

Supplemental "Transmit Simultaneously" Test Report

REPORT NO.:RF940816H02H-5MODEL NO.:AP-5131RECEIVED:Nov. 26, 2009TESTED:Apr. 16 to 19, 2009ISSUED:Apr. 21, 2009

APPLICANT: Symbol Technologies Inc.

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1. CERTIFICATION PRODUCT : Symbol WLAN 802.11abg Access Point BRAND NAME : Symbol MODEL NO. : AP-5131 **TESTED:** Apr. 16 to 19, 2009 **APPLICANT :** Symbol Technologies Inc. TEST ITEM: **ENGINEERING SAMPLE STANDARDS :** 47 CFR FCC Part 15, Subpart C ANSI C63.4-2003 : Midol- Ven , DATE: Apr. 21, 2009 (Midoli Peng, Specialist) PREPARED BY TECHNICAL ACCEPTANCE DATE: Apr. 21, 2009 (Hank Chung, Deputy Manager) **APPROVED BY** DATE: Apr. 21, 2009 (May Chen, Deputy Manager) Note: Per a request of the FCC, the access point radio was tested for radiated emissions

Per a request of the FCC, the access point radio was tested for radiated emissions in restricted bands while transmitting on both 2.4 GHz and 5 GHz at simultaneously.



2. DUAL XMIT, RADIATED EMISSION MEASUREMENT

3.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Field strength limits are at the distance of 3 meters, emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

- 1. The lower limit shall apply at the transition frequencies.
- 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



3.2 TEST INSTRUMENTS

Below 1GHz test :

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ADVANTEST Spectrum Analyzer	U3751	170100022	Nov. 18, 2009	Nov. 17, 2010
ADVANTEST Spectrum Analyzer	U3772	160100280	Sep. 21, 2009	Sep. 20, 2010
HP Pre_Amplifier	8449B	3008A01922	Sep. 25, 2009	Sep. 24, 2010
ROHDE & SCHWARZ Test Receiver	ESCS 30	100027	May 05, 2009	May 04, 2010
SCHWARZBECK Broadband Antenna	VULB-9168	263	Apr. 29, 2009	Apr. 28, 2010
Schwarzbeck Horn_Antenna	BBHA9120	D123	Sep. 21, 2009	Sep. 20, 2010
Schwarzbeck Horn_Antenna	BBHA 9170	BBHA9170153	Jan. 23, 2010	Jan. 22, 2011
RF Switches	EM-H-01-1	1009	Aug. 10, 2009	Aug. 08, 2010
RF Cable	8DFB	STACAB-30M- 1GHz-091	Nov. 20, 2009	Nov. 19, 2010
Software	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
CT Antenna Tower & Turn Table	TT100	ADT01	NA	NA
CORCOM AC Filter	MRI2030	107/108	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The horn antenna, HP preamplifier (model: 8449B) and Spectrum Analyzer (model: U3772) are used only for the measurement of emission frequency above 1GHz if tested.

3. The test was performed in Open Site No. A.

The VCCI Site Registration No. is R-782.
 The FCC Site Registration No. is 91097.
 The CANADA Site Registration No. is IC 7450G-1.



Above 1GHz test :								
DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL				
ROHDE & SCHWARZ Spectrum Analyzer	FSP40	100036	Dec. 18, 2009	Dec. 17, 2010				
Agilent PSA Spectrum Analyzer	E4446A	MY46180622	Apr. 24 , 2009	Apr. 23 , 2010				
HP Pre_Amplifier	8449B	300801923	Nov. 02, 2009	Nov. 01, 2010				
ROHDE & SCHWARZ Test Receiver	ESCS30	847124/029	Aug. 28, 2009	Aug. 27, 2010				
SCHWARZBECK TRILOG Broadband Antenna	VULB 9168	138	Apr. 29, 2009	Apr. 28, 2010				
Schwarzbeck Horn_Antenna	BBHA9120	D124	Dec. 18, 2009	Dec. 17, 2010				
Schwarzbeck Horn_Antenna	BBHA 9170	BBHA9170153	Jan. 22, 2010	Jan. 21, 2011				
R&S Loop Antenna	HFH2-Z2	100070	Feb. 3, 2010	Feb. 2, 2012				
RF Switches	EMH-011	1001	NA	NA				
RF CABLE (Chaintek)	Sucoflex 106	28077	Aug. 14, 2009	Aug. 13, 2010				
RF Cable	8DFB	STCCAB-30M- 1GHz	NA	NA				
Software	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA				
CT Antenna Tower & Turn Table	NA	NA	NA	NA				

