



21-21160
Symbol 802.11a/b/g Wireless LAN Radio Module

FCC ID: H9P2121160

Technical rationale to support Radio Frequency testing at specified Data Rate.

The 21-21160 RF Module supports both IEEE 802.11a and IEEE 802.11g technologies. These technologies are capable of data rates of up to 54Mbps. The modulation technique employed is OFDM (Orthogonal Frequency Division Multiplex).

In order to test for a 'worst case' condition, 6Mbps was chosen as this gives rise to the highest RF output power and hence 'worst case' for the spectrum mask and emission profiles.

The highest data rate of 54Mbps reduces the RF power by approx 2.4-3.6dB below that RF Power value obtained at 6Mbps.

Therefore, Symbol Technologies declares the figure of 6Mbps data rate for OFM modulation produces the 'worst case' condition to demonstrate compliance.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Alan Parrish".

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**POWER AND BANDWIDTH COMPARISON BETWEEN DATA RATES & MOD/SCHEMES ON
BEHALF OF SYMBOL TECHNOLOGIES**

The sample used for testing was a Symbol 21-21160 Module Serial Number TH4290078, this unit is the same build standard (Rev 3.5) as those recorded in BABT Test Reports OR611511/01 Issue 01, OR611511/02 Issue 04 RO611511/01 Issue 02, RO611511/02 Issue 02 and RO611511/03 Issue 01.

Power

The EUT was connected to the peak power analyser via a 20dB attenuator & cable. The previously measured path loss was then offset in the peak power analyser and the average power measured.

Average Power 2.4GHz RLAN

Sample No OS 611511/24

Temperature 23°C

Humidity 44%

Operating Frequency		2412MHz	2442MHz	2472MHz
Data Rate/Mod/Sch		Average Power dBm		
802.11b	1 Mbps (BPSK)	17.29	17.25	17.29
	2 Mbps (BPSK)	17.53	17.35	17.45
	5.5 Mbps (CCK)	17.59	17.58	17.54
	11 Mbps (CCK)	17.63	17.60	17.58
802.11g	6 Mbps (OFDM)	16.09	16.10	16.16
	9 Mbps (OFDM)	15.98	15.99	16.05
	12 Mbps (OFDM)	14.29	14.49	14.50
	18 Mbps (OFDM)	14.40	14.53	14.72
	24 Mbps (OFDM)	11.90	12.03	12.12
	36Mbps (OFDM)	11.84	11.91	11.99
	48 Mbps (OFDM)	10.20	10.37	10.80
	54 Mbps (OFDM)	10.12	9.95	10.03

Average Power 5GHz Hyper LAN

Sample No OS 611511/24

Temperature 23°C

Humidity 44%

Operating Frequency	5180MHz	5240MHz	5320MHz	5745MHz	5805MHz	5830MHz
Data Rate/Mod/Sch	Average Power dBm					
6 Mbps (OFDM)	16.14	16.20	16.06	16.15	16.12	16.04
9 Mbps (OFDM)	15.94	15.98	16.03	16.04	16.01	15.82
12 Mbps (OFDM)	14.79	15.04	14.21	14.15	15.01	14.35
18 Mbps (OFDM)	14.66	14.40	14.47	14.42	14.21	14.39
24 Mbps (OFDM)	14.07	11.47	11.81	12.04	12.40	12.30
36Mbps (OFDM)	11.59	11.67	11.41	11.82	12.28	12.14
48 Mbps (OFDM)	10.84	10.69	10.13	10.08	10.14	10.34
54 Mbps (OFDM)	9.61	9.51	9.71	9.80	10.04	10.05

6dB Bandwidth

The EUT was transmitted at the maximum output power at all data rates via a 20dB attenuator & cable to the spectrum analyser. The analyser settings were adjusted to display the resultant trace on the screen with 100kHz Res & 300kHz Vid coupling. Using a peak detector on Max hold/view, the delta markers were used to display the 6dB bandwidth from the peak point of the signal.

6dB Bandwidth 2.4GHZ RLAN

6dB B/W Sample No OS 611511/24 Temperature 23°C Humidity 44%

Operating Frequency		2412MHz	2442MHz	2472MHz
Data Rate/Mod/Sch		6dB Bandwidth MHz		
802.11b	1 Mbps (BPSK)	12.986	12.986	12.966
	2 Mbps (BPSK)	12.665	12.485	12.645
	5.5 Mbps (CCK)	12.826	12.806	12.806
	11 Mbps (CCK)	12.345	12.325	12.164
802.11g	6 Mbps (OFDM)	16.513	16.493	16.473
	9 Mbps (OFDM)	16.513	16.493	16.473
	12 Mbps (OFDM)	16.513	16.493	16.473
	18 Mbps (OFDM)	16.513	16.493	16.473
	24 Mbps (OFDM)	16.513	16.493	16.473
	36Mbps (OFDM)	16.513	16.493	16.473
	48 Mbps (OFDM)	16.513	16.493	16.473
	54 Mbps (OFDM)	16.513	16.493	16.473

26dB emission bandwidth

The EUT was connected to a spectrum analyser via a 20dB attenuator & cable. The RBW was set to 100kHz & VBW to 300kHz. The span was adjusted to encompass the whole of the fundamental. The peak detector was selected and the trace set to view. The -26dB points were searched for using the Marker delta function from the peak of the trace. The resultant difference in markers was recorded as the Emission Bandwidth.

Emission Bandwidth 5GHz

26dB B/W Sample No OS 611511/24 Temperature 23°C Humidity 44%

Operating Frequency	5180MHz	5240MHz	5320MHz	5745MHz	5805MHz	5830MHz
Data Rate/Mod/Sch	26dB Emission Bandwidth MHz					
6 Mbps (OFDM)	34.469	35.271	35.271	30.140	33.186	31.272
9 Mbps (OFDM)	36.072	36.072	35.271	27.896	34.469	29.509
12 Mbps (OFDM)	29.820	29.820	28.056	22.124	25.972	24.218
18 Mbps (OFDM)	29.656	28.537	27.896	21.323	23.246	22.936
24 Mbps (OFDM)	26.293	23.246	21.002	18.597	19.078	18.607
36Mbps (OFDM)	19.078	19.078	19.078	18.437	18.597	18.607
48 Mbps (OFDM)	17.956	18.116	17.796	17.956	17.796	17.806
54 Mbps (OFDM)	18.277	18.277	18.116	18.277	18.116	18.126

MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are: -

Test Discipline	Frequency / Parameter	MU
For Emissions Bandwidth	±210.894kHz	±0.5dB
For Output Power	Not Applicable	±0.5dB