

TEST REPORT For FCC

Test Report No. : TK-FR9018

Date of Issue : 06/24/2009

FCC ID : QBTLTK-2000M

Description of Product : Multicall Charger Paging System

Model No. : LT-2000MC

Applicant : **Lee Technology Korea Co., Ltd.**
3rd Floor # 499-2 Sang 3-Dong, Wonmi-Gu
Bucheon-City, Kyungki-Do, Korea

Manufacturer : **Lee Technology Korea Co., Ltd.**
3rd Floor # 499-2 Sang 3-Dong, Wonmi-Gu
Bucheon-City, Kyungki-Do, Korea


Standards : FCC Part90

Test Date : 06/22/2009 – 06/24/2009

Test Results : ☒ PASS ☐ FAIL

The test results relate only to the items tested.

Tested by:


Kyoung-Moon Choi
Test Engineer
Date: 06/24/2009

Reviewed by:



K. T. Kang
Technical Manager
Date: 06/25/2009

TABLE OF CONTENTS

| | | |
|---|---|----|
| 1.0 | General Product Description | 2 |
| 1.1 | Tested Frequency | 3 |
| 1.2 | Power Input into the Final Amplifier | 3 |
| 1.3 | Model Differences | 4 |
| 1.4 | Device Modifications | 4 |
| 1.5 | Peripheral Devices | 4 |
| 1.6 | Calibration Details of Equipment Used for Measurement | 5 |
| 1.7 | Test Facility..... | 5 |
| 1.8 | Laboratory Accreditations and Listings | 5 |
| 2.0 | Summary of tests | 6 |
| 2.1 | Technical Characteristic Test..... | 7 |
| 2.1.1 | Power Limit..... | 7 |
| 2.1.2 | Type of Emission..... | 9 |
| 2.1.3 | Transmitter Spurious Conducted Emission | 10 |
| 2.1.4 | Field Strength of Surious Radiation..... | 13 |
| APPENDIX A – Test Equipment Used For Tests | | 16 |
| Test Setup Photo and Configurationb-(Part 90) | | 17 |

1.0 General Product Description

| | | |
|-------------------------|---|---|
| EUT Type | : | Paging Transmitter with Charging cradle |
| FCC Rule Part(s) | : | §2; §15; §90 |
| Model name | : | LTK-2000MC |
| Serial number | : | Identical prototype |
| Tx Freq. Range | : | 450.0250 ~ 469.9975 MHz |
| Channel Space Bandwidth | | 12.5kHz |
| Type of Modulation | : | 10K2F1D |
| Frequency Tolerance: | : | ± 0.00025 % (2.5ppm) |
| Maximum Output Power | : | Conducted: 1.766W |
| Power Source | : | 12 Vdc |
| Antenna type | : | Helical antenna Gain: -2dBi |

1.1 Tested Frequency

| | LOW | MID | HIGH |
|-----------------|----------|----------|----------|
| Frequency (MHz) | 450.0250 | 460.0000 | 469.9775 |

1.2 Power Input into the Final Amplifier

DC Voltages and currents into the final amplifier :

Vce : 12 volts

Ic : 680mA

1.3 Model Differences

None

1.4 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.5 Peripheral Devices

| Device | Manufacturer | Model No. | Serial No. |
|------------|--------------------------------|------------|----------------|
| E U T | Lee Technology Korea Co., Ltd. | LTK-2000MI | - |
| AC Adaptor | HJC Hua Jung Comp.Co., Ltd. | HASU11FB42 | 662401200738 4 |




1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to RRA & HCT, therefore, all test data recorded in this report is traceable to RRA & HCT.

