

EMC Test Report

Application for Grant of Equipment Authorization

Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8 FCC Part 15 Subpart C

ZWave Option Module model SLZW0001

FCC ID: KJM-SLZW0001
IC CERTIFICATION #: 3288A-SLZW0001

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TEST SITE(S): NTS Silicon Valley
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IC SITE REGISTRATION #: 2845B-7

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REVISION HISTORY

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SCOPE

An electromagnetic emissions test has been performed on the Systech Corporation ZWave Option Module model SLZW0001, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3

RSS 210 Issue 8 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”

FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in NTS Silicon Valley test procedures:

ANSI C63.4:2003

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer’s declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body’s review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure

compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Systech Corporation ZWave Option Module model SLZW0001 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 3

RSS 210 Issue 8 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”

FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Systech Corporation ZWave Option Module model SLZW0001 and therefore apply only to the tested sample. The sample was selected and prepared by Zen Barelka of Systech Corporation.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY**DEVICES OPERATING IN THE 902 – 928 / 2400 – 2483.5 / 5725 – 5850 MHz BANDS**

| FCC Rule Part | RSS Rule Part | Description | Measured Value / Comments | Limit / Requirement | Result |
|---------------------|----------------------------|--|---|---|----------|
| 15.249 (a) | RSS 210 A2.9 (1) | Fundamental Signal Strength | 92.3 dB μ V/m @ 908.39 MHz (-1.7dB) | 94dBmV/m @ 3m | Complies |
| 15.249 (a) / 15.209 | RSS 210 A2.9 (1) & Table 2 | Radiated Spurious Emissions, 30 - 9100 MHz | 45.5 dB μ V/m @ 3633.6 MHz (-8.5dB) | Harmonics 54dBuV/m @ 3m or general limits (see page 16) | Complies |

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

| FCC Rule Part | RSS Rule part | Description | Measured Value / Comments | Limit / Requirement | Result (margin) |
|---------------|-----------------------|-----------------------------|---|--|---------------------|
| 15.203 | - | RF Connector | Integral antenna | Unique or integral antenna required | Complies |
| 15.207 | RSS GEN Table 2 | AC Conducted Emissions | 47.0 dB μ V @ 0.507 MHz (-9.0dB) | Refer to page 15 | Complies (- 9.0 dB) |
| 15.109 | RSS GEN 7.2.3 Table 1 | Receiver spurious emissions | 45.5 dB μ V/m @ 3633.6 MHz (-8.5dB) | Refer to page 16 | Complies |
| - | RSP 100 RSS GEN 7.1.5 | User Manual | | Statement required regarding non-interference | Complies |
| - | RSP 100 RSS GEN 7.1.5 | User Manual | | Statement for products with detachable antenna | Complies |
| - | RSP 100 RSS GEN 4.4.1 | 99% Bandwidth | 104kHz | Information only | N/A |

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

| Measurement Type | Measurement Unit | Frequency Range | Expanded Uncertainty |
|------------------------------------|------------------|-------------------|----------------------|
| Radiated emission (field strength) | dB μ V/m | 25 to 1000 MHz | \pm 3.6 dB |
| | | 1000 to 40000 MHz | \pm 6.0 dB |
| Conducted Emissions (AC Power) | dB μ V | 0.15 to 30 MHz | \pm 2.4 dB |

EQUIPMENT UNDER TEST (EUT) DETAILS**GENERAL**

The Systech Corporation ZWave Option Module model SLZW0001 is a radio module that is designed to be installed in other equipment to provide a radio communication link. Since the EUT could be placed in any position in the end product, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 2.1-3.6 Volts DC.

The sample was received on May 30, 2012 and tested on May 30, 2012. The EUT consisted of the following component(s):

| Company | Model | Description | Serial Number | FCC ID |
|---------------------|--------|-----------------|---------------|--------------|
| Systech Corporation | ZM3102 | Wireless Module | 000040 | KJM-SLZW0001 |

ANTENNA SYSTEM

The antenna is integral to the device.

