



**Spectrum Research
& Testing Lab., Inc.**

No. 101-10, Ling 8,
Shan-Tong Li, Chung-Li
City, Taoyuan, Taiwan,
R.O.C.

TEST REPORT

Reference No.: A06050503
Report No.: FCCA06050503
Page:1 of 22
Date: Jun 05, 2006

Product Name: MULTI SENSOR
Model Number: MS-1
Applicant: SPAL-USA
512 Tuttle street Des Moines, Iowa 50309
Date of Receipt: May. 05,2006
Finished date of Test: May 29, 2006
Applicable Standards: 47 CFR Part 15, Subpart C
ANSI C63.4: 2003

We, **Spectrum Research & Testing Laboratory Inc.**, hereby certify that one sample of the above was tested in our laboratory with positive results according to the above-mentioned standards. The records in the report are an accurate account of the results. Details of the results are given in the subsequent pages of this report.

Checked By : 2 1st Auth., Date: 6/5/2006
(Nick Hsieh)

Approved By : 2 JHO, Date: 6/5/2006
(Johnson Ho, Director)

NVLAQ[®]

Lab Code: 200099-0

 Spectrum Research & Testing Lab., Inc. No. 101-10, Ling 8, Han-Tong Li, Chung-Li City, Taoyuan, Taiwan, R.O.C.	TEST REPORT	Reference No.: A06050503 Report No.: FCCA06050503 Page:2 of 22 Date: Jun 05, 2006
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1. DOCUMENT POLICY AND TEST STATEMENT

1.1 DOCUMENT POLICY

- The report shall not be reproduced except in full, without the written approval of SRT Lab, Inc.
- The report must not be used by the applicant to claim that the product is endorsed by NVLAP.
- The NVLAP logo applies only to the applicable standards specified in this report.

1.2 TEST STATEMENT

- The test results in the report apply only to the unit tested by SRT Lab.
- There was no deviation from the requirements of test standards during the test.
- The new battery power source 3Vdc, was used during the test.
- The antennas were soldered on the PCB.

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2. DESCRIPTION OF EUT AND TEST MODE

2.1 GENERAL DESCRIPTION OF EUT

PRODUCT	MULTI SENSOR
MODEL NO.	MS-1
POWER SUPPLY	3Vdc, 220mA(Battery)
CABLE	N/A
I/O PORT/INTERFACE	N/A
FREQUENCY BAND	433.92MHz
CARRIER FREQUENCY	433.92MHz
NUMBER OF CHANNEL	1
CHANNEL SPACING	N/A
RF OUTPUT POWER	0.01W=10dBm
I.F. & L.O.	L.O.: 433.92MHz
MODULATION TYPE	ASK
BIT RATE OF TRANSMISSION	4 kHz
ANTENNA TYPE	Integral Antenna

NOTE: The EUT is the transmitter part of a multi sensor. For more detailed information, please refer to the specifications or User's manual provided by manufacturer.

2.2 DESCRIPTION OF EUT INTERNAL DEVICE

DEVICE	BRAND / MAKER	MODEL #	FCC ID/DOC	REMARK
N/A				

2.3 DESCRIPTION OF TEST MODE

The EUT was operated in continually transmitting mode.

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2.4 DESCRIPTION OF SUPPORT UNIT

The EUT was configured by the requirement of ANSI C63.4 and CISPR 22. All interface ports were connected to the appropriate support units via specific cables. The support units and cables are listed below.

NO	DEVICE	BRAND	MODEL #	FCC ID/DOC	CABLE
1	N/A				

NOTE: For the actual test configuration, please refer to the photos of testing.

3. DESCRIPTION OF APPLIED STANDARDS

The EUT is a kind of wireless product and according to the specifications provided by the applicant, must comply with the requirements of the following standards:

47 CFR Part 15, Subpart C

All tests have been performed and recorded as per the above standards.

4. CONDUCTED EMISSION TEST

The test item was not performed, because the EUT uses 3Vdc battery as power source.

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5. RADIATED EMISSION TEST

5.1 RADIATED EMISSION LIMIT

FCC part15C 15.209 limits of radiated emission measurement for frequency below 1000 MHz

FREQUENCY (MHz)	DISTANCE (m)	FIELDS STRENGTH (dB μ V/m)
30 - 88	3	40.0
88 - 216	3	43.5
216 - 960	3	46.0
ABOVE 960	3	54.0

FCC part15C 15.231(b) limit of fundamental and spurious emissions measurement.