1.7 Test Facility

The measurement facility is located at 477-6, Hager-Ri, Yoju-Up, Yoju-Gun Kyunggi-Do, 469-803, Korea. Tel: +82-31-883-5092/Fax: +82-31-883-5169. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.8 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation | Logo |
|---------|--------|---|--|
| USA | FCC | 3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements. |  343818 |
| KOREA | KCC | EMI (10 meter Open Area Test Site and two conducted sites) Radio(3 & 10 meter Open Area Test Sites and one conducted site) |  KR100 |
| Canada | IC | 3 & 10 meter Open Area Test Sites and one conducted site |  4769B-1 |

2.0 Summary of tests

| FCC Part Section(s) | Parameter | Test Condition | Status (note 1) |
|---------------------|---|----------------|-----------------|
| 90.205 | Power Limit | Conducted | C |
| 90.207 | Type of Emission | | C |
| 2.1057 | Transmitter Spurious Conducted Emission | | C |
| 90.210 | Field Strength of Spurious Radiation | Radiated | C |

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:

2.1 Technical Characteristic Test

2.1.1 Power Limit

90.205(h) 450–470 MHz:

The maximum allowable station effective radiated power(ERP) is dependent upon the station's antenna HAAT and required service area and will be authorized in accordance with table 2. (I.e. 2W for service area less than 3 km.)

Table 2-450-470 MHz-Maximum ERP/Reference HAAT for a Specific Service Area Radius

| | Service area radius (km) | | | | | | | | | |
|---------------------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | 3 | 8 | 13 | 16 | 24 | 32 | 40 | 48 | 64 | 80 |
| Max. ERP(W) ¹ | 2 | 100 | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Up to reference HAAT (m) ³ | 15 | 15 | 15 | 27 | 63 | 125 | 250 | 410 | 950 | 2700 |

¹ Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCCReport R-6602, Fig. 29 (See Sec. 73.699, Fig. 10 b).

³ When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reduced in accordance with the following equation:

$ERP_{allow} = ERP_{max} \times (HAAT_{ref} / HAAT_{actual})$

Test Setup Layout

CONDUCTED OUTPUT POWER

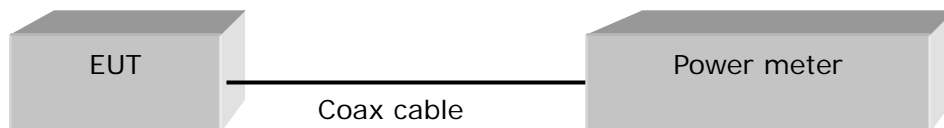


Figure 1 : Measurement setup for the carrier frequency separation

Limit : 2Watts

Test Results

CONDUCTED OUTPUT POWER

| Frequency (MHz) | Peak output power(dBm) | Peak output power(W) | Result |
|--------------------|---------------------------|-------------------------|----------|
| 450.0250 | 32.46 | 1.761 | Complies |
| 460.0000 | 32.47 | 1.766 | Complies |
| 469.9975 | 32.40 | 1.738 | Complies |

2.1.2 Type of Emission

90.207(e):

For non-voice paging operations, only A1A, A1D, A2B, A2D, F1B, F1D, F2B, F2D, G1B, G1D, G2B, or G2D emissions will be authorized.

LTK-2000MI : F1D

This equipment is a non-voice only paging operations

This equipment does not have audio low pass filter

2.1003 (4) Type of Emission : 10K2F1D

$$B_n = 2M + 2DK$$

$$M = 1200 \text{ bits per second}$$

$$D = 4.5 \text{ KHz (Peak Deviation)}$$

$$K = 1$$

$$B_n = 2(1200\text{bps}/2) + 2(4500) = 10.2\text{k}$$

2.1.3 Transmitter Spurious Conducted Emission

2.1057 Frequency spectrum to be investigated.

(a) In all of the measurements set forth in 2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:

(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

RBW = 100 kHz

VBW = 100 kHz (\geq RBW)