ENCLOSURE

The EUT does not have an enclosure as it is designed to be installed within the enclosure of other products.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

| Company | Model | Description | Serial Number | FCC ID |
|-------------------------|-------------|-------------|---------------|--------|
| Phihong AC Power Supply | PSAA20R-033 | AC Adapter | P10300259A1 | - |

No remote support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

| Port | Connected To | Cable(s) | | |
|----------|--------------|-----------------------|------------------------|-----------|
| | | Description | Shielded or Unshielded | Length(m) |
| DC Power | AC Adapter | Two wire with ferrite | Unshielded | 1 |
| AC Power | AC Mains | Direct connect | - | - |

EUT OPERATION

During emissions testing the EUT was transmitting a continuous modulated signal.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

| Site | Registration Numbers | | Location |
|-----------|-----------------------|---------|---|
| | FCC | Canada | |
| Chamber 7 | A2LA accreditation | 2845B-7 | 41039 Boyce Road Fremont, CA 94538-2435 |

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

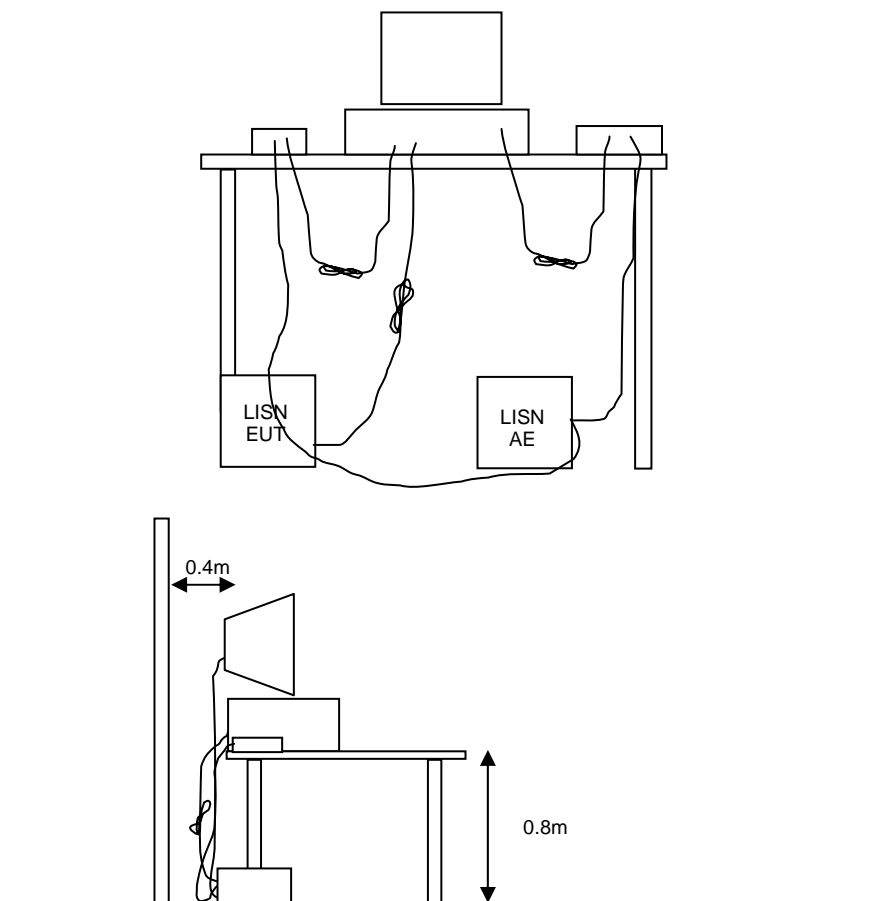


Figure 1 Typical Conducted Emissions Test Configuration

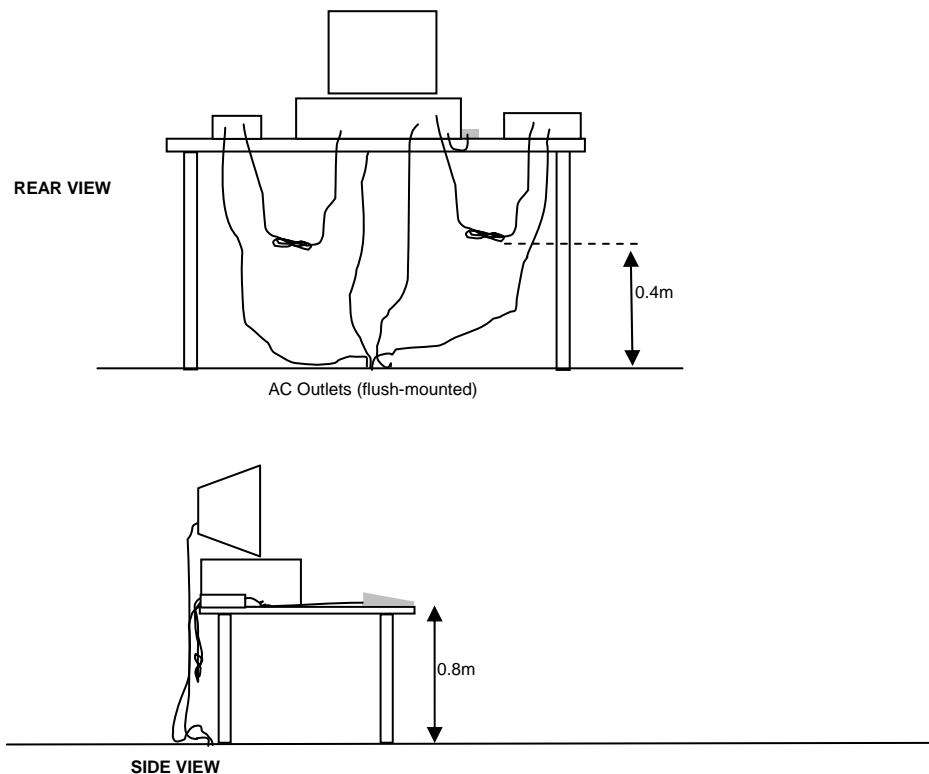
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

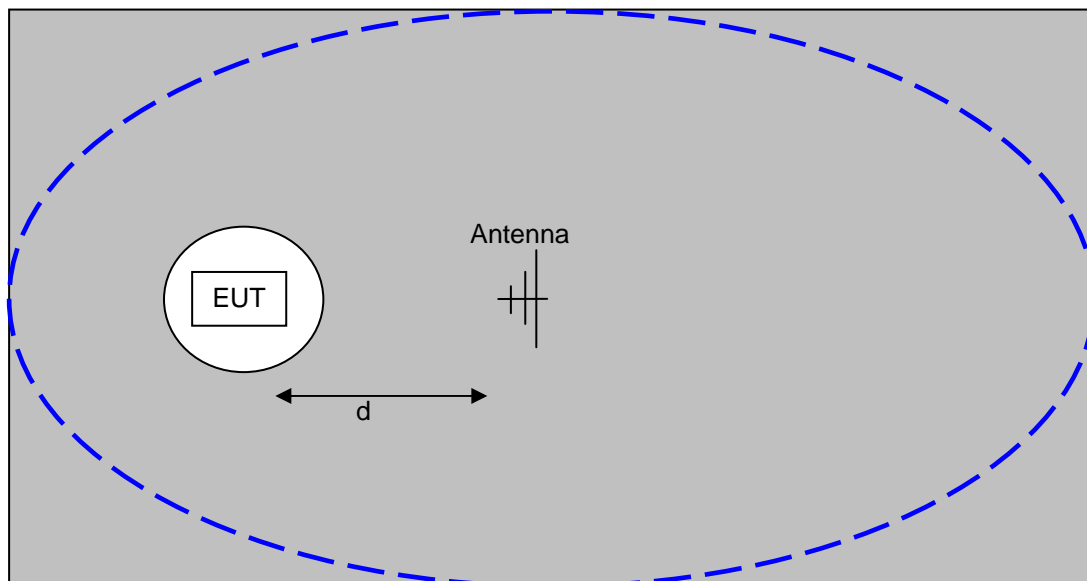
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

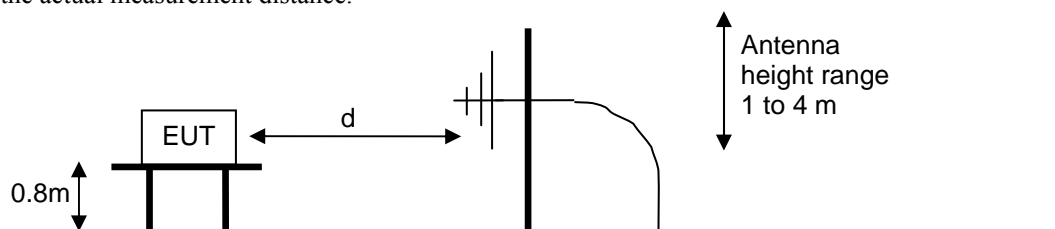
When testing above 18 GHz, the receive antenna is located at 1 meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.



