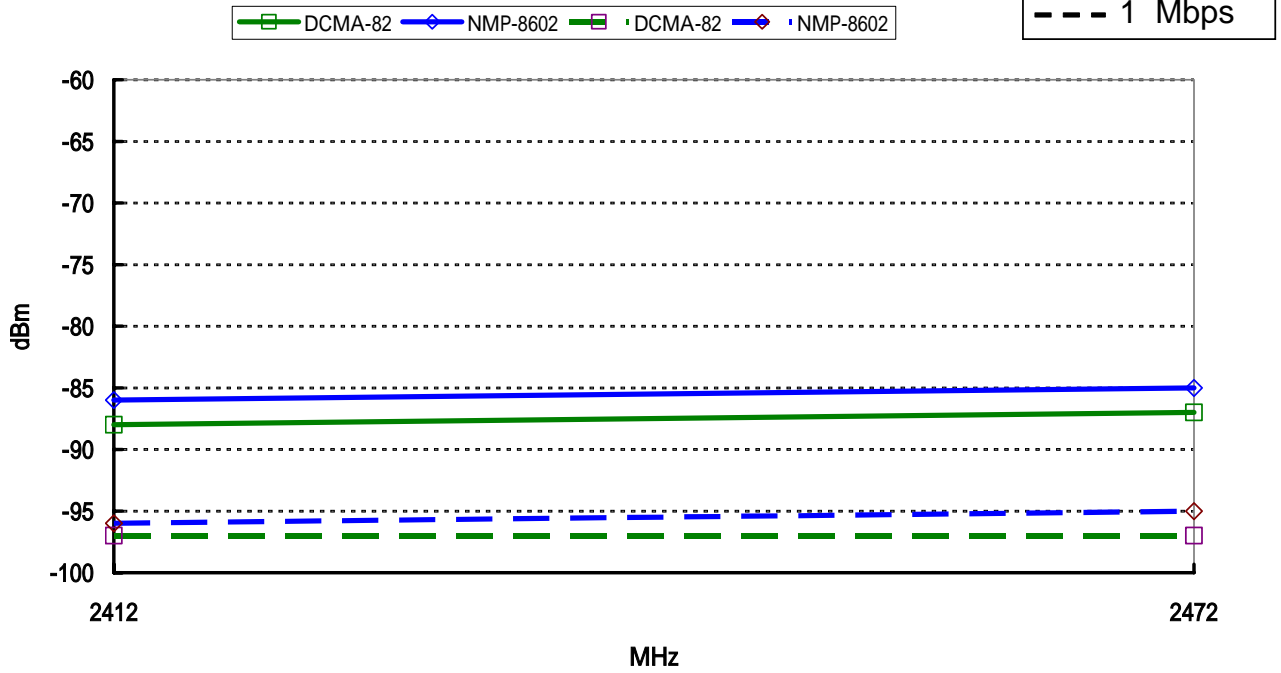
1. TX packets were generated by N4010 and sent to DUT.
2. DUT was configured as RX mode under ART link mode to receive the packets from N4010.
3. N4010 reduced the power level until the PER<10% @OFDM & PER<8%@CCK mode.