FREQUENCY (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750 (NOTE 5)	125 to 375 (NOTE 7)
174-260	3750	375 (NOTE 7)
260-470	3750 to 12500 (NOTE 6)	375 to 1250
Above 470	12500	1250

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dB μ V/m) = 20 log Emission level (μ V/m).
3. In the emission tables above, the tighter limit applies at the band edges.
4. Distance refers to the distance between measuring instrument, antenna, and the closest point of any part of the device or system.
5. Limit = $20\log(56.81818(F) - 6136.3636)$; F : Fundamental Frequency (MHz)
6. Limit = $20\log(41.667 \times F - 7083.3333)$; F : Fundamental Frequency (MHz)
7. Limit = The Limit of Fundamental Frequency – 20dB
8. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

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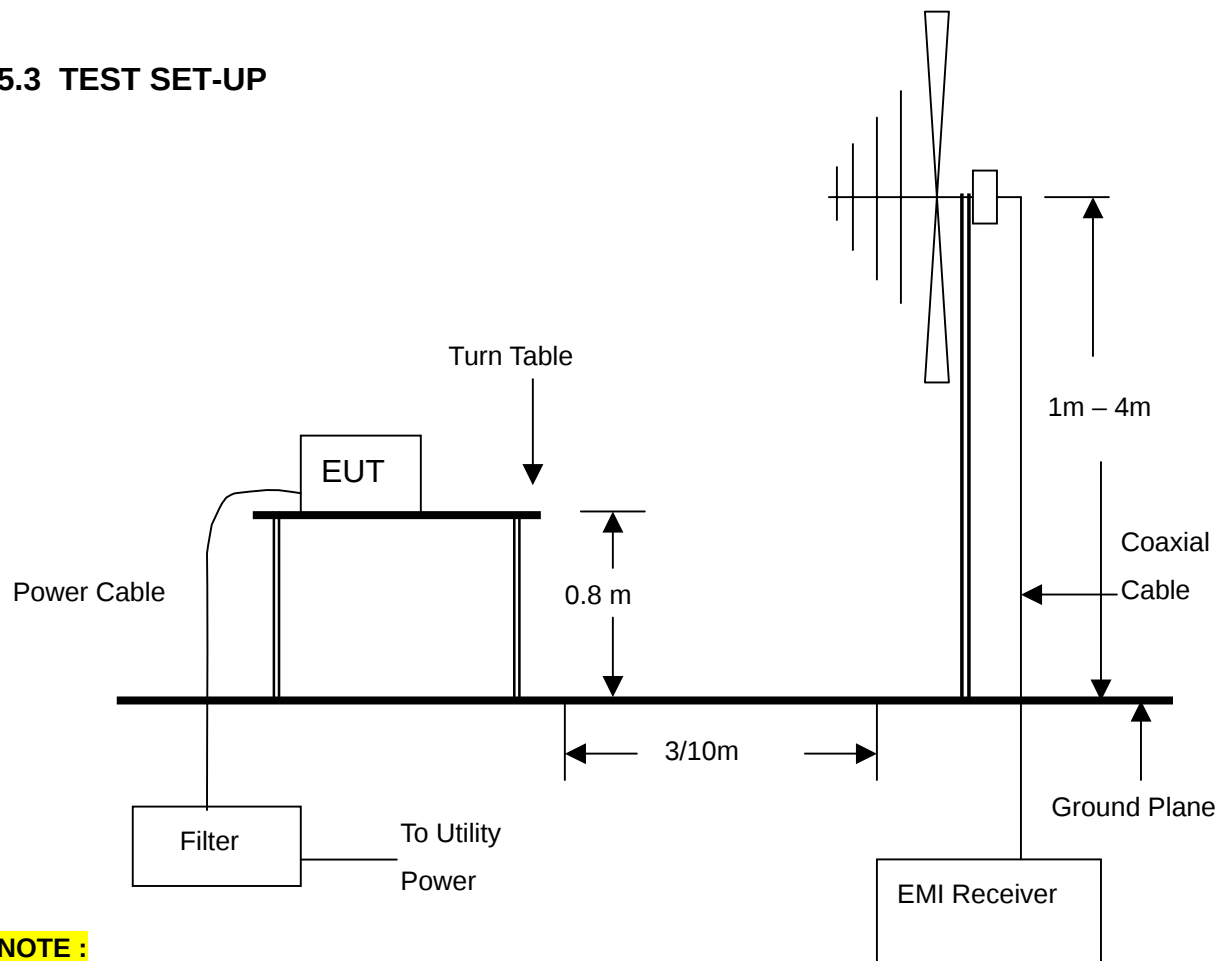
5.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test :

