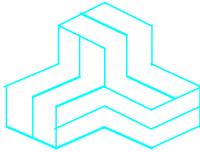


ENGINEERING TEST REPORT



Radio-Z Module MODEL NO.: L-ZM2102

FCC ID: TOB-LZM2102

Applicant:

Logitech Inc. - Canada
2355 Skymark Avenue, Suite 200
Mississauga, ON
Canada L4W 4Y6

Tested in Accordance With

**FCC Part 15, Subpart C, Section 15.249
Low Power Transmitters
Operating in the Frequency Band 902 - 928 MHz**

UltraTech's File No.: LOG-003F15C249

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs

Date: September 20, 2005



Report Prepared by: Dan Huynh

Tested by: Mr. Hung Trinh, EMC/RFI Technician

Issued Date: September 20, 2005

Test Dates: September 1, 2005

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com



TABLE OF CONTENTS

| | |
|--|-----------|
| EXHIBIT 1. INTRODUCTION..... | 1 |
| 1.1. SCOPE..... | 1 |
| 1.2. RELATED SUBMITTAL(S)/GRANT(S)..... | 1 |
| 1.3. NORMATIVE REFERENCES | 1 |
| EXHIBIT 2. PERFORMANCE ASSESSMENT | 2 |
| 2.1. CLIENT INFORMATION | 2 |
| 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION | 2 |
| 2.3. EUT'S TECHNICAL SPECIFICATIONS..... | 3 |
| 2.4. LIST OF EUT'S PORTS | 3 |
| 2.5. ANCILLARY EQUIPMENT | 3 |
| 2.6. GENERAL TEST SETUP | 3 |
| EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS..... | 4 |
| 3.1. CLIMATE TEST CONDITIONS..... | 4 |
| 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS | 4 |
| EXHIBIT 4. SUMMARY OF TEST RESULTS..... | 5 |
| 4.1. LOCATION OF TESTS | 5 |
| 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS | 5 |
| 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES | 5 |
| EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS | 6 |
| 5.1. TEST PROCEDURES | 6 |
| 5.2. MEASUREMENT UNCERTAINTIES..... | 6 |
| 5.3. MEASUREMENT EQUIPMENT USED..... | 6 |
| 5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER | 6 |
| 5.5. AC/DC POWER LINE CONDUCTED EMISSIONS [47 CFR 15.107(a) & 15.207]..... | 7 |
| 5.6. 20 dB BANDWIDTH | 13 |
| 5.7. FUNDAMENTAL FIELD STRENGTH AND HARMONIC EMISSIONS (RADIATED @ 3 METERS) [47 CFR 15.249(a), 15.209 & 15.205]...... | 15 |
| EXHIBIT 6. MEASUREMENT UNCERTAINTY | 17 |
| 6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY | 17 |
| 6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY | 18 |

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

| | |
|--------------------------------------|--|
| Reference: | FCC Part 15, Subpart C, Section 15.249 |
| Title: | Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 |
| Purpose of Test: | To gain FCC Certification Authorization for Low Power Licensed-Exempt Transmitters operating in the Frequency Band 902 - 928 MHz. |
| Test Procedures: | Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. |
| Environmental Classification: | Commercial, industrial or business environment residential |

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

| Publication | Year | Title |
|------------------------------|----------------------------------|---|
| FCC CFR Parts 0-19 | 2005 | Code of Federal Regulations – Telecommunication |
| ANSI C63.4 | 2003 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| FCC Public Notice DA 00-1407 | 2000 | Part 15 Unlicensed Modular Transmitter Approval |
| CISPR 22 +A1 EN 55022 | 2003-04-10 2004-10-14 2003 | Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment |
| CISPR 16-1-1 | 2003 | Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus |
| CISPR 16-2-1 | 2003 | Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement |
| CISPR 16-2-3 | 2003 | Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Radiated disturbance measurement |

