

# CFR 47 FCC Part 15.231

## TEST REPORT

Product : **Transceiver**

Trade Name : N/A

Model Number : AL-1950-EDPB

FCC ID : ELVNTRLD

Prepared for

### **Nutek Corporation**

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Prepared by

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#### **Remark:**

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The test result in the report is only subjected to the test sample.

# Statement of Compliance

**Applicant:** Nutek Corporation

**Manufacturer:** Nutek Corporation

**Product:** Transceiver

**Model No.:** AL-1950-EDPB

**Tested Power Supply:** 3.7Vdc Battery

**Date of Final Test:** Oct. 02, 2012

**Configuration of Measurements and Standards Used :**

FCC Rules and Regulations Part 15 Subpart C

1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of IETC.

Report Issued: 2012/11/23

Project Engineer: 

Elli Chang

Approved: 

Jerry Liu

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## 1 Summary of Measurement

<b>Report Clause</b>	<b>Test Parameter</b>	<b>Reference Document CFR47 Part15</b>	<b>Results</b>
4	Radiated Emission	§15.231(b), 15.209	Pass
5	Emission bandwidth	§15.231(c)	Pass
6	AC Power Line Conducted Emission test	§15.207	Pass

## 2 General Information

### 2.1 Description of Equipment Under Test

- Product** : Transceiver
- Model Number** : AL-1950-EDPB
- Applicant** : **Nutek Corporation**  
NO. 167, Lane 235, Bauchiau Rd., Shindian City, Taipei County  
23145, Taiwan
- Manufacturer** : **Nutek Corporation**  
NO. 167, Lane 235, Bauchiau Rd., Shindian City, Taipei County  
23145, Taiwan
- Power Supply** : 3.7Vdc Battery
- Operating Frequency** : 433.92MHz
- Channel Number** : 1 channel
- Type of Modulation** : ASK
- Antenna description** : This device uses Helix antenna.  
The antenna is integral to the device, thereby meeting the  
requirement of FCC 15.203.
- Date of Test** : Sep. 18 ~ Oct. 02, 2012
- Additional Description** : 1) The Model Number "**AL-1950-EDPB**" is representative  
selected in the test and included in this report.  
2) For more detail specification about EUT, please refer to the  
user's manual.

## 2.2 Details of tested peripheral equipment

### 2.2.1 Personal Computer

#### PC31

Model Number : SGH017PFWL  
CPU Speed : Intel Core 2 Duo E5400  
RAM : 2GB DDR3 1333MHz  
EMC Compliance : CE, TUV, NCC, BSMI: R33275  
Hard Disk Driver : 250GB Serial ATA2 3.0Gb/s 7200rpm  
Manufacturer : HP  
Switching Power Supply : LiteOn, PS-4321-9HP, 320W  
Power Cord : Non-shielded, Detachable, 1.8m, w/o core

### 2.2.2 Monitor

#### MT28

Model Number : CMV 92GH 19"  
Serial Number : 92GHAGCN9120288  
EMC Compliance : FCC, CE, BSMI: R31374, UL, TUV  
Manufacturer : CHIMEI  
Power Cord : Non-shielded, Detachable, 1.8m, w/o core  
D-Sub Cable : Non-shielded, Detachable, 1.8m, with core

### 2.2.3 Keyboard

#### KB35 (USB)

Model Number : Y-U0011  
Serial Number : N/A  
EMC Compliance : CE, FCC, C-Tick, BSMI T51160, VCCI  
Manufacturer : LOGITECH  
Data Cable : Non-Shielded, Un-detachable, 1.5m

2.2.4 Mouse

USB62

Model Number : M-U0028  
Serial Number : N/A  
EMC Compliance : FCC, CE, BSMI T41126, VCCI  
Manufacturer : LOGITECH  
Data Cable : Non-shielded, Un-detachable, 1.8m

2.2.5 Printer

PR20

Model Number : ESPON ACULASER M1200  
Serial Number : LWVZ127636  
EMC Compliance : BSMI 33126, CE  
Manufacturer : EPSON  
Data Cable : Shielded, Detachable, 1.8m, w/o core  
Power Cord : Non-shielded, Detachable, 1.8m, w/o core

2.2.6 Test Cable

USB Cable : Non-shielded, Detachable, 1.0m, w/o core

## 2.3 Test Facility

- Site Description** : Conduction 1 OATS 2
- Name of Firm** : Interocean EMC Technology Corp.
- Company web** : <http://www.ietc.com.tw>
- Site 1, 2, 3 Location** : No. 5-2, Lin 1, Tin-Fu, Lin-Kou Dist., New Taipei City, Taiwan 244, R.O.C.
- Site Filing** :
- Federal Communication Commissions – USA  
Registration No.: 96399 (OATS 1 & 2)  
Registration No.: 518958 (OATS 3)  
Designation No.: TW1020
  - Voluntary Control Council for Interference by Information Technology Equipment (VCCI) – Japan  
Member No.: 1349  
Registration No. (Conducted Room): C-1094  
Registration No. (Conducted Room): T-1562  
Registration No. (OATS 1): R-1040; G-274  
Registration No. (OATS 2): R-1041
  - Industry Canada (IC)  
OUR FILE: 46405-4437 Submission: 145171  
Registration No. (OATS 1): Site# 4437A-1  
Registration No. (OATS 2): Site# 4437A-2  
Registration No. (OATS 3): Site# 4437A-3
- Site Accreditation** :
- Bureau of Standards and Metrology and Inspection (BSMI) – Taiwan, R.O.C.  
Accreditation No.:  
SL2-IN-E-0026 for CNS13438 / CISPR22  
SL2-R1-E-0026 for CNS13439 / CISPR13  
SL2-R2-E-0026 for CNS13439 / CISPR13  
SL2-A1-E-0026 for CNS13783-1 / CISPR14-1  
SL2-L1-E-0026 for CNS 14115 / CISPR 15
  - Taiwan Accreditation Foundation (TAF)  
Accreditation No.: 1113
  - TÜV NORD  
Certificate No: TNTW0801R-04



### 3 Test specifications

#### 3.1 Test standard

The EUT was performed according to FCC Part 15 Subpart C Section 15.231 procedure and setup followed by ANSI C63.4, 2003 requirements.

