EMC
TEST REPORT

Report No. : EME-010608
Model No. : XI-825
Issued Date : Aug. 9, 2001

Applicant : Z-COM, Inc.
7F-2, No.9, Prosperity 1St RD., Science-Based Industrial Park, Hsinchu, Taiwan R.O.C.

Test By : Intertek Testing Services Taiwan Ltd.
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Test Engineer

Elton Chen

Approved By

J. T. CHEN
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1. General Information

1.1 Identification of the EUT

Manufacturer	: Z-COM, Inc.
Product	: CF WIRELESS LAN CARD
Model No.	: XI-825
FCC ID.	: M4Y-08250
Operating Frequency	: 2412~2462 MHz
Channel Number	: 11 Channels
Frequency of Each Channel	: 2412MHz, 2417MHz, 2422MHz, 2427MHz, 2432MHz, 2437MHz, 2442MHz, 2447MHz, 2452MHz, 2457MHz, 2462MHz
Type of Modulation	: CCK (11Mps, 5.5Mbps), DQPSK(2Mbps), DBPSK(1Mbps)
Power Supply	: 5Vdc from Notebook
Power Cord	: N/A
Sample Received	: July 16, 2001
Test Date(s)	: July 19, 2001 to Aug. 9, 2001

The attached antenna on antenna port is a fixed internal antenna. (Please refer to Antenna.pdf)

A DOC report has been generated for the client.

1.2 Additional information about the EUT

The 11Mpbs IEEE 802.11b Wireless LAN Compact Flash Adapter is a standard CF interface adapter integrated with wireless LAN technology. 11Mbps data rate gives equivalent Ethernet speed to access corporate network or the Internet in a wireless environment. When installed, 11 Mbps Wireless LAN compact Flash Adapter is able to communicate with any 802.11 and 802.11b compliant products.

For more detail features, please refer to user's Manual (User’s Manual.pdf)

1.3 Test Standard

The equipment under test (EUT) is a CF WIRELESS LAN CARD. The transmitter portion is subject to the FCC Part 15 Subpart C Section 15.247 evaluation. Test date is included in this report.

1.4 Support equipment

Notebook

Product No.	: 2609
Serial No.	: BA-ZHNHN
Manufacturer	: IBM

2. Test Condition

2.1 Test Standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section § 15.247.

The AC power conducted emissions was invested over the frequency range from 0.45MHz to 30MHz using a receiver bandwidth of 9kHz.

Radiated emissions were invested over the frequency range from 30MHz to 1000MHz using a receiver bandwidth of 120kHz and the frequency range from 1GHz to 10th harmonics using a receiver bandwidth of 1MHz.

Radiated emission testing was performed at a 3-meter test site.

The EUT setup configuration describes as follows:

Plug the EUT into Notebook via a PCMCIA to CF Card Simulator. Power on the notebook then run the test program “RF.EXE”.

Select the wanted mode (Continuously Transmit) to perform all the tests.

2.2 Modifications Required for Compliance

No modification were installed during test performance to bring the product into compliance (Please note that this list does not include changes made specifically by Z-COM, Inc. Prior to compliance testing.)

2.3 Test Equipment

Equipment	Brand	Model No.	Series No.
EMI Receiver	Rohde & Schwarz	ESCS 30	825788/014
EMI Receiver	Rohde & Schwarz	ESMI	825428/005
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	848.766/052
EMI Receiver	Rohde & Schwarz	ESCS 30	825788/014
EMI Spectrum	Rohde & Schwarz	ESMI	825428/005
Pre-Amplifier	Advantest	BB525C	83120047
Horn Antenna	EMCO	3115	9906-5822
Horn Antenna	SCHWARZBECK	BBHA 9170	159
Bilog Antenna	SCHWARZBECK	VULB 9160	3111
Turn Table	HDGmbH	DS 420S	N/A
Antenna Tower	HDGmbH	MA 240	240/573

Note:
1. The calibration interval of the above instruments is 12 months.

3. Modulated Bandwidth

3.1 Operating Environment

Temperature: 26 ℃
Relative Humidity: 58 %

3.2 Test Setup & procedure

The minimum 6dB bandwidth per FCC §15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth set at 100 kHz, and the SPAN>>RBW. The test was performed in 3 channels (1 near bottom, 1 near middle and 1 near top). The minimum 6-dB modulation bandwidth is in the following Table. See 6dB bandwidth CH1, CH6 and CH11 plots.

