FCC Part 15.247(d) Band Edge Compliance Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) Band Edge Compliance Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	04 Oct 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006

FCC Part 15.247(d) Band Edge Compliance Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF external antenna connector was connected to the EUT.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz to show compliance of spurious at band edges are at least 20dB below the carriers. For restricted band spurious at band edges, peak and average measurement plots were taken using the following setting:
   a. Peak Plot:
      RBW = VBW = 1MHz
   b. Average Plot
      RBW = 1MHz, VBW = 10Hz
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with specified modulation and data rate.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

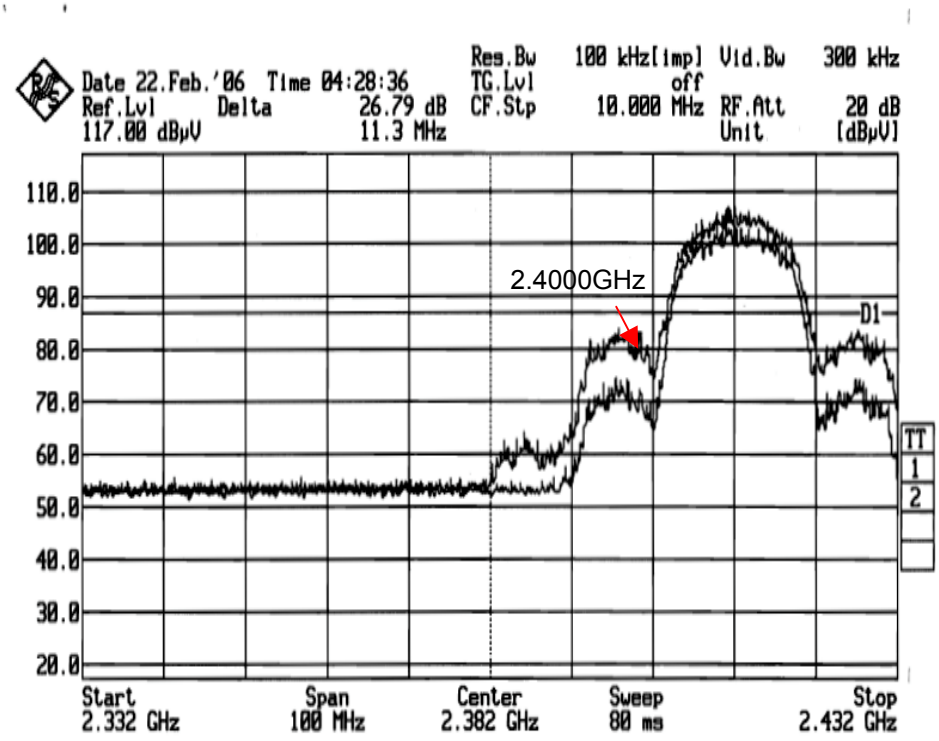
Band Edge Compliance Test Setup

FCC Part 15.247(d) Band Edge Compliance Results

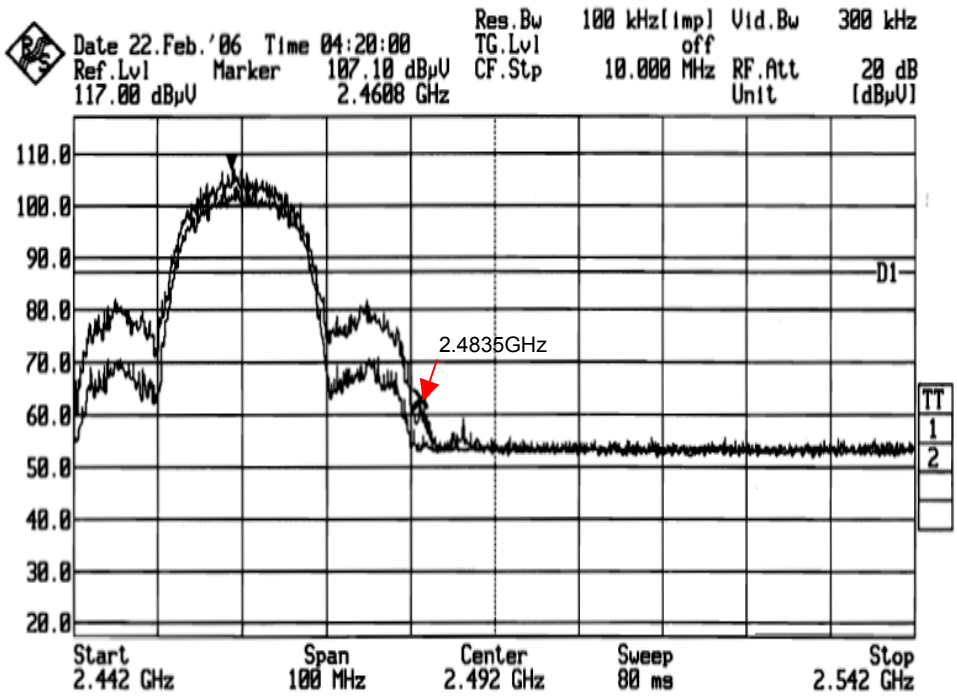
Operating Mode	WLAN 802.11b/g	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Attached Plots	26 - 37	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

No significant signal was found and they were below the specified limit.

Band Edge Compliance Plots (20dB Delta from Carrier at Band Edge) - WLAN 802.11b

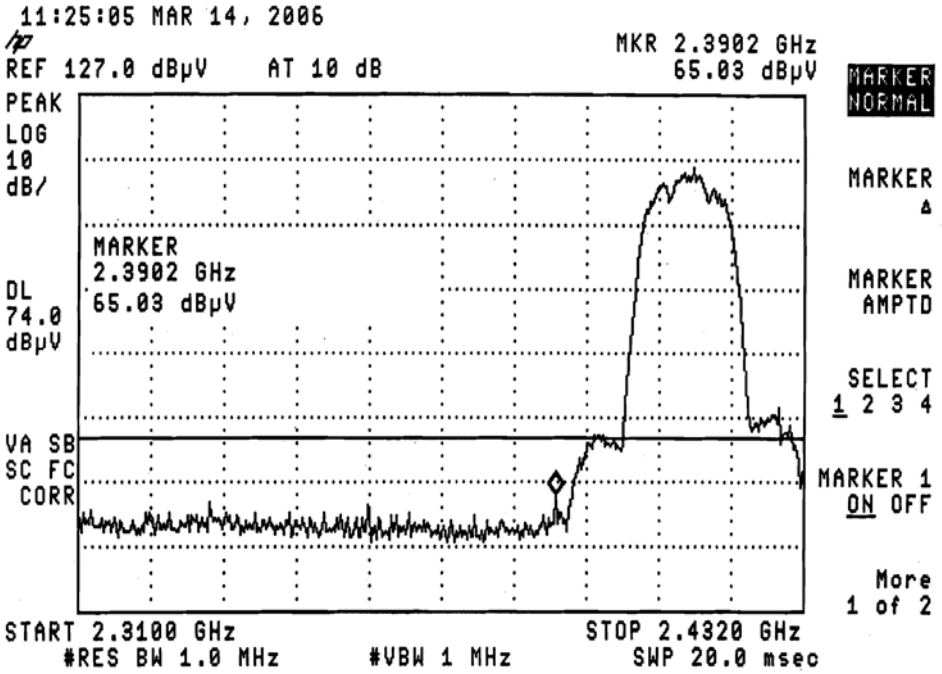


Plot 26 – Lower Band Edge at 2.4000GHz (WLAN 802.11b)

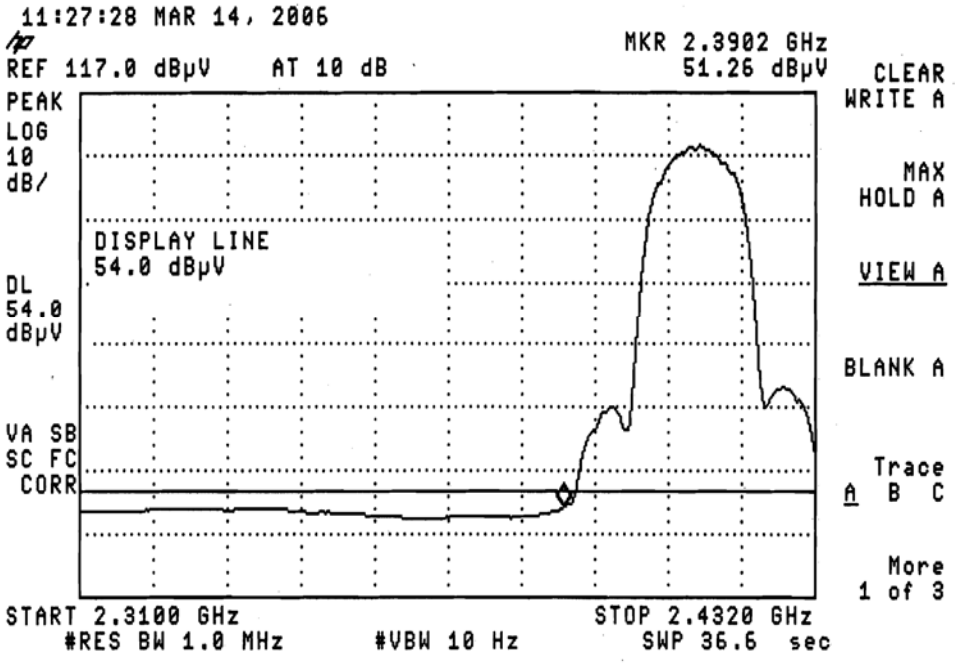


Plot 27 – Upper Band Edge at 2.4835GHz (WLAN 802.11b)

Band Edge Compliance Plots (Restricted Band)- WLAN 802.11b

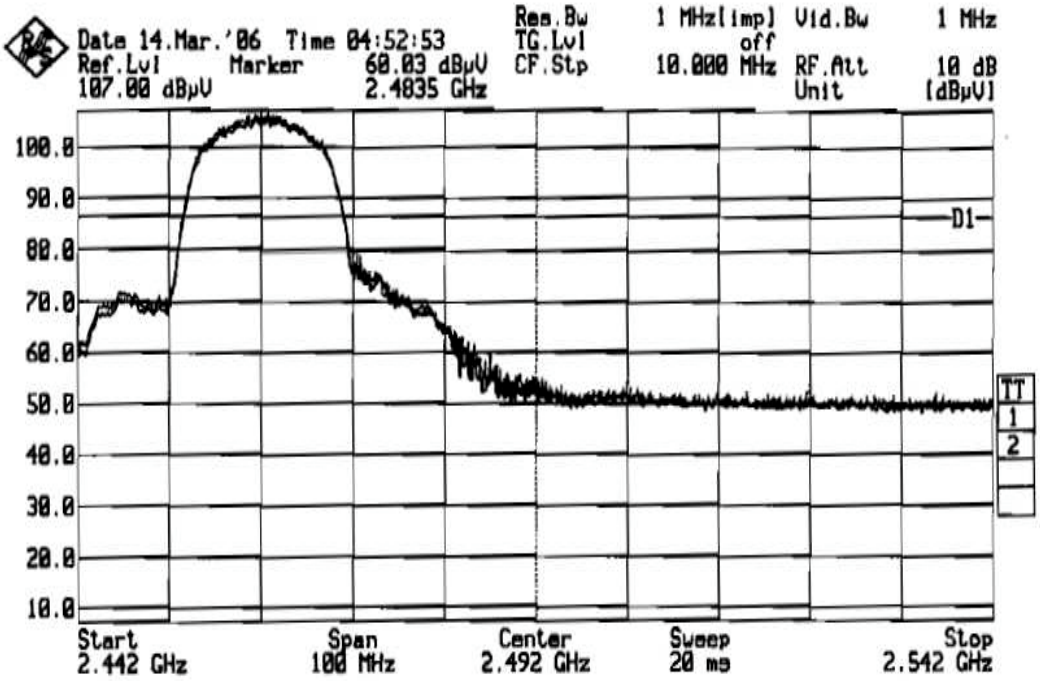


Plot 28 – Peak Plot for Lower Band Edge (WLAN 802.11b)

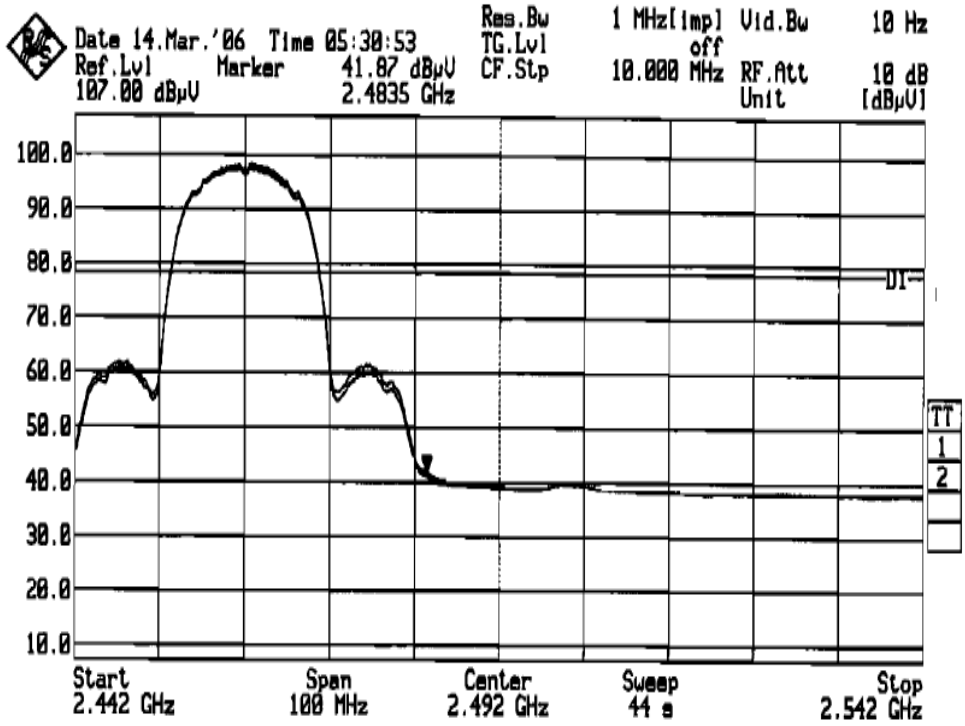


Plot 29 – Average Plot for Lower Band Edge (WLAN 802.11b)