4. Record the final power level on the RF port of DUT.

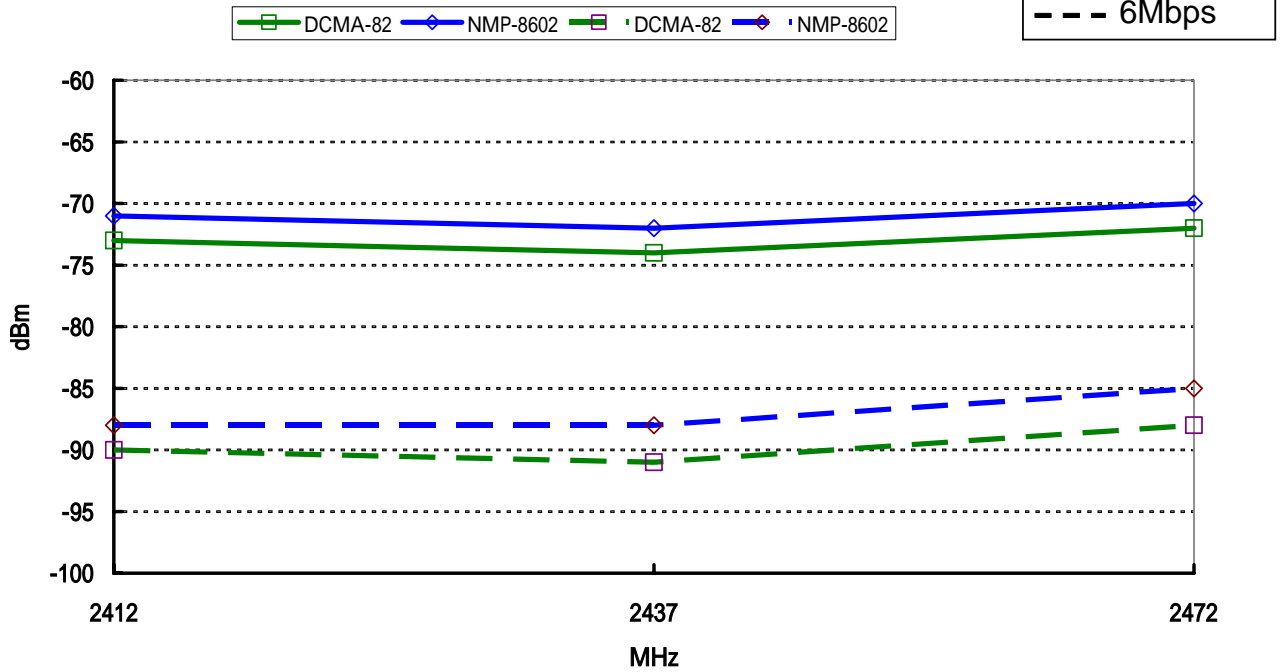
■ Test Result

Sensitivity (dBm)				
Freq (MHz)	Datarate	SR5	DCMA-82	NMP-8602
4920	54Mbps	-74	-73	-71
4960	54Mbps	-74	-73	-71
5180	54Mbps	-74	-74	-74
5300	54Mbps	-74	-73	-73
5500	54Mbps	-74	-72	-73
5825	54Mbps	-74	-73	-72
4920	6Mbps	-91	-89	-90
4960	6Mbps	-91	-91	-90
5180	6Mbps	-91	-91	-91
5300	6Mbps	-91	-91	-91
5500	6Mbps	-92	-90	-91
5825	6Mbps	-91	-89	-89
2412	54Mbps	NA	-73	-71
2437	54Mbps	NA	-74	-72
2472	54Mbps	NA	-72	-70
2412	6Mbps	NA	-90	-88
2437	6Mbps	NA	-91	-88
2472	6Mbps	NA	-88	-85
2412	11Mbps	NA	-88	-86
2472	11Mbps	NA	-87	-85
2412	1Mbps	NA	-97	-96
2472	1Mbps	NA	-97	-95