#### 3.2 Operation mode

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "X axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report

The EUT was operated in continuous transmission mode during all of the tests.



**X axis mode**



**Y axis mode**



**Z axis mode**

### 3.3 Test Equipment

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSP40	100478	2013/05/29
Preamplifier	Agilent	8449B	3008A01434	2013/05/02
Preamplifier	Agilent	83050A	3950A00225	2013/08/28
Horn Antenna	COM-POWER	AH-118	10081	2013/05/29
Horn Antenna	Schwarzbeck	BBHA 9120	9120D-583	2013/05/01
Horn Antenna	Schwarzbeck	BBHA 9170	213	2013/07/24
Cable	HARBOUR	27478LL142	CBL22	2013/09/27
EMI Test Receiver	Rohde & Schwarz	ESCI	100836	2013/08/08
Biconical Antenna	Schwarzbeck	BBA 9106	VHA 9103-2419	2013/03/28
Log Antenna	Schwarzbeck	UHALP 9108 A	0739	2013/03/28
Pre-Amplifier	SCHAFFNER	CPA9231A	3351	2013/01/17
RF Cable	IETC	8DFB	CBL14	2013/07/12
EMI Test Receiver	Rohde & Schwarz	ESCS30	100135	2013/08/14
RF Cable	HARBOUR	RG-58/U	CBL48	2013/07/31
L.I.S.N.	Schaffner	MN2050D	1597	2013/07/22
L.I.S.N.	Rohde & Schwarz	ESH3-Z5	100176	2013/07/29

Note: The above equipments are within the valid calibration period.

## 4 Radiated emission test

### 4.1 Limits

According to FCC 15.231(b) requirement:

In addition to the provisions of §15.205, the field strength of emissions from intentional radiator operated under this section shall not exceed the following:

#### Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	( $\mu$ V/m@3m)	(dB $\mu$ V/m@3m)	( $\mu$ V/m@3m)	(dB $\mu$ V/m@3m)
433.92	10996	80.8	1099.6	60.8

#### General Radiated emission Limit

Spurious Emission tested through until 10<sup>th</sup> harmonic. Radiated emissions, which fall in the restricted bands, as defined in §15.205 (a), comply with the radiated emission limits specified in §15.209 (a).

Frequency (MHz)	15.209 Limits	
	( $\mu$ V/m@3m)	(dB $\mu$ V/m@3m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remark :

1. The table above tighter limit applies at the band edges.
2. The measurement distance in meters, which that between form closest point of EUT to instrument antenna.

## 4.2 Calculation of Average Factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.

Averaging factor in dB =  $20 \log (\text{duty cycle})$

The duration of one cycle = 112.68ms

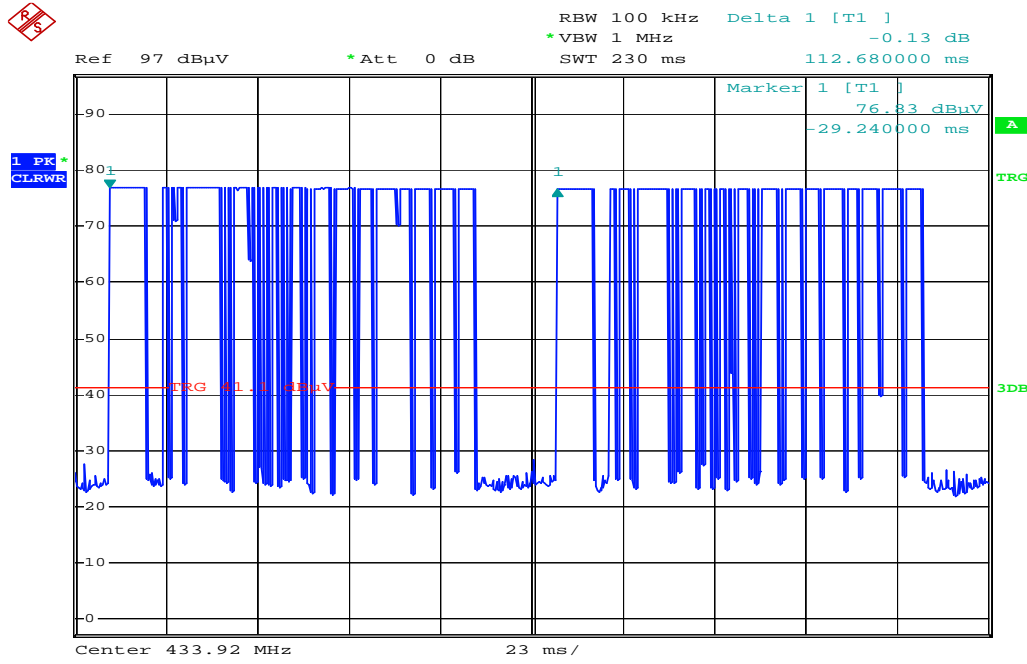
The duty cycle is simply the on-time divided by 100ms