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
EMI TEST RECEIVER	9 kHz TO 2750 MHz	ROHDE & SCHWARZ	ESCS30/ 836858/008	AUG. 2006 ETC
BI-LOG ANTENNA	25 MHz TO 2 GHz	EMCO	3142/ 9701-1124	APR. 2007 SRT
PRE-AMPLIFIER	1GHz-26.5GHz Gain:30dB(typ.)	HP	8449B/ 3008A01019	DEC. 2006 ETC
SPECTRUM	9KHz TO 26.5GHz	HP	8953E/ 3710A03220	MAY 2007 ETC
HORN ANTENNA	1GHz TO 18GHz	EMCO	3115/ 9602-4681	NOV. 2006 ETC
OATS	3 – 10 M MEASUREMENT	SRT	SRT-1	APR. 2007 SRT

1. The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.
2. The Open Area Test Site (SRT-1) is registered by FCC with No. 90957 and VCCI with No. R-1081.
3. The Open Area Test Site (SRT-2) is registered by FCC with No. 98458 and VCCI with No. R-1168.

5.3 TEST SET-UP



NOTE :

1. The EUT system was put on a wooden table with 0.8m heights above a ground plane.
2. For the actual test configuration, please refer to the photos of testing.

5.4 TEST PROCEDURE

The EUT was tested according to the requirement of ANSI C63.4 and CISPR 22. The measurements were made at an open area test site with 3 meter measurement distance under 1 GHz and with 3m distance above 1GHz. The frequency spectrum measured started from 30 MHz. Under 1 GHz, all readings were quasi-peak values with 120 kHz resolution bandwidth of the test receiver. Above 1 GHz, the measurements were made at an open area test site with 3 meter measurement distance and all readings were peak or average values with 1 MHz resolution bandwidth of the test receiver. The EUT system was operated in all typical methods by users. The cables connected to EUT and support units were moved to find the maximum emission levels for each frequency.

5.5 EUT OPERATING CONDITION

Same as section 2.3 of this report.

5.6 Maximum Modulation Percentage

Duty Cycle = 50%

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5.7 RADIATED EMISSION TEST RESULT

Temperature:	26°C	Humidity:	70%RH
Ferquency Range:	30MHz – 5GHz	Measured Distance:	3m
Receiver Detector:	Peak/QP/AV	Tested By:	Roger

Fundamental

Frequency (MHz)	Correct Factor (dB)	Antenna Factor (dB/m)	Polarization	Reading (dBμV)		Emission Level (dBμV/m)		Limit (dBμV/m)		Margin (dB)		AZ (°)	EL (m)
				Peak	AV	Peak	AV	Peak	AV	Peak	AV		
433.99	3.78	15.97	H	66.0	56.0	85.7	75.7	100.83	80.83	-15.1	-5.1	25.5	1.68
433.99	3.78	15.97	V	57.7	49.5	77.4	69.2	100.83	80.83	-23.4	-11.6	45.8	1.78