3.3 Measured Data of Test results:

Channel	Frequency (MHz)	Bandwidth (MHz)	Limit
1	2412	11.06	>500kHz
6	2437	10.17	>500kHz
11	2462	10.08	>500kHz

4. Peak Power Output

4.1 Operating Environment

Temperature: 26 ℃
Relative Humidity: 58 %

4.2 Test Setup & procedure

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm coaxial cable connected to spectrum analyzer. The resolutions bandwidth of spectrum analyzer set at 3MHz and the span of the spectrum analyzer was set to larger than 6dB Bandwidth plus 10 MHz or more. The test was performed in 3 channels (1 near bottom, 1 near middle and 1 near top). The Peak power measured result for modulated output power is in the following table.
See Peak Power Output CH1, CH6 and CH11 plots.

4.3 Measured Data of Test results:

Channel	Frequency (MHz)	Power Output (dBm)	Limit (dBm)
1	2412.43	15.28	+30
6	2438.26	16.22	+30
11	2461.37	15.48	+30

The result of EIRP:

Channel	Frequency (MHz)	Power Output (dBm)	Antenna Gain (dBi)	Calculated EIRP (dBm)	EIRP limit (dBm)
1	2412.43	15.28	0.58	15.86	36
6	2438.26	16.22	0.58	16.8	36
11	2461.37	15.48	0.58	16.06	36

Note: Calculated EIRP: power output (dBm) + Antenna Gain (dBi)

5. Antenna Conducted Spurious Emission

5.1 Operating Environment

Temperature: 26 ℃
Relative Humidity: 58 %

5.2 Test Setup & procedure

Antenna spurious emission per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz.
Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.
See Conducted Spur. emission CH 1-1, 1-2 and 1-3; CH 6-1, 6-2 and 6-3; CH 11-1, 11-2 and 11-3 plots.

5.3 Measured Data of The highest spurious conducted emission:

Channel	Frequency (MHz)	Emission level (dBm)	Limit
1	4828.21	-41.33	-4.72
6	4879.93	-38.11	-3.78
11	4931.65	-35.41	-4.52

Note: 1. Limit = peak power output – 20dB
2. All the other emissions were very low the limit.