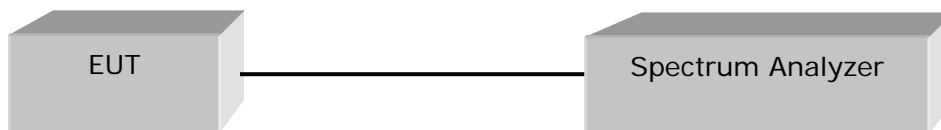
Span = 100 MHz

Trace = max hold

Detector function = peak

Sweep = auto

Test Setup Layout

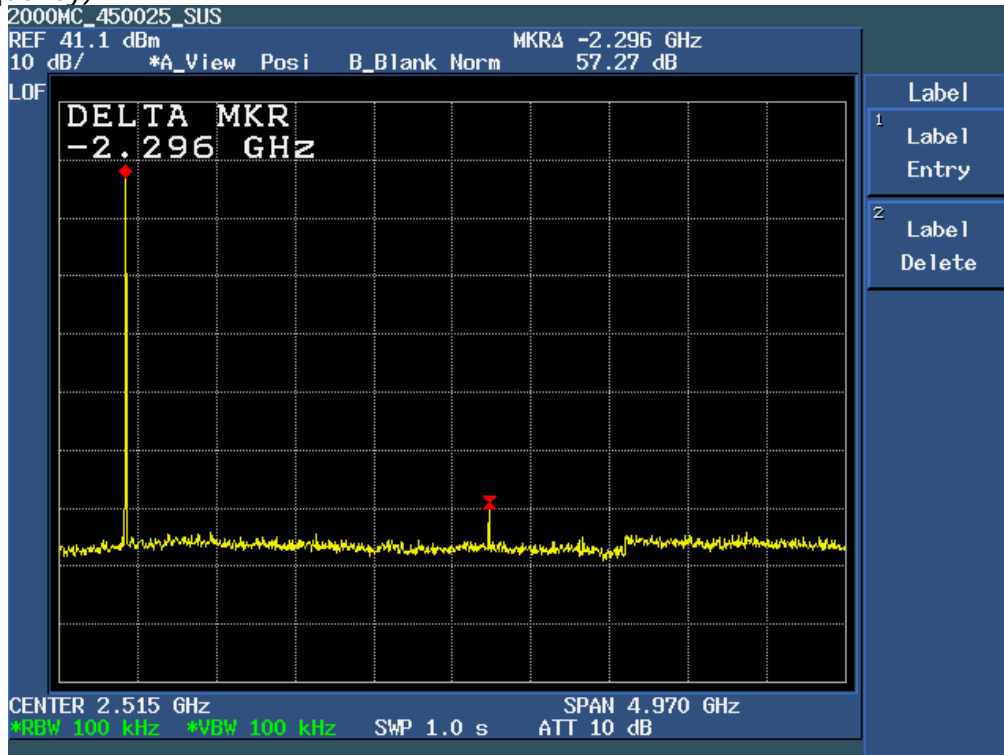


Limit