 Turn Table
 Image: Construct of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

 2. The horn antenna, HP preamplifier (model: 8449B) and Spectrum Analyzer (model: FSP40) are used only for the measurement of emission frequency above 1GHz if tested.

 3. The test was performed in Open Site No. C.

 4. The FCC Site Registration No. is 656396.

 5. The VCCI Site Registration No. is R-1626.

 6. The CANADA Site Registration No. is IC 7450G-3.



3.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- a. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- b. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- e. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using the quasi-peak method or average method as specified and then reported in Data sheet peak mode and QP mode.
- f. The emissions up to 40 GHz were examined. Those emission falling within a restricted band were evaluated against the "restricted band emission limit" (54 dB μ V / 74 dB μ V).

NOTE:

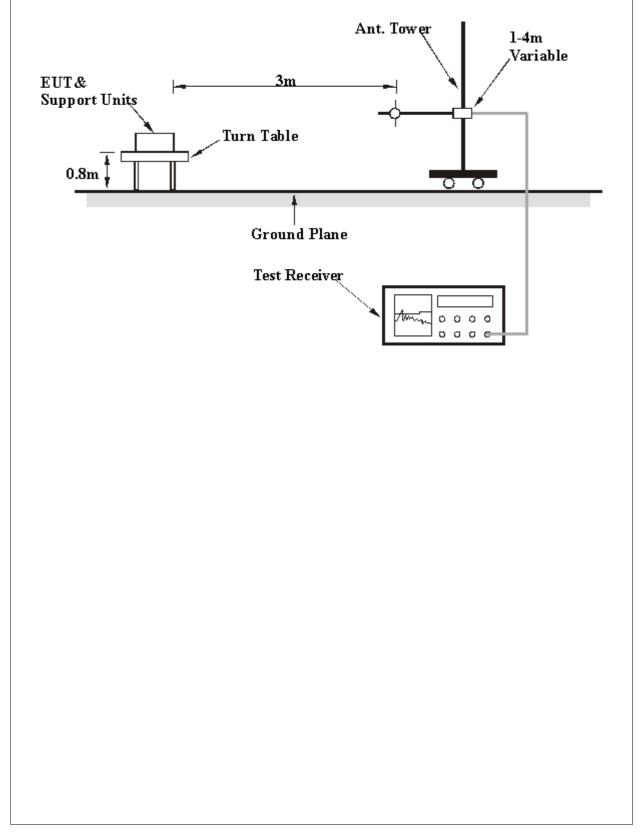
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
- 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 300 Hz for Average detection (AV) at frequency above 1GHz.

3.4 DEVIATION FROM TEST STANDARD

No deviation



3.5 TEST SETUP





3.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on the testing table.
- b. Prepared other computer systems to act as a communication partner and placed them outside of testing area.
- c. The communication partner run test program "Wintrion V00.02" to enable EUT under transmission/receiving condition continuously at specific channel frequency via UTP cable and wireless.

Note:

For 15.247:

The EUT was tested for out of band radiated emissions with the unit transmitting on 802.11g, 2437 MHz and 802.11a, 5785 MHz. These frequencies and power levels were chosen because these frequencies produced the worst case radiated emissions during the radiated emissions in restricted bands test performed previously. The unit was set to transmit at the same power level as was used in the initial radiated emissions tests and was transmitting at the same data rate. (Please refer to RF940816H02H-3 test report)

The harmonic of the fundamental signals were recerded in this report.