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

| APPLICANT | |
|-----------------|---|
| Name: | Logitech Inc. |
| Address: | 2355 Skymark Avenue, suite 200 Mississauga, ON L4W 4Y6 Canada L4W 4Y6 |
| Contact Person: | Samuel Asare Phone #: 905-273-4571 EXT: 2443 Fax #: 905-273-9789 Email Address: Samuel_asare@logitech.com |

| MANUFACTURER | |
|-----------------|---|
| Name: | Wanlida Group of Companies |
| Address: | No. 618, Jiahe Rd. Xiamen, Fujian, China |
| Contact Person: | Linden Lin Phone #: 86-592-5700999 Ext. 8618 Fax #: 86-592-5701337 Email Address: Linden@malata.com |

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

| | |
|--------------------------------|--|
| Brand Name: | Logitech Inc. - Canada |
| Product Name: | Radio-Z Module |
| Model Name or Number: | L-ZM2102 |
| Serial Number: | Test Sample |
| Type of Equipment: | Low Power Transceiver |
| Input Power Supply Type: | N/A |
| Primary User Functions of EUT: | Provide data communication link through air. |

2.3. EUT'S TECHNICAL SPECIFICATIONS

| TRANSMITTER | |
|--|---|
| Equipment Type: | Mobile Base station (fixed use) |
| Intended Operating Environment: | Residential Commercial, light industry & heavy industry |
| Power Supply Requirement: | 3.3 V |
| RF Output Power Rating: | 90.56 dB μ V/m Peak |
| Operating Frequency Range: | 908.42 MHz |
| RF Output Impedance: | 50 Ohms |
| 20 dB Bandwidth: | 68.54 kHz |
| Modulation Type: | FSK |
| Emission Designation: | F1D |
| Oscillator Frequencies: | 32 MHz |
| Antenna Connector Type: | Integral |
| Antenna Description: | Manufacturer: Zensys Type: Monopole Model: ZM1220 Frequency Range: 908.42 MHz In/Out Impedance: 50 Ohms Gain: 4dBi |

2.4. LIST OF EUT'S PORTS

None.

2.5. ANCILLARY EQUIPMENT

None.

2.6. GENERAL TEST SETUP

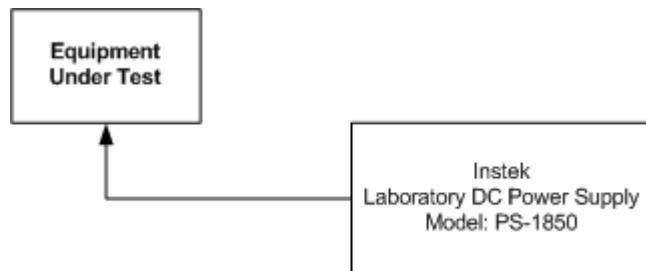


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

| | |
|---------------------|---------|
| Temperature: | 21°C |
| Humidity: | 51% |
| Pressure: | 102 kPa |
| Power input source: | 3.3 V |

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

| | |
|----------------------------------|---|
| Operating Modes: | EUT was configured to transmit continuously for emissions measurements. |
| Special Test Software: | None |
| Special Hardware Used: | None |
| Transmitter Test Antenna: | The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment. |

| | |
|--|-------------------------|
| Transmitter Test Signals: | |
| Frequency Band(s): | 908.42 MHz |
| Test Frequency(ies): | 908.42 MHz |
| Transmitter Wanted Output Test Signals: | |
| • RF Power Output (measured maximum output power): | 90.56 dB μ V/m Peak |
| • Normal Test Modulation: | FSK |
| • Modulating signal source: | Internal |

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

- All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.
- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.
- The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Jan. 10, 2005

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

| FCC Section(s) | Test Requirements | Compliance (Yes/No) |
|---------------------------|--|---------------------|
| 15.107(a) & 15.207 | AC Power Conducted Emissions | Yes |
| -- | 20 dB Bandwidth | Yes |
| 15.249(a), 15.209, 15.205 | Transmitter Radiated Emissions, Harmonic Emissions | Yes |

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and ULTR-P001-2004.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The Radio-Z Module is a fully integrated RF communication module that uses the unlicensed Short-Range-Device (SRD) frequency band of 908.42MHz. The module is dedicated for wireless control and monitoring of residential products like lighting and appliance control, energy management, access control, security and building automation.