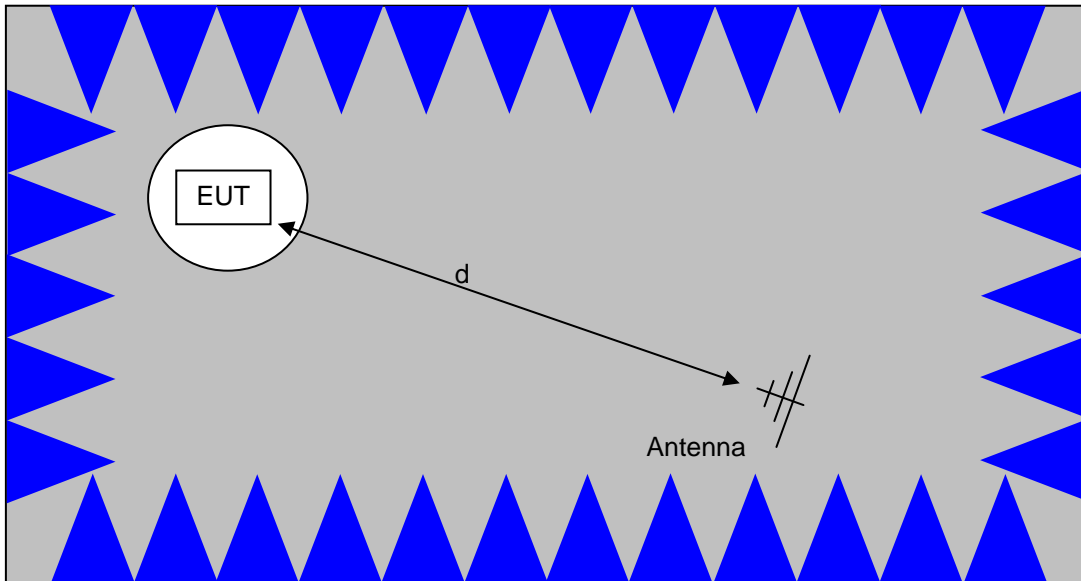
Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.

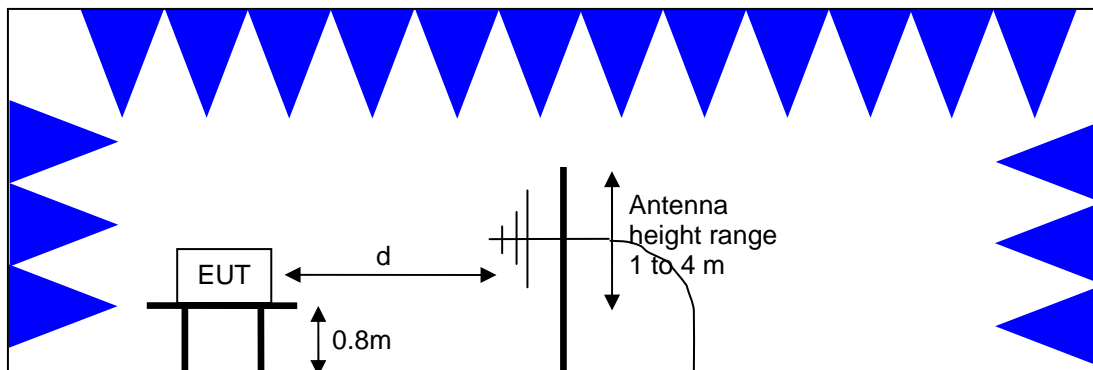


Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

| Frequency (MHz) | Average Limit (dBuV) | Quasi Peak Limit (dBuV) |
|--------------------|--|--|
| 0.150 to 0.500 | Linear decrease on logarithmic frequency axis between 56.0 and 46.0 | Linear decrease on logarithmic frequency axis between 66.0 and 56.0 |
| 0.500 to 5.000 | 46.0 | 56.0 |
| 5.000 to 30.000 | 50.0 | 60.0 |