Duty Cycle =  $(0.81\text{ms} \times 45 + 0.39\text{ms} \times 33) = 49.32 \text{ ms} / 100\text{ms}$

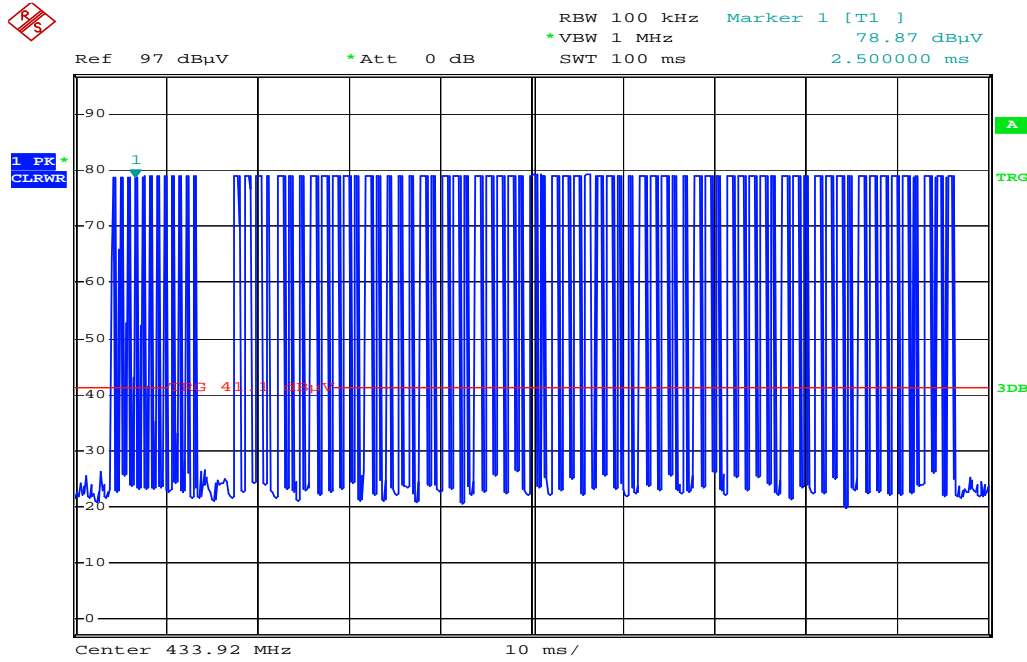
Therefore, the averaging factor is found by  $20 \log 0.4932 = -6.14 \text{ dB}$

Please see the diagrams below.