LINK

Frequency (MHz)	Correct Factor (dB)	Antenna Factor (dB/m)	Polarization	Reading (dBμV) Peak/QP	Emission Level (dBμV/m) Peak/QP	Limit (dBμV/m) Peak/QP	Margin (dB) Peak/QP	AZ (°)	EL (m)
265.8050	2.91	12.16	H	4.1	19.2	46.0	-26.8	351.2	3.9
335.9000	3.20	14.47	H	4.0	21.7	46.0	-24.3	67.8	3.4
503.3600	4.14	16.14	H	4.1	24.4	46.0	-21.6	376.4	3.3
647.9500	4.75	19.09	H	3.8	27.6	46.0	-18.4	264.6	2.8
733.1250	5.14	21.30	H	3.1	29.5	46.0	-16.5	245.8	2.7
926.0850	5.85	22.79	H	2.4	31.0	46.0	-15.0	216.7	2.8
328.7600	3.16	14.32	V	4.3	21.8	46.0	-24.2	61.8	3.8
540.2200	4.32	16.62	V	4.2	25.1	46.0	-20.9	47.8	2.4
648.2925	4.75	19.13	V	3.9	27.8	46.0	-18.2	54.2	1.6
696.4400	5.01	20.86	V	3.7	29.6	46.0	-16.4	54.6	3.7
738.3000	5.15	21.34	V	3.1	29.6	46.0	-16.4	76.8	3.8
803.5850	5.35	21.92	V	2.7	30.0	46.0	-16.0	325.6	3.7

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TX

Frequency (MHz)	Correct Factor (dB)	Antenna Factor (dB/m)	Polarization	Reading (dBμV) Peak/QP	Emission Level (dBμV/m) Peak/QP	Limit (dBμV/m) Peak/QP	Margin (dB) Peak/QP	AZ (°)	EL (m)
306.3400	3.05	13.83	H	4.9	21.8	60.8	-39.0	348.1	1.9
384.9300	3.49	15.55	H	3.8	22.8	60.8	-38.0	326.7	3.6
605.2400	4.62	17.58	H	3.7	25.9	60.8	-34.9	348.1	2.4
697.6900	5.01	20.89	H	2.2	28.1	60.8	-32.7	80.7	3.9
745.2400	5.17	21.41	H	2.8	29.4	60.8	-31.5	296.4	1.2
867.9950	5.66	22.30	H	29.1	57.1	60.8	-3.8	19.6	1.2
193.9300	2.46	10.58	V	13.0	26.0	60.8	-34.8	296.8	3.1
336.5200	3.20	14.49	V	4.3	22.0	60.8	-38.8	265.7	3.8
513.8900	4.19	16.27	V	4.1	24.6	60.8	-36.3	256.1	2.0
638.4100	4.72	18.77	V	4.0	27.5	60.8	-33.3	226.4	3.7
706.1000	5.05	21.05	V	3.4	29.5	60.8	-31.3	241.9	2.7
867.9800	5.66	22.30	V	21.3	49.3	60.8	-11.6	326.7	1.2

NOTE :

1. Measurement uncertainty is +/-2dB.
2. "*": Measurement value was too low to be detected.
3. Emission Level = Reading Value + Ant. Factor + Cable Loss.
4. The field strength of other emission frequencies were very low against the limit.
5. The emission level is lower than equipment 's noise.
6. Above 1GHz and up to 4.5GHz, the noise is very small.

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6. BAND EDGE TEST

6.1 BAND EDGE LIMIT

FCC part15C 15.231(b) limit of fundamental and spurious emissions measurement.

FREQUENCY (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750 (NOTE 4)	125 to 375 (NOTE 6)
174-260	3750	375
260-470	3750 to 12500 (NOTE 5)	375 to 1250 (NOTE 6)
Above 470	12500	1250

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level ($\mu\text{V/m}$) = $20 \log$ Emission level ($\mu\text{V/m}$).
3. In the emission tables above, the tighter limit applies at the band edges.
4. Limit = $20 \log(56.81818(F) - 6136.3636)$; F : Fundamental Frequency (MHz)
5. Limit = $20 \log(41.667(F) - 7083.3333)$; F : Fundamental Frequency (MHz)
6. Limit = The Limit of Fundamental Frequency – 20dB
7. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

6.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test :

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9 kHz TO 7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	MAR. 2007 ETC

NOTE:

1. The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

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6.3 TEST SET-UP

The EUT was connected to Receiver(or spectrum) by 50Ω coaxial cable.



6.4 TEST PROCEDURE

Please refer to FCC Part15C 15.231.

6.5 EUT OPERATING CONDITION

Same as section 2.3 of this report.