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands¹ (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

| Frequency Range (MHz) | Limit (uV/m) | Limit (dBuV/m @ 3m) |
|-----------------------|------------------------------|--|
| 0.009-0.490 | 2400/F _{KHz} @ 300m | 67.6-20*log ₁₀ (F _{KHz}) @ 300m |
| 0.490-1.705 | 24000/F _{KHz} @ 30m | 87.6-20*log ₁₀ (F _{KHz}) @ 30m |
| 1.705 to 30 | 30 @ 30m | 29.5 @ 30m |
| 30 to 88 | 100 @ 3m | 40 @ 3m |
| 88 to 216 | 150 @ 3m | 43.5 @ 3m |
| 216 to 960 | 200 @ 3m | 46.0 @ 3m |
| Above 960 | 500 @ 3m | 54.0 @ 3m |

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

| Frequency Range (MHz) | Limit (uV/m @ 3m) | Limit (dBuV/m @ 3m) |
|-----------------------|-------------------|---------------------|
| 30 to 88 | 100 | 40 |
| 88 to 216 | 150 | 43.5 |
| 216 to 960 | 200 | 46.0 |
| Above 960 | 500 | 54.0 |

¹ The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

RADIATED FUNDAMENTAL & SPURIOUS EMISSIONS SPECIFICATION LIMITS – 15.249 and RSS 210 A2.9

The table below shows the limits for the fundamental emission and for its harmonics. Harmonics that fall in restricted bands² and all other spurious emissions are subject to the general limits of RSS 210 and FCC Part 15 Subpart C.

| Frequency Range (MHz) | Limit for Fundamental @ 3m | Limit for Harmonics @ 3m |
|-----------------------|----------------------------|--------------------------|
| 902 – 928 | 50,000 uV/m 94dBuV/m | 500 uV/m 54dBuV/m |
| 2400 – 2483.5 | 50,000 uV/m 94dBuV/m | 500 uV/m 54dBuV/m |
| 5725 - 5850 | 50,000 uV/m 94dBuV/m | 500 uV/m 54dBuV/m |

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

² The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40 * \text{LOG}_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data**Radiated Emissions, 30 - 10,000 MHz, 30-May-12**

| <u>Manufacturer</u> | <u>Description</u> | <u>Model</u> | <u>Asset #</u> | <u>Cal Due</u> |
|----------------------------|---------------------------------------|---------------------|-----------------------|-----------------------|
| Hewlett Packard | Microwave Preamplifier, 1-26.5GHz | 8449B | 263 | 3/29/2013 |
| EMCO | Antenna, Horn, 1-18 GHz (SA40-Blu) | 3115 | 1386 | 9/21/2012 |
| Hewlett Packard | SpecAn 9 kHz - 40 GHz, FT (SA40) Blue | 8564E (84125C) | 1393 | 5/1/2013 |
| Sunol Sciences | Biconilog, 30-3000 MHz | JB3 | 1549 | 5/25/2013 |
| Rohde & Schwarz | EMI Test Receiver, 20 Hz-7 GHz | ESIB7 | 1756 | 5/21/2013 |
| Hewlett Packard | Preamplifier, 100 kHz - 1.3 GHz | 8447D OPT 010 | 1826 | 5/18/2013 |

Conducted Emissions – AC Power Port, 30-May-12

| <u>Manufacturer</u> | <u>Description</u> | <u>Model #</u> | <u>Asset #</u> | <u>Cal Due</u> |
|----------------------------|-------------------------------------|-----------------------|-----------------------|-----------------------|
| Rohde & Schwarz | Pulse Limiter | ESH3 Z2 | 1401 | 15-May-13 |
| Rohde & Schwarz | EMI Test Receiver, 20 Hz-7 GHz | ESIB7 | 1538 | 06-Dec-12 |
| Fischer Custom Comm | LISN, 25A, 150kHz to 30MHz, 25 Amp, | FCC-LISN-50-25-2-09 | 2001 | 15-Feb-13 |

Appendix B Test Data

T87722 Pages 22 - 30



EMC Test Data

| | | | |
|------------------------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product | SLZW0001 Module | T-Log Number: | T87722 |
| | | Account Manager: | Chrsitine Krebill |
| Contact: | Zen Barelka | | |
| Emissions Standard(s): | FCC 15.249/FCC 15b | Class: | B |
| Immunity Standard(s): | - | Environment: | Radio |

EMC Test Data

For The

Systech Corporation

Product

SLZW0001 Module

Date of Last Test: 6/11/2012

| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

Radiated Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. The EUT was tested in all three orthogonal orientations.