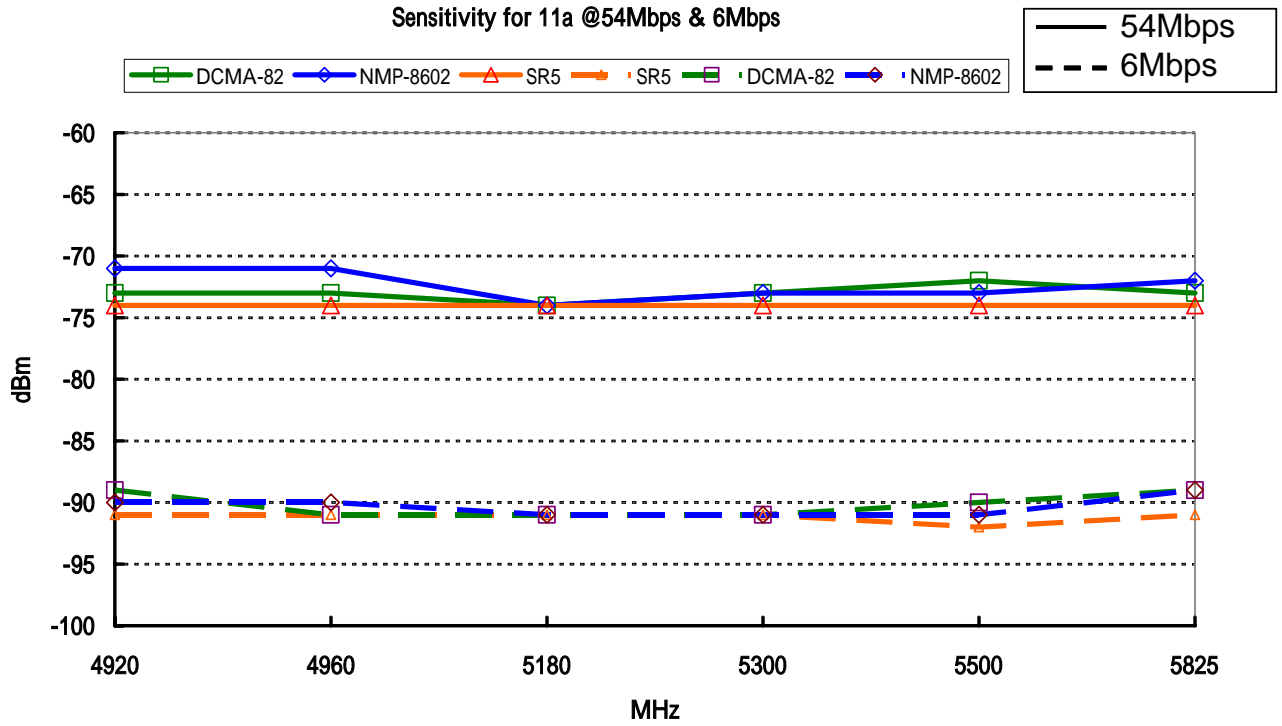
Sensitivity for 11b @11Mbps & 1Mbps



Sensitivity for 11g @54Mbps & 6Mbps



Sensitivity for 11a @54Mbps & 6Mbps



3-4 Current Consumption

■ **Purpose:**

To verify the current consumption during different operation modes

■ **Test Equipment:**

1. DC power supply

■ **Test Result**

* Under ART test mode		TX99 RF power (dBm)			current consumption (mA)		
Freq (MHz)	Mode	SR5	DCMA-82	NMP-8602	SR5	DCMA-82	NMP-8602
4920	6Mbps_TX99	12	20.5	18	610	960	810
	Continuous RX				220	250	260
	Idle				230	280	300
5220	6Mbps_TX99	21	22.7	18	880	1040	800
	Continuous RX				220	250	260
	Idle				230	280	300
5825	6Mbps_TX99	20.5	20.5	18	970	910	880
	Continuous RX				220	250	260
	Idle				230	280	300
2412	6Mbps_TX99	NA	23	19	NA	720	580
	Continuous RX	NA			NA	240	260
	Idle	NA			NA	280	300
2472	6Mbps_TX99	NA	23	19	NA	700	550
	Continuous RX	NA			NA	240	260
	Idle	NA			NA	280	300
2412	11Mbps_TX99	NA	23	23	NA	680	720
	Continuous RX	NA			NA	200	220
	Idle	NA			NA	230	250
2472	11Mbps_TX99	NA	23	22.5	NA	700	680
	Continuous RX	NA			NA	200	220
	Idle	NA			NA	230	250