For 15.407:

The EUT was tested for out of band radiated emissions with the unit transmitting on 802.11g, 2437 MHz and 802.11a, 5200 MHz. These frequencies and power levels were chosen because these frequencies produced the worst case radiated emissions during the radiated emissions in restricted bands test performed previously. The unit was set to transmit at the same power level as was used in the initial radiated emissions tests and was transmitting at the same data rate. (Please refer to RF940816H02H-4 test report)

The harmonic of the fundamental signals were recerded in this report.



There are six antennas provided to this EUT, please refer to the following table: For 2.4GHz

No.	Symbol P/N	Gain (dBi)	Cable Loss (dB)	Net Gain (dB)	Antenna Type	Connector	Remark
1	*ML-2452-APA2-01	3.0	0	3.0	Dipole	RP SMA	Omni
2	ML-2499-11PNA2-01	11.2	2.7	8.5	Panel	Reverse BNC	Directional
3	ML-2499-HPA3-01	4.6	1.3	3.3	Dipole	Reverse BNC	Omni
4	**ML-2499-BYGA2-01	14.2	0.3	13.9	Yagi	RP SMA	Directional
For 5	5GHz						
No.	Symbol P/N	Gain (dBi)	Cable Loss (dB)	Net Gain (dB)	Antenna Type	Connector	Remark
1	*ML-2452-APA2-01	4.0	0	4.0	Dipole	RP SMA	Omni
2	ML-5299-WPNA1-01	14.2	1.2	13.0	Patch	RP SMA	Directional
3	ML-5299-HPA1-01	5.9	0.84	5.0	Omni	RP SMA	Omni

Note:

1. All of the above antennas are Indoor Antenna except the Symbol P/N: ML-2499-BYGA2-01.

2. "*" is a Dual Band antenna can be used in both 2.4GHz and 5GHz.

3. "***" is an Outdoor Antenna it can only be used in point-to-point applications.

4. For 2.4GHz Antenna No. 2 and 3 have Extend cable (0.5 dB loss).

5. For 2.4GHz Antenna No. 4 has Extend cable (0.5 dB loss) and Arrestor (1.0 dB loss).

From the above modes, **Antenna 2** was chosen for final test.



3.7 TEST RESULTS (For 15.247)

TEST MODE	Dual transmission 11g, 2437MHz 11a, 5785MHz	FREQUENCY RANGE	30MHz~1000MHz
INPUT POWER	120Vac, 60Hz	DETECTOR FUNCTION & BANDWIDTH	Peak (PK) Average (AV) 1 MHz
ENVIRONMENTAL CONDITIONS	24deg. C, 61%RH, 1023 hPa	TESTED BY	Kevin Huang

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M										
	Freq.	Emission	Limit	Margin	Antenna	Table	Raw	Correction			
No.	(MHz)	Level	(dBuV/m)	(dB)	Height	Angle	Value	Factor			
	(10112)	(dBuV/m)	(ubuv/iii)	(ub)	(m)	(Degree)	(dBuV)	(dB/m)			
1	125.04	31.74 QP	43.50	-11.76	1.00 H	152	18.90	12.84			
2	200.02	33.54 QP	43.50	-9.96	2.25 H	134	21.82	11.72			
3	250.00	33.26 QP	46.00	-12.74	1.51 H	31	19.59	13.67			
4	440.05	37.45 QP	46.00	-8.55	2.12 H	243	17.85	19.60			
5	480.00	37.21 QP	46.00	-8.79	2.02 H	174	16.47	20.74			
6	499.99	34.74 QP	46.00	-11.26	2.54 H	123	13.43	21.31			
7	520.00	35.65 QP	46.00	-10.35	1.00 H	192	13.91	21.74			
8	624.99	33.96 QP	46.00	-12.04	1.00 H	289	10.11	23.85			
9	875.01	35.22 QP	46.00	-10.78	1.00 H	224	7.41	27.81			
10	999.99	43.86 QP	54.00	-10.14	1.00 H	105	14.65	29.21			

	ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
	Freq.	Emission	Limit	Margin	Antenna	Table	Raw	Correction			
No.	(MHz)	Level	(dBuV/m)	(dB)	Height	Angle	Value	Factor			
	(101112)	(dBuV/m)	(ubuv/iii)	(ub)	(m)	(Degree)	(dBuV)	(dB/m)			
1	64.22	27.89 QP	40.00	-12.11	1.00 V	105	14.87	13.02			
2	125.00	33.85 QP	43.50	-9.65	1.00 V	116	21.02	12.83			
3	250.02	35.24 QP	46.00	-10.76	1.23 V	186	21.57	13.67			
4	398.41	33.12 QP	46.00	-12.88	1.41 V	163	14.70	18.42			
5	480.00	35.86 QP	46.00	-10.14	1.21 V	175	15.12	20.74			
6	500.01	34.83 QP	46.00	-11.17	1.42 V	109	13.52	21.31			
7	520.03	36.76 QP	46.00	-9.24	2.01 V	168	15.02	21.74			
8	625.01	35.58 QP	46.00	-10.42	2.52 V	116	11.73	23.85			
9	875.02	34.53 QP	46.00	-11.47	1.51 V	262	6.72	27.81			
10	1000.00	41.83 QP	54.00	-12.17	1.50 V	301	12.62	29.21			

NOTE:

1. Emission level = Raw value + Correction Factor

Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
 Margin value = Emission level - Limit value

4. The other emission levels were very low against the limit.



TEST MODE	Dual transmission 11g, 2437MHz 11a, 5785MHz	FREQUENCY RANGE	1000MHz~17550MHz
INPUT POWER	120Vac, 60Hz	DETECTOR FUNCTION & BANDWIDTH	Peak (PK) Average (AV) 1 MHz
ENVIRONMENTAL CONDITIONS	24deg. C, 61%RH, 1023 hPa	TESTED BY	Phoenix Huang

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
	Freq.	Emission	Limit	Margin	Antenna	Table	Raw	Correction		
No.	(MHz)	Level	(dBuV/m)	(dB)	Height	Angle	Value	Factor		
	(10112)	(dBuV/m)	(ubuv/iii)	(ub)	(m)	(Degree)	(dBuV)	(dB/m)		
1	4874.00	43.85 PK	74.00	-30.15	1.05 H	261	8.30	35.55		
2	4874.00	30.68 AV	54.00	-23.32	1.05 H	261	-4.87	35.55		
3	7311.00	50.42 PK	74.00	-23.58	1.33 H	265	8.38	42.04		
4	7311.00	37.75 AV	54.00	-16.25	1.33 H	265	-4.29	42.04		
5	11570.00	57.63 PK	74.00	-16.37	1.25 H	74	10.66	46.97		
6	11570.00	44.54 AV	54.00	-9.46	1.25 H	74	-2.43	46.97		

	ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M										
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)			
1	4874.00	44.90 PK	74.00	-29.10	1.05 V	200	9.35	35.55			
2	4874.00	33.10 AV	54.00	-20.90	1.05 V	200	-2.45	35.55			
3	7311.00	51.59 PK	74.00	-22.41	1.40 V	61	9.55	42.04			
4	7311.00	40.85 AV	54.00	-13.15	1.40 V	61	-1.19	42.04			
5	11570.00	57.46 PK	74.00	-16.54	1.33 V	21	10.49	46.97			
6	11570.00	44.95 AV	54.00	-9.05	1.33 V	21	-2.02	46.97			

NOTE:

1. Emission level = Raw value + Correction Factor

2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)

3. Margin value = Emission level - Limit value

4. The other emission levels were very low against the limit.



3.8 TEST RESULTS (For 15.407)

TEST MODE	Dual transmission 11g, 2437MHz 11a, 5220MHz	FREQUENCY RANGE	30MHz~1000MHz
INPUT POWER	120Vac, 60Hz	DETECTOR FUNCTION & BANDWIDTH	Peak (PK) Average (AV) 1 MHz
ENVIRONMENTAL CONDITIONS	24deg. C, 61%RH, 1023 hPa	TESTED BY	Kevin Huang