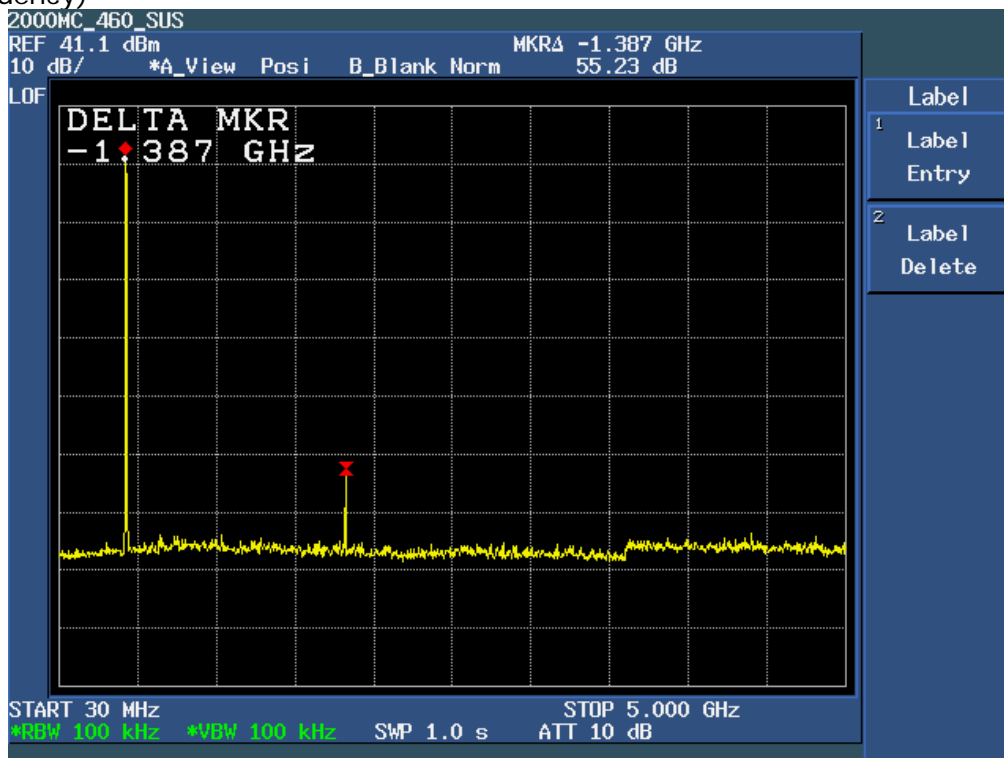
-13dBm

See next pages for actual measured spectrum plots.

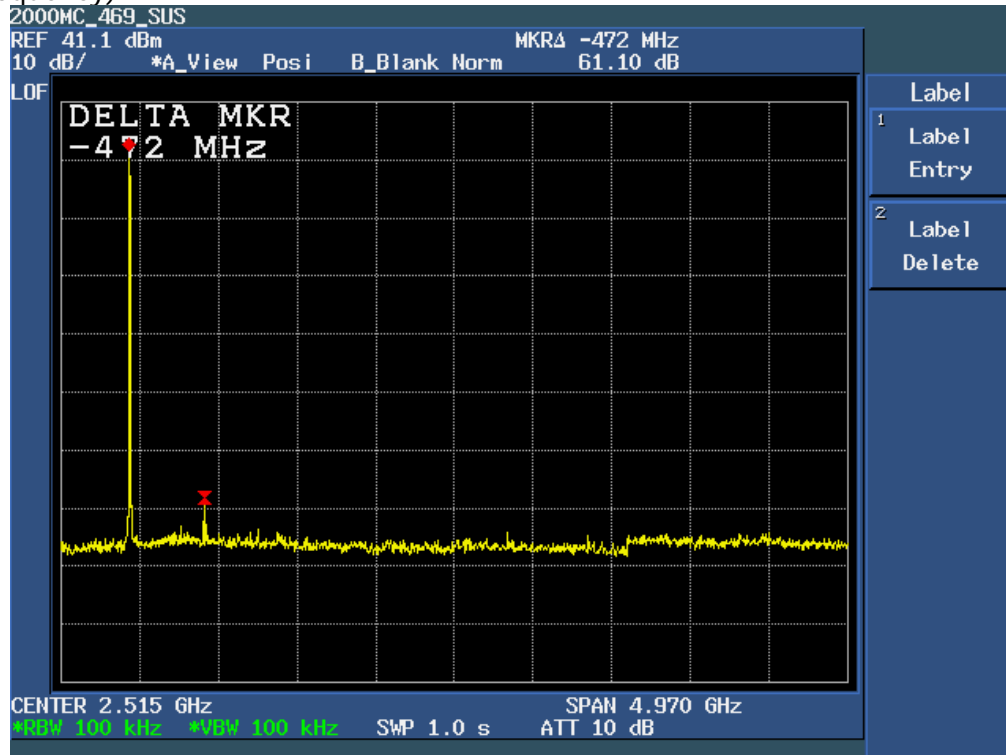
(Low Frequency)



(Mid Frequency)



(High Frequency)



