EMI TEST REPORT

Test Report No. : 24GE0078-HO-1

Applicant:	**ASYST SHINKO, INC.**
Type of Equipment:	**MCOM : Merge/diverge Communication Modem**
Model No.:	**MCOM**
FCC ID:	**RVEVEHICLEMCOM**
Test standard:	**FCC Part 15 Subpart C Section 15.209:2002**
Test Result:	**Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contains a true representation of the EMC profile.
4. The test results in this report are traceable to the national or international standards.
5. This test report does not constitute an endorsement by NIST/NVLAP or U.S. Government.

Date of test: April 8, 2002

Tested by:
Seigo kakehi

Approved by:
Kazutoyo Nakanishi
Site Manager of EMC Service

UL Apex Co., Ltd.
Yokowa EMC Lab.
108 Yokowa-cho, Ise-shi, Mie-ken, 516-1106 JAPAN
Telephone: +81 596 39 1485
Facsimile: +81 596 39 0232

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SECTION 1: Client information

Company name : ASYST SHINKO, INC.

Trade name : ASYST SHINKO

Address : 100 Takegahana-cho, Ise-shi, Mie-ken, 516-0005 JAPAN

Number : +81 596 36 1260

Facsimile Number : +81 596 36 0345

Contact Person : Mitsuyoshi Kuroda

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : MCOM: Merge/diverge Communication Modem

Model No. : MCOM

Sample No. : MCOM-001

Condition of EUT : Production model

Rating : DC 24V , DC 5V , DC ±12V

Country of Manufacture : Japan

Receipt Date of Sample : April 8, 2002

2.2 Product Description

Model: MCOM, referred to as the EUT in this report, is a MCOM: Merge/diverge Communication Modem.

The specification is as follows;
Communication unit's carrier frequency (Intentional Radiators) : 88.8kHz (on/off keying)
: 353.25kHz two level FSK (342.9 kHz and 363.6 kHz)
Communication unit's main clock(Unintentional Radiators) : 24MHz

1) Power line communication

***This power line is not for the Public utilities, but it is the standalone line for the Radio Communication.**

The communication unit CMC (**C**ommunication **M**odem **C**ontroller) is used for the communication between the ground Vehicle Controller and several vehicles in the conveyance system.
The communication signals are overlaid onto the power line for non-conductive power supply to the vehicles. In some systems, a separate signal lines may be used.

The communication unit MCOM (**M**erge/diverge **Co**mmunication **M**odem) is used for the communication between vehicle and the ground Vehicle Controller.

They modulates the signals sent from the Vehicle controller and transmits the modulated signals to the vehicles. It also demodulates the signals sent from the vehicles and transmits them to the Vehicle controller.
The communication method in use is FSK (frequency shift keying).
The communication frequencies are as follows.

	From	to	Frequency
(1)	CMC(Tx)	MCOM(Rx):	285.7 kHz and 315.8 kHz two level FSK
(2)	MCOM(Tx)	CMC(Rx):	342.9 kHz and 363.6 kHz two level FSK

***CMC is approved by FCC separately.**

2) Induction line communication

The communication unit MCOM (**M**erge/diverge **Co**mmunication **M**odem) is used for the communication between vehicle and other Vehicle.

MCOM outputs the detection signal of one bit in the controller when the existence of the signal which other vehicle transmitted.
A Induction line is installed on both sides of the track. Therefore one transformer and circuit are each right and left, and they are equal. It can be changed if one transformer is used for the reception or it is used for the transmission. A left-right coil is combined with the loop line, and it can watch each other's transmitting signal. Then, a trouble such as the breakage of the transformer can be diagnosed.

The communication method in use is Adoption of On Off Keying Method.
The communication frequencies are 88.8kHz.

*The evaluation of EUT : MCOM was carried out in the Test Report for FCC Part 15 Subpart B.

SECTION 3: Test specification, methods & procedures

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C Section 15.209 : 2002
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.209 Radiated emission limits; general requirements

3.2 Methods & Procedures

No.	Item	Test Procedure	Specification	Remarks
1	Radiated emission	ANSI C63.4:2001	Section 15.209(a)	3m
2	Conducted emission	ANSI C63.4:2001	Section 15.207(a)	LISN
*UL Apex's EMI Work Procedures No.QPM05.				

These tests were performed without any deviations from test procedure excluding below additions or deviations.

3.3 Exclusion from standards

No.	Item	Test Procedure	Specification	Remarks
2	Conducted emission	ANSI C63.4:2001	Section 15.207(a)	LISN

*1) The test is not applicable since the EUT does not have AC mains and is not designed to be connected to the public utility (AC) power line.