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)		
1	125.04	31.74 QP	43.50	-11.76	1.00 H	155	18.90	12.84		
2	200.02	33.63 QP	43.50	-9.87	2.24 H	131	21.91	11.72		
3	250.00	33.35 QP	46.00	-12.65	1.56 H	35	19.68	13.67		
4	440.05	37.53 QP	46.00	-8.47	2.11 H	245	17.93	19.60		
5	480.00	37.32 QP	46.00	-8.68	2.01 H	177	16.58	20.74		
6	499.99	34.68 QP	46.00	-11.32	2.54 H	121	13.37	21.31		
7	520.00	35.62 QP	46.00	-10.38	1.00 H	191	13.88	21.74		
8	624.99	33.87 QP	46.00	-12.13	1.00 H	285	10.02	23.85		
9	875.01	35.34 QP	46.00	-10.66	1.00 H	225	7.53	27.81		
10	999.99	43.78 QP	54.00	-10.22	1.00 H	103	14.57	29.21		

	ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
No.	Freq. (MHz)	Emission	Limit (dBuV/m)	Margin (dB)	Antenna	Table	Raw	Correction		
		Level			Height	Angle	Value	Factor		
		(dBuV/m)	(ubuv/iii)		(m)	(Degree)	(dBuV)	(dB/m)		
1	64.22	27.69 QP	40.00	-12.31	1.00 V	104	14.67	13.02		
2	125.00	33.85 QP	43.50	-9.65	1.00 V	117	21.02	12.83		
3	250.02	35.27 QP	46.00	-10.73	1.22 V	181	21.60	13.67		
4	398.41	33.11 QP	46.00	-12.89	1.42 V	163	14.69	18.42		
5	480.00	35.69 QP	46.00	-10.31	1.22 V	177	14.95	20.74		
6	500.01	34.88 QP	46.00	-11.12	1.41 V	103	13.57	21.31		
7	520.03	36.78 QP	46.00	-9.22	2.01 V	172	15.04	21.74		
8	625.01	35.53 QP	46.00	-10.47	2.53 V	111	11.68	23.85		
9	875.02	34.43 QP	46.00	-11.57	1.51 V	262	6.62	27.81		
10	1000.00	41.76 QP	54.00	-12.24	1.53 V	301	12.55	29.21		

NOTE:

- 1. Emission level = Raw value + Correction Factor
- 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 3. Margin value = Emission level Limit value
- 4. The other emission levels were very low against the limit.



TEST MODE	Dual transmission 11g, 2437MHz 11a, 5220MHz	FREQUENCY RANGE	1000MHz~17550MHz	
INPUT POWER	120Vac, 60Hz	DETECTOR FUNCTION & BANDWIDTH	Peak (PK) Average (AV) 1 MHz	
ENVIRONMENTAL CONDITIONS	24deg. C, 61%RH, 1023 hPa	TESTED BY	Phoenix Huang	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)	
1	4874.00	43.81 PK	74.00	-30.19	1.05 H	261	8.26	35.55	
2	4874.00	30.62 AV	54.00	-23.38	1.05 H	261	-4.93	35.55	
3	7311.00	50.40 PK	74.00	-23.60	1.33 H	265	8.36	42.04	
4	7311.00	37.72 AV	54.00	-16.28	1.33 H	265	-4.32	42.04	

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M									
No.	Freq. (MHz)	Emission	Limit (dBuV/m)	Margin (dB)	Antenna	Table	Raw	Correction	
		Level			Height	Angle	Value	Factor	
		(dBuV/m)			(m)	(Degree)	(dBuV)	(dB/m)	
1	4874.00	44.75 PK	74.00	-29.25	1.05 V	200	9.20	35.55	
2	4874.00	32.87 AV	54.00	-21.13	1.05 V	200	-2.68	35.55	
3	7311.00	51.46 PK	74.00	-22.54	1.38 V	58	9.42	42.04	
4	7311.00	40.56 AV	54.00	-13.44	1.38 V	58	-1.48	42.04	

NOTE:

- 1. Emission level = Raw value + Correction Factor
- 2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
- 3. Margin value = Emission level Limit value
- 4. The other emission levels were very low against the limit.



4. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025:

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: <u>www.adt.com.tw/index.5/phtml</u>. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab: Tel: 886-2-26052180

Fax: 886-2-26052180

Hsin Chu EMC/RF Lab: Tel: 886-3-5935343 Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Telecom Lab: Tel: 886-3-3183232 Fax: 886-3-3185050

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