The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

| | |
|----------------|-------|
| Temperature: | 25 °C |
| Rel. Humidity: | 35 % |

Summary of Results

| Run # | Test Performed | Limit | Result | Value / Margin |
|-------|---|--|--------|------------------------------------|
| 2 | Fundamental Signal Field Strength, 908.4MHz | FCC 15.249 RSS 210 Annex 2.9 | Pass | 92.3 dBµV/m @ 908.39 MHz (-1.7 dB) |
| 2 | Transmitter Radiated Spurious Emissions, 30 - 9,100 MHz | FCC 15.209 & 15.249 RSS 210/RSS GEN | Pass | 45.5 dBµV/m @ 3633.6 MHz (-8.5 dB) |
| 3 | 99% Bandwidth | RSS-GEN | N/A | 104kHz |
| 4 | Receiver Radiated Spurious Emissions, 30 - 1,820 MHz | 15.109 | Pass | Please refer to Run 2 |

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Test Notes

The EUT operates at 908.4MHz only.

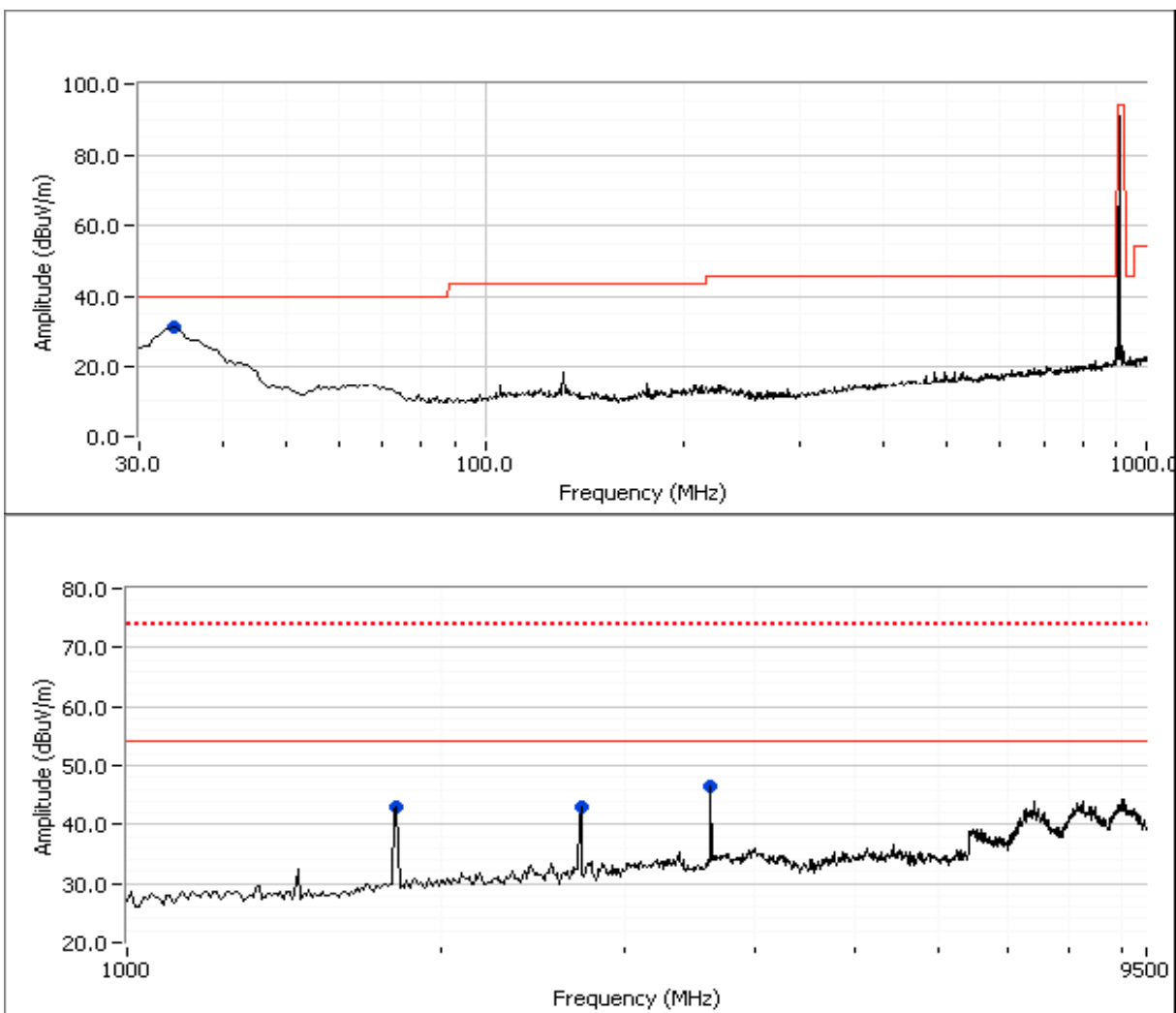
| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