5.5. AC/DC POWER LINE CONDUCTED EMISSIONS [47 CFR 15.107(a) & 15.207]

5.5.1. Limits

The equipment shall meet the limits of the following table:

| Test Frequency Range (MHz) | Class B Limits | | Measuring Bandwidth |
|----------------------------|-------------------------|----------------------|--|
| | Quasi-Peak (dB μ V) | Average (dB μ V) | |
| 0.15 to 0.5 | 66 to 56* | 56 to 46* | RBW = 9 kHz VBW \geq 9 kHz for QP VBW = 1 Hz for Average |
| 0.5 to 5 | 56 | 46 | RBW = 9 kHz VBW \geq 9 kHz for QP VBW = 1 Hz for Average |
| 5 to 30 | 60 | 50 | RBW = 9 kHz VBW \geq 9 kHz for QP VBW = 1 Hz for Average |

* Decreasing linearly with logarithm of frequency.

5.5.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

5.5.3. Test Equipment List

| Test Instruments | Manufacturer | Model No. | Serial No. | Frequency Range |
|------------------------------------|-----------------|-----------|------------|---|
| Spectrum Analyzer/ EMI Receiver | Hewlett Packard | HP 8593EM | 3412A00103 | 9 kHz – 26.5 GHz |
| Transient Limiter | Hewlett Packard | 11947A | 310701998 | 9 kHz – 200 MHz 10 dB attenuation |
| L.I.S.N. | EMCO | 3825/2 | 89071531 | 9 kHz – 200 MHz 50 Ohms / 50 μ H |
| 24'x16'x8' RF Shielded Chamber | RF Shielding | -- | -- | -- |

5.5.4. Test Data

| Frequency (MHz) | RF Level (dB μ V) | Receiver Detector (QP/AVG) | QP Limit (dB μ V) | AVG Limit (dB μ V) | Margin (dB) | Pass/Fail | Line Tested (L1/L2) |
|-----------------|-----------------------|----------------------------|-----------------------|------------------------|-------------|-----------|---------------------|
| Tx Mode | | | | | | | |
| 0.214825 | 30.7 | QP | 63.0 | 53.0 | -32.3 | Pass | L1 |
| 0.214825 | 28.5 | AVG | 63.0 | 53.0 | -24.5 | Pass | L1 |
| 0.584625 | 27.3 | QP | 56.0 | 46.0 | -28.7 | Pass | L1 |
| 0.584625 | 23.9 | AVG | 56.0 | 46.0 | -22.1 | Pass | L1 |
| Rx Mode | | | | | | | |
| 0.215200 | 33.5 | QP | 63.0 | 53.0 | -29.5 | Pass | L1 |
| 0.215200 | 31.7 | AVG | 63.0 | 53.0 | -21.3 | Pass | L1 |
| 0.585000 | 28.5 | QP | 56.0 | 46.0 | -27.5 | Pass | L1 |
| 0.585000 | 26.2 | AVG | 56.0 | 46.0 | -19.8 | Pass | L1 |
| 0.215288 | 33.3 | QP | 63.0 | 53.0 | -29.7 | Pass | L2 |
| 0.215288 | 31.5 | AVG | 63.0 | 53.0 | -21.5 | Pass | L2 |
| 0.584575 | 29.2 | QP | 56.0 | 46.0 | -26.8 | Pass | L2 |
| 0.584575 | 26.5 | AVG | 56.0 | 46.0 | -19.5 | Pass | L2 |