SECTION 4: Operation of E.U.T. during testing

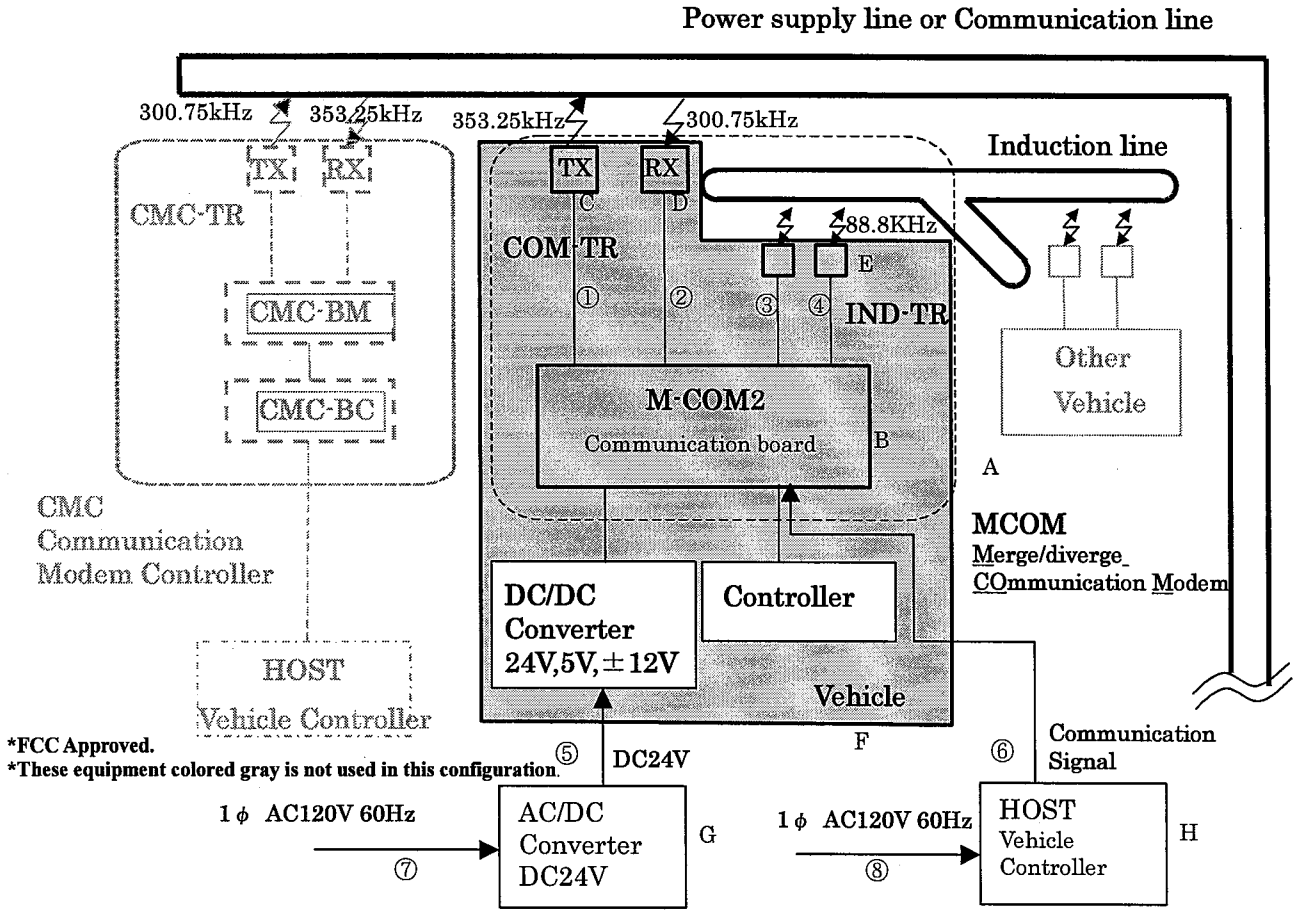
4.1 Operating Modes

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to typical use.