Band Edge Compliance Plots (Restricted Band) - WLAN 802.11b

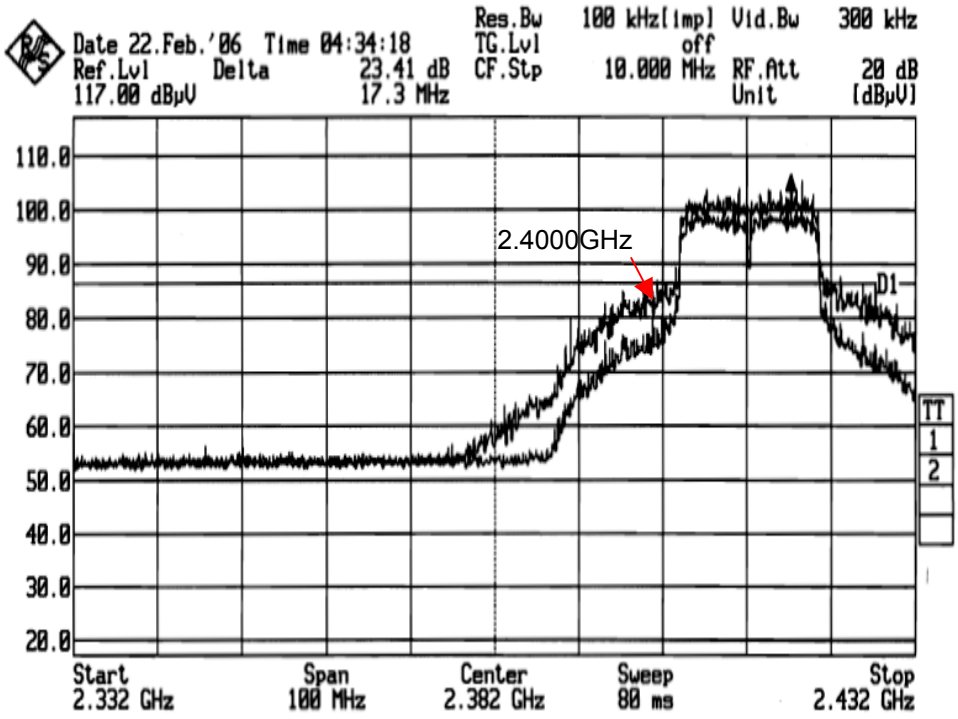


Plot 30 – Peak Plot for Upper Band Edge (WLAN 802.11b)

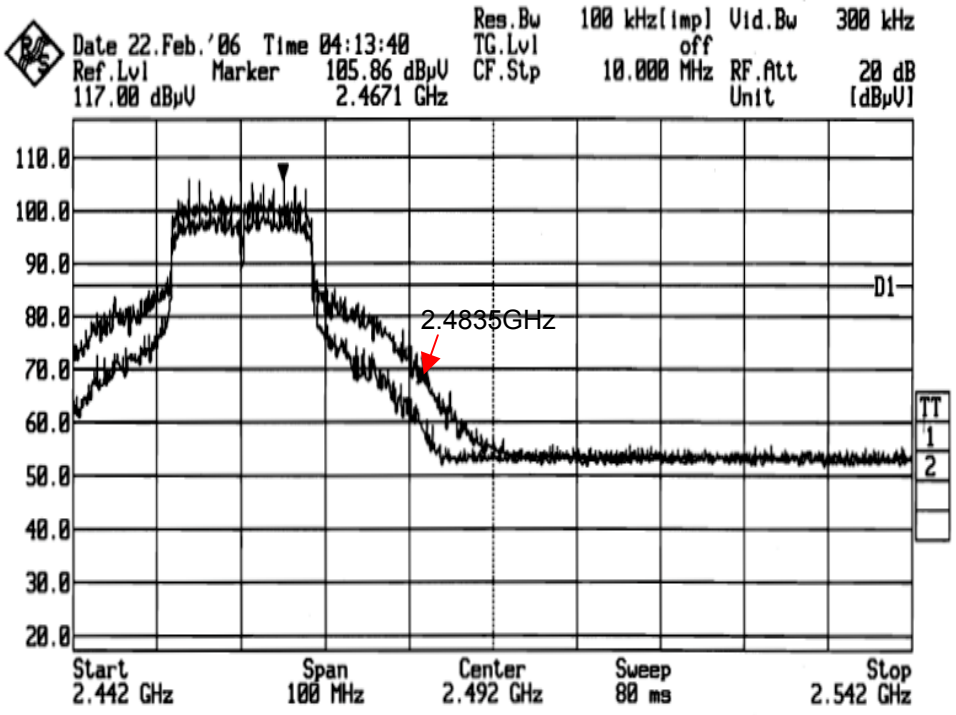


Plot 31 – Average Plot for Upper Band Edge (WLAN 802.11b)

Band Edge Compliance Plots (20dB Delta from Carrier at Band Edge) - WLAN 802.11g

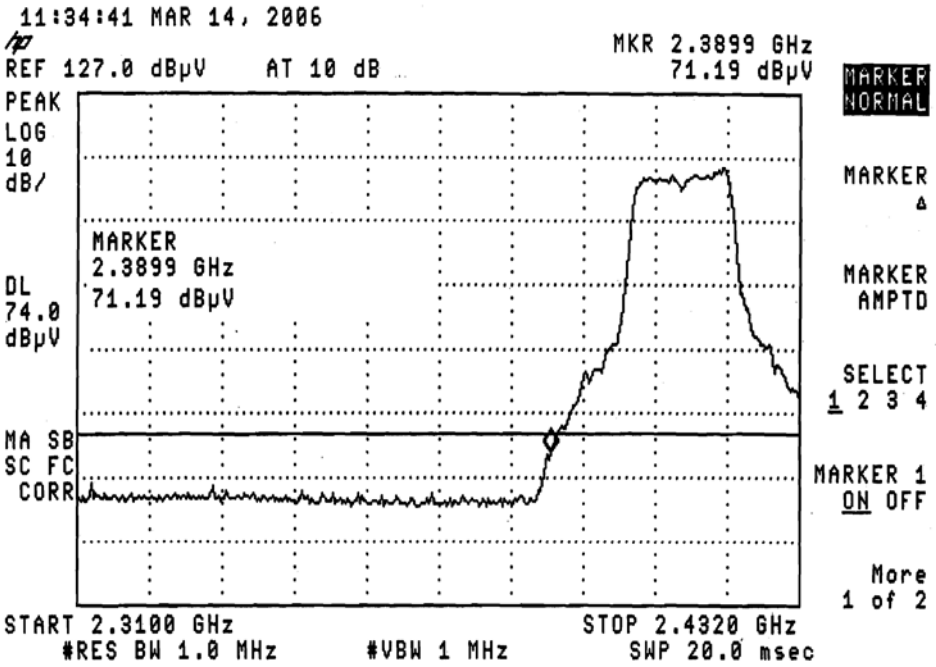


Plot 32 – Lower Band Edge at 2.4000GHz (WLAN 802.11g)

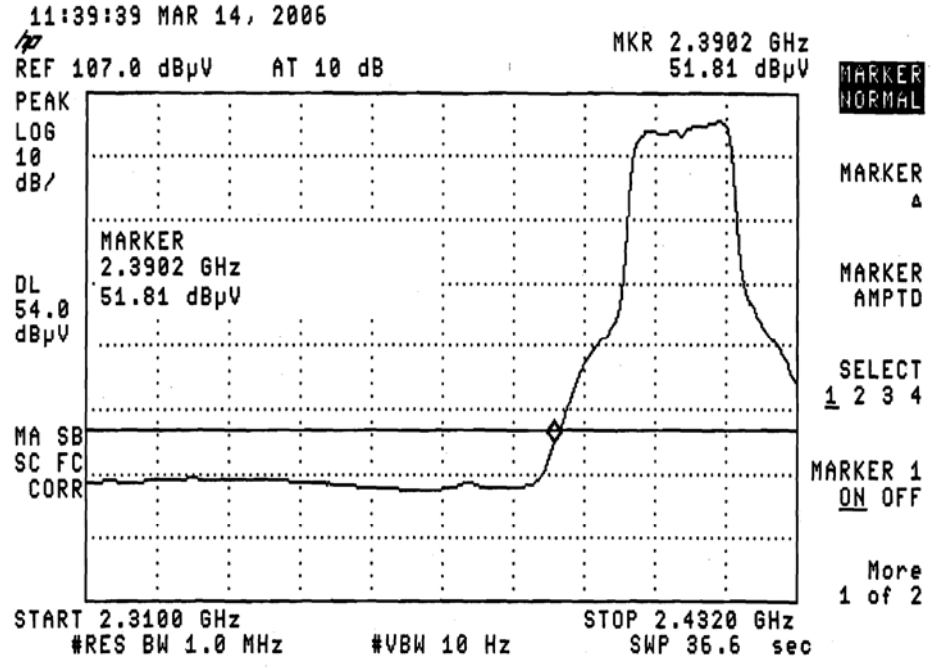


Plot 33 – Upper Band Edge at 2.4835GHz (WLAN 802.11g)

Band Edge Compliance Plots (Restricted Band) - WLAN 802.11g

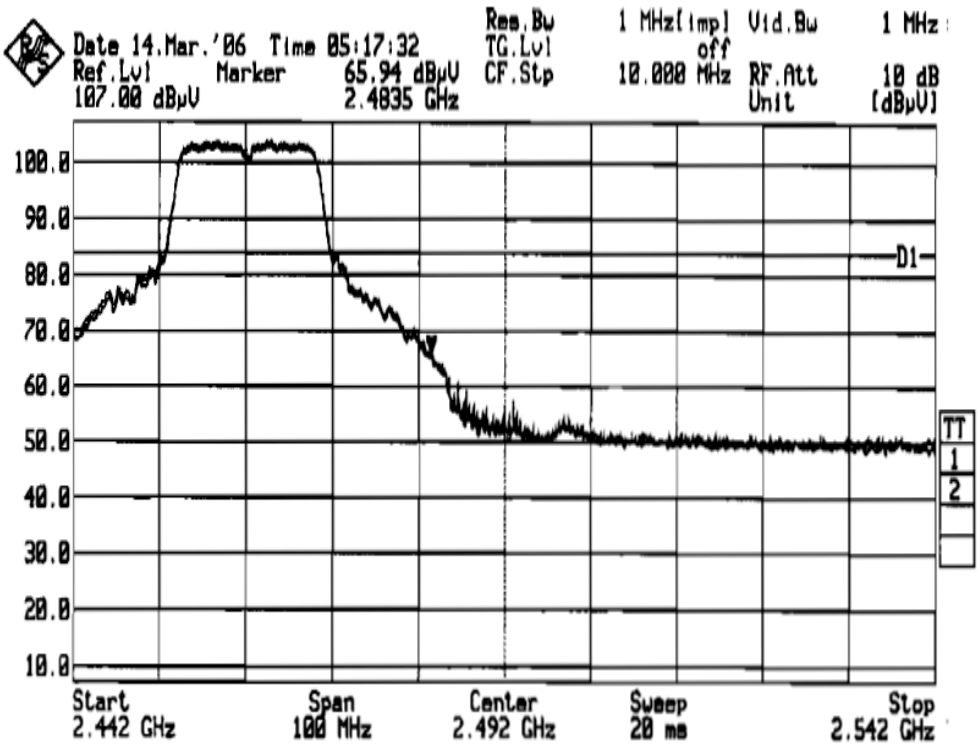


Plot 34 – Peak Plot for Lower Band Edge (WLAN 802.11g)

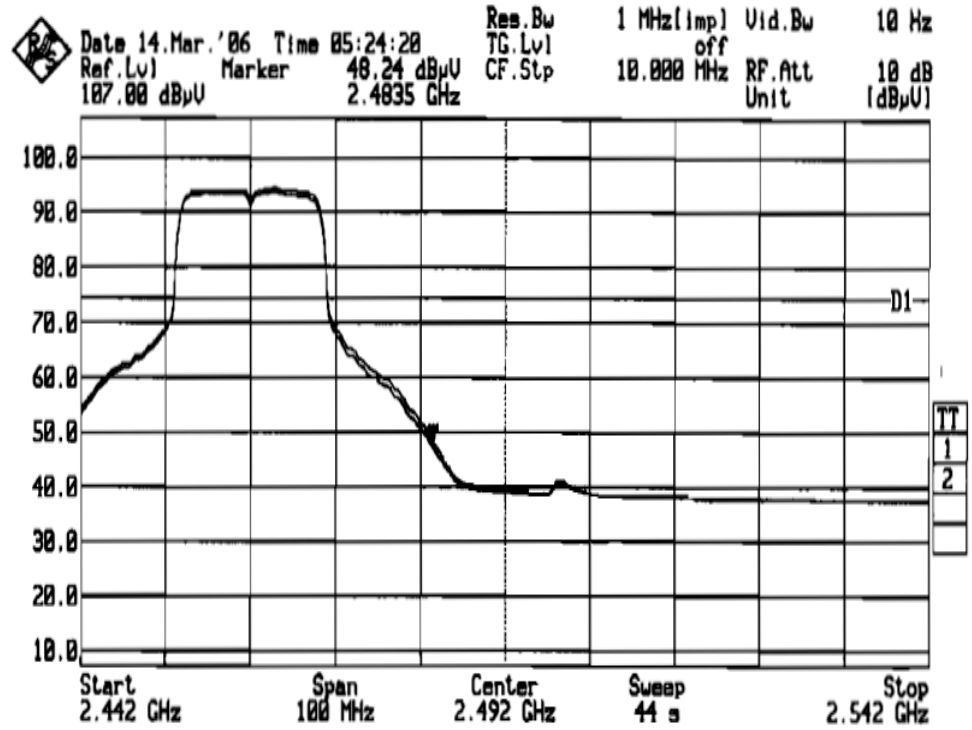


Plot 35 – Average Plot for Lower Band Edge (WLAN 802.11g)

Band Edge Compliance Plots (Restricted Band) - WLAN 802.11g



Plot 36 – Peak Plot for Upper Band Edge (WLAN 802.11g)



Plot 37 – Average Plot for Upper Band Edge (WLAN 802.11g)

PART 4

This part (Part 4) details the following test results on WLAN 802.11a:

1. **Conducted Emission Test**
2. **Radiated Emission Test**
3. **Maximum Peak Power Test**
4. **Band Edge Compliance Test**

FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (QP)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz–26.5GHz) – ESMI2	ESMI	829214/006 829550/001	22 Apr 2006
EMCO LISN (for EUT) – LISN9	3825/2	9309-2128	24 Jan 2006
EMCO LISN (for supporting) – LISN6	3825/2	9309-2127	03 May 2006
R&S Pulse Limiter – PL2	ESH3-Z2	100347	15 Apr 2006

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz Q-P limit (Class B) = 1000 µV = 60.0 dBµV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBµV
(Calibrated for system losses)

Therefore, Q-P margin = 40.0 - 60.0 = -20.0 i.e. **20.0 dB below Q-P limit**

Conducted Emissions Test Setup (Front View)

Conducted Emissions Test Setup (Rear View)

FCC Parts 15.107(a) and 15.207 Conducted Emission Results

Operating Mode	WLAN 802.11a (Lower Band)	Temperature	22°C
Test Input Power	110V 60Hz	Relative Humidity	58%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
		Tested By	Tan Swee Seng

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.1593	52.9	-12.6	47.1	-8.4	Live	36
0.2235	41.7	-21.0	35.4	-17.3	Neutral	36
0.3459	37.7	-21.4	27.6	-21.5	Neutral	36
13.4845	37.3	-22.7	27.1	-22.9	Neutral	36
19.0935	39.3	-20.7	29.3	-20.7	Live	36
19.7465	37.2	-22.8	27.1	-22.9	Live	36

Operating Mode	WLAN 802.11a (Middle Band)	Temperature	22°C
Test Input Power	110V 60Hz	Relative Humidity	58%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
		Tested By	Tan Swee Seng

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.2357	47.8	-14.4	37.8	-14.4	Live	52
0.2847	40.9	-19.8	30.8	-19.9	Neutral	52
0.6025	29.6	-26.4	29.1	-16.9	Neutral	52
0.8560	29.6	-26.4	28.9	-17.1	Neutral	52
19.0935	39.3	-20.7	34.1	-15.9	Live	52
19.1910	38.2	-21.8	27.7	-22.3	Neutral	52

Operating Mode	WLAN 802.11a (Upper Band)	Temperature	22°C
Test Input Power	110V 60Hz	Relative Humidity	58%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
		Tested By	Tan Swee Seng

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.2602	43.0	-18.4	32.9	-18.5	Neutral	149
0.3337	36.8	-22.6	26.7	-22.7	Neutral	149
0.5908	31.4	-24.6	25.4	-20.6	Neutral	149
13.5708	45.1	-14.9	41.6	-8.4	Live	149
19.3085	37.3	-22.7	32.8	-17.2	Live	149
19.6708	37.4	-22.6	28.9	-21.1	Live	149

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   9kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±2.4dB.