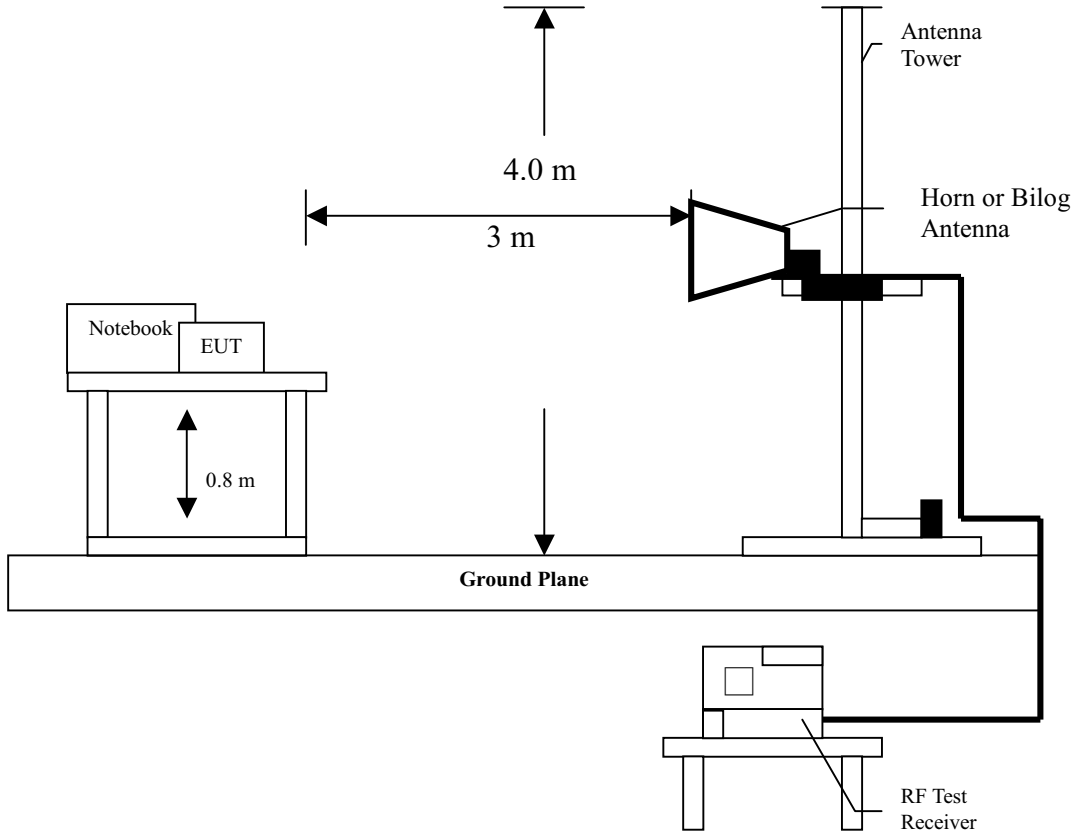
6. Radiated Spurious Emission

6.1 Operating Environment

Temperature:	26	℃
Relative Humidity:	60	%

6.2 Test Setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



The signal is maximized through rotation and placement in the three orthogonal axes.
Radiated emission measurement was performed from 30MHz to tenth harmonics.
The EUT and its peripherals are placed on a turn table which is 0.8 meter above ground.
The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4/1992 on radiated measurement.
The bandwidth below 1GHz setting on the field strength meter (ESMI) is 120kHz and above 1GHz is 1MHz.

6.3 Radiated Spurious Emission Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81. In the General Radiated Emission Test, the uncertainty is within ±2.5dB

"*" means the emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209 is based on Quasi peak detector data for frequencies below 1000 MHz and average detector data for frequencies over 1000MHz.

6.4 Radiated Spurious Emission Test Data

Worst Case Radiated Spurious Emission
at Channel 11, 4175.4 MHz, margin: -0.75 dB

EUT : XI-825
Test Channel : Channel 1
Test Mode : Transmitter

Freq. (MHz)	Corr. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Calculated		Limit At 3m (dBuV/m)	Margin (dB)
				(dBuV)	(uV/m)		
160.1	10.5	1.1	30.50	42.10	127.35	43.5	-1.40
199	13.9	1	19.30	34.20	51.286	43.5	-9.30
231.9	11.3	1.1	29.30	41.70	121.619	46	-4.30
280.6	12.8	1.3	30.40	44.50	167.88	46	-1.50
298.2	13.2	1.3	26.00	40.50	105.925	46	-5.50
298.4	13.2	1.3	26.20	40.70	108.393	46	-5.30
335.1	14	1.5	25.50	41.00	112.202	46	-5.00
397.3	15.3	1.6	24.40	41.30	116.145	46	-4.70
463.6	16.6	1.6	23.20	41.40	117.49	46	-4.60
729.1	20.7	2	22.40	45.10	179.887	46	-0.90
860.4	22.1	2.4	17.10	41.60	120.226	46	-4.40
2037.66	28.4	2.45	13.39	44.24	162.93	54	-9.76
*4075.4	33.8	3.4	14.76	51.96	396.278	54	-2.04
*4824	34.1	2.05	8.94	45.09	179.68	54	-8.91
7236	37.8	7.36	-	-	-	54	-
9648	38.4	8.5	-	-	-	54	-
*12060	39.4	9.57	-	-	-	54	-

Remark:
1. Corrected Level = Reading Level + Antenna Factor + Cable Loss
3. All Readings below 1GHz are Quasi-Peak, above are average value
4. All the Harmonics don’t show on the above table were undetectable.
5. “-“ means the value was undetectable.

EUT : XI-825
Test Channel : Channel 6
Test Mode : Transmitter

Freq. (MHz)	Corr. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Calculated		Limit At 3m (dBuV/m)	Margin (dB)
				(dBuV)	(uV/m)		
160.1	10.5	1.1	30.50	42.10	127.35	43.5	-1.40
199	13.9	1	19.30	34.20	51.286	43.5	-9.30
231.9	11.3	1.1	29.30	41.70	121.619	46	-4.30
280.6	12.8	1.3	30.40	44.50	167.88	46	-1.50
298.2	13.2	1.3	26.00	40.50	105.925	46	-5.50
298.4	13.2	1.3	26.20	40.70	108.393	46	-5.30
335.1	14	1.5	25.50	41.00	112.202	46	-5.00
397.3	15.3	1.6	24.40	41.30	116.145	46	-4.70
463.6	16.6	1.6	23.20	41.40	117.49	46	-4.60
729.1	20.7	2	22.40	45.10	179.887	46	-0.90
860.4	22.1	2.4	17.10	41.60	120.226	46	-4.40
2062.7	28.4	2.45	13.80	44.65	170.805	54	-9.35
*4125.4	33.8	3.4	12.24	49.44	296.483	54	-4.56
*4874	34.1	2.1	10.43	46.63	214.536	54	-7.37
*7311	37.8	7.36	-	-	-	54	-
9748	38.4	8.5	-	-	-	54	-
*12185	39.4	9.57	-	-	-	54	-