6.6 BAND EDGE TEST RESULT

EUT: MULTI SENSOR MODEL: MS-1 MODE: TX

TEST STANDARD: FCC part15 Subpart C 15.231 TEST SITE: SHIELDED ROOM

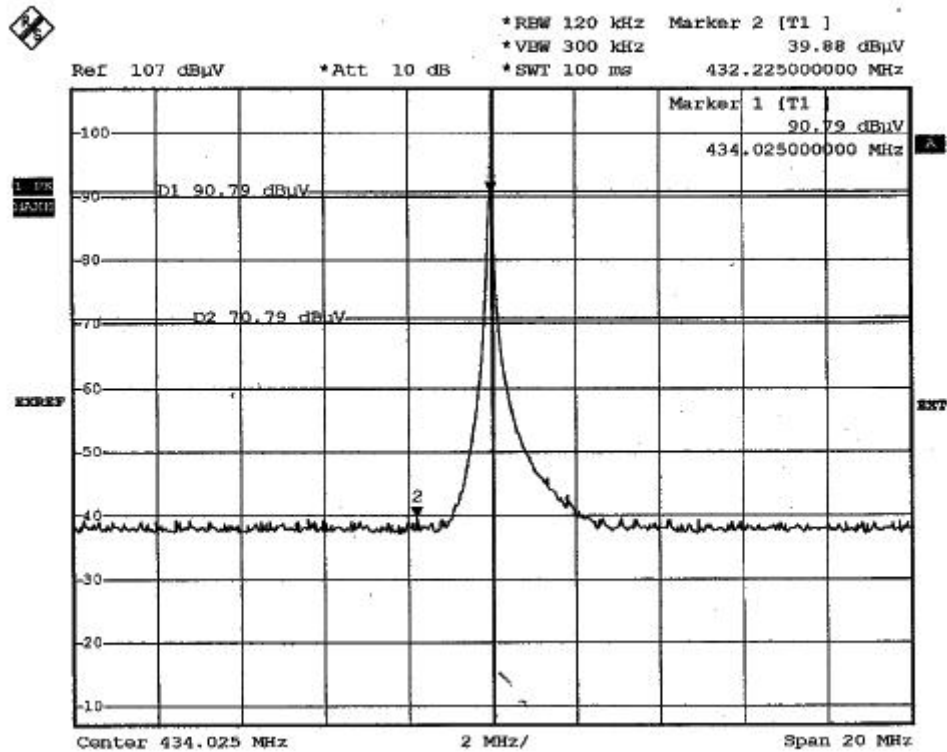
AMBIENT TEMPERATURE : 26 °C RELATIVE HUMIDITY : 70 %RH

TEST PERSONNEL : Roger APPROVED BY: JOHNSON

Frequency (MHz)	RF LEVEL 120kHz BW (dBuV)	Limit of Power(dBuV)	MARGIN (dB)	PASS/FAIL
434.025	39.88	70.79	-30.91	PASS



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7. FREQUENCY BANDWIDTH

7.1 FREQUENCY BANDWIDTH LIMIT

FREQUENCY (MHz)	BANDWIDTH LIMIT(kHz)
Above 70-900	$0.25\% \times \text{Center Frequency (MHz)}$
Above 900	$0.5\% \times \text{Center Frequency (MHz)}$

NOTE:

1. Bandwidth is determined at the points 20dB down from the modulated carrier.

7.2 TEST EQUIPMENT

The following test equipment was used during the radiated emission test :

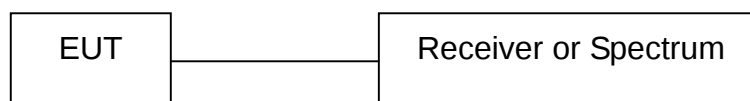
EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
SPECTRUM	9 kHz TO 7GHz	ROHDE & SCHWARZ	FSP7/ 839511/010	MAR. 2007 ETC

NOTE:

1. The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

7.3 TEST SET-UP

The EUT was connected to receiver(or spectrum) by 50Ω coaxial cable.



7.4 TEST PROCEDURE

Please refer to FCC Part15C 15.231.

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7.5 EUT OPERATING CONDITION

Same as section 2.3 of this report.