FCC Part 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6
13.36 - 13.41			

FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*
* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.	

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	04 Oct 2006
HP Preamplifier (100kHz-1.3GHz) – PA2	8447D	2944A08173	01 Apr 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
Schaffner Bilog Antenna – BL9	CBL6143	5045	13 May 2006
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2006
HP Spectrum Analyser (30Hz-40GHz)	8564E	3846A01433	27 Apr 2006
Bandstop Filter (2.4-2.5 GHz)	BRM50701	017	13 Aug 2006

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which attitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 10th harmonics of the EUT fundamental frequency or 40GHz whichever is lower, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

Sample Calculation Example

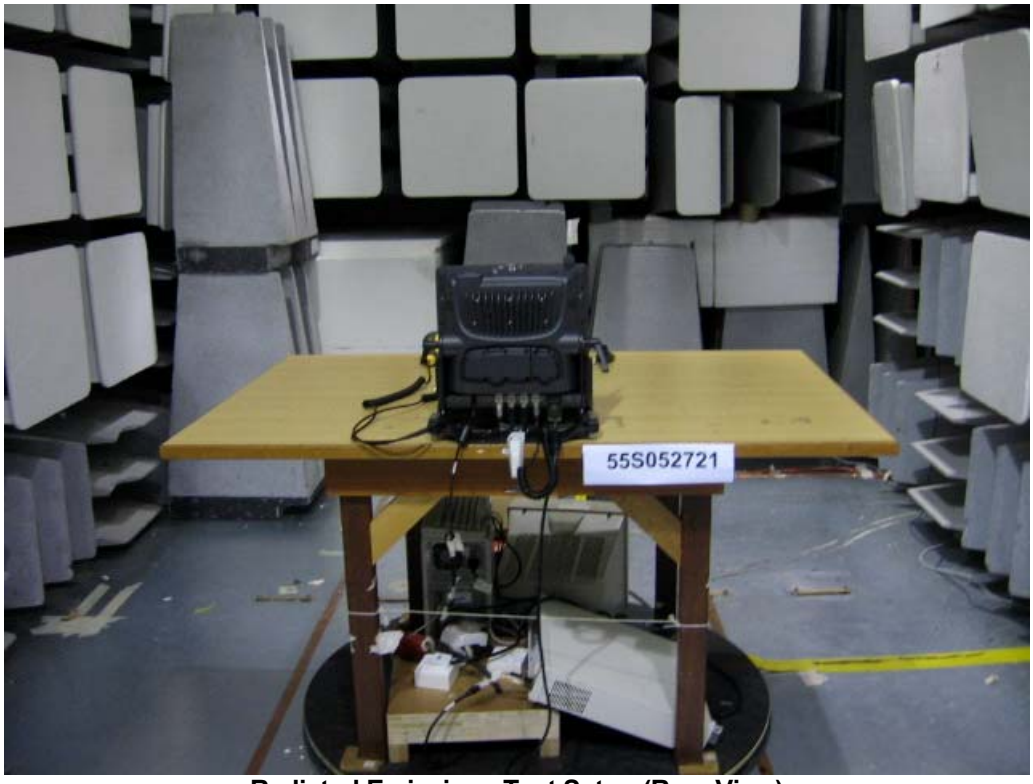
At 300 MHz Q-P limit (Class B) = 200 μV/m = 46.0 dBμV/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40.0 - 46.0 = -6.0 i.e. **6 dB below Q-P limit**

Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Operating Mode	WLAN 802.11a (Lower Band)	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Test Distance	3m	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
91.4901	37.4	-6.1	0	100	V	36
127.0348	37.5	-6.1	0	100	V	36
281.2211	38.5	-7.5	24	102	V	36
363.4322	39.9	-6.1	55	130	H	36
--	--	--	--	--	--	--
--	--	--	--	--	--	--

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m) Note 4	Average Margin (dB) Note 5	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
10.3602	48.4	--	-5.6	65	100	H	36
10.4809	48.5	--	-5.5	78	100	H	48
15.5404	44.3	--	-9.7	54	100	H	36
15.7205	43.1	--	-109	90	100	H	48
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Operating Mode	WLAN 802.11a (Middle Band)	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Test Distance	3m	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
162.8901	36.2	-7.4	359	101	V	52
283.1711	40.8	-5.2	301	100	H	52
311.5045	37.1	-8.9	333	110	V	52
823.8912	36.7	-9.3	278	121	V	52
--	--	--	--	--	--	--
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Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m) Note 4	Average Margin (dB) Note 5	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
10.5203	48.5	--	-5.5	45	100	H	52
10.6401	48.1	--	-5.9	55	100	H	64
15.7806	43.2	--	-10.8	67	100	H	52
15.9602	43.7	--	-10.4	77	100	H	64
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Operating Mode	WLAN 802.11a (Upper Band)	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Test Distance	3m	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
151.2311	33.3	-10.2	222	101	V	149
340.4301	35.8	-10.2	143	120	V	149
365.1290	30.1	-15.9	30	121	V	149
933.4581	40.7	-5.4	236	100	H	149
--	--	--	--	--	--	--
--	--	--	--	--	--	--

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m) Note 4	Average Margin (dB) Note 5	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
11.4903	47.8	--	-6.2	3	100	H	149
11.5702	48.1	--	-5.9	43	100	H	157
11.6101	48.1	--	-5.9	78	100	H	161
17.2350	44.5	--	-9.5	44	100	H	149
17.3551	43.5	--	-10.5	54	100	H	157
17.4150	43.2	--	-10.8	65	100	H	161

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. For the measurement below 1GHz, the worst case channel was selected for test.
3. The external antenna was used during the measurement as it was found to be the worst case configuration.
4. The transmitting antenna was found to be in the worst case condition when it was orientated in a vertical position.
5. As the measured peak shows compliance to the average limit, as such no average measurement was required.
6. The average margin indicates the margin of the measured peak value below the average limit.
7. "--" indicates no emissions were found and shows compliance to the limits.
8. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz.
9. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.

10. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
    30MHz - 1GHz
    RBW: 120kHz VBW: 1MHz
    >1GHz
    RBW: 1MHz VBW: 1MHz
11. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
12. The channel in the table refers to the transmit channel of the EUT.
13. Radiated Emissions Measurement Uncertainty
    All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 40GHz (QP only @ 3m & 10m) is ±4.3dB (for EUTs < 0.5m X 0.5m X 0.5m).

FCC Part 15.407(a) Maximum Output Power Limits

The EUT shows compliance to the requirements of this section, which states:

1. For the band 5.15GHz - 5.25GHz, the maximum output power over the frequency band of operation shall not exceeded the lesser of 50mW or 4dBm + 10logB, where B is the 26dB emission bandwidth in MHz.
2. For the 5.25GHz - 5.35GHz and 5.47GHz - 5.725GHz bands, the maximum output power over the frequency band of operation shall not exceeded the lesser of 250mW or 11dBm + 10logB, where B is the 26dB emission bandwidth in MHz.
3. For the 5.725GHz - 5.825GHz band, the maximum output power over the frequency band of operation shall not exceeded the lesser of 1W or 17dBm + 10logB, where B is the 26dB emission bandwidth in MHz.

FCC Part 15.407(a) Maximum Output Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyzer (30Hz-40GHz)	8564E	3846A01433	27 Apr 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2006
Agilent Synthesized Sweeper – SG10	83620B	3844A01337	24 Jan 2008

FCC Parts 15.407(a) Maximum Output Power Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 1MHz and 1/T where T is the pulse duration over which transmitter is on at maximum power.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.407(a) Maximum Output Power Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 36 (5.180GHz) with specified modulation and data rate.
2. The span of the spectrum analyser was set to wide enough to encompass the emission bandwidth of the transmitting signal.
3. The signal capturing was set in max hold mode and last for 60 seconds.
4. The maximum output power was computed by integrating the spectrum across the 26dB entire emission bandwidth (EBW) or apply a bandwidth correction factor of 10log (EBW / 1MHz) to the spectral peak of the emission.
5. Repeat steps 1 to 4 on channels 48 (5.240GHz), 52 (5.260GHz), 64 (5.320GHz), 149 (5.745GHz), 157 (5.785GHz), and 161 (5.805GHz) respectively.

Maximum Output Power Test Setup

FCC Part 15.407(a) Maximum Output Power Results

Operating Mode	WLAN 802.11a	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)	Data Rate

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)	Data Rate
Lower Band				
36	5.180	0.0011	0.050	6Mbps
48	5.240	0.0007	0.050	6Mbps
Middle Band				
52	5.260	0.0013	0.250	6Mbps
64	5.320	0.0035	0.250	6Mbps
Upper Band				
149	5.745	0.0034	1.000	6Mbps
157	5.785	0.0043	1.000	6Mbps
161	5.805	0.0036	1.000	6Mbps

FCC Part 15.407(b) Band Edge Compliance Limits

The EUT shows compliance to the requirements of this section, which states:

1. For transmitter operating in the 5.15GHz - 5.25GHz band, all emissions outside the 5.15GHz - 5.25GHz band shall not exceed an EIRP of -27dBm/MHz.
2. For transmitter operating in the 5.25GHz - 5.35GHz band, all emissions outside of the 5.15GHz - 5.35GHz band shall not exceed an EIRP of -27dBm/MHz.
3. For transmitter operating in the 5.725GHz - 5.825GHz band, all emissions within the frequency range from the band edge to 10MHz above or below the band edge shall not exceed an EIRP of -17dBm/MHz. For frequencies 10MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27dBm/MHz.

FCC Part 15.407(b) Band Edge Compliance Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	04 Oct 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006

FCC Part 15.407(b) Band Edge Compliance Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF external antenna connector was connected to the EUT.
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.407(b) Band Edge Compliance Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 36 (5.180GHz) with specified modulation and data rate.
2. The spurious emission at the band edge of 5.150GHz were captured and recorded.
3. The EUT was replaced with the substitution antenna with the antenna input was connected to the signal generator via a 10dB attenuator (if possible). The antenna was set to vertical polarization.
4. The signal generator was set to the recorded spurious frequency in step 2. The output level of the signal generator was adjusted until the test receiver was at least 20dB above the level when the signal generator was switched off.
5. The test antenna was raised and lowered through the specified range of heights (1m – 4m) until the maximum signal level was received on the test receiver.
6. The substitution antenna was rotated until the maximum level was detected on the test receiver.
7. The output level of the signal generator was adjusted until the received signal level at the test receiver was equal to the level recorded in step 2 (A dBm). The signal generator output level was recorded as B (in dBm).
8. The spurious emission at the band edge, P (e.i.r.p) was computed as followed:

P (e.i.r.p) = B – C – D + E

where C = Cable loss between the signal generator and the substitution

D = Attenuation level if attenuator is used

E = Substitution antenna gain

9. The steps 5 to 8 were repeated with the receiving antenna was set to horizontal polarization.
10. Comparison was made on both measured results with vertical and horizontal polarizations. The highest value out of vertical and horizontal polarizations was recorded.
11. The steps 1 to 10 were repeated with the EUT was set to transmit at Channel 64 to capture band edge spurious emission at band edge 5.35GHz.
12. The steps 1 to 10 were repeated with the EUT was set to transmit at Channels 149 and 161 to capture the spurious emission band edge at 5.725GHz and 5.825GHz respectively.