The operating mode/system were as follows:

Operation : Continuous transmitting (88.8kHz/On Off keying, and 353.25kHz/two level FSK)
Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

4.2 Configuration and peripherals



*Cabling was taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	MCOM	MCOM	MCOM-001	SHINKO	EUT
B	M-COM2	3ASSYC807901	A8050628033	SHINKO	EUT
			A8050628034	SHINKO	
C	COM-TR(RX)	3CL520A011500-02	-	SHINKO	EUT
D	COM-TR(TX)	3CL520A011500-01	-	SHINKO	EUT
E	IND-TR	3CL520A011400	-	SHINKO	EUT
F	Vehicle	VHT5-1	-	SHINKO	-
G	DC24V Power Supply	PAB25-1TR	30081818	KIKUSUI	-
H	Host	-	-	SHINKO	-

*All the responsibility of manufacturing this EUT was transferred to ASYST SHINKO INC., from Shinko Electric Co., Ltd. in October, 2002. This EUT has no change from the one tested as Shinko Electric Co., Ltd..
*The test was performed with the 2 sets of EUT.

List of cables used

No.	Name	Length (m)	Shield	Backshell Material	Remark
①	Interconnection Cable	1.0	Shielded	Polyvinyl chloride	-
②	Interconnection Cable	1.0	Shielded	Polyvinyl chloride	-
③	Interconnection Cable	2.0	Shielded	Polyvinyl chloride	-
④	Interconnection Cable	2.0	Shielded	Polyvinyl chloride	-
⑤	Power Supply Cable	3.0	Shielded	Polyvinyl chloride	-
⑥	Communication Signal Cable	3.0	Shielded	Polyvinyl chloride	-
⑦	AC Power Supply Cable	2.0	Unshielded	Polyvinyl chloride	-
⑧	AC Power Supply Cable	2.0	Unshielded	Polyvinyl chloride	-

SECTION 5: Summary of test results

5.1 Test results

No.	Item	Test Procedure	Specification	Worst margin	Result
1	Radiated emission	ANSI C63.4:2001	Section 15.209(a)	**Carrier 353.25kHz** We recorded the frequency detected highly after carrier frequency was modulated. 23.0dB (357.05kHz : 90deg) **Carrier 88.8kHz** 38.7dB (88.44kHz : 0deg) **Spurious(9kHz-30MHz)** 16.3dB (1379.90kHz : 0deg Carrier 353.25kHz) 20.9dB (888.80kHz : 90deg Carrier 88.8kHz)	Complied

UL Apex Co., Ltd. hereby confirms that E.U.T., in the configuration tested, complies with the specifications FCC Part 15 Subpart C Section 15.209.

<–20dB Bandwidth>
Refer to Appendix 2.

5.2 Uncertainty

Radiated Emission Test

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is ±2.5dB.
The data listed in this test report may exceed the test limit because it does not have enough margin.

5.3 Test Location

UL Apex Co., Ltd. Yokowa No.1 test site
108 Yokowa-cho, Ise-shi, Mie-ken 516-1106 Japan
Telephone number : +81-596-39-1485
Facsimile number : +81-596-39-0232
No.1 test site has been fully described in a report submitted to FCC office, and listed on October 26, 2000 (Registration number: 90412).

*NVLAP Lab. code : 200109-0

*We, A-Pex International Co., Ltd. merged with UL Japan Co.,Ltd., a subsidiary of Underwriters Laboratories Inc. (UL) and changed our name to “UL Apex Co.,Ltd.” effective April 10, 2003.

5.4 Photographs of test setup

Refer to Appendix 1.

5.5 Data of EMI Test

Refer to Appendix 2.

5.6 Test instruments

Refer to Appendix 3.

SECTION 6: Radiated emission

6.1 Operating environment

The test was carried out in an open site.

Temperature : See data
Humidity : See data

6.2 Test configuration

EUT was placed on a carpet for insulation above a reference ground plane. EUT was set up typical spacing for the other equipments. I/O cables that were connected to the peripherals were bundled in center.
Test was performed with the Loop antenna positioned in both the 0° and 90° of polarization.
The center of the Loop antenna was 1 m height from the ground plane.
A drawing of the set up is shown in the photos of Appendix 1.

6.3 Test conditions

Frequency range : 9kHz to 30MHz (Loop Antenna)
Test distance : 3m
EUT position : Floor Standing

6.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on an open test site with a ground plane and at a distance of 3m.
Pre check measurements were performed at high-level of 80-90MHz, 270-290MHz and 500-700MHz in a screened room. Otherwise the noise from EUT might have been concealed by the ambient noise.
Measurements were performed with quasi-peak, average and peak detector.
The center of the Loop antenna was 1 m height from the ground plane and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.
The measurements were performed for both the 0° and 90° of polarization antenna polarization.
The EUT was put into operation at Transmitting mode.
The radiated emission measurements were made with the following detector function of the test receiver and spectrum analyzer.