7.6 FREQUENCY BANDWIDTH TEST RESULT

EUT: MULTI SENSOR MODEL: MS-1 MODE: TX

TEST STANDARD: FCC part15 Subpart C 15.231 TEST SITE: SHIELDED ROOM

AMBIENT TEMPERATURE : 26 °C RELATIVE HUMIDITY : 70 %RH

TEST PERSONNEL: Roger APPROVED BY: JOHNSON

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	<u>20</u> dB DOWN BW (kHz)	MINIMUM LIMIT (kHz)	MAXIMUM LIMIT (kHz)	PASS/FAIL
1	434.025	332		1085.06	PASS

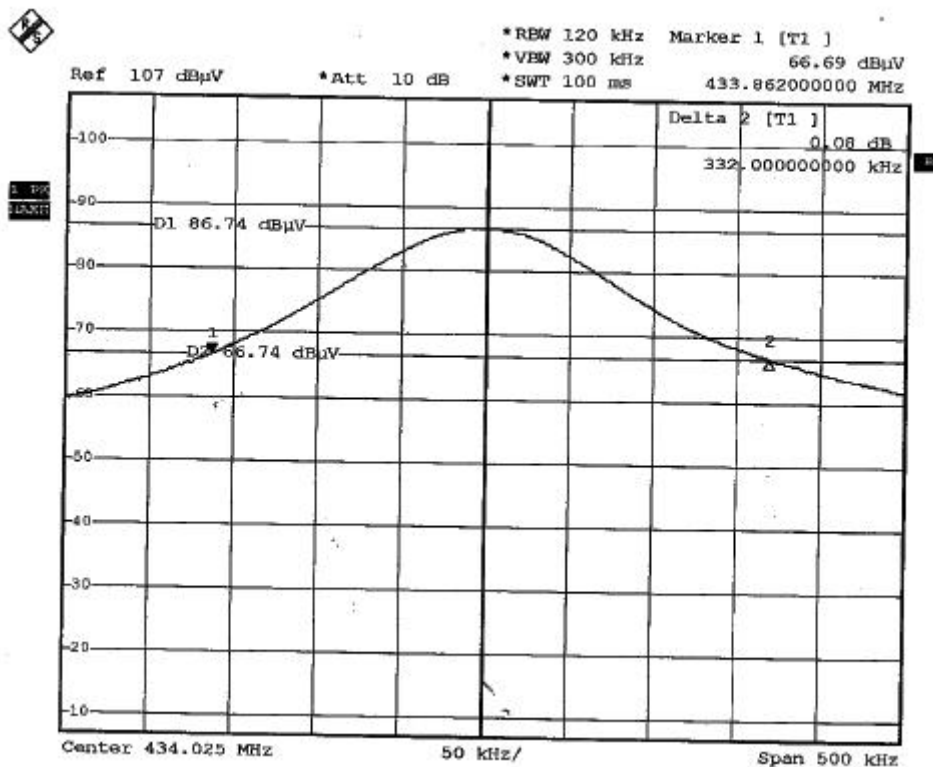


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8. RELEASE OR OPERATING TIME

8.1 RELEASE TIME OR OPERATING LIMIT

1. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
2. A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- 3). Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.
4. Intentional radiators, which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

8.2 TEST EQUIPMENT

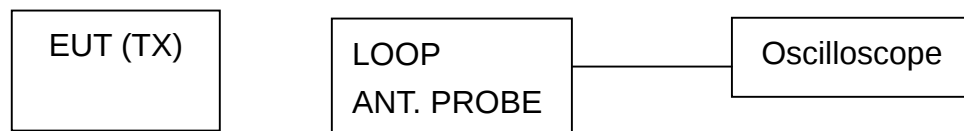
The following test equipment was used during the radiated emission test :

EQUIPMENT/ FACILITIES	SPECIFICATIONS	MANUFACTURER	MODEL#/ SERIAL#	DUE DATE OF CAL. & CAL. CENTER
OSCILLOSCOPE	500MHz	HP	54616B/ US39150351	APR. 2007 ETC

NOTE:

1. The calibration interval of the above test equipment is one year and the calibrations are traceable to NML/ROC and NIST/USA.

8.3 TEST SET-UP



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8.4 TEST PROCEDURE

A specific loop antenna was connected to oscilloscope to detect the EUT's release time.

The oscilloscope displayed the EUT's release time and took a picture of measurement.

8.5 EUT OPERATING CONDITION

The EUT is normal use function.