Band Edge Compliance Test Setup

FCC Part 15.407(b) Band Edge Compliance Results

Operating Mode	WLAN 802.11a	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Attached Plots	38 - 41	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

5.15GHz - 5.35GHz @ 6Mbps (WLAN 802.11a) (See plots 38 - 39 for details)

Spurious (GHz)	Maximum EIRP outside Band edge (dBm)	Limit (dBm)	Margin (dB)
Lower Edge			
<5.15GHz	--	-27	--
Upper Edge			
>5.35GHz	--	-27	--

See plots 36 - 37 for details

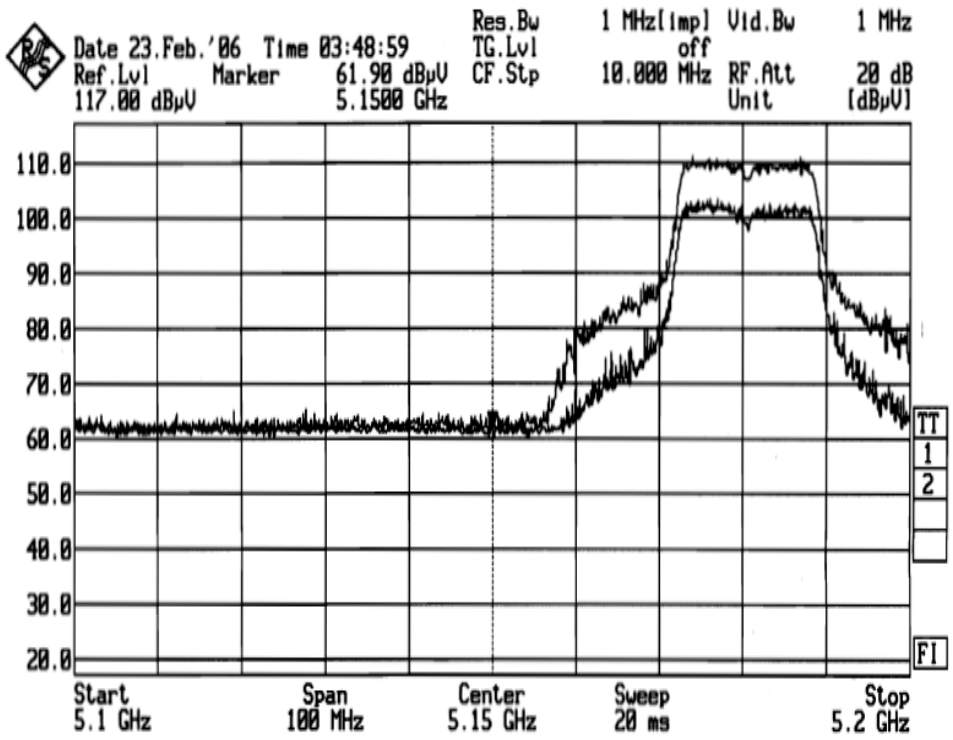
5.725GHz - 5.825GHz @ 6Mbps (WLAN 802.11a) (See plots 40 - 41 for details)

Spurious (GHz)	Maximum EIRP outside Band edge (dBm)	Limit (dBm)	Margin (dB)
Lower Edge			
5.715 - 5.725	--	-17.0	--
< 5.715	--	-27.0	--
Upper Edge			
5.825 - 5.835	--	-17.0	--
>5.835	--	-27.0	--

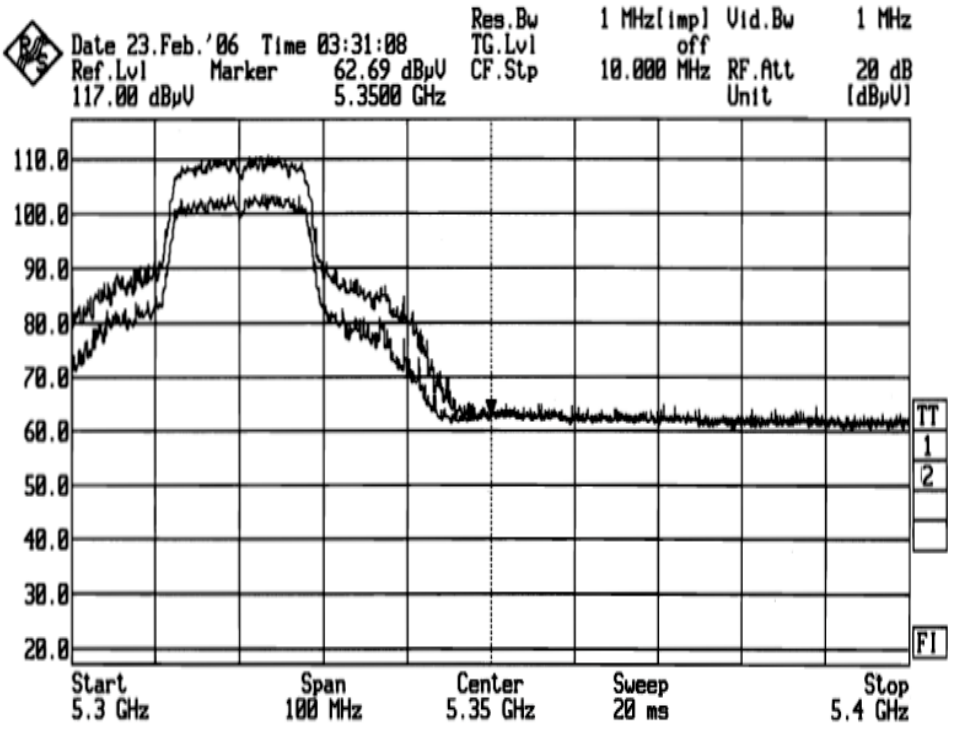
Notes

1. "--" indicates no emissions were found and shows compliance to the limits.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.

Band Edge Compliance Plots - WLAN 802.11a (5.150GHz - 5.350GHz)

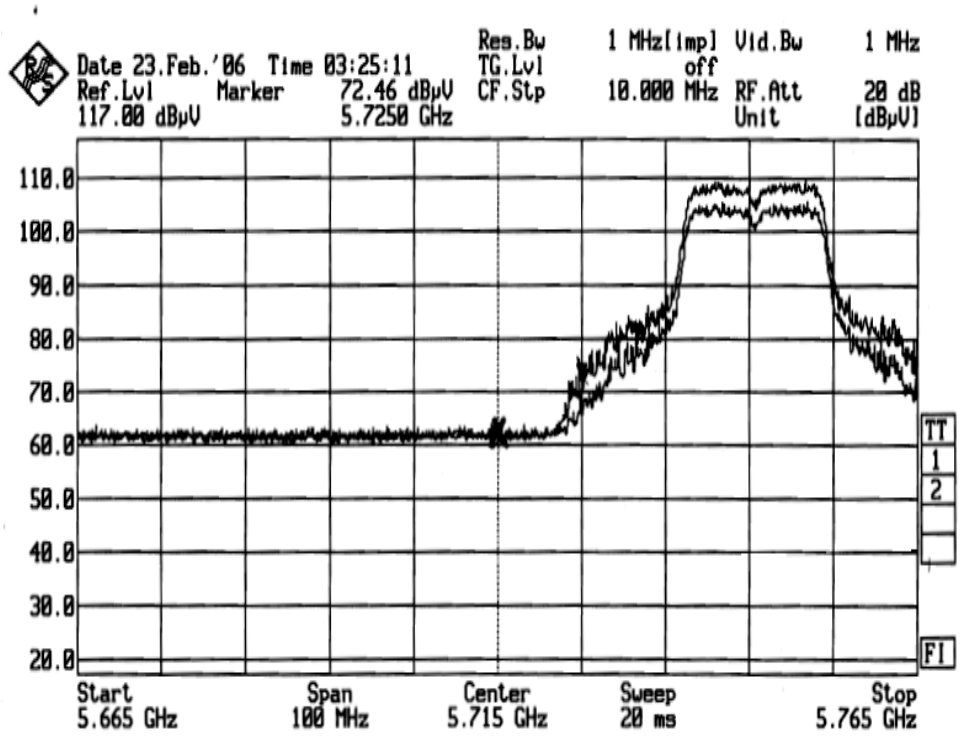


Plot 38 – Lower Band Edge at 5.1500GHz

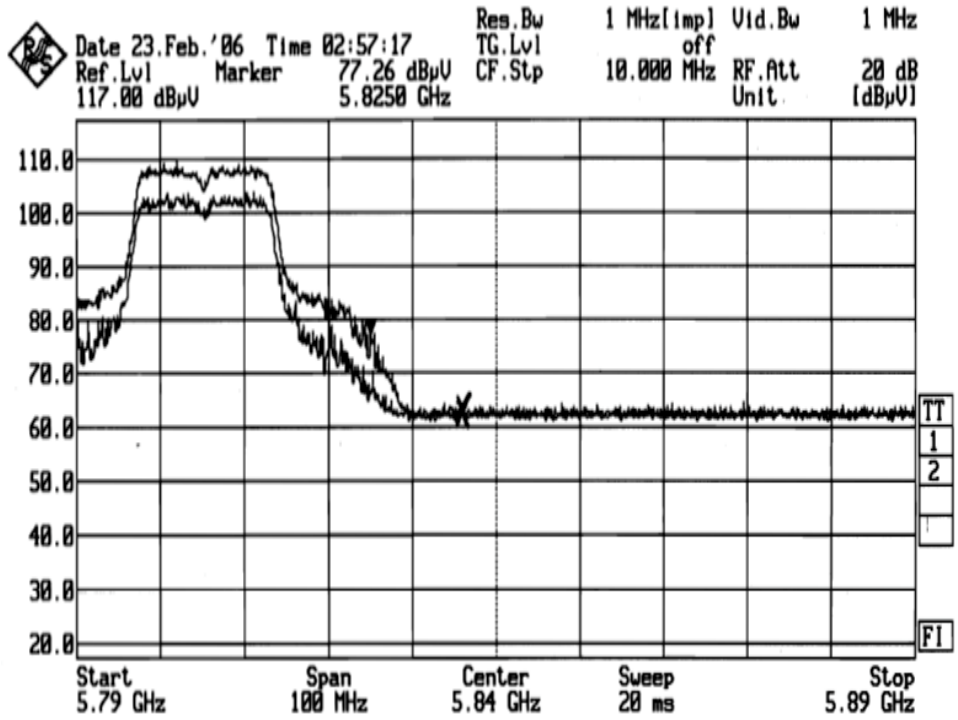


Plot 39 – Upper Band Edge at 5.3500GHz

Band Edge Compliance Plots - WLAN 802.11a (5.725GHz - 5.825GHz)



Plot 40 – Lower Band Edge at 5.7250GHz



Plot 41 – Upper Band Edge at 5.8250GHz

PART 5

This part (Part 5) details the following test results on WLAN 802.11a (ISM Band):

1. **Conducted Emission Test**
2. **Radiated Emission Test**
3. **Maximum Peak Power Test**
4. **Band Edge Compliance Test**

FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (QP)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz–26.5GHz) – ESMI2	ESMI	829214/006 829550/001	22 Apr 2006
EMCO LISN (for EUT) – LISN9	3825/2	9309-2128	24 Jan 2006
EMCO LISN (for supporting) – LISN6	3825/2	9309-2127	03 May 2006
R&S Pulse Limiter – PL2	ESH3-Z2	100347	15 Apr 2006

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz Q-P limit (Class B) = 1000 µV = 60.0 dBµV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBµV
(Calibrated for system losses)

Therefore, Q-P margin = 40.0 - 60.0 = -20.0 i.e. **20.0 dB below Q-P limit**

Conducted Emissions Test Setup (Front View)

Conducted Emissions Test Setup (Rear View)

FCC Parts 15.107(a) and 15.207 Conducted Emission Results

Operating Mode	WLAN 802.11a (ISM Band)	Temperature	22°C
Test Input Power	110V 60Hz	Relative Humidity	58%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
		Tested By	Tan Swee Seng

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.2847	42.1	-18.6	35.0	-15.7	Neutral	165
0.3459	35.8	-23.3	25.7	-23.4	Neutral	165
0.5908	31.5	-24.5	25.4	-20.6	Live	165
19.1910	39.4	-20.6	32.3	-17.7	Live	165
19.3930	38.2	-21.8	29.8	-20.2	Neutral	165
19.6455	37.1	-22.9	28.9	-21.1	Live	165

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   9kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±2.4dB.

FCC Part 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6
13.36 - 13.41			

FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*
* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.	

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	04 Oct 2006
HP Preamplifier (100kHz-1.3GHz) – PA2	8447D	2944A08173	01 Apr 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
Schaffner Bilog Antenna – BL9	CBL6143	5045	13 May 2006
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2006
HP Spectrum Analyser (30Hz-40GHz)	8564E	3846A01433	27 Apr 2006
Bandstop Filter (2.4-2.5 GHz)	BRM50701	017	13 Aug 2006

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

5. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which attitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 10th harmonics of the EUT fundamental frequency or 40GHz whichever is lower, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

Sample Calculation Example

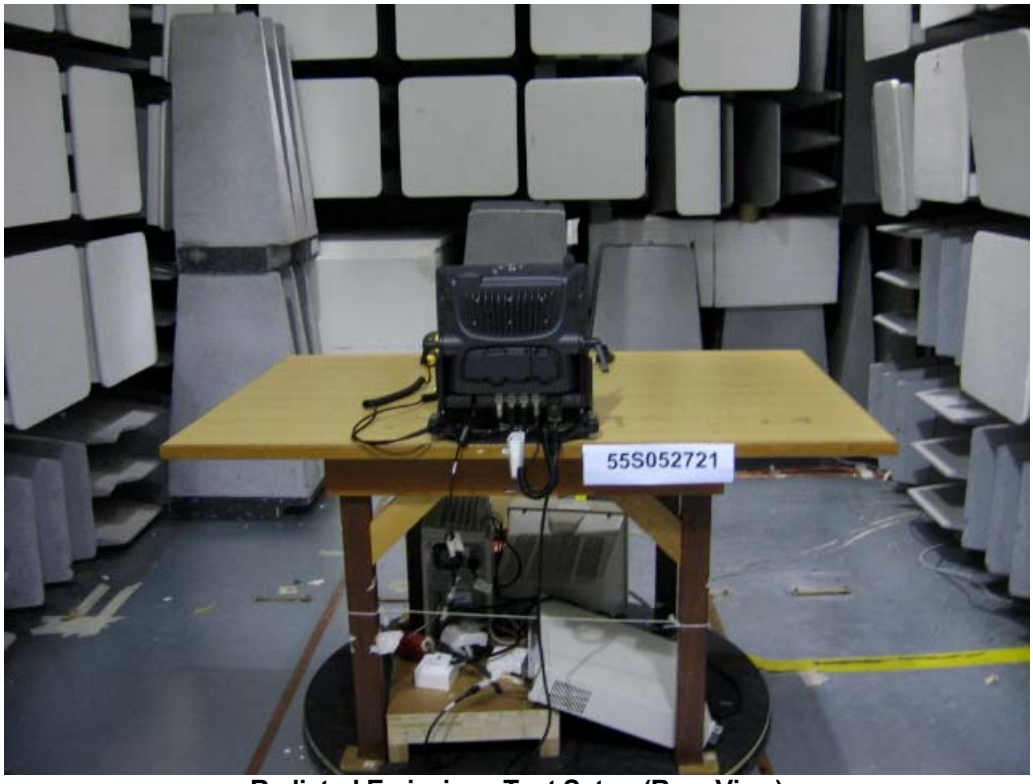
At 300 MHz Q-P limit (Class B) = 200 μV/m = 46.0 dBμV/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40.0 - 46.0 = -6.0 i.e. **6 dB below Q-P limit**

Radiated Emissions Test Setup (Front View)



Radiated Emissions Test Setup (Rear View)

FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Operating Mode	WLAN 802.11a (ISM Band)	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Test Distance	3m	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
340.1145	36.9	-9.1	21	120	H	165
383.9763	31.2	-14.8	3	115	H	165
458.3478	29.8	-16.2	255	100	V	165
541.7712	35.9	-10.1	340	100	H	165
601.4219	34.3	-11.7	168	103	V	165
739.9986	38.5	-7.5	171	100	H	165

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m) Note 4	Average Margin (dB) Note 5	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
11.6502	47.5	--	-6.5	87	103	H	165
17.4750	44.3	--	-9.7	66	100	H	165
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. For the measurement below 1GHz, the worst case channel was selected for test.
3. The external antenna was used during the measurement as it was found to be the worst case configuration.
4. The transmitting antenna was found to be in the worst case condition when it was orientated in a vertical position.
5. As the measured peak shows compliance to the average limit, as such no average measurement was required.
6. The average margin indicates the margin of the measured peak value below the average limit.
7. "--" indicates no emissions were found and shows compliance to the limits.
8. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz.
9. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.

10. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
    30MHz - 1GHz
    RBW: 120kHz VBW: 1MHz
    >1GHz
    RBW: 1MHz VBW: 1MHz
11. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
12. The channel in the table refers to the transmit channel of the EUT.
13. Radiated Emissions Measurement Uncertainty
    All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 40GHz (QP only @ 3m & 10m) is ±4.3dB (for EUTs < 0.5m X 0.5m X 0.5m).

FCC Part 15.247(b)(3) Maximum Peak Power Limits

The EUT shows compliance to the requirements of this section, which states the maximum peak power of the EUT employing digital modulation shall not exceed 1W (30dBm).

FCC Part 15.247(b)(3) Maximum Peak Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	04 Oct 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
Agilent Synthesized Sweeper – SG10	83620B	3844A01337	24 Jan 2008
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006
EMCO Horn Antenna – H14	3115	0003-6087	19 May 2006

FCC Part 15.247(b)(3) Maximum Peak Power Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF external antenna connector was connected to the EUT.
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(b)(3) Maximum Peak Power Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 165 (5.825GHz) with specified modulation and data rate.
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. The EUT was replaced with the substitution antenna with the antenna input was connected to the signal generator via a 10dB attenuator (if possible). The antenna was set to vertical polarization.
4. The signal generator was set to the recorded transmitting frequency in step 2. The output level of the signal generator was adjusted until the test receiver was at least 20dB above the level when the signal generator was switched off.
5. The test antenna was raised and lowered through the specified range of heights (1m – 4m) until the maximum signal level was received on the test receiver.
6. The substitution antenna was rotated until the maximum level was detected on the test receiver.
7. The output level of the signal generator was adjusted until the received signal level at the test receiver was equal to the level recorded in step 2 (A dBm). The signal generator output level was recorded as B (in dBm).
8. The maximum peak power, P (e.i.r.p) was computed as followed:

   P (e.i.r.p) = B – C – D + E

   where C = cable loss between the signal generator and the substitution

   D = attenuation level if attenuator is used

   E = substitution antenna gain
9. The steps 5 to 8 were repeated with the receiving antenna was set to horizontal polarization.
10. Comparison was made on both measured results with vertical and horizontal polarizations. The highest value out of vertical and horizontal polarizations was recorded.

Maximum Peak Power Test Setup

FCC Part 15.247(b)(3) Maximum Peak Power Results

Operating Mode	WLAN 802.11a (ISM Band)	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
		Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Limit (W)	Data Rate
165	5.825	0.0046	1.000	6Mbps

Notes

1. The measurement was done using an external antenna attached to the EUT, which was found to be emitting the highest RF power. The antenna was orientated in a vertical position where the highest emission was detected.

FCC Part 15.247(d) Band Edge Compliance Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) Band Edge Compliance Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	04 Oct 2006
MITEQ Preamplifier (0.1-26.5GHz) – PA4	NSP2650-N	604879	07 Nov 2006
EMCO Horn Antenna – H15	3115	0003-6088	19 May 2006

FCC Part 15.247(d) Band Edge Compliance Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF external antenna connector was connected to the EUT.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with specified modulation and data rate.
2. The frequency span of the spectrum analyser was set to wide enough to capture the band edge of the transmission band, 2.5850GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.

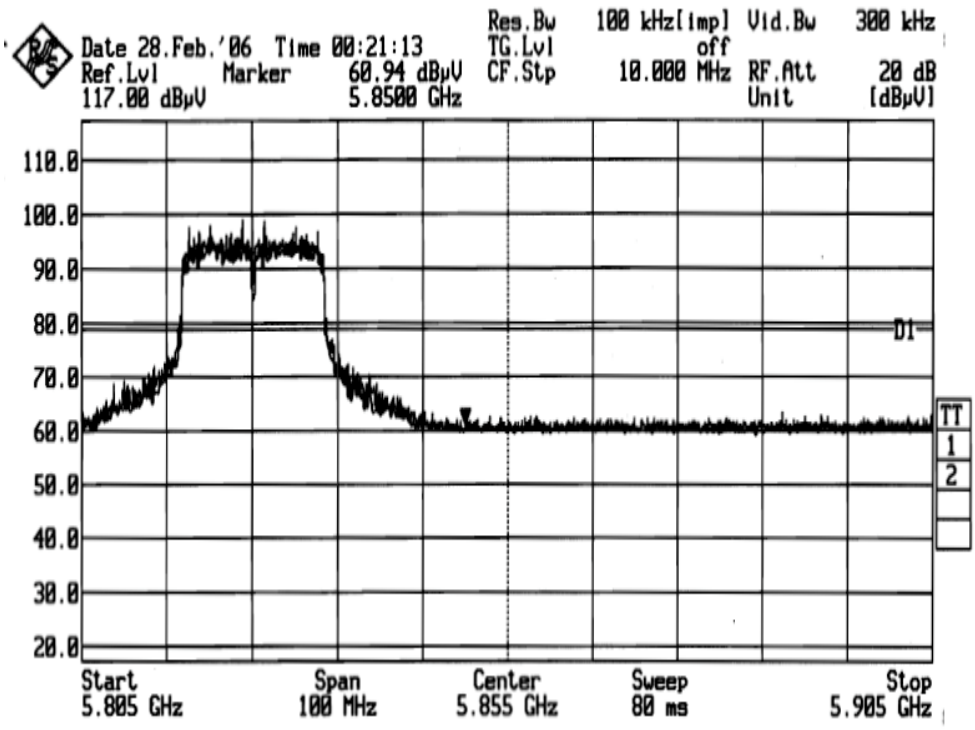
Band Edge Compliance Test Setup

FCC Part 15.247(d) Band Edge Compliance Results

Operating Mode	WLAN 802.11b (ISM Band)	Temperature	23°C
Test Input Power	110V 60Hz	Relative Humidity	55%
Attached Plots	42	Atmospheric Pressure	1030mbar
		Tested By	Thor Wen Lei

No significant signal was found and they were below the specified limit.

Band Edge Compliance Plots - WLAN 802.11a (ISM Band)



Plot 42 – Upper Band Edge at 5.8500GHz @ 6Mbps

PART 6

This part (Part 6) details the following test results on Bluetooth and WLAN 802.11a/b/g:

1. **Maximum Permissible Exposure (MPE) Test**
2. **Duty Cycle Computation**

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Limits

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (min)
0.3 - 1.34	614	1.63	100 Note 2	30
1.34 - 30	824 / f	2.19 / f	180 / f^2 Note 2	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f / 1500	30
1500 - 100000	-	-	1.0	30
Notes				
1. f = frequency in MHz				
2. Plane wave equivalent power density				

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
PMM 8053 Portable Field Meter	8053	0220J10308	02 Apr 2006
PMM Electric and Magnetic Field Analyzer	EHP-50A	1311L10515	02 Apr 2006

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Setup

1. The EUT and supporting equipment were set up as shown on the setup photo.
2. The relevant field probe was positioned at least 20cm away from the EUT and supporting equipment boundary.

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was first carried out at one of the positions / sides of the EUT.
3. Power density measurement (mW/cm^2) was made using the field meter set to the required averaging time.
4. Steps 2 and 3 were repeated for the next position and its associate EUT operating mode, until all possible positions and modes were measured.

Sample Calculation Example

At 2400 MHz, limit = 1.0 mW/cm^2

Power density reading obtained directly from field meter = 0.3 mW/cm^2 averaged over the required 30 minutes.

Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm^2 i.e. **0.7 mW/cm^2 below limit**

Maximum Permissible Exposure (MPE) Test Setup

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Results

Operating Mode	Bluetooth	Temperature	24°C
Test Input Power	110V 60Hz	Relative Humidity	52%
Test Distance	20cm	Atmospheric Pressure	1029mbar
		Tested By	Foo Kai Maun

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm^2)	Margin (mW/cm^2)	Averaging Time (min)	Limit (mW/cm^2)
0	2.402	0.0001	-0.9999	30	1.0
39	2.441	0.0001	-0.9999	30	1.0
78	2.480	0.0001	-0.9999	30	1.0

Operating Mode	Bluetooth + WLAN 802.11b	Temperature	24°C
Test Input Power	110V 60Hz	Relative Humidity	52%
Test Distance	20cm	Atmospheric Pressure	1029mbar
		Tested By	Foo Kai Maun

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm^2)	Margin (mW/cm^2)	Averaging Time (min)	Limit (mW/cm^2)
0 (Bluetooh) + 1 (802.11b)	2.402 (Bluetooth) + 2.412 (802.11b)	0.0158	-0.9842	30	1.0
39 (Bluetooh) + 7 (802.11b)	2.441 (Bluetooth) + 2.437 (802.11b)	0.0162	-0.9838	30	1.0
78 (Bluetooh) + 11 (802.11b)	2.480 (Bluetooth) + 2.462 (802.11b)	0.0155	-0.9845	30	1.0

Operating Mode	Bluetooth + WLAN 802.11g	Temperature	24°C
Test Input Power	110V 60Hz	Relative Humidity	52%
Test Distance	20cm	Atmospheric Pressure	1029mbar
		Tested By	Foo Kai Maun

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm^2)	Margin (mW/cm^2)	Averaging Time (min)	Limit (mW/cm^2)
0 (Bluetooh) + 1 (802.11g)	2.402 (Bluetooth) + 2.412 (802.11g)	0.0112	-0.9888	30	1.0
39 (Bluetooh) + 7 (802.11g)	2.441 (Bluetooth) + 2.437 (802.11g)	0.0120	-0.9880	30	1.0
78 (Bluetooh) + 11 (802.11g)	2.480 (Bluetooth) + 2.462 (802.11g)	0.0115	-0.9885	30	1.0

Operating Mode	Bluetooth + WLAN 802.11a	Temperature	24°C
Test Input Power	110V 60Hz	Relative Humidity	52%
Test Distance	20cm	Atmospheric Pressure	1029mbar
		Tested By	Foo Kai Maun

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm^2)	Margin (mW/cm^2)	Averaging Time (min)	Limit (mW/cm^2)
0 (Bluetooh) + 36 (802.11a)	2.402 (Bluetooth) + 5.180 (802.11a)	0.0135	-0.9865	30	1.0
78 (Bluetooh) + 48 (802.11a)	2.480 (Bluetooth) + 5.240 (802.11a)	0.0136	-0.9864	30	1.0
0 (Bluetooh) + 52 (802.11a)	2.402 (Bluetooth) + 5.260 (802.11a)	0.0144	-0.9856	30	1.0
78 (Bluetooh) + 64 (802.11a)	2.480 (Bluetooth) + 5.320 (802.11a)	0.0145	-0.9855	30	1.0
0 (Bluetooh) + 149 (802.11a)	2.402 (Bluetooth) + 5.745 (802.11a)	0.0144	-0.9856	30	1.0
39 (Bluetooh) + 157 (802.11a)	2.441 (Bluetooth) + 5.785 (802.11a)	0.0156	-0.9844	30	1.0
78 (Bluetooh) + 161 (802.11a)	2.480 (Bluetooth) + 5.805 (802.11a)	0.0154	-0.9846	30	1.0

Operating Mode	Bluetooth + WLAN 802.11a (ISM Band)	Temperature	24°C
Test Input Power	110V 60Hz	Relative Humidity	52%
Test Distance	20cm	Atmospheric Pressure	1029mbar
		Tested By	Foo Kai Maun

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm^2)	Margin (mW/cm^2)	Averaging Time (min)	Limit (mW/cm^2)
0 (Bluetooh) + 165 (802.11a)	2.402 (Bluetooth) + 5.825 (802.11a)	0.0143	-0.9857	30	1.0
39 (Bluetooh) + 165 (802.11a)	2.441 (Bluetooth) + 5.825 (802.11a)	0.0144	-0.9856	30	1.0
78 (Bluetooh) + 165 (802.11a)	2.480 (Bluetooth) + 5.825 (802.11a)	0.0139	-0.9861	30	1.0

Notes

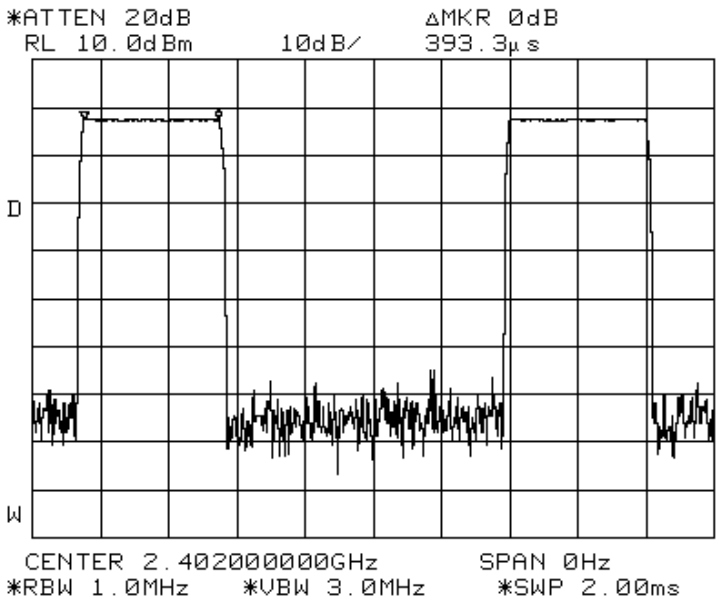
1. All possible modes of operation were investigated. Only the worst case highest radiation levels were measured. Measurements were taken at the required averaging time. All other radiation levels were relatively insignificant.