Frequency : 9kHz -90kHz(BW 200Hz), 110kHz -150kHz(BW 200Hz), 150kHz -490kHz(BW 10kHz)
Detector Type : AV / PK (Test Receiver)

Frequency : 90kHz -110kHz(BW 200Hz), 490kHz –30MHz(BW 10kHz)
Detector Type : QP (Test Receiver)

6.5 Results

Summary of the test results: Pass
Date: April 8, 2002 Tested by: Seigo Kakehi

APPENDIX 1: Photographs of test setup

Page 11: Radiated emission

APPENDIX 2: Data of EMI test

Page 12: –20dB Bandwidth

Page 13-16: Data of carrier and spurious (9kHz to 30MHz)

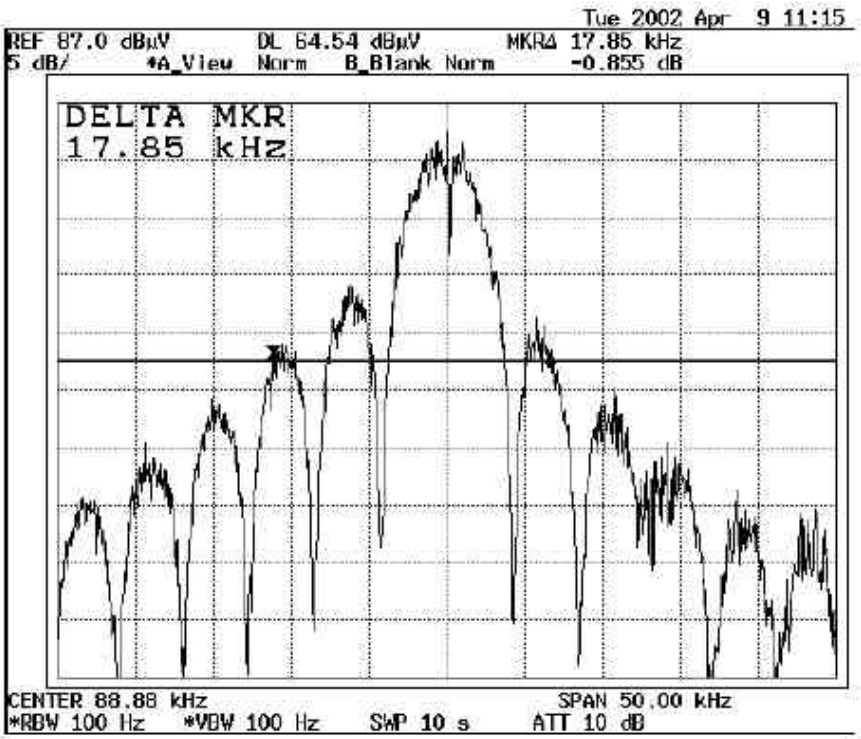
Page 17: Duty Cycle

APPENDIX 3: Test instruments

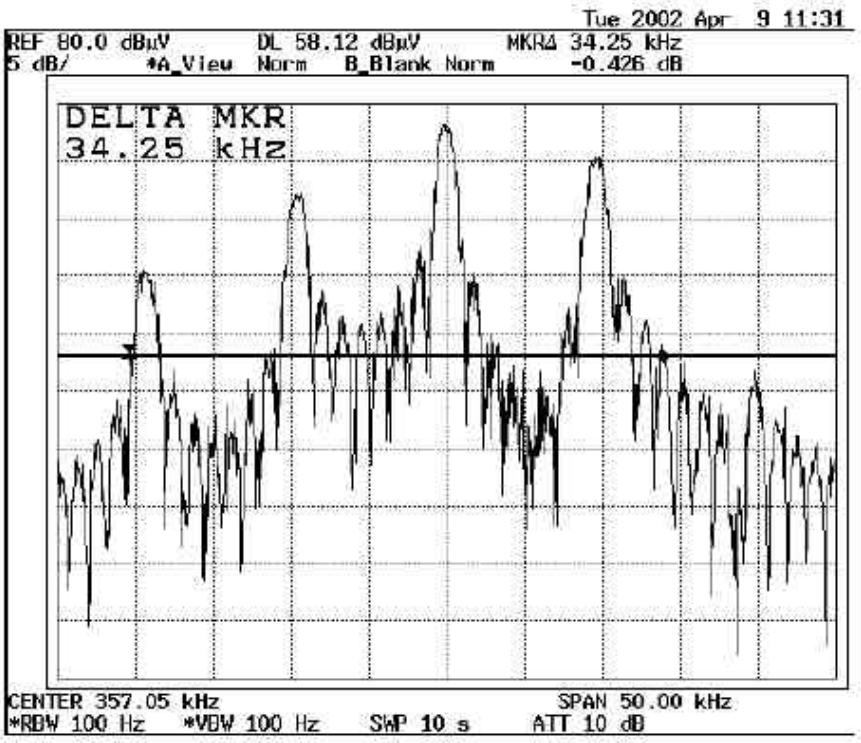
Page 18: Test instruments

Radiated emission

Radiated emission -20dB Bandwidth (88.8kHz Transmitting)