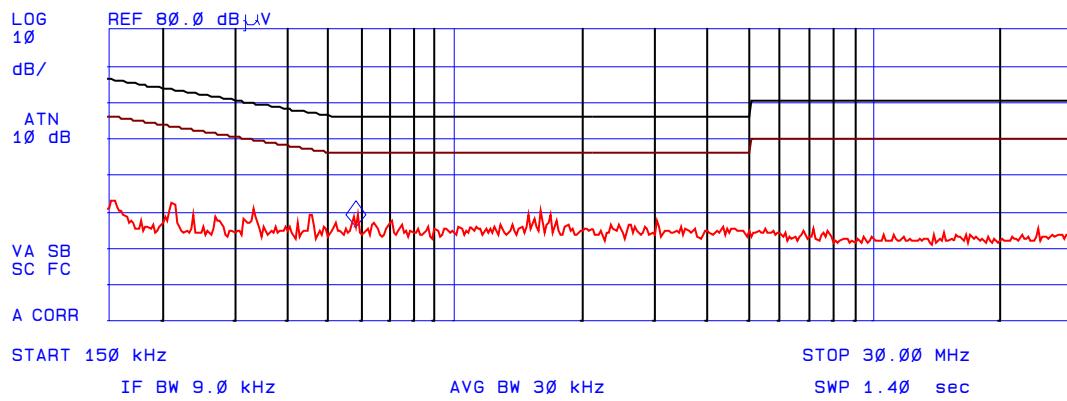
See the following plots for detailed measurements.

Plot 5.5.4.1: DC Power Line Conducted Emissions
Line Tested: Line 1 (TX Mode)
Line Voltage: 3.3 VDC

Hz

| | Signal Freq (MHz) | PK Amp | QP Amp | AV Amp | AV Δ L2 |
|---|-------------------|--------|--------|--------|----------------|
| 1 | 0.214825 | 34.3 | 30.7 | 28.5 | -24.6 |
| 2 | 0.584625 | 30.2 | 27.3 | 23.9 | -22.1 |

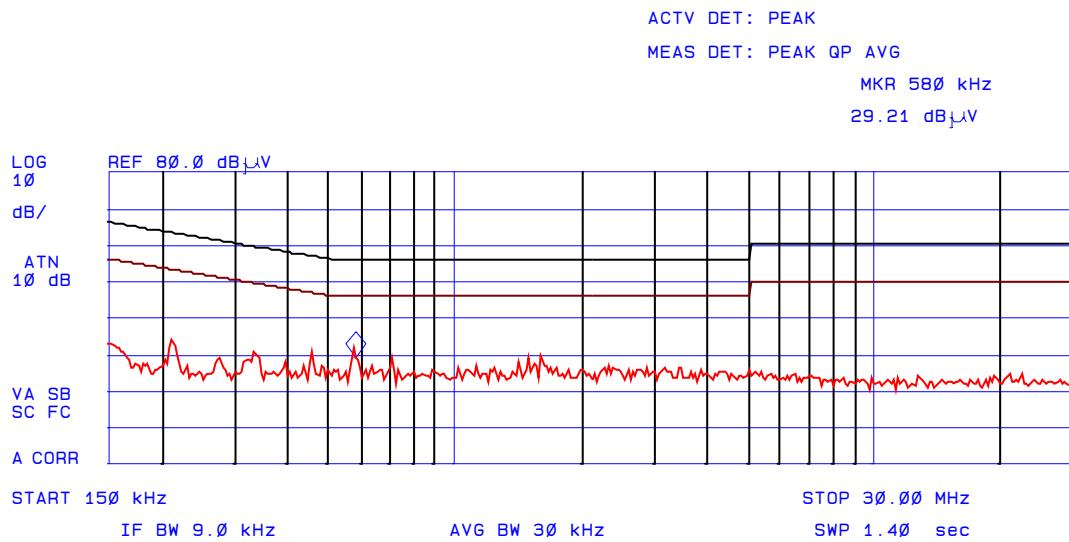
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 580 kHz
25.68 dB μ V



Plot 5.5.4.2: DC Power Line Conducted Emissions
Line Tested: Line 2 (Tx Mode)
Line Voltage: 3.3 VDC

Hz

| | Signal Freq (MHz) | PK Amp | QP Amp | AV Amp | AV Δ L2 |
|---|-------------------|--------|--------|--------|----------------|
| 1 | 0.215575 | 36.5 | 33.7 | 31.8 | -21.2 |
| 2 | 0.582425 | 32.2 | 29.1 | 26.6 | -19.4 |