Remark:
1. Corrected Level = Reading Level + Antenna Factor + Cable Loss
3. All Readings below 1GHz are Quasi-Peak, above are average value
4. All the Harmonics don’t show on the above table were undetectable.
5. “-“ means the value was undetectable.

EUT : XI-825
Test Channel : Channel 11
Test Mode : Transmitter

Freq. (MHz)	Corr. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Calculated		Limit At 3m (dBuV/m)	Margin (dB)
				(dBuV)	(uV/m)		
160.1	10.5	1.1	30.50	42.10	127.35	43.5	-1.40
199	13.9	1	19.30	34.20	51.286	43.5	-9.30
231.9	11.3	1.1	29.30	41.70	121.619	46	-4.30
280.6	12.8	1.3	30.40	44.50	167.88	46	-1.50
298.2	13.2	1.3	26.00	40.50	105.925	46	-5.50
298.4	13.2	1.3	26.20	40.70	108.393	46	-5.30
335.1	14	1.5	25.50	41.00	112.202	46	-5.00
397.3	15.3	1.6	24.40	41.30	116.145	46	-4.70
463.6	16.6	1.6	23.20	41.40	117.49	46	-4.60
729.1	20.7	2	22.40	45.10	179.887	46	-0.90
860.4	22.1	2.4	17.10	41.60	120.226	46	-4.40
2087.7	28.4	2.45	10.29	41.14	114.025	54	-12.86
*4175.4	33.8	3.4	16.05	53.25	459.727	54	-0.75
*4924	34.1	2.12	7.35	43.57	150.834	54	-10.43
*7386	37.8	7.36	-	-	-	54	-
9848	38.4	8.5	-	-	-	54	-
*12310	39.4	9.57	-	-	-	54	-

Remark:
1. Corrected Level = Reading Level + Antenna Factor + Cable Loss
3. All Readings below 1GHz are Quasi-Peak, above are average value
4. All the Harmonics don’t show on the above table were undetectable.
5. “-“ means the value was undetectable.

6.5 Radiated Emission Configuration Photograph

For electronic filing, the worst-case radiated emission configuration photographs are saved with filename: Radiated emission setup 1.jpg and Radiated emission setup 2.jpg.

7. Power Spectral Density

7.1 Operating Environment

Temperature: 26 ℃
Relative Humidity: 58 %

7.2 Test Setup & procedure

The power spectral density per FCC §15.247(d) was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 30kHz, a span of 1.5 MHz, and the sweep time set at 500 seconds. The test was performed in 3 channels (1 near bottom, 1 near middle and 1 near top). The Power Spectral Density measured result is in the following table.
See Power Spectral Density CH 1, CH 6 and CH 11 plots.

7.3 Measured Data of Test results:

Channel	Frequency (MHz)	Measured level (dBm)	Limit (dBm)
1	2412.92	-9.89	+8
6	2436.38	-9.38	+8
11	2461.38	-9.91	+8