-20dB Bandwidth (353.25kHz Transmitting)



Data of Carrier and Spurious Test(9kHz to 30MHz)

UL Apex Co., Ltd.
YOKOWA NO.1 OPEN SITE

Company	: ASYST SHINKO, INC.	Report No	: 24GE0078-HO-1
Equipment	: MCOM(M-COM2,COM-TR(RX),COM-TR(TX),IND-TR)	Regulation	: FCC 15.209(a)
Model	: MCOM	Test Distance	: 3m
Power	: DC 24.0V	Date	: 2002/4/8
Mode	: Transmitting		
Fundamental	: 88.88kHz	FCC ID	: RVEVEHICLEMCOM
Serial No.	: MCOM-001		
Temperature	: 20deg.C		
Humidity	: 69%		

ENGINEER : Seigo Kakehi

Frequency Rage :9kHz-90kHz AV DETECT(Test Receiver: BW 200Hz)
Frequency Rage :110kHz-490kHz AV DETECT
(Test Receiver: 110-150kHz BW 200Hz,150kHz-490kHz BW 10kHz)
Frequency Rage :490kHz-30MHz QP DETECT(Test Receiver: BW 10kHz)

No.	FREQ	ANT	READING		ANT	ATTEN	CABLE	AMP	RESULT		LIMIT	MARGIN	
		TYPE	0 deg	90 deg	Factor		LOSS	GAIN	0deg	90deg		0deg	90deg
	[kHz]		[dBuV]		[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]		[dBuV/m]	[dB]	
1	88.44	BB	74.8	74.7	20.1	0.0	0.1	25.0	70.0	69.9	108.7	38.7	38.8
2	177.76	BB	71.6	66.5	20.1	0.0	0.1	27.6	64.2	59.1	102.6	38.4	43.5
3	283.18	BB	61.3	64.6	20.1	0.0	0.2	28.3	53.3	56.6	98.6	45.3	42.0
4	358.10	BB	56.6	62.5	20.1	0.0	0.2	28.7	48.2	54.1	96.5	48.3	42.4
5	443.16	BB	33.8	33.7	20.1	0.0	0.2	28.9	25.2	25.1	94.7	69.5	69.6
6	530.60	BB	47.0	56.3	20.1	0.0	0.3	29.1	38.3	47.6	73.1	34.8	25.5
7	625.29	BB	50.7	47.1	20.1	0.0	0.3	29.2	41.9	38.3	71.7	29.8	33.4
8	708.65	BB	49.2	52.0	20.1	0.0	0.3	29.3	40.3	43.1	70.6	30.3	27.5
9	796.47	BB	48.0	47.6	20.1	0.0	0.3	29.3	39.1	38.7	69.6	30.5	30.9
10	888.80	BB	53.4	56.5	20.1	0.0	0.3	29.2	44.6	47.7	68.6	24.0	20.9

REMARKS
ANTENNA TYPE : 9kHz-30MHz (Loop Antenna)
CALCULATION : RESULT = READING + ANT Factor + ATTEN + Cable Loss - AMP Gain
LIMIT (0.009 to 0.490MHz) : 2400/FREQ(CONVERTED dBuV/m) + 40log(300/3)
LIMIT (0.490 to 1.705MHz) : 24000/FREQ(CONVERTED dBuV/m) + 40log(30/3)
LIMIT (1.705 to 30MHz) : 30(CONVERTED dBuV/m) + 40log(30/3)

All other spurious emissions are more than 20dB below the limits.

* ATTEN. was not used for factor 0.0 dB of the above table.
* Loop antenna is rotated from 0 to 180 degree to find and measure the position of the maximum radiation level.