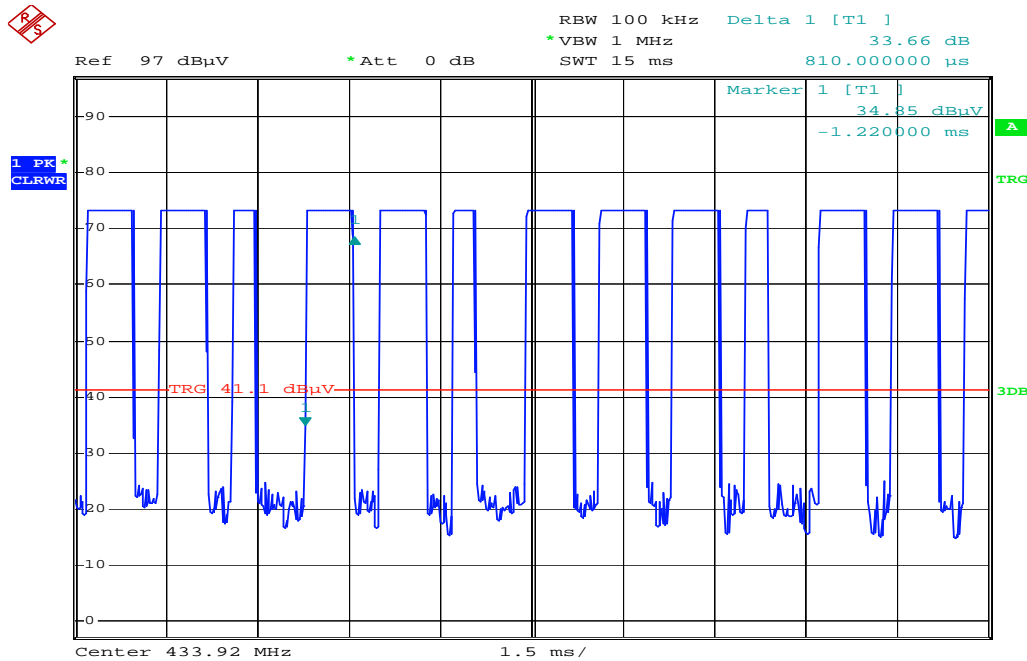
# Duty Cycle



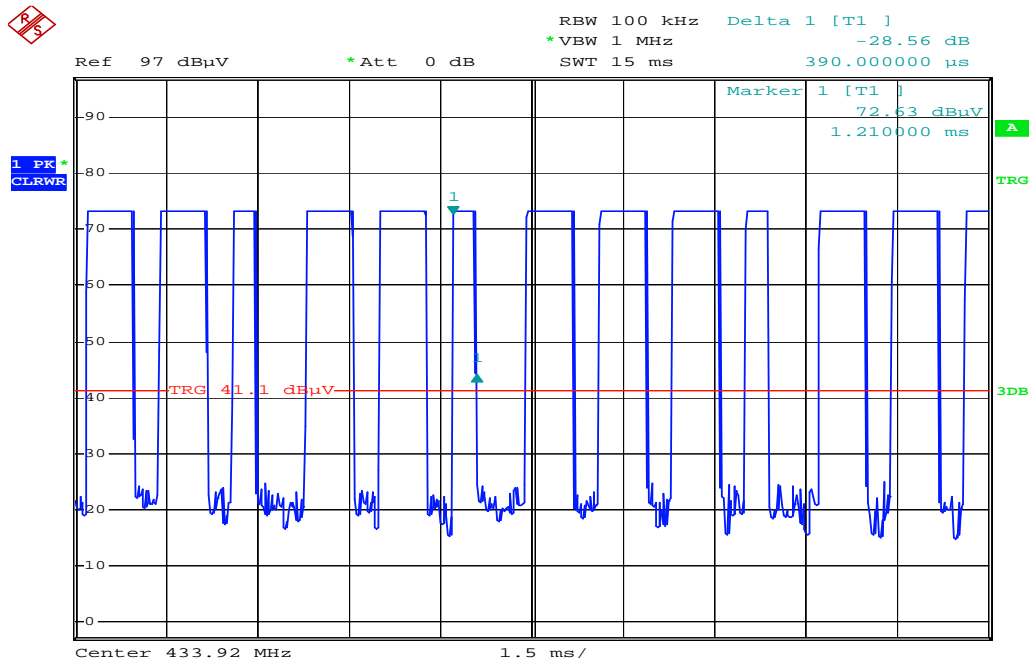
### Time Slot



### Time Slot 1

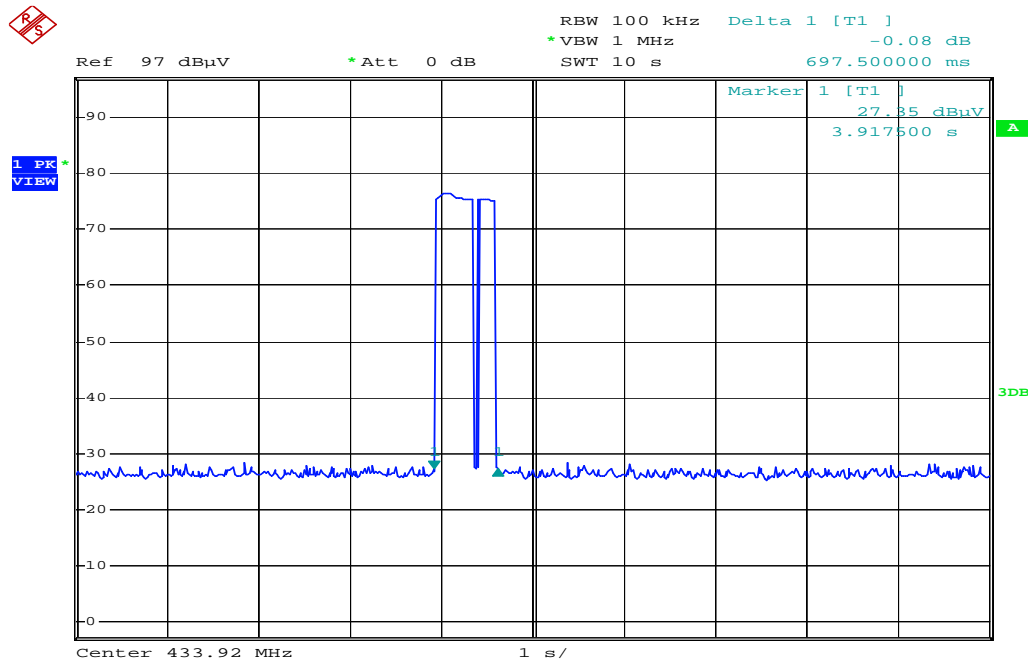


### Time Slot 2



### Time Slot 3

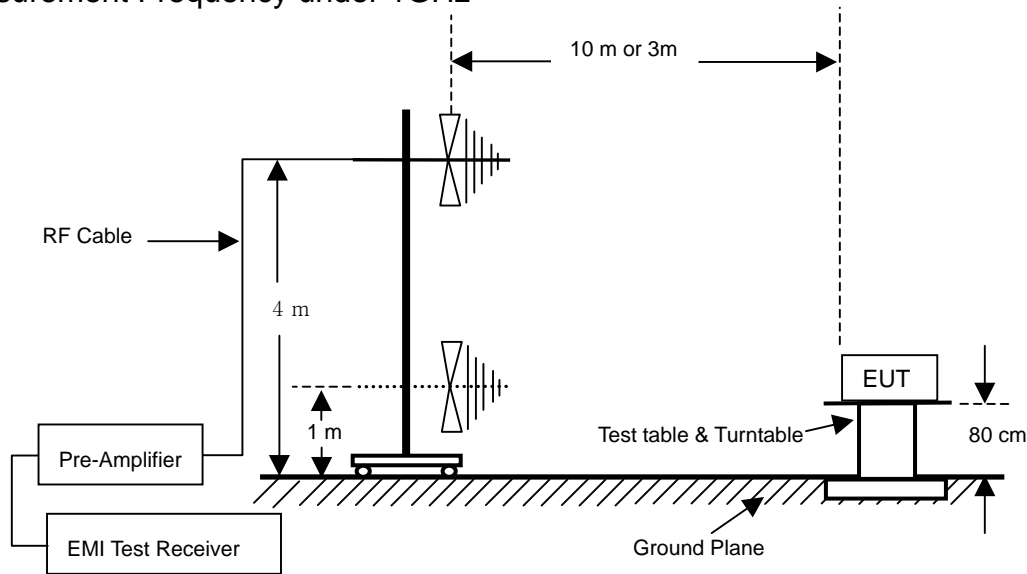
The EUT was complied with the requirement of FCC 15.231 (a)(1), which employed a switch that will automatically deactivate the transmitter within less than 5 seconds of being released.