3-5 FCC regulation power level & test result

- Following data had been measured in ADT 3M open site

Model	Mode	freq.	Avg power	FCC 2nd harmonic margin	Conclusion
WNC DCMA-82	11a_6Mbps	5825	21dBm	-5.2dB	PASS FCC
WNC DCMA-82	11a_11Mbps	2437	23dBm	-9.3dB	PASS FCC
Ubiquiti SR5	11a_6Mbps	5825	20dBm	+14.2dB	FAIL
Ubiquiti SR5	11a_6Mbps	5825	18dBm	+13.4dB	FAIL
Senao NMP-8602	11a_6Mbps	5825	15dBm	+2.7dB	FAIL
Senao NMP-8602	11a_6Mbps	5825	17dBm	+4.4dB	FAIL

3-6 DCMA-82 target power table

Average power table

Power	Condition	MIN	TYP	MAX	UNITS
11a	54 Mbps	16	18	19	dBm
	48 Mbps	17	19	20	
	36 Mbps	19	20	21	
	6, 9, 12, 18 Mbps	21	22	23	
11g	54 Mbps	18	20	21	
	48 Mbps	19	21	22	
	36 Mbps	21	22	23	
	6, 9, 12, 18 Mbps	22	23	24	
11b	1, 2, 5.5, 11Mbps	22	23	24	

Peak power table

Power	Condition	MIN	TYP	MAX	UNITS
11a	54 Mbps	23	24	25	dBm
	48 Mbps	24	25	26	
	36 Mbps	25	26	27	
	6, 9, 12, 18 Mbps	27	28	29	
11g	54 Mbps	25	26	27	
	48 Mbps	25	27	28	
	36 Mbps	27	28	29	
	6, 9, 12, 18 Mbps	28	29	30	
11b	1, 2, 5.5, 11Mbps	25	26	27	

- The delta between peak power and average power of OFDM signal(11a/g) is 5~10dB. 5~6dB is a reasonable value. But base on different measurement method and instrument the delta could be 10 or over 10dB. Like Ubiquiti's SR5 FCC report shown their peak to avg. ratio is over 10dB
- The delta between peak power and average power of CCK signal(11b) is 2~3dB. Usually the delta of 11b signal is more consistent.

4. Summary

4-1_ For spectrum mask, DCMA-82 got the best performance, except for 4920~4980MHz.

(The higher sidelobe for 4.9Ghz band signals of DCMA-82 won't be a problem for filing FCC)

















4-2_ For 11a EVM, DCMA-82 got the best performance from 4920 to 5850MHz and 2dB better in power level based on same EVM level.

4-3_ For 11g & 11b EVM, DCMA-82 & MNP-8602 got the similar performance.

4-4_ For 11a sensitivity, SR5 got the best performance, 1dB better than DCMA-82, and 2dB better than MNP-8602. There are two explanations. First, SR5 adapts Atheros Gen IV chipset, AR5312, which RX performance is better than Gen VI, AR5414. Second, SR5 is the solution for 11a only, therefore, SR5 save the path loss of diplexer.

4-5_ For 11b/g sensitivity, DCMA-82 got the best performance, and 2dB better than MNP-8602.

4-6_ The summary comparison table is shown as below,

Mode	Frequency band	SR5	DCMA-82	NMP-8602
TX power	4900~5000MHz			
	5150~5700MHz			
	5700~5850MHz			
	2400~2500MHz	NA		
Frequency mask	4900~5000MHz			
	5150~5700MHz			
	5700~5850MHz			
	2400~2500MHz	NA		
EVM	4900~5000MHz			
	5150~5700MHz			
	5700~5850MHz			
	2400~2500MHz	NA		
Sensitivity	4900~5000MHz			
	5150~5700MHz			
	5700~5850MHz			
	2400~2500MHz	NA	