2.1.4 Field Strength of Surious Radiation

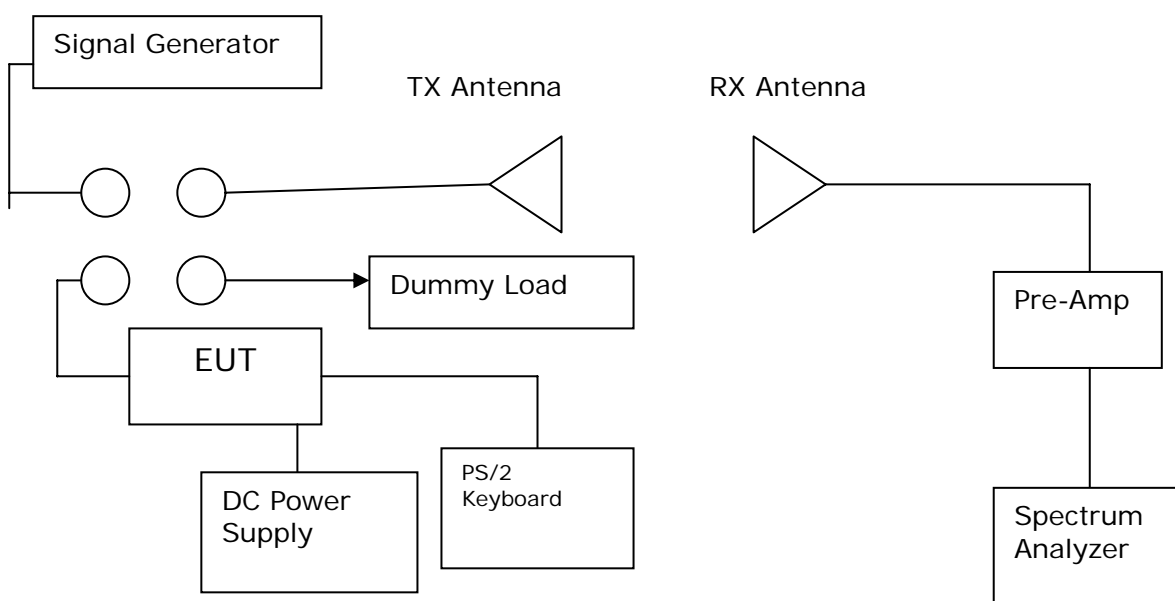
REGULATIONS : 2.1053 , 90.210

TEST METHOD/GUIDE : ANSI/TIA-603-C

Test Procedure

1. Adjust the spectrum analyzer for the following Setting:
 - a) WBW : 10kHz(<1GHz), 1MHz(>1GHz).
 - b) VBW : 300kHz(<1GHz), 3MHz(>1GHz).
 - c) Sweep Speed : 50mS
 - d) Detector mode : Positive Peak
2. The transmitter was placed on a wooden turntable, and it was transmitting into non-radiation load which was also placed on the turntable.
3. The measurement antenna was placed at a distance of 3meters from the EUT. During test, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
4. The frequency range up to tenth harmonic of the fundamental frequency was investigated.
5. Remove the EUT and replace it with substitution antenna A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Measuring Equipment Configuration



Test result : Low Frequency : $43 + 10\text{LOG}(1.76) = 45.46 \text{ dB}$

| No | Emission Frequency (MHz) | Spectrum Reading (dBm) | Generator Reading (dBm) | Ant. Polarity | Antenna Gain (dBi) | Cable Loss (dB) | Result (dBm) | Margin (dBm) | Limit (dBm) |
|----|--------------------------|------------------------|-------------------------|---------------|--------------------|-----------------|--------------|--------------|-------------|
| 1 | 450.0250 | -27.55 | 41.10 | H | -7.43 | 1.64 | 29.88 | -7.12 | 37.00 |
| 2 | 900.0500 | -71.44 | -37.00 | H | 6.80 | 2.74 | -35.09 | -22.12 | -12.97 |
| 3 | 1350.0750 | -82.18 | -52.81 | H | 7.75 | 3.45 | -50.66 | -37.69 | -12.97 |