Run #1: Preliminary Radiated Emissions, 30-9500 MHz, Fundamental and Transmitter Spurious Emissions

Date of Test: 5/30/2012
 Test Engineer: Jack Liu
 Test Location: FT7

Config. Used: 1
 Config Change: None
 EUT Voltage: 120/60Hz

| Frequency Range | Test Distance | Limit Distance | Extrapolation Factor |
|-----------------|---------------|----------------|----------------------|
| 30 - 9,100 MHz | 3 | 3 | 0.0 |





EMC Test Data

| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

Run #1: Preliminary Radiated Emissions, 30-9500 MHz, Fundamental and Transmitter Spurious Emissions

| Frequency | Level | Pol | RSS 210 / FCC 15.249 | | Detector | Azimuth | Height | Comments | Orientation |
|-----------|--------------|-----|----------------------|--------|-----------|---------|--------|----------|-------------|
| MHz | dB μ V/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters | | |
| 33.369 | 31.4 | V | 40.0 | -8.6 | Peak | 206 | 1.0 | | Back |
| 1806.670 | 44.0 | H | 54.0 | -10.0 | Peak | 274 | 1.0 | | Back |
| 1861.670 | 41.8 | V | 54.0 | -12.2 | Peak | 64 | 1.3 | | Back |
| 2714.170 | 44.4 | V | 54.0 | -9.6 | Peak | 205 | 1.6 | | Back |
| 3630.830 | 45.4 | H | 54.0 | -8.6 | Peak | 311 | 1.0 | | Back |

Note 1: As the device can be hand-held or as the device can be operated in different orientations, measurements were made with the device in three orthogonal orientations. The emissions were found to be the highest with the EUT flat on the test table (back).

Note 2: QP detector used below 1GHz, Peak and average detectors above 1GHz.

Run #2: Maximized Readings - Fundamental and Transmitter Spurious Emissions from Run #1

Date of Test: 5/30/2012
Test Engineer: Jack Liu
Test Location: FT7

Config. Used: 1
Config Change: None
EUT Voltage: 120/60Hz

Fundamental Field Strength

| Frequency | Level | Pol | RSS 210 / FCC 15.249 | | Detector | Azimuth | Height | Comments | Orientation |
|-----------|--------------|-----|----------------------|--------|-----------|---------|--------|----------|-------------|
| MHz | dB μ V/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters | | |
| 908.442 | 85.0 | V | 94.0 | -9.0 | QP | 200 | 1.4 | | Back |
| 908.389 | 92.3 | H | 94.0 | -1.7 | QP | 271 | 1.5 | | Back |
| 908.442 | 89.6 | V | 94.0 | -4.4 | QP | 202 | 1.0 | | Side |
| 908.389 | 90.2 | H | 94.0 | -3.8 | QP | 275 | 1.5 | | Side |
| 908.442 | 89.0 | V | 94.0 | -5.0 | QP | 240 | 1.0 | | Upright |
| 908.389 | 86.1 | H | 94.0 | -7.9 | QP | 244 | 1.5 | | Upright |