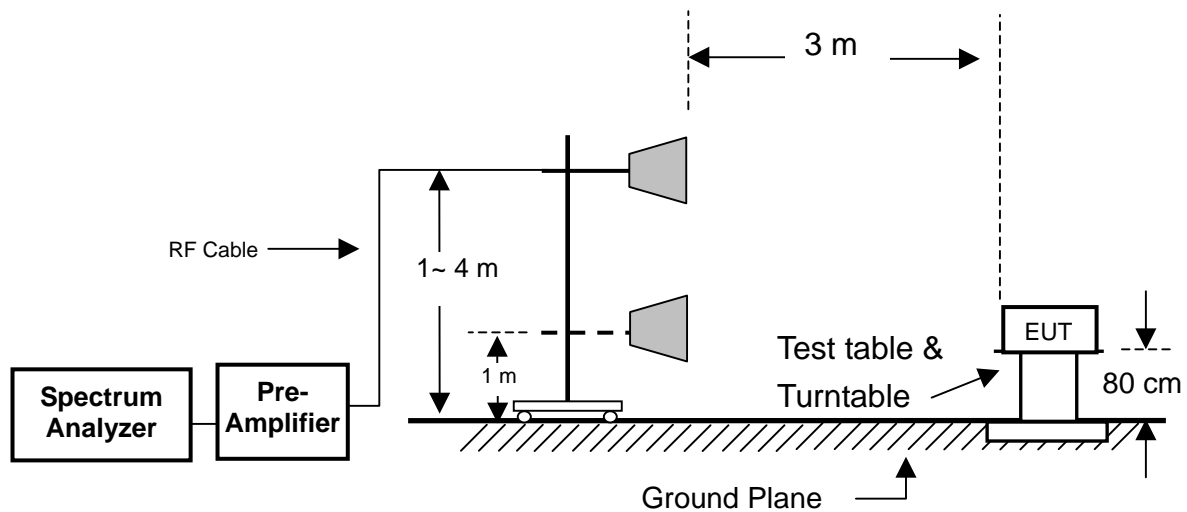


### 4.3 Configuration of Measurement

#### Measurement Frequency under 1GHz



#### Measurement Frequency above 1GHz



### 4.4 Test Procedure

Radiated emission measurements frequency range were performed from 30MHz to 4GHz. Spectrum Analyzer Resolution Bandwidth set to 100kHz or greater for frequencies from 30MHz to 1GHz, and set 1MHz Resolution Bandwidth for frequencies above 1GHz.

The EUT is place on non-conductive turntable for the test. If peripheral devices apply to the EUT, the peripheral devices will be connected to EUT and whole system. During the emission test, the signal is maximized through rotation and all cables were present worst-case emissions. The height of antenna and polarization is constantly changed for exploring maximum signal reading. The height of antenna can be up form reference ground to 4 meter and down to 1 meter.

### 4.5 Test Result

**PASS.**

The final test emission data is shown as following tables.

### Radiated Emission below 1GHz

Frequency (MHz)	Antenna Polarization	Reading (dB $\mu$ V)	Preamp (dB)	Correction Factor (dB/m)	Corrected Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Det. Mode
84.580	H	46.18	30.59	8.85	24.44	40.00	-15.56	QP
128.970	H	41.61	29.89	15.62	27.34	43.52	-16.18	QP
168.990	H	40.50	29.93	17.69	28.26	43.52	-15.26	QP
198.770	H	40.54	29.89	19.49	30.14	43.52	-13.38	QP
267.340	H	39.94	30.07	21.85	31.72	46.02	-14.30	QP
380.600	H	38.73	29.44	20.16	29.45	46.02	-16.57	QP
65.890	V	46.39	30.44	8.03	23.98	40.00	-16.02	QP
132.480	V	42.48	29.92	16.39	28.95	43.52	-14.57	QP
163.290	V	39.58	30.10	18.45	27.93	43.52	-15.59	QP
228.670	V	41.64	30.09	20.93	32.48	46.02	-13.54	QP
337.810	V	41.36	29.59	18.30	30.07	46.02	-15.95	QP
412.340	V	38.72	29.35	20.77	30.14	46.02	-15.88	QP

Remark : Corrected Level = Reading – Preamp + Correction Factor  
 Correction Factor = Antenna Factor + Cable Loss