8.6 RELEASE OR OPERATING TIME TEST RESULT

EUT: MULTI SENSOR MODEL: MS-1 MODE: TX

TEST STANDARD: FCC part15 Subpart C 15.231 TEST SITE: SHIELDED ROOM

AMBIENT TEMPERATURE : 26 °C RELATIVE HUMIDITY : 70 %RH

TEST PERSONNEL: Roger APPROVED BY: JOHNSON

Start release time(ms)	Stop time(ms)	Total release time(ms)	Limit of release time<(s)
340	900	560	5

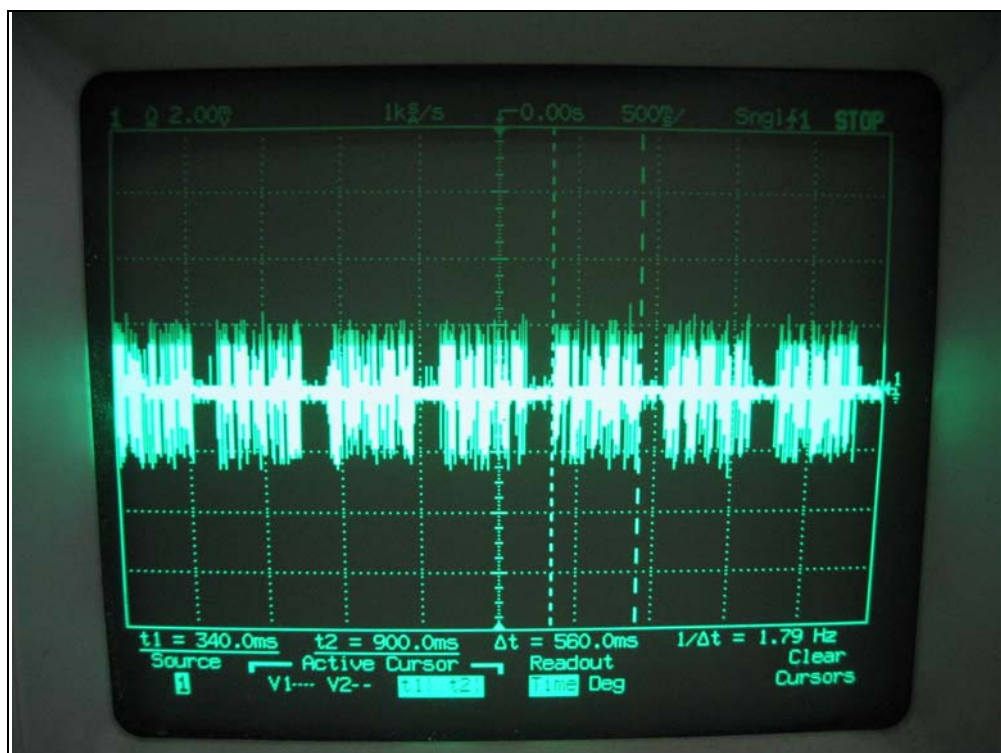


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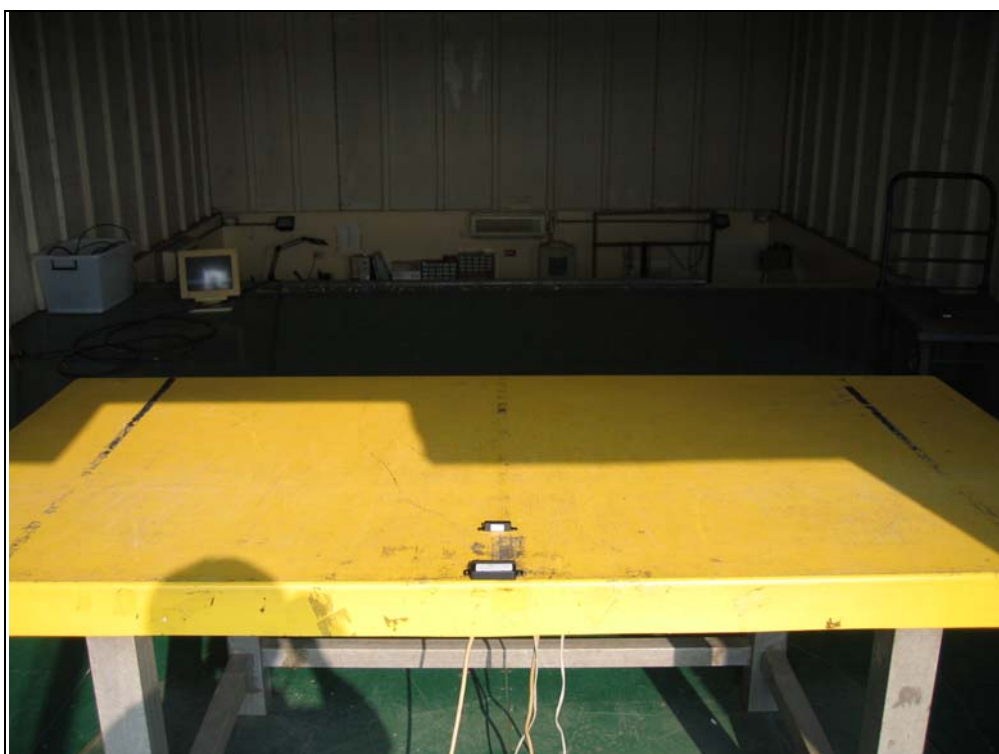
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9. PHOTOS OF TESTING