Data of Carrier and Spurious Test(9kHz to 30MHz)

UL Apex Co., Ltd.
YOKOWA NO.1 OPEN SITE

Company	: ASYST SHINKO, INC.	Report No	: 24GE0078-HO-1
Equipment	: MCOM(M-COM2,COM-TR(RX),COM-TR(TX),IND-TR)	Regulation	: FCC 15.209(a)
Model	: MCOM	Test Distance	: 3m
Power	: DC 24.0V	Date	: 2002/4/8
Mode	: Transmitting	FCC ID	: RVEVEHICLEMCOM
Fundamental	: 353.25kHz		
Serial No.	: MCOM-001		
Temperature	: 20deg.C		
Humidity	: 69%		

ENGINEER : Seigo Kakehi

Frequency Rage :9kHz-90kHz AV DETECT(Test Receiver: BW 200Hz)
Frequency Rage :110kHz-490kHz AV DETECT
(Test Receiver: 110-150kHz BW 200Hz,150kHz-490kHz BW 10kHz)
Frequency Rage :490kHz-30MHz QP DETECT(Test Receiver: BW 10kHz)

No.	FREQ	ANT	READING		ANT	ATTEN	CABLE	AMP	RESULT		LIMIT	MARGIN	
		TYPE	0 deg	90 deg	Factor		LOSS	GAIN	0deg	90deg		0deg	90deg
	[kHz]		[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]		[dBuV/m]	[dB]	
1	357.05	BB	70.1	81.4	20.1	0.0	0.2	28.7	61.7	73.0	96.0	34.3	23.0
2	704.05	BB	49.4	56.2	20.1	0.0	0.3	29.3	40.5	47.3	70.7	30.2	23.4
3	1032.87	BB	54.6	43.8	20.1	0.0	0.4	29.4	45.7	34.9	67.3	21.6	32.4
4	1379.90	BB	57.4	52.4	20.1	0.0	0.4	29.4	48.5	43.5	64.8	16.3	21.3
5	1726.81	BB	42.2	41.8	20.1	0.0	0.4	29.4	33.3	32.9	69.5	36.2	36.6
6	2081.02	BB	35.6	35.7	20.1	0.0	0.4	29.4	26.7	26.8	69.5	42.8	42.7
7	2472.75	BB	35.2	35.7	20.1	0.0	0.4	29.4	26.3	26.8	69.5	43.2	42.7
8	2826.00	BB	36.0	31.2	20.0	0.0	0.4	29.4	27.0	22.2	69.5	42.5	47.3
9	3155.82	BB	48.6	43.6	20.0	0.0	0.4	29.4	39.6	34.6	69.5	29.9	34.9
10	3492.57	BB	45.8	45.0	20.0	0.0	0.5	29.4	36.9	36.1	69.5	32.6	33.4

REMARKS
ANTENNA TYPE : 9kHz-30MHz (Loop Antenna)
CALCULATION : RESULT = READING + ANT Factor + ATTEN + Cable Loss - AMP Gain
LIMIT (0.009 to 0.490MHz) : 2400/FREQ(CONVERTED dBuV/m) + 40log(300/3)
LIMIT (0.490 to 1.705MHz) : 24000/FREQ(CONVERTED dBuV/m) + 40log(30/3)
LIMIT (1.705 to 30MHz) : 30(CONVERTED dBuV/m) + 40log(30/3)

All other spurious emissions are more than 20dB below the limits.

* ATTEN. was not used for factor 0.0dB of the above table.
* Loop antenna is rotated from 0 to 180 degree to find and measure the position of the maximum radiation level.

Data of Carrier and Spurious Test(9kHz to 30MHz)

UL Apex Co., Ltd.
YOKOWA NO.1 OPEN SITE

Company	: ASYST SHINKO, INC.	Report No	: 24GE0078-HO-1
Equipment	: MCOM (M-COM2, COM-TR(RX), COM-TR(TX), IND-TR)	Regulation	: FCC 15.209(a)
Model	: MCOM	Test Distance	: 3m
Power	: DC 24.0V	Date	: 2002/4/8
Mode	: Transmitting		
Fundamental	: 88.88kHz	FCC ID	: RVEVEHICLEMCOM
Serial No.	: MCOM-001		
Temperature	: 20deg.C		
Humidity	: 69%		