### Fundamental and harmonics emissions

Freq. (MHz)	Antenna Polarization	Reading (dB $\mu$ V)	Preamp (dB)	Correction Factor (dB/m)	Average Factor (dB)	Corrected Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Det. Mode
433.92	H	57.41	0.00	21.28	--	78.69	80.8	-2.11	PK
867.84	H	36.91	29.41	29.34	--	36.84	60.8	-23.96	PK
1301.76	H	43.56	27.32	28.18	--	44.42	54.0	-9.58	PK
1735.68	H	41.58	27.73	29.50	--	43.35	60.8	-17.45	PK
2169.60	H	46.99	27.97	30.68	--	49.70	60.8	-11.10	PK
2603.52	H	42.27	27.79	32.13	--	46.61	60.8	-14.19	PK
3037.44	H	37.34	27.70	33.55	--	43.19	60.8	-17.61	PK
3471.36	H	43.42	27.77	33.84	--	49.49	60.8	-11.31	PK
3905.28	H	39.70	27.59	35.61	--	47.72	54.0	-6.28	PK
4339.20	H	40.31	27.38	36.59	--	49.52	54.0	-4.48	PK
433.92	V	61.83	0.00	21.04	--	82.87	100.8	-17.93	PK
433.92	V	61.83	0.00	21.04	-6.14	76.73	80.8	-4.07	AV
867.84	V	35.52	29.41	28.92	--	35.03	60.8	-25.77	PK
1301.76	V	43.77	27.32	28.18	--	44.63	54.0	-9.37	PK
1735.68	V	48.79	27.73	29.50	--	50.56	60.8	-10.24	PK
2169.60	V	57.01	27.97	30.68	--	59.72	60.8	-1.08	PK
2603.52	V	52.27	27.79	32.13	--	56.61	60.8	-4.19	PK
3037.44	V	42.74	27.70	33.55	--	48.59	60.8	-12.21	PK
3471.36	V	44.59	27.77	33.84	--	50.66	60.8	-10.14	PK
3905.28	V	40.50	27.59	35.61	--	48.52	54.0	-5.48	PK
4339.20	V	41.19	27.38	36.59	--	50.40	54.0	-3.60	PK

Remark :

1. Corrected Level = Reading – Preamp + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “ \* ” Mark indicated Background Noise Level
4. The signal bandwidth was measured and less then 100KHz RBW so PDCF factor is not required to correct the fundamental signal peak result.

## **5 Emission bandwidth**

### **5.1 Limits**

According to FCC 15.231(c) requirement:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz to 900 MHz. Those devices operating above 900 MHz, the emission spurious shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

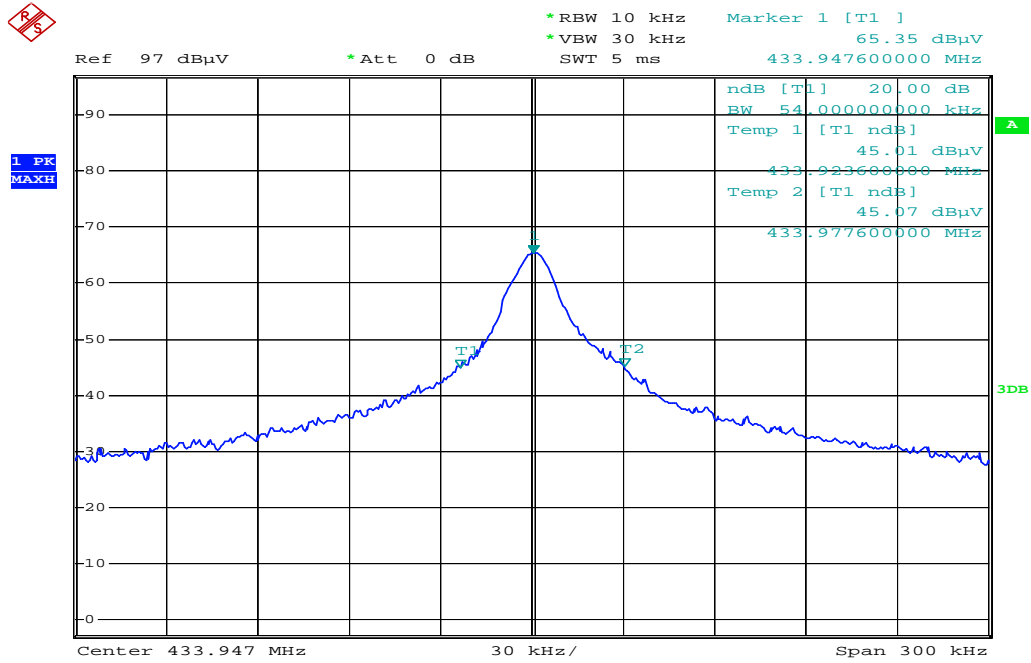
B.W (20dBc) Limit = 0.25% \* f(MHz) = 0.25% \* 433.92MHz = 1084.8kHz

### **5.2 Test Result**

**PASS.**

The final test data is shown as following.

Channel Frequency (MHz)	Measured 20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92	54	1084.8	PASS