8. Emission on the band edge §FCC 15.247(C)

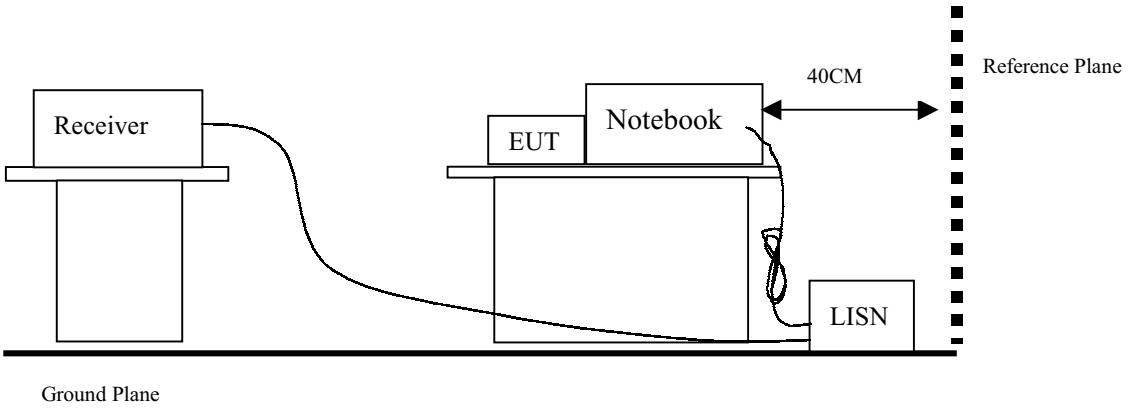
Emissions outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dBc below the level of the fundamental (2400~2483.5MHz). Please refer to the attachment plots. (Band-edge CH 1 and CH 11.pdf)

9. AC Line Conducted Emission §FCC 15.207

9.1 Operating Environment

Temperature: 24 ℃
Relative Humidity: 65 %

9.2 Test Setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/1992 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

Emission Limit

FCC Part 15 Paragraph 15.207		
Freq. (MHz)	Maximum RF Line Voltage	
	uV	dBuV
0.45 - 30	250	48.0

9.3 Conducted Emission Data

Worst Case Conducted Emission
at Channel 11, Line 4.674MHz ,margin:-14.9 dB

EUT : XI-825
Test Mode : Channel 1
Worst Case Condition : Transmitter Mode

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	4.162	24.7	48	-23.30
LINE	4.738	31.2	48	-16.80
LINE	4.874	31.8	48	-16.20
LINE	8.57	29.1	48	-18.90
LINE	10.97	30.6	48	-17.40
LINE	18.434	30.2	48	-17.80
NEUTRAL	4.482	30.2	48	-17.80
NEUTRAL	4.546	30.6	48	-17.40
NEUTRAL	4.874	29	48	-19.00
NEUTRAL	5.386	28.1	48	-19.90
NEUTRAL	7.986	28.8	48	-19.20
NEUTRAL	10.77	30.7	48	-17.30

Remark:
1. The reading value including cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81. In the Conducted Emission Test, the uncertainty is within ±2dB
3. The average measurement was not performed when the peak measured data under the limit of average detection.

EUT : XI-825
Test Mode : Channel 6
Worst Case Condition : Transmitter Mode

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	4.418	28.8	48	-19.20
LINE	4.674	32.4	48	-15.60
LINE	4.93	30.9	48	-17.10
LINE	7.978	29.7	48	-18.30
LINE	10.634	30.7	48	-17.30
LINE	17.146	26.4	48	-21.60
NEUTRAL	3.834	26.9	48	-21.10
NEUTRAL	4.154	27.7	48	-20.30
NEUTRAL	4.61	31.5	48	-16.50
NEUTRAL	5.322	28.6	48	-19.40
NEUTRAL	10.898	30.4	48	-17.60
NEUTRAL	18.162	28.3	48	-19.70

Remark:
1. 1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81. In the Conducted Emission Test, the uncertainty is within ±2dB
3. The average measurement was not performed when the peak measured data under the limit of average detection.

EUT : XI-825
Test Mode : Channel 11
Worst Case Condition : Transmitter Mode

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	3.962	27	48	-21.00
LINE	4.674	33.1	48	-14.90
LINE	4.802	31.1	48	-16.90
LINE	4.994	30.4	48	-17.60
LINE	10.378	31.3	48	-16.70
LINE	17.466	27	48	-21.00
NEUTRAL	4.482	29.8	48	-18.20
NEUTRAL	4.674	32.4	48	-15.60
NEUTRAL	4.802	30.9	48	-17.10
NEUTRAL	5.186	28.8	48	-19.20
NEUTRAL	10.506	30.3	48	-17.70
NEUTRAL	17.77	28.4	48	-19.60
NEUTRAL	4.482	29.8	48	-18.20

Remark:
1. 1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81. In the Conducted Emission Test, the uncertainty is within ±2dB
3. The average measurement was not performed when the peak measured data under the limit of average detection.

9.4 AC Line Conducted Emission Configuration Photograph

For electronic filing, the worst-case conducted emission configuration photographs are saved with filename: AC line conducted setup 1.jpg and AC line conducted setup 2.jpg