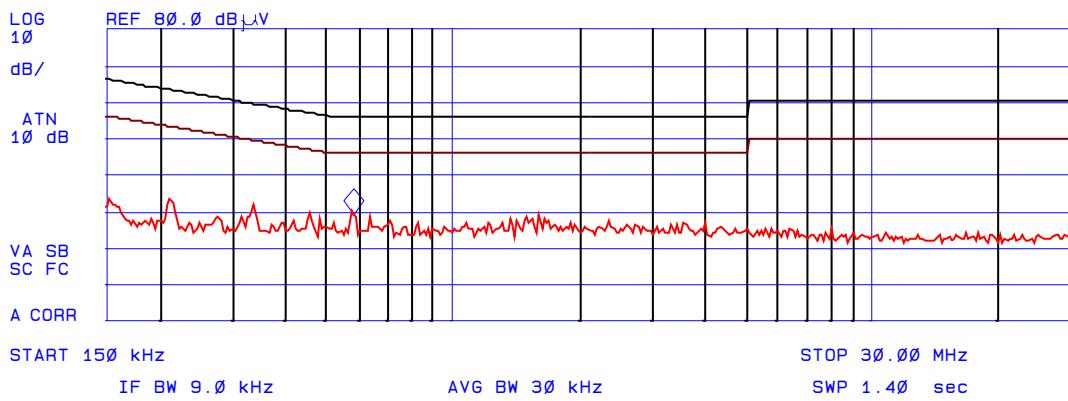


Plot 5.5.4.3: DC Power Line Conducted Emissions
Line Tested: Line 1 (Rx Mode)
Line Voltage: 3.3 VDC

۱۰۰

| Signal | Freq (MHz) | PK Amp | QP Amp | AV Amp | AV Δ L2 |
|--------|------------|--------|--------|--------|----------------|
| 1 | 0.215200 | 36.4 | 33.5 | 31.7 | -21.4 |
| 2 | 0.585000 | 31.6 | 28.5 | 26.2 | -19.8 |

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 58Ø kHz
29.09 dBVA



ULTRATECH GROUP OF LABS
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel.: 905-829-1570, Fax. : 905-829-8050

File #: LOG-003F15C249
September 20, 2005

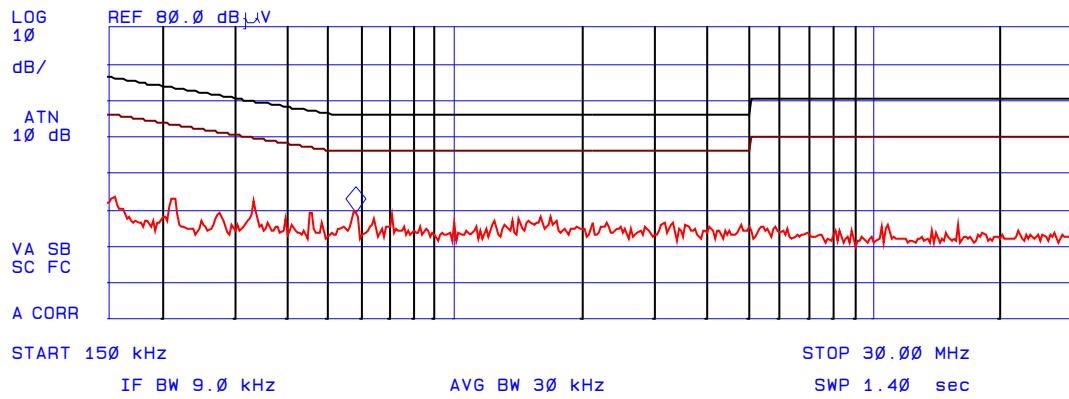
All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 5.5.4.4: DC Power Line Conducted Emissions
Line Tested: Line 2 (Rx Mode)
Line Voltage: 3.3 VDC

۲۰۰

| Signal | Freq (MHz) | PK Amp | QP Amp | AV Amp | AVΔL2 |
|--------|------------|--------|--------|--------|-------|
| 1 | 0.215288 | 36.7 | 33.3 | 31.5 | -21.6 |
| 2 | 0.584575 | 32.0 | 29.2 | 26.5 | -19.5 |

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 58Ø kHz
29.04 dBµV



5.6. 20 dB BANDWIDTH

5.6.1. Limits

No limit. Test is performed for information only.