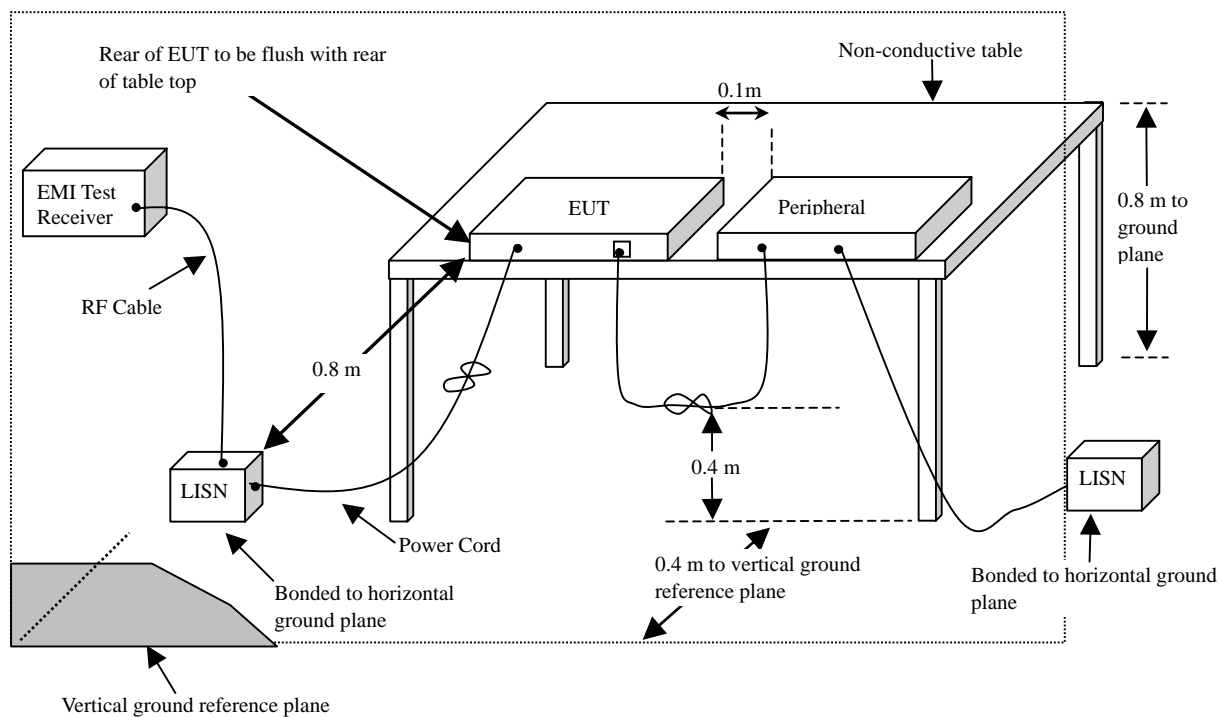
## 6 AC Power Line Conducted Emission test

### 6.1 Limits

Frequency (MHz)	Quasi-Peak (dB $\mu$ V)	Average (dB $\mu$ V)
0.15 to 0.5	66 to 56	56 to 46
> 0.5 to 5	56	46
> 5 to 30	60	50

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 6.2 Configuration of Measurement



### 6.3 Test Procedures

- 1) The EUT was placed 80cm height above ground on a non-conductive table and vertical conducting plane located 40cm to the rear of the EUT.
- 2) The EUT was connected to the main power through Line Impedance Stabilization Networks (LISN). This setup provided a 50ohm/50mH coupling impedance for the measuring equipment. The auxiliary equipment will place in secondary LISN.
- 3) 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 C63.4/2003 on conducted measurement.

### 6.4 Test Result

**PASS.**

The final test data is shown as following pages.

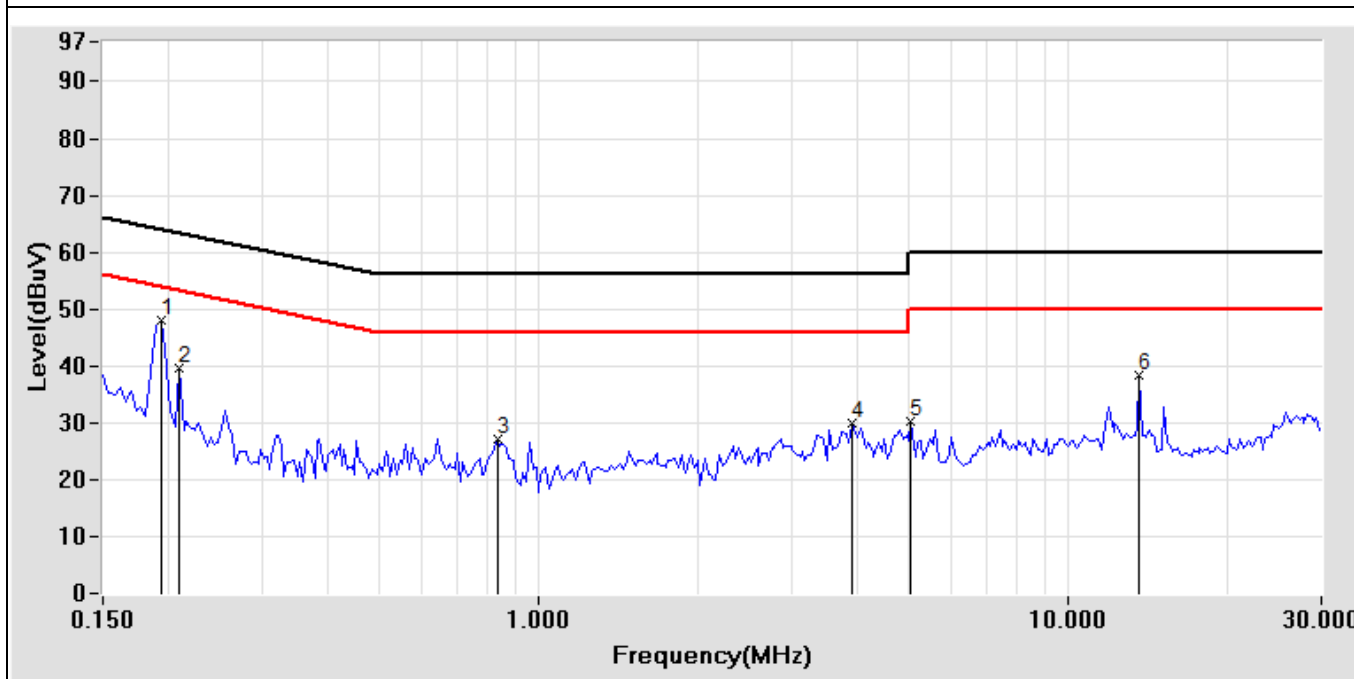
## Power Line Conducted Test Data

EUT: Transceiver CLIENT: Nutek Corporation MODEL: AL-1950-EDPB RATING: From PC Temperature: 26.1 °C Humidity: 50 %	POLARITY: Line DISTANCE: Serial No.: FILE/DATA#: Nutek.emi/2 OPERATOR: Elli TEST SITE: Conduction1
---	---