| No | Emission Frequency (MHz) | Spectrum Reading (dBm) | Generator Reading (dBm) | Ant. Polarity | Antenna Gain (dBi) | Cable Loss (dB) | Result (dBm) | Margin (dBm) | Limit (dBm) |
|----|--------------------------|------------------------|-------------------------|---------------|--------------------|-----------------|--------------|--------------|-------------|
| 1 | 450.0250 | -76.51 | 34.90 | V | -7.43 | 1.64 | 23.68 | -13.32 | 37.00 |
| 2 | 900.0500 | -76.64 | -48.12 | V | 6.80 | 2.74 | -46.21 | -33.24 | -12.97 |
| 3 | 1350.0750 | -82.11 | -52.40 | V | 7.75 | 3.45 | -50.25 | -37.28 | -12.97 |

Test result : mid Frequency : $43 + 10\text{LOG}(1.77) = 45.48 \text{ dB}$

| No | Emission Frequency (MHz) | Spectrum Reading (dBm) | Generator Reading (dBm) | Ant. Polarity | Antenna Gain (dBi) | Cable Loss (dB) | Result (dBm) | Margin (dBm) | Limit (dBm) |
|----|--------------------------|------------------------|-------------------------|---------------|--------------------|-----------------|--------------|--------------|-------------|
| 1 | 460.0000 | -27.66 | 40.97 | H | -7.43 | 1.68 | 29.71 | -7.29 | 37.00 |
| 2 | 920.0000 | -68.12 | -33.50 | H | 6.80 | 2.69 | -31.54 | -18.55 | -12.99 |
| 3 | 1380.0000 | -81.81 | -50.00 | H | 7.60 | 3.74 | -48.29 | -35.30 | -12.99 |
| 4 | 1840.0000 | -76.64 | -42.00 | H | 8.00 | 4.40 | -40.55 | -27.56 | -12.99 |

| No | Emission Frequency (MHz) | Spectrum Reading (dBm) | Generator Reading (dBm) | Ant. Polarity | Antenna Gain (dBi) | Cable Loss (dB) | Result (dBm) | Margin (dBm) | Limit (dBm) |
|----|--------------------------|------------------------|-------------------------|---------------|--------------------|-----------------|--------------|--------------|-------------|
| 1 | 460.0000 | -34.82 | 36.54 | V | -7.43 | 1.68 | 25.28 | -11.72 | 37.00 |
| 2 | 920.0000 | -73.43 | -45.12 | V | 6.80 | 2.69 | -43.16 | -30.17 | -12.99 |
| 3 | 1380.0000 | -71.74 | -40.12 | V | 7.60 | 3.74 | -38.41 | -25.42 | -12.99 |
| 4 | 1840.0000 | -70.88 | -42.13 | V | 8.00 | 4.40 | -40.68 | -27.69 | -12.99 |

Test result : High Frequency : $43 + 10\text{LOG}(1.74) = 45.40 \text{ dB}$

| No | Emission Frequency (MHz) | Spectrum Reading (dBm) | Generator Reading (dBm) | Ant. Polarity | Antenna Gain (dBi) | Cable Loss (dB) | Result (dBm) | Margin (dBm) | Limit (dBm) |
|----|--------------------------|------------------------|-------------------------|---------------|--------------------|-----------------|--------------|--------------|-------------|
| 1 | 469.9975 | -26.41 | 41.36 | H | -7.44 | 1.71 | 30.06 | -6.94 | 37.00 |
| 2 | 939.9995 | -74.84 | -42.00 | H | 6.90 | 2.77 | -40.02 | -27.05 | -12.97 |
| 3 | 1410.0015 | -82.09 | -52.12 | H | 7.70 | 3.71 | -50.28 | -37.31 | -12.97 |