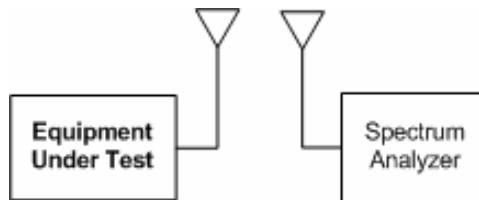
5.6.2. Method of Measurements

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63.4

5.6.3. Test Equipment List

| Test Instruments | Manufacturer | Model No. | Serial No. | Frequency Range |
|-------------------|-----------------|---------------|------------|-----------------|
| Spectrum Analyzer | Rohde & Schwarz | FSEK20/B4/B21 | 834157/005 | 9 kHz- 40 GHz |
| Log Periodic | EMCO | 3148 | 23845 | 200 MHz – 2 GHz |

5.6.4. Test Arrangement



5.6.5. Test Data

| Frequency (MHz) | 20 dB Bandwidth (kHz) |
|-----------------|-----------------------|
| 908.42 | 68.54 |

Plot 5.6.5.1: 20 dB Bandwidth
Test Frequency: 908.42 MHz



5.7. FUNDAMENTAL FIELD STRENGTH AND HARMONIC EMISSIONS (RADIATED @ 3 METERS) [47 CFR 15.249(a), 15.209 & 15.205]

5.7.1. Limits

- The Field Strength of emissions from intentional radiators operated within this frequency band shall comply with the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (mV/m) | Field Strength of Harmonics (μV/m) |
|-----------------------------|--------------------------------------|------------------------------------|
| 902 - 928 | 50 | 500 |

- The fundamental frequency shall not fall within any restricted frequency band specified in 15.205. All rf other emissions that fall in the restricted bands shall not exceed the general radiated emission limits specified in 15.209(a).

FCC 47 CFR 15.205(a)
 -- Restricted Frequency Bands --

| MHz | MHz | MHz | GHz |
|-----------------|-------------------|---------------|---------------|
| 0.090 - 0.110 | 162.0125 - 167.17 | 2310 - 2390 | 9.3 - 9.5 |
| 0.49 – 0.51 | 167.72 - 173.2 | 2483.5 - 2500 | 10.6 - 12.7 |
| 2.1735 - 2.1905 | 240 - 285 | 2655 - 2900 | 13.25 - 13.4 |
| 8.362 - 8.366 | 322 - 335.4 | 3260 - 3267 | 14.47 - 14.5 |
| 13.36 - 13.41 | 399.9 - 410 | 3332 - 3339 | 14.35 - 16.2 |
| 25.5 – 25.67 | 608 - 614 | 3345.8 - 3358 | 17.7 - 21.4 |
| 37.5 – 38.25 | 960 - 1240 | 3600 - 4400 | 22.01 - 23.12 |
| 73 - 75.4 | 1300 - 1427 | 4500 - 5250 | 23.6 - 24.0 |
| 108 – 121.94 | 1435 - 1626.5 | 5350 - 5460 | 31.2 - 31.8 |
| 123 – 138 | 1660 - 1710 | 7250 - 7750 | 36.43 - 36.5 |
| 149.9 – 150.05 | 1718.8 - 1722.2 | 8025 - 8500 | Above 38.6 |
| 156.7 – 156.9 | 2200 – 2300 | 9000 - 9200 | |

FCC 47 CFR 15.209(a)
 -- Field Strength Limits within Restricted Frequency Bands --

| Frequency (MHz) | Field Strength Limits (μV/m) | Distance (Meters) |
|-----------------|------------------------------|-------------------|
| 0.009 - 0.490 | 2,400 / F (KHz) | 300 |
| 0.490 - 1.705 | 24,000 / F (KHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 – 960 | 200 | 3 |
| Above 960 | 500 | 3 |