2 A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.

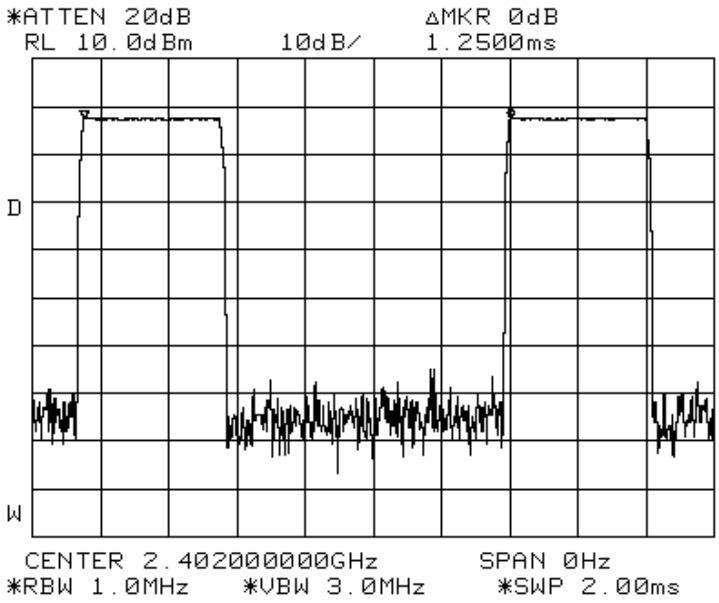
3 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 0.1MHz – 3GHz is ±15%.

FCC Part 15.35(c) Duty Cycle Correction Factor - Bluetooth



On Time



Period

Duty Cycle Factor (worst- case) = 20 log [Total On time / Period]
= 20 log [(0.3933 / 1.25)]
= **-10.0dB**

This Report is issued under the following conditions:

1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.

2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.

3. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that PSB Corporation approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that PSB Corporation in any way "guarantees" the later performance of the product/equipment.

4. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. PSB Corporation therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.

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10. Unless otherwise stated, the tests are carried out in PSB Corporation Pte Ltd, No.1 Science Park Drive Singapore 118221.

May 2005

ANNEX A

EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS

Front View (With External Antenna Attached)

Rear View (With External Antenna Attached)

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

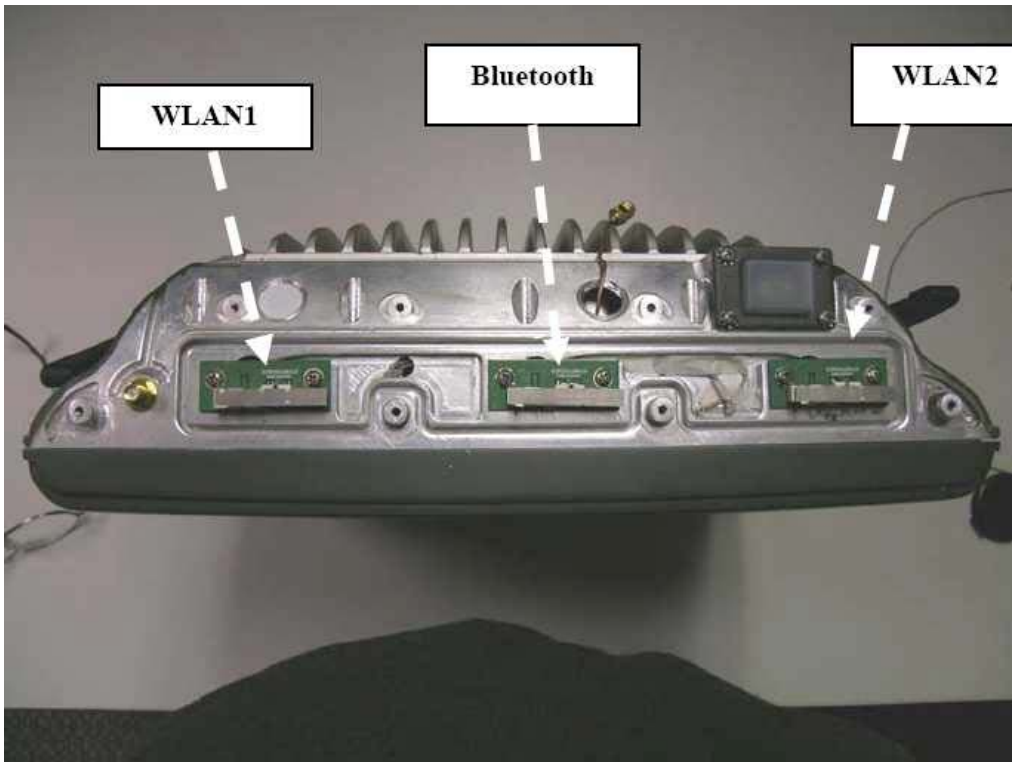
EUT PHOTOGRAPHS

Front View (With External Antenna Removed)

Rear View (With External Antenna Removed)