| No | Emission Frequency (MHz) | Spectrum Reading (dBm) | Generator Reading (dBm) | Ant. Polarity | Antenna Gain (dBi) | Cable Loss (dB) | Result (dBm) | Margin (dBm) | Limit (dBm) |
|----|--------------------------|------------------------|-------------------------|---------------|--------------------|-----------------|--------------|--------------|-------------|
| 1 | 469.9975 | -35.32 | 35.98 | V | -7.44 | 1.71 | 24.68 | -12.32 | 37.00 |
| 2 | 939.9995 | -74.58 | -45.12 | V | 6.90 | 2.77 | -43.14 | -30.17 | -12.97 |
| 3 | 1410.0015 | -81.77 | -49.14 | V | 7.70 | 3.71 | -47.30 | -34.33 | -12.97 |

APPENDIX A – Test Equipment Used For Tests

| No | Description | Manufacturer | Model No. | Serial No. | Due Cal. |
|----|--------------------------|------------------|---------------------|------------|------------|
| 1 | Test Receiver | Rohde & Schwarz | ESHS 10 | 862970/018 | 2010.06.11 |
| 2 | Test Receiver | Rohde & Schwarz | ESVS 10 | 826008/014 | 2010.05.20 |
| 3 | Spectrum Analyzer | Hewlett Packard | 8566B | 2311A02394 | 2010.05.15 |
| 4 | Spectrum Analyzer | Rohde & Schwarz | FSP13 | 100130 | 2010.05.15 |
| 5 | Modulation Analyzer | Hewlett Packard | 8901B | 3438A05094 | 2010.05.15 |
| 6 | Audio analyzer | Hewlett Packard | 8903B | 3011A12915 | 2010.05.15 |
| 7 | Preamplifier | Hewlett Packard | 8447F | 2805A02570 | 2010.05.15 |
| 8 | Preamplifier | A.H. Systems | PAM-0118 | 164 | 2010.04.17 |
| 9 | Signal Generator | Hewlett Packard | 8673D | 2708A00448 | 2010.05.15 |
| 10 | Power Meter | Hewlett Packard | 437B | 312U24787 | 2010.04.21 |
| 11 | Power Sensor | Hewlett Packard | 8482B | 3318A06943 | 2010.05.15 |
| 12 | Digital Multi Meter | Tektronix | DMM916 | 138401 | 2010.05.15 |
| 13 | Loop Antenna | Rohde & Schwarz | HFH2-Z2.335.4711.52 | 826532/006 | 2011.02.06 |
| 14 | Dipole Antenna | Rohde & Schwarz | VHAP | 574 | 2010.07.07 |
| 15 | Dipole Antenna | Rohde & Schwarz | VHAP | 575 | 2010.07.17 |
| 16 | Dipole Antenna | Rohde & Schwarz | UHAP | 545 | 2010.07.17 |
| 17 | Dipole Antenna | Rohde & Schwarz | UHAP | 546 | 2010.07.07 |
| 18 | Biconical Antenna | Eaton Corp. | 94455-1 | 0977 | 2010.07.03 |
| 19 | Biconical Antenna | EMCO | 3104C | 9111-2468 | 2010.07.03 |
| 20 | Log Periodic Antenna | EMCO | 3146 | 2051 | 2010.06.05 |
| 21 | Log Periodic Antenna | EMCO | 3146 | 8901-2320 | 2010.07.03 |
| 22 | Horn Antenna | A.H. Systems | SAS-571 | 414 | 2011.03.16 |
| 23 | Trilog-Broadband Antenna | SCHWARZBECK | VULB 9168 | 9168-350 | 2011.03.27 |
| 24 | LISN | EMCO | 3810/2 | 2228 | 2010.05.15 |
| 25 | Waveform Generator | Hewlett Packard | 33120A | US34001190 | 2010.05.15 |
| 26 | Digital Oscilloscope | Tektronix | TDS 340A | B012287 | 2010.05.15 |
| 27 | Dummy Load | Bird Electronics | 8251 | 11511 | 2010.04.17 |