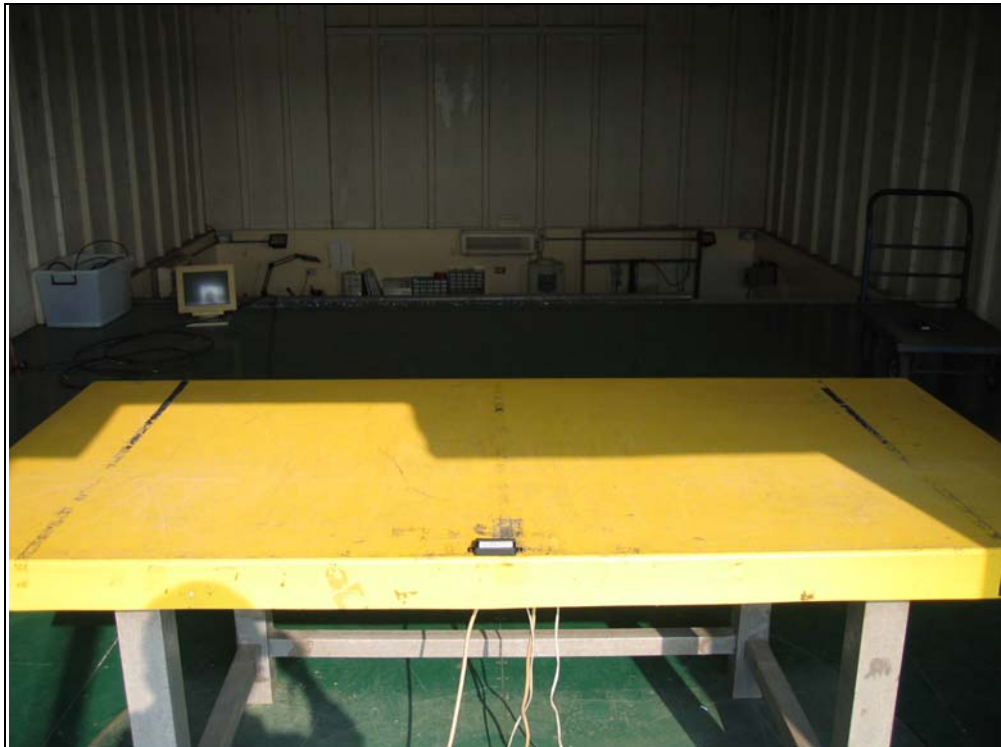
Radiated test-LINK





TEST REPORT

Radiated test-TX



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10. TERMS OF ABRIVATION

AV.	Average detection
AZ(°)	Turn table azimuth
Correct.	Correction
EL(m)	Antenna height (meter)
EUT	Equipment Under Test
Horiz.	Horizontal direction
LISN	Line Impedance Stabilization Network
NSA	Normalized Site Attenuation
PK.	Peak detection
Q.P.	Quasi-peak detection
SRT Lab	Spectrum Research & Testing Laboratory, Inc.
Vert.	Vertical direction