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS



EUT's Internal Antennas

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

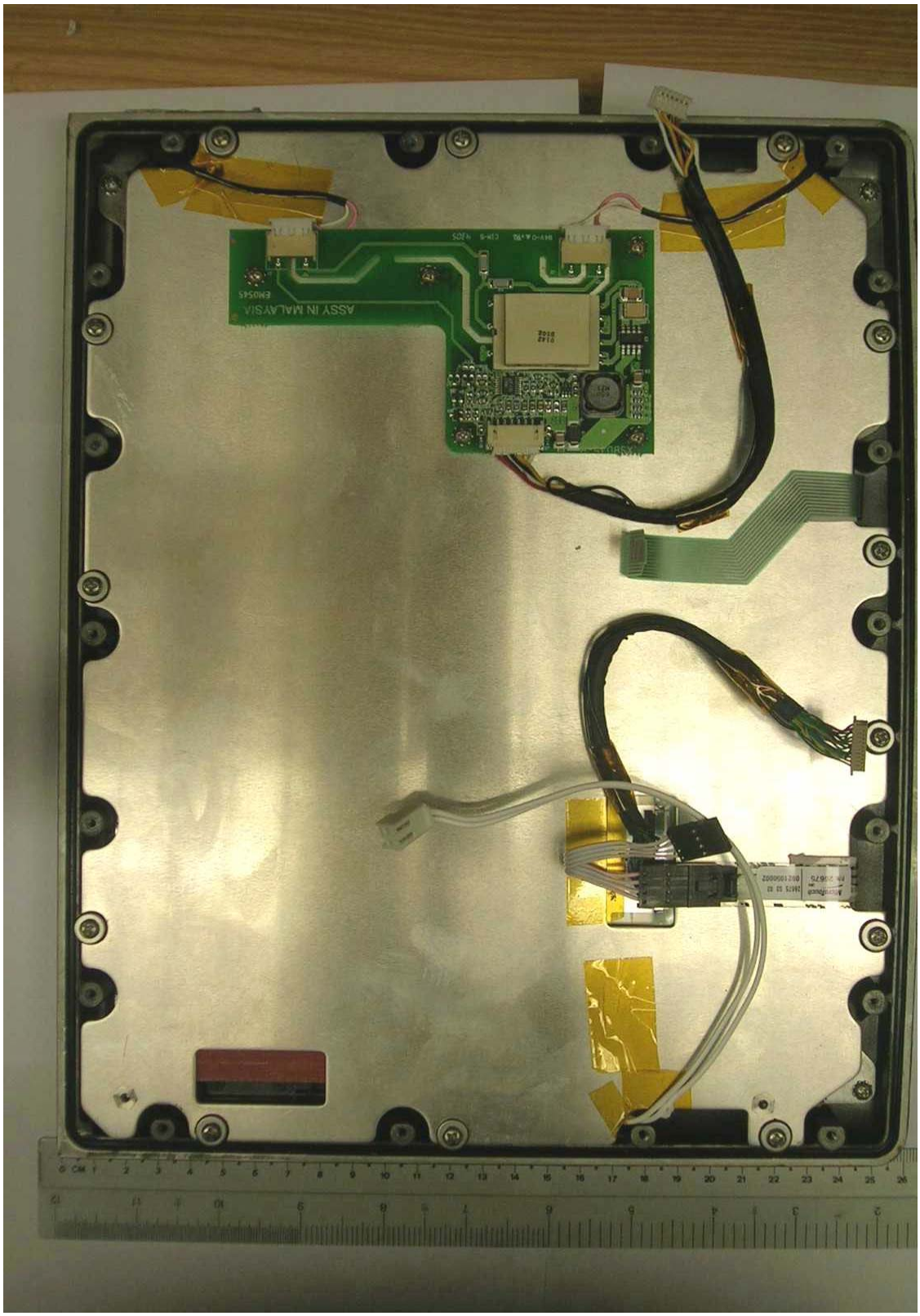
EUT PHOTOGRAPHS

Antenna Port on the EUT

EUT's External Antenna

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

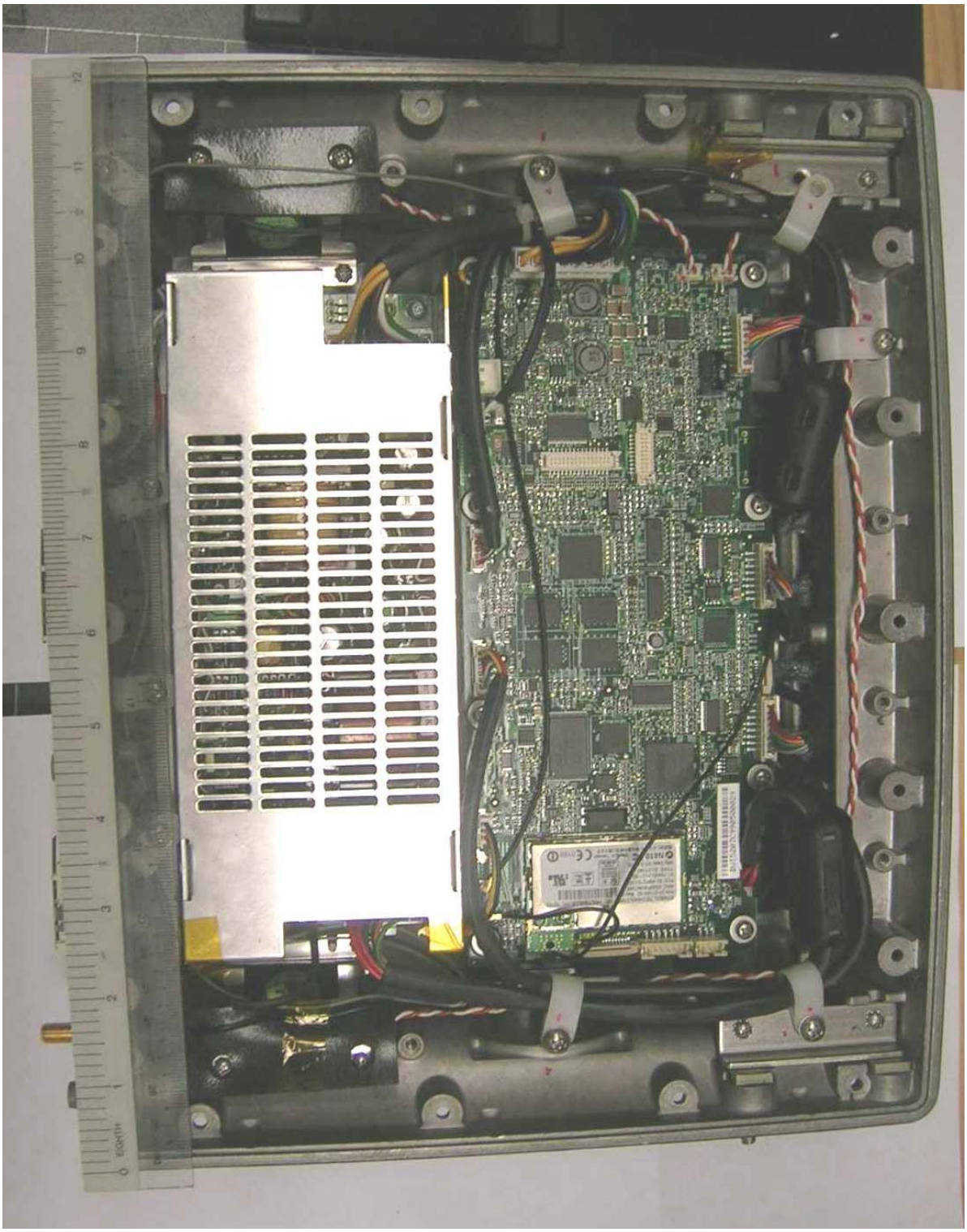
EUT PHOTOGRAPHS



EUT Internal View 1

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

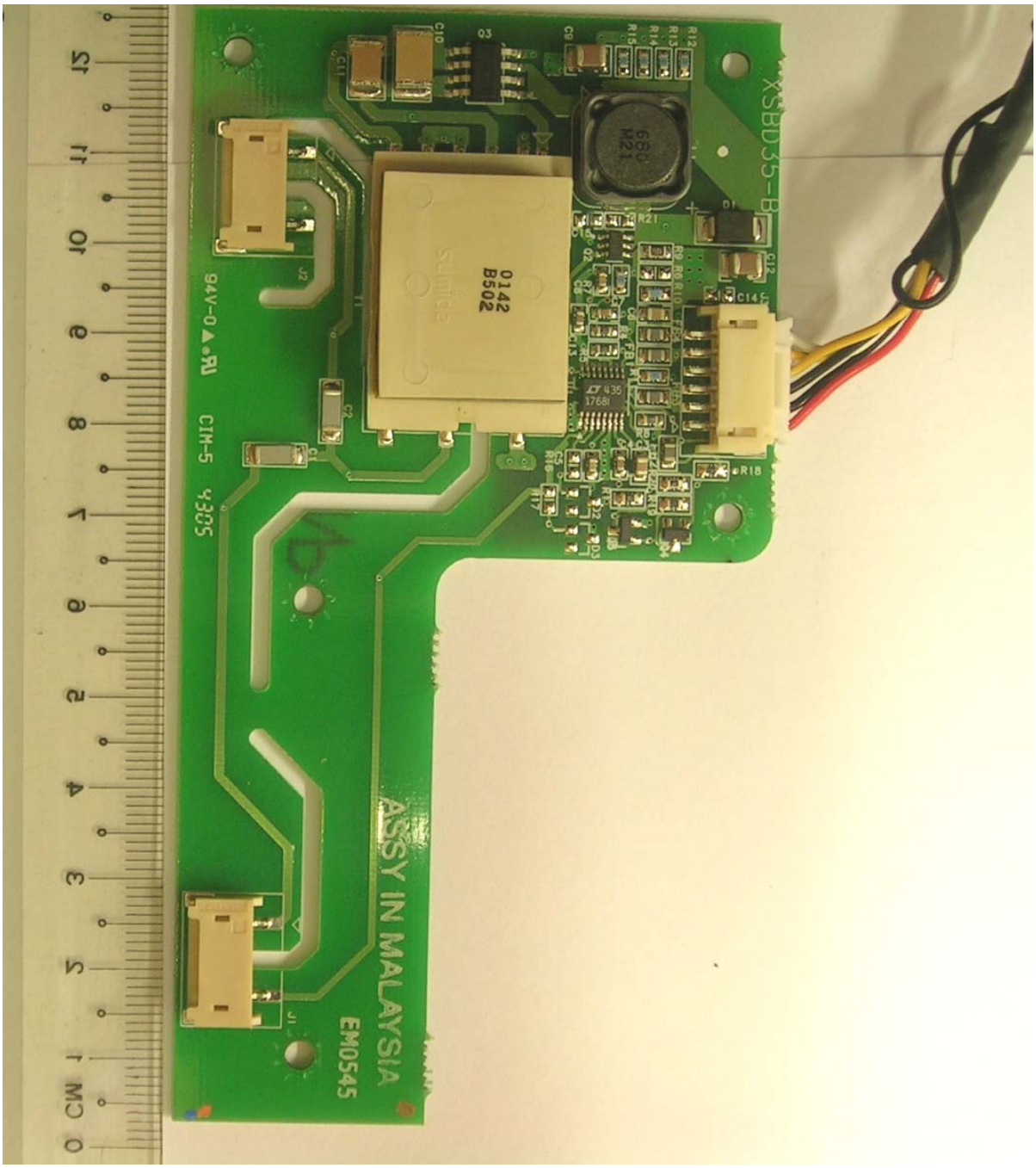
EUT PHOTOGRAPHS



EUT Internal View 2

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

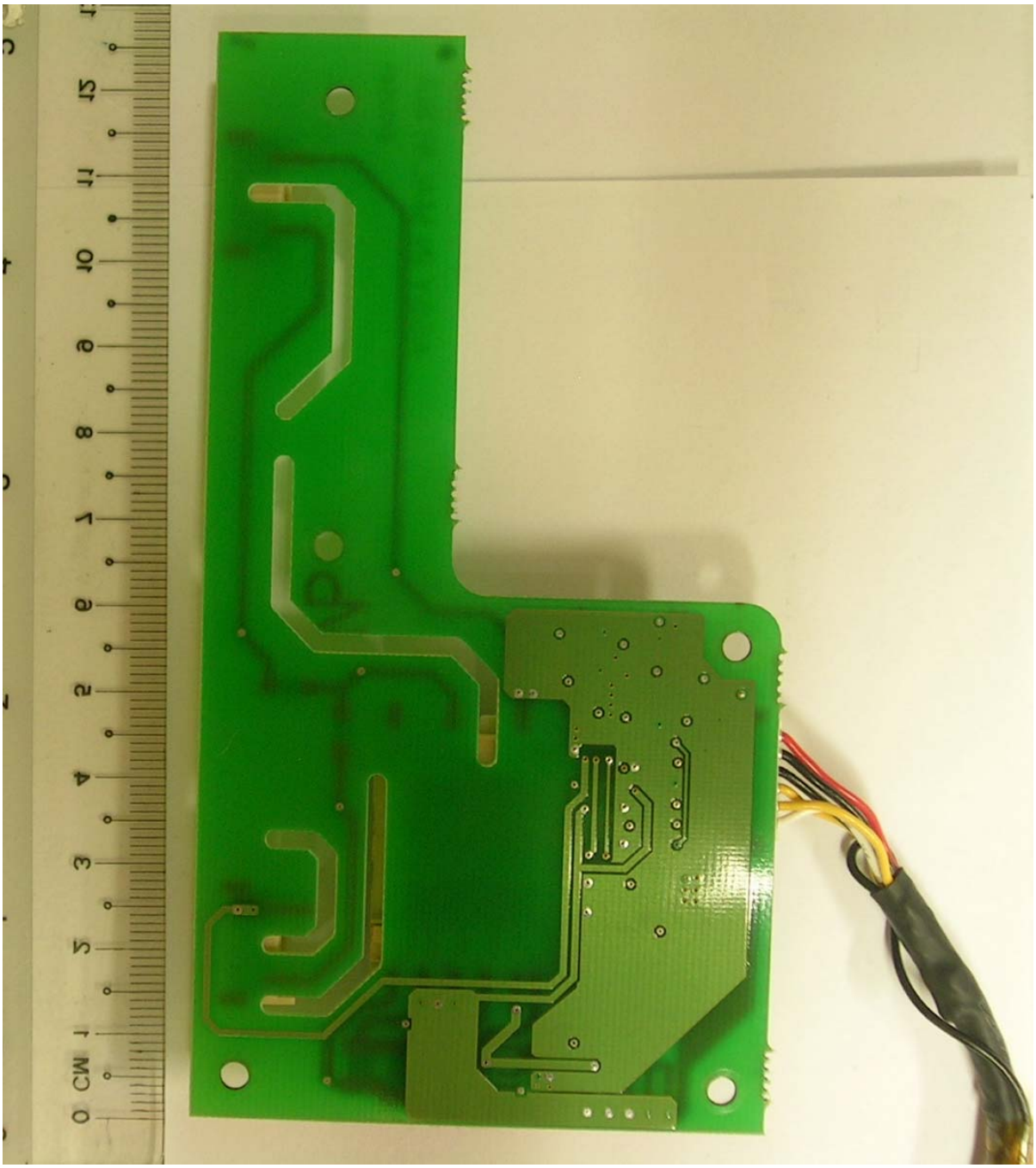
EUT PHOTOGRAPHS



PCB Component Side - LCD Display Board

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

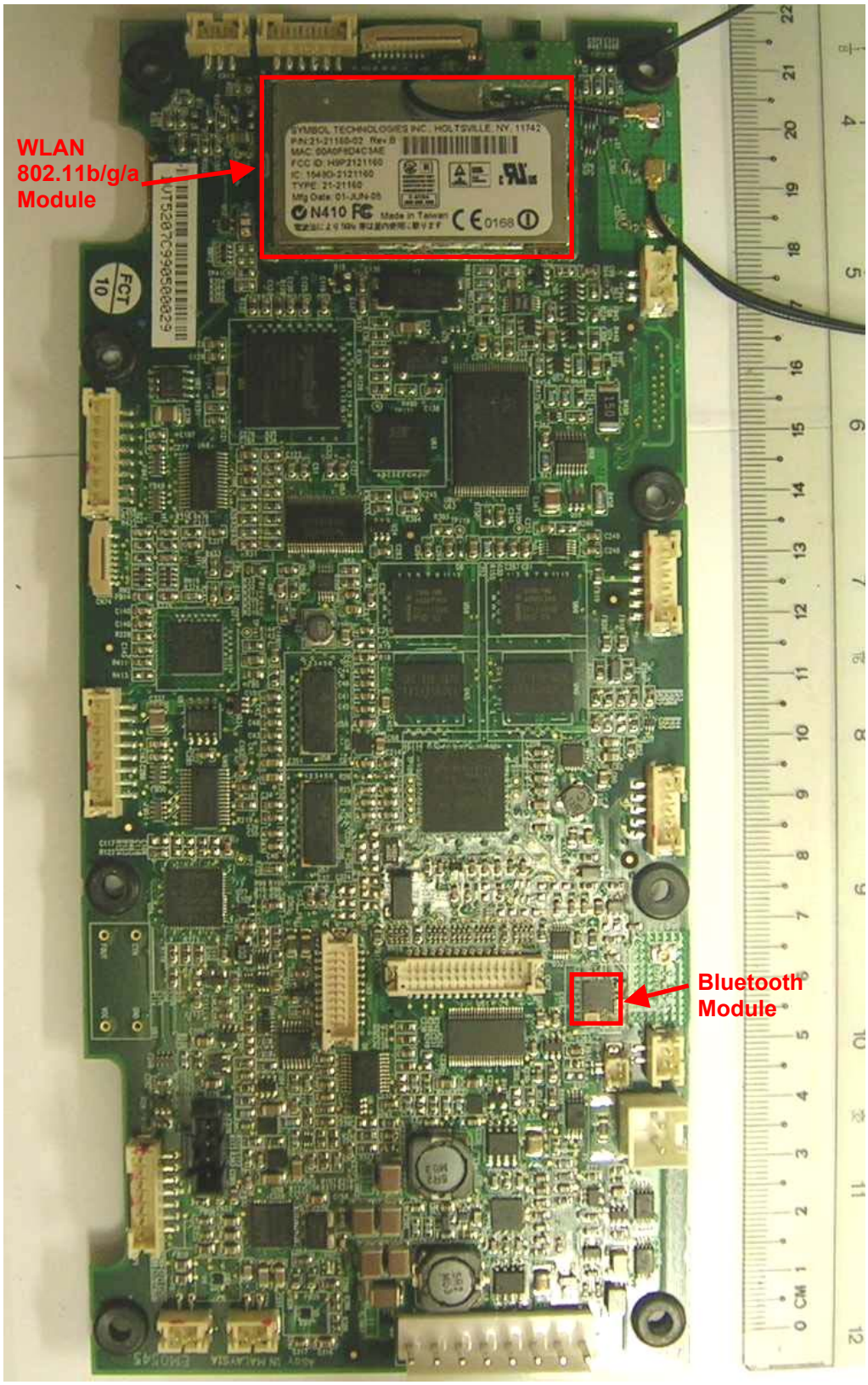
EUT PHOTOGRAPHS



PCB Trace Side - LCD Display Board

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

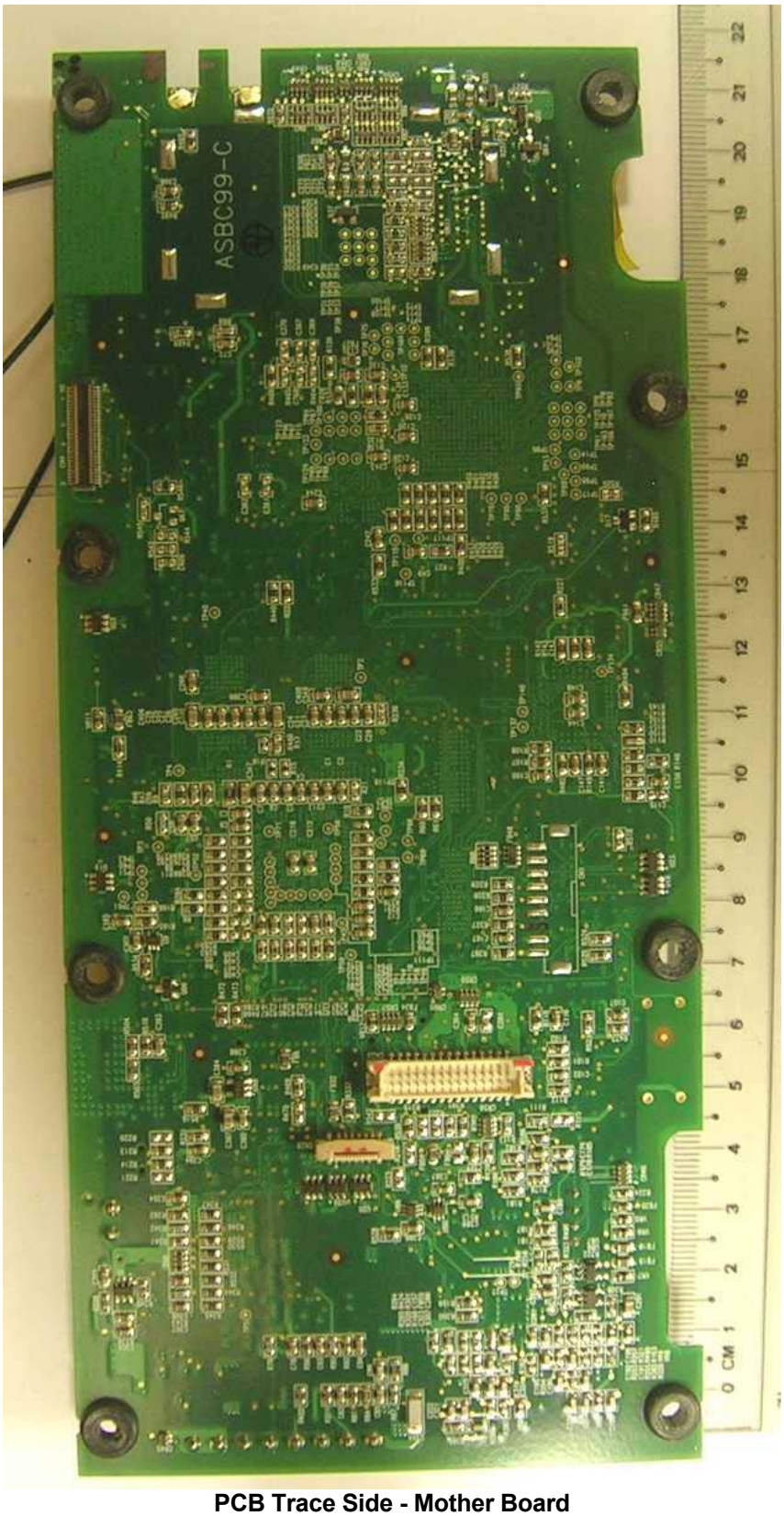
EUT PHOTOGRAPHS



PCB Component Side - Mother Board

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS



PCB Trace Side - Mother Board

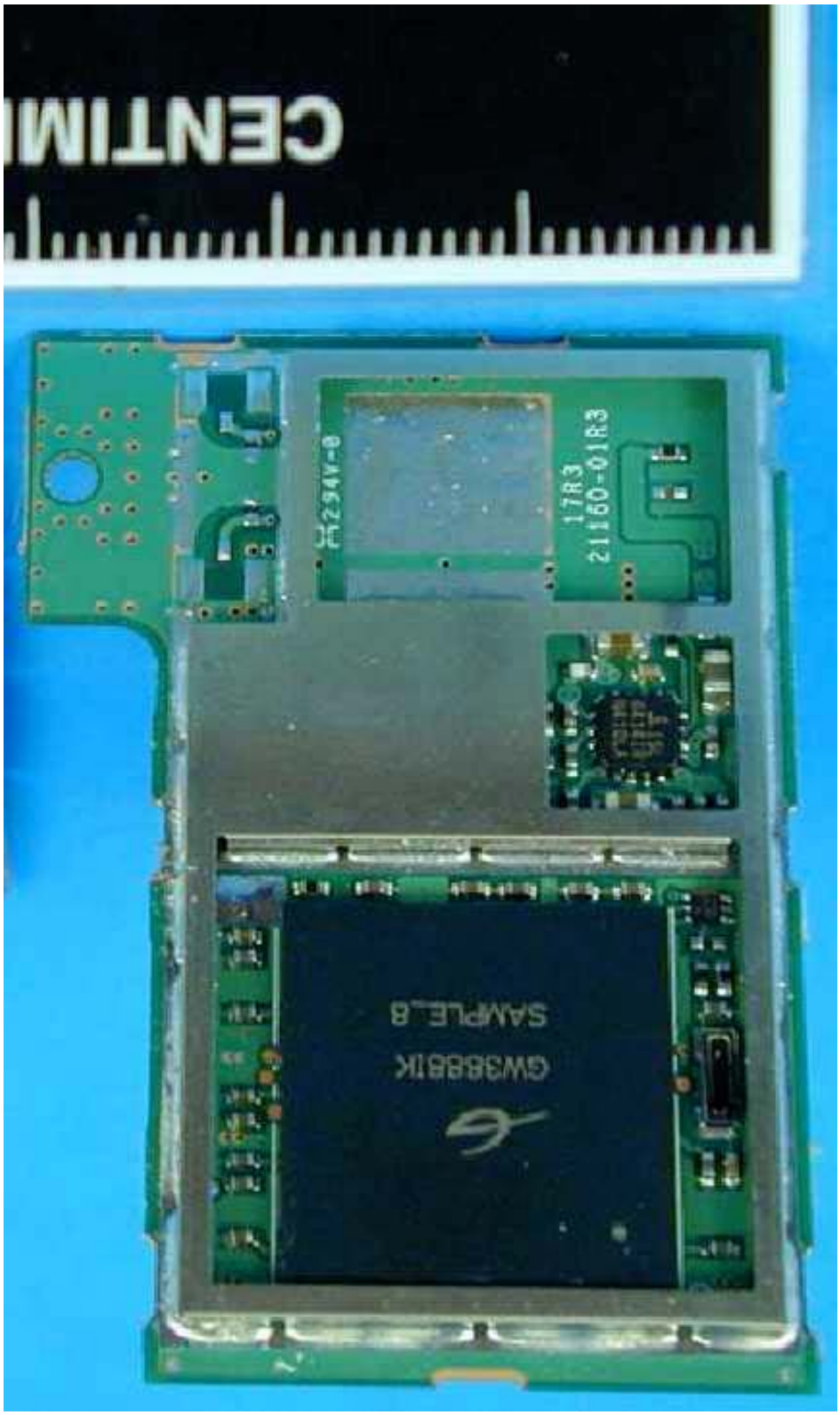
EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS

WLAN (802.11a/b/g) Module (With RF Shield)

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

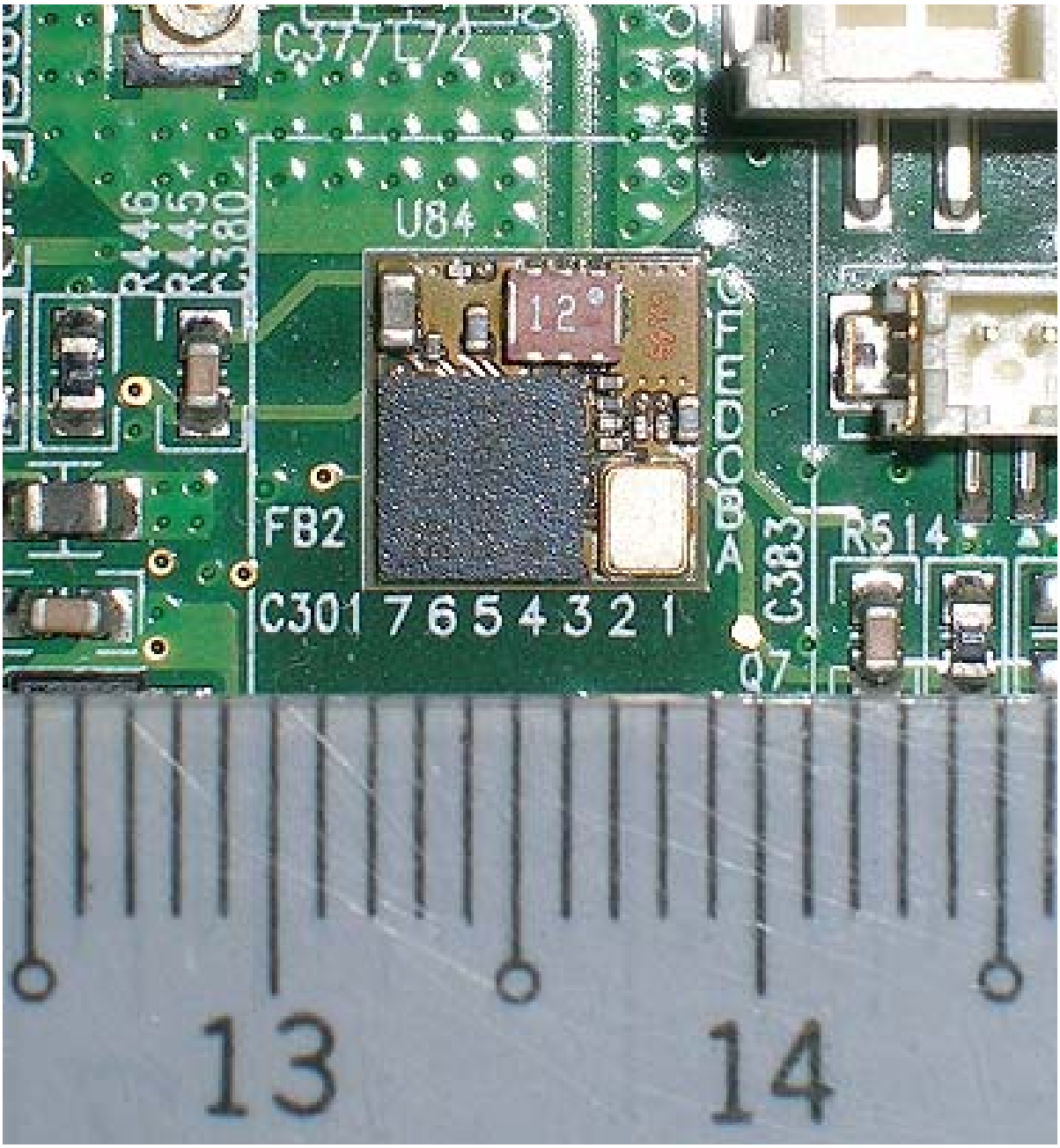
EUT PHOTOGRAPHS



WLAN (802.11a/b/g) Module (With RF Shield Removed)

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS



Bluetooth Module

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

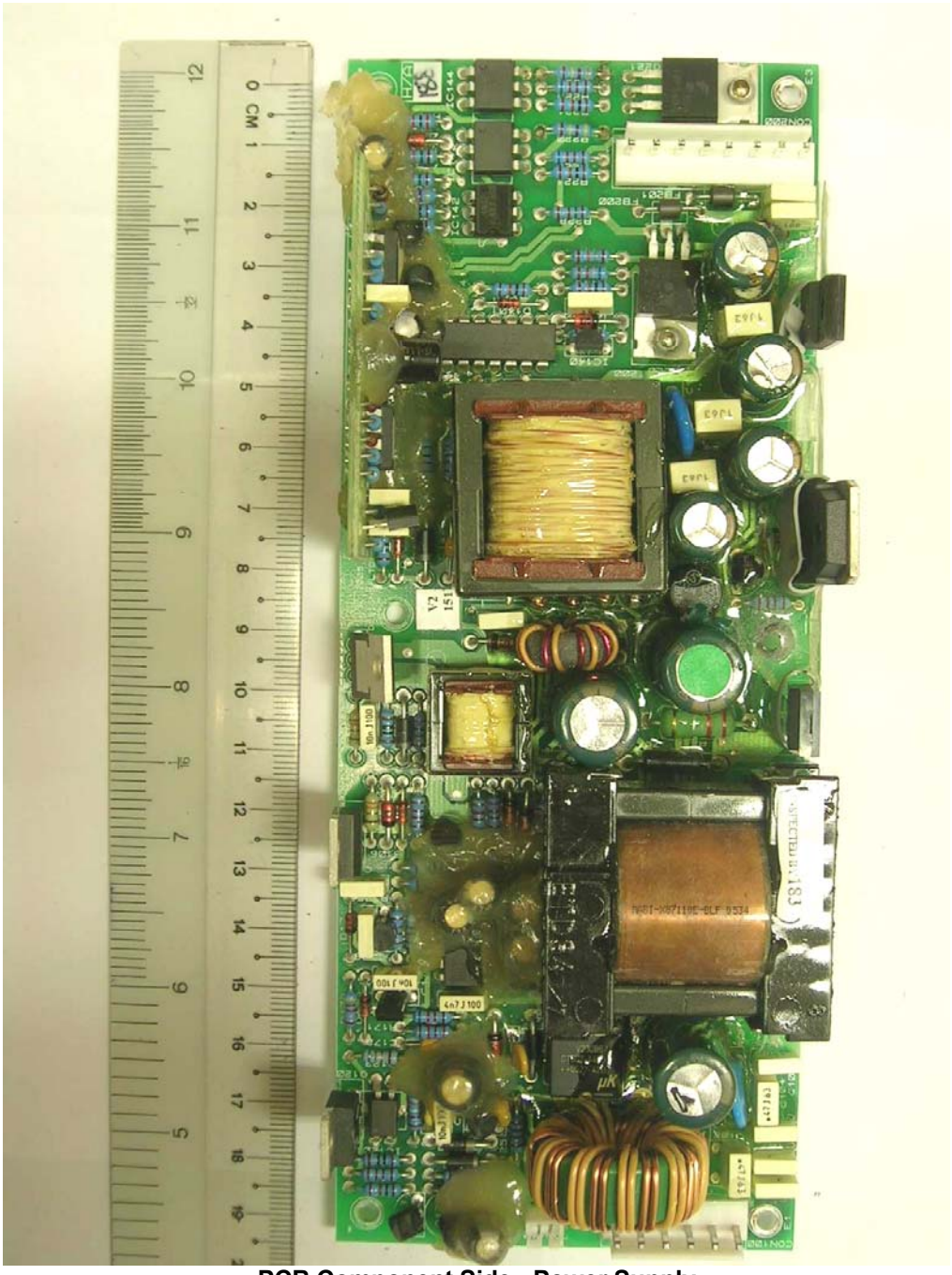
EUT PHOTOGRAPHS

AC/DC Power Supply - View 1

AC/DC Power Supply - View 2

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

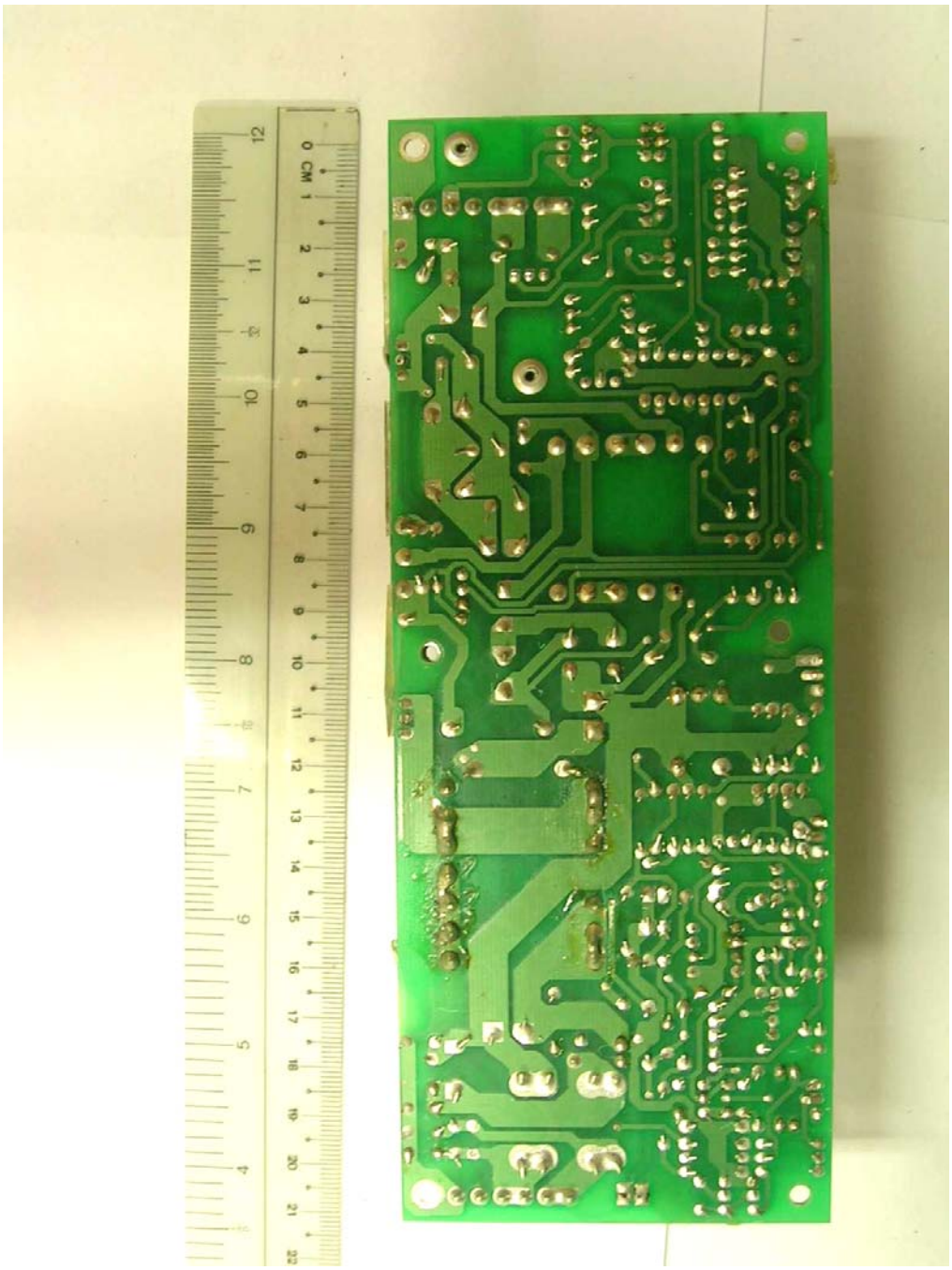
EUT PHOTOGRAPHS



PCB Component Side - Power Supply

EUT PHOTOGRAPHS / DIAGRAMS ANNEX A

EUT PHOTOGRAPHS



PCB Trace Side - Power Supply

ANNEX B

FCC LABEL & POSITION

FCC LABEL & POSITION ANNEX B

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

Sample Label

Physical Location of FCC Label on EUT

ANNEX C

USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)