ENGINEER : Seigo Kakehi

Frequency Rage :9kHz-90kHz and 110kHz-490kHz PK Data

No.	FREQ	ANT	AV READING		ANT	ATTEN	CABLE	AMP	Duty	RESULT		LIMIT	MARGIN	
		TYPE	0 deg	90 deg	Factor		LOSS	GAIN	Factor	0deg	90deg	(PK)	0deg	90deg
	[kHz]		[dBuV]		[dB/m]	[dB]	[dB]	[dB]	[dB]	[dBuV/m]		[dBuV/m]	[dB]	
1	88.44	BB	74.8	74.7	20.1	0.0	0.1	25.0	20.0	90.0	89.9	128.7	38.7	38.8
2	177.76	BB	71.6	66.5	20.1	0.0	0.1	27.6	20.0	84.2	79.1	122.6	38.4	43.5
3	283.18	BB	61.3	64.6	20.1	0.0	0.2	28.3	20.0	73.3	76.6	118.6	45.3	42.0
4	358.10	BB	56.6	62.5	20.1	0.0	0.2	28.7	20.0	68.2	74.1	116.5	48.3	42.4
5	443.16	BB	33.8	33.7	20.1	0.0	0.2	28.9	20.0	45.2	45.1	114.6	69.4	69.5

REMARKS
CALCULATION : RESULT = READING + ANT Factor + ATTEN + Cable Loss - AMP Gain + *Duty Factor
*Duty Factor : 20dB(Duty 10%)

* ATTEN. was not used for factor 0.0 dB of the above table.
* Loop antenna is rotated from 0 to 180 degree to find and measure the position of the maximum radiation level.

Data of Carrier and Spurious Test(9kHz to 30MHz)

UL Apex Co., Ltd.
YOKOWA NO.1 OPEN SITE

Company : ASYST SHINKO, INC.
Equipment : MCOM (M-COM2, COM-TR(RX), COM-TR(TX), IND-TR)
Model : MCOM
Power : DC 24.0V
Mode : Transmitting
Fundamental : 353.25kHz
Serial No. : MCOM-001
Temperature : 20deg.C
Humidity : 69%

Report No : 24GE0078-HO-1
Regulation : FCC 15.209(a)
Test Distance : 3m
Date : 2002/4/8
FCC ID : RVEVEHICLEMCOM

ENGINEER : Seigo Kakehi

Frequency Rage :9kHz-90kHz and 110kHz-490kHz PK Data

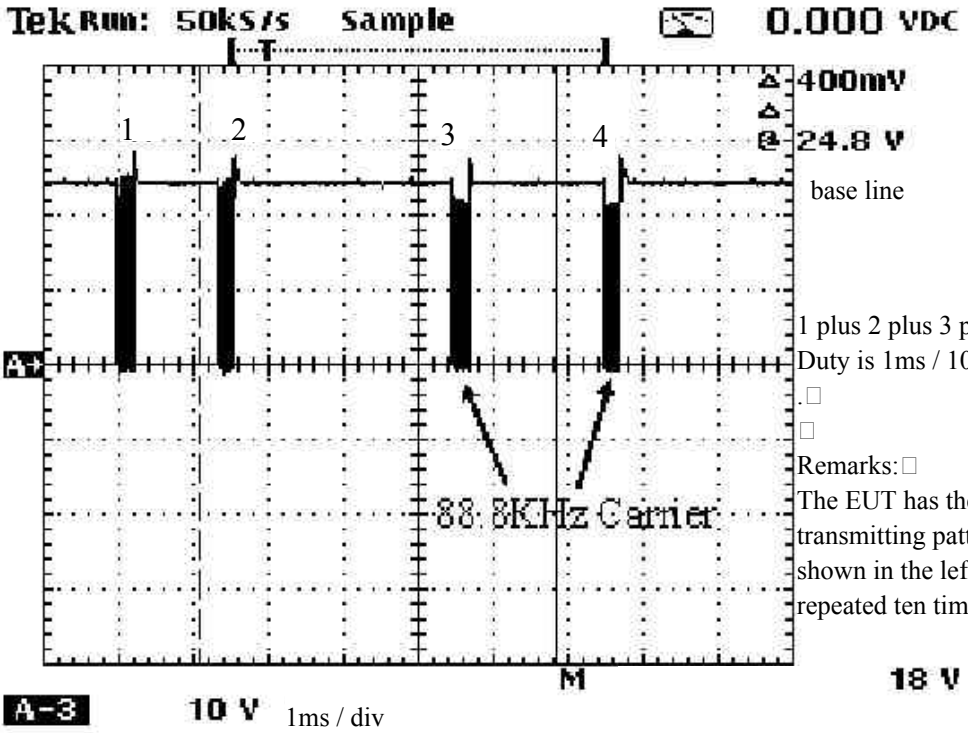
No.	FREQ	ANT	AV READING		ANT	ATTEN	CABLE	AMP	Duty	RESULT		LIMIT	MARGIN	
		TYPE	0 deg	90 deg	Factor		LOSS	GAIN	Factor	0deg	90deg	(PK)	0deg	90deg
	[kHz]		[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dB]	[dBuV/m]		[dBuV/m]	[dB]	
1	357.05	BB	70.1	81.4	20.1	0.0	0.2	28.7	12.0	73.7	85.0	116.0	42.3	31.0