Frequency (MHz)	Factor (dB)	Meter Reading (dBμV)		Emission Level (dBμV)		Limits (dBμV)		Margin (dB)	
		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
0.193	0.23	45.72	40.80	45.95	41.03	63.91	53.91	-17.96	-12.88
0.209	0.23	35.03	26.67	35.26	26.90	63.24	53.24	-27.98	-26.34
0.837	0.24	25.68	22.14	25.92	22.38	56.00	46.00	-30.08	-23.62
3.904	0.25	27.86	22.88	28.11	23.13	56.00	46.00	-27.89	-22.87
5.017	0.33	27.81	22.74	28.14	23.07	60.00	50.00	-31.86	-26.93
13.560	0.69	36.61	23.84	37.30	24.53	60.00	50.00	-22.70	-25.47

**Remark:**

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



Test Mode: Working Mode

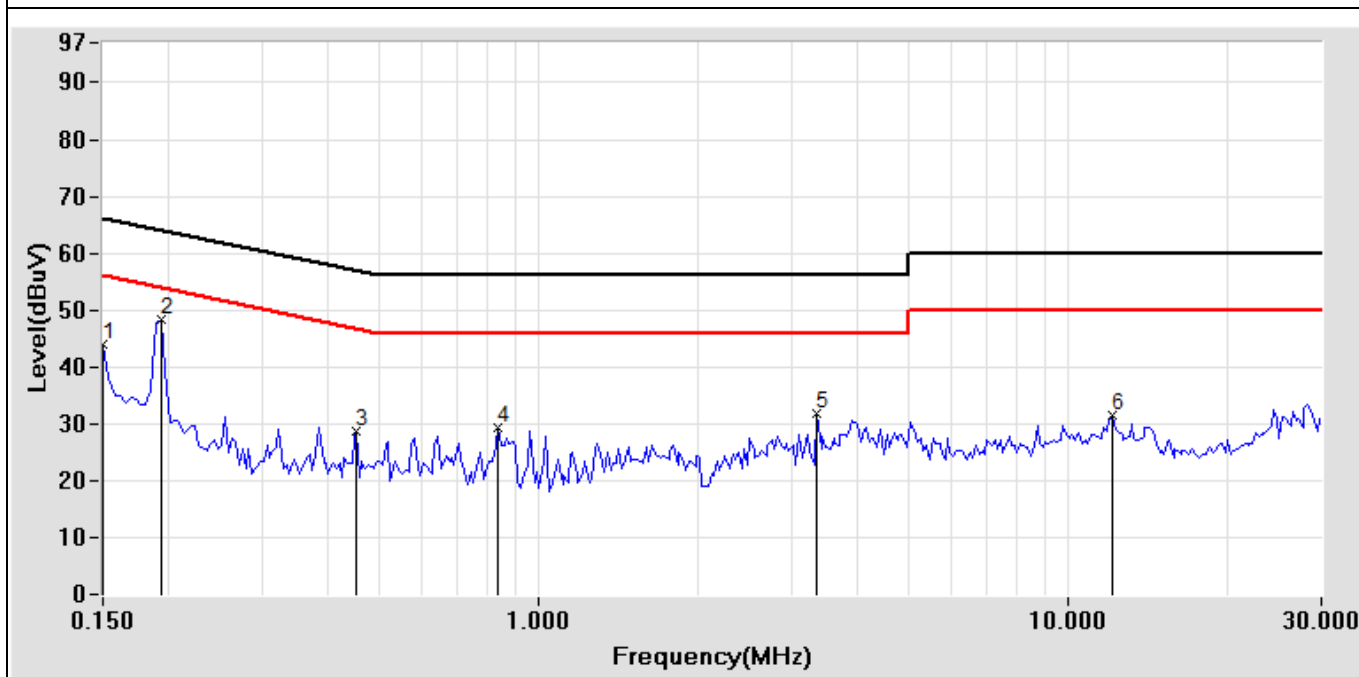
## Power Line Conducted Test Data

EUT: Transceiver CLIENT: Nutek Corporation MODEL: AL-1950-EDPB RATING: From PC Temperature: 26.1 °C Humidity: 50 %	POLARITY: Neutral DISTANCE: Serial No.: FILE/DATA#: Nutek.emi/3 OPERATOR: Elli TEST SITE: Conduction1
---	--

Frequency (MHz)	Factor (dB)	Meter Reading (dBµV)		Emission Level (dBµV)		Limits (dBµV)		Margin (dB)	
		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
0.150	0.26	41.95	35.14	42.21	35.40	66.00	56.00	-23.79	-20.60
0.193	0.25	45.52	40.28	45.77	40.53	63.91	53.91	-18.14	-13.38
0.451	0.26	25.68	21.84	25.94	22.10	56.86	46.86	-30.92	-24.76
0.834	0.27	27.88	24.16	28.15	24.43	56.00	46.00	-27.85	-21.57
3.349	0.24	27.60	23.04	27.84	23.28	56.00	46.00	-28.16	-22.72
12.048	0.71	25.73	19.79	26.44	20.50	60.00	50.00	-33.56	-29.50

**Remark:**

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



Test Mode: Working Mode