5.7.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

5.7.3. Test Equipment List

| Test Instruments | Manufacturer | Model No. | Serial No. | Frequency Range |
|------------------------------------|-----------------|---------------|------------|---------------------------------------|
| Spectrum Analyzer/ EMI Receiver | Rohde & Schwarz | FSEK20/B4/B21 | 834157/005 | 9 kHz – 40 GHz with external mixer |
| Microwave Amplifier | Hewlett Packard | HP 83017A | | 1 GHz to 26.5 GHz |
| Biconilog Antenna | EMCO | 3143 | 1029 | 20 MHz to 2 GHz |
| Horn Antenna | EMCO | 3155 | 9701-5061 | 1 GHz – 18 GHz |

5.7.4. Test Data

The emissions were scanned from 30 MHz to 10 GHz and all emissions within 20 dB below the limits were recorded.

| Frequency (MHz) | Peak E-Field @3m (dB μ V/m) | Average E-Field @3m (dB μ V/m) | Antenna Plane (H/V) | Field Strength Limit of Fundamental/Harmonic (dB μ V/m) | Field Strength Limit of § 15.209 (dB μ V/m) | Margin (dB) |
|--------------------|---------------------------------------|--|---------------------------|---|---|----------------|
| 908.42 | 85.65 | -- | V | 94.0 | -- | -8.3 |
| 908.42 | 90.56 | -- | H | 94.0 | -- | -3.4 |
| 2725.26 | 45.06 | 35.04 | V | 54.0 | 54.0 | -18.9 |
| 2725.26 | 45.39 | 35.25 | H | 54.0 | 54.0 | -18.7 |

EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION (Line Conducted) | PROBABILITY DISTRIBUTION | UNCERTAINTY (dB) | |
|--|-----------------------------|------------------|-------------|
| | | 9-150 kHz | 0.15-30 MHz |
| EMI Receiver specification | Rectangular | ± 1.5 | ± 1.5 |
| LISN coupling specification | Rectangular | ± 1.5 | ± 1.5 |
| Cable and Input Transient Limiter calibration | Normal (k=2) | ± 0.3 | ± 0.5 |
| Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1+\Gamma_1\Gamma_R)$ | U-Shaped | ± 0.2 | ± 0.3 |
| System repeatability | Std. deviation | ± 0.2 | ± 0.05 |
| Repeatability of EUT | -- | -- | -- |
| Combined standard uncertainty | Normal | ± 1.25 | ± 1.30 |
| Expanded uncertainty U | Normal (k=2) | ± 2.50 | ± 2.60 |

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION (Radiated Emissions) | PROBABILITY DISTRIBUTION | UNCERTAINTY (\pm dB) | |
|--|-----------------------------|-------------------------|---------------|
| | | 3 m | 10 m |
| Antenna Factor Calibration | Normal (k=2) | ± 1.0 | ± 1.0 |
| Cable Loss Calibration | Normal (k=2) | ± 0.3 | ± 0.5 |
| EMI Receiver specification | Rectangular | ± 1.5 | ± 1.5 |
| Antenna Directivity | Rectangular | ± 0.5 | ± 0.5 |
| Antenna factor variation with height | Rectangular | ± 2.0 | ± 0.5 |
| Antenna phase center variation | Rectangular | 0.0 | ± 0.2 |
| Antenna factor frequency interpolation | Rectangular | ± 0.25 | ± 0.25 |
| Measurement distance variation | Rectangular | ± 0.6 | ± 0.4 |
| Site imperfections | Rectangular | ± 2.0 | ± 2.0 |
| Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(Bi)$ 0.3 (Lp) Uncertainty limits $20\log(1+\Gamma_1\Gamma_R)$ | U-Shaped | ± 1.1 -1.25 | ± 0.5 |
| System repeatability | Std. Deviation | ± 0.5 | ± 0.5 |
| Repeatability of EUT | | - | - |
| Combined standard uncertainty | Normal | +2.19 / -2.21 | +1.74 / -1.72 |
| Expanded uncertainty U | Normal (k=2) | +4.38 / -4.42 | +3.48 / -3.44 |

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$