REMARKS
CALCULATION : RESULT = READING + ANT Factor + ATTEN + Cable Loss - AMP Gain + *Duty Factor
*Duty Factor : 12dB(Duty 25%)

* ATTEN. was not used for factor 0.0 dB of the above table.
* Loop antenna is rotated from 0 to 180 degree to find and measure the position of the maximum radiation level.

Revised date March 3, 2004

Duty Cycle 10%(88.8kHz Transmitting)

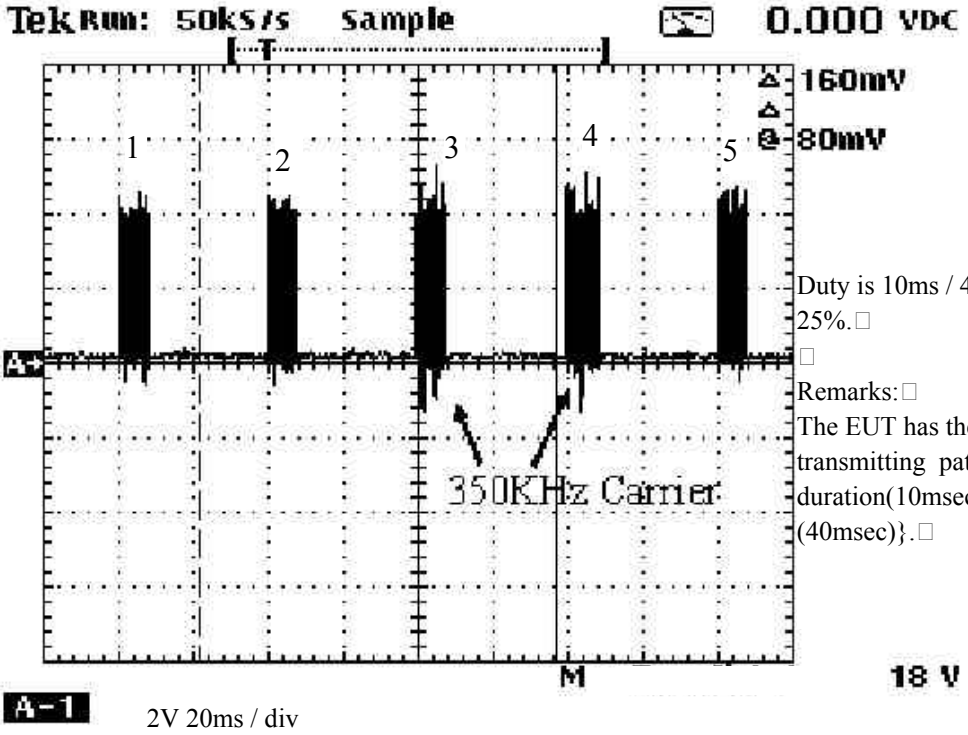


base line

1 plus 2 plus 3 plus 4 plus is 1ms.
Duty is 1ms / 10ms and is also 10%
.

Remarks:
The EUT has the function of
transmitting pattern(10msec) as is
shown in the left side. Its pattern is
repeated ten times per 100msec.

Duty Cycle 25%(353.25kHz Transmitting)



Duty is 10ms / 40ms and is also
25%.

Remarks:
The EUT has the function of
transmitting pattern, {"on"
duration(10msec) within 1 period
(40msec)}.

APPENDIX 3
Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Test Item	Calibration Date * Interval(month)
AF-02	Pre Amplifier	Anritsu	MH648A	RE	2002/04/01 * 12
SA-01	Spectrum Analyzer	Hewlett Packard	8567A	RE	2002/04/03 * 12
TR-02	Test Receiver	Rohde & Schwarz	ESVS30	RE	2002/04/17 * 12
CC-1ORC	Yokowa No.1 open coaxial(0.01-1000MHz)	A-PEX	CC-11,CC-12,CC-14, CC-15,CC-16,,SW-11 ,SW-12	RE	2002/03/31 * 12
YOATS-01	Open Test Site	JSE	10m	RE	2002/03/17 * 12
LP-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	RE	2001/09/18 * 12

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
Test Item :
RE: Radiated emission,