Spurious Emissions

| Frequency | Level | Pol | RSS 210 / FCC 15.249 | | Detector | Azimuth | Height | Comments | Orientation |
|-----------|--------------|-----|----------------------|--------|-----------|---------|--------|----------|-------------|
| MHz | dB μ V/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters | | |
| 3633.610 | 45.5 | H | 54.0 | -8.5 | AVG | 315 | 1.0 | | Back |
| 1816.840 | 42.5 | H | 54.0 | -11.5 | AVG | 262 | 1.0 | | Back |
| 2725.270 | 42.3 | V | 54.0 | -11.7 | AVG | 182 | 1.6 | | Back |
| 33.369 | 28.3 | V | 40.0 | -11.7 | QP | 206 | 1.0 | | Back |
| 3633.550 | 48.9 | H | 74.0 | -25.1 | PK | 315 | 1.0 | | Back |
| 2725.220 | 47.0 | V | 74.0 | -27.0 | PK | 182 | 1.6 | | Back |
| 1816.870 | 45.3 | H | 74.0 | -28.7 | PK | 262 | 1.0 | | Back |

| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

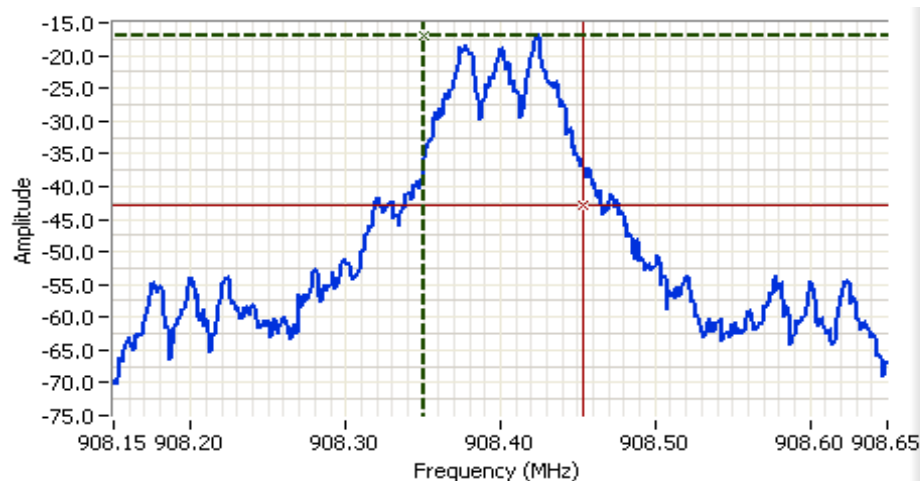
Run #3: Bandwidth Measurement(s)

Date of Test: 5/30/2012
 Test Engineer: Jack Liu
 Test Location: FT7

Config. Used: 1
 Config Change: None
 EUT Voltage: 120/60Hz

| Power Setting | Frequency (MHz) | Resolution Bandwidth | Video Bandwidth | 99% Bandwidth |
|---------------|-----------------|----------------------|-----------------|---------------|
| - | 908.4 | 5kHz | 20kHz | 104KHz |

Note 1: 99% bandwidth measured in accordance with RSS GEN, with RB > 1% of the span and between 1-5% of the signal bandwidth and VB > 3xRB





Analyzer Settings

Rohde&Schwarz, ESI
 CF: 908.400 MHz
 SPAN: 500 kHz
 RB: 5.00 kHz
 VB: 20.0 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 0.0 DB
 Sweep Time: 50.0ms
 Ref Lvl: -5.6 DBM

Comments

99% power BW: 104 kHz

| | | | |
|----------|----------|--------|---|
| Cursor 1 | 908.3500 | -16.92 |  |
| Cursor 2 | 908.4540 | -42.92 |  |

Delta Freq. 104 kHz
 Delta Amplitude 26.00



EMC Test Data

| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

Run #4: Receiver Spurious Emissions

As all the emissions observed during the test in Run #2 were below the limits for a receiver except for the Tx fundamental, a separate receive mode test was not necessary to demonstrate compliance.

| Frequency Range | Test Distance | Limit Distance | Extrapolation Factor |
|-----------------|---------------|----------------|----------------------|
| 30 - 1,820 MHz | 3 | 3 | 0.0 |

| Frequency | Level | Pol | FCC 15.109 | | Detector | Azimuth | Height | Comments | Orientation |
|-----------|--------------|-----|------------|--------|-----------|---------|--------|----------|-------------|
| MHz | dB μ V/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters | | |
| - | - | - | - | - | - | - | - | - | - |



EMC Test Data

| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

Conducted Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/30/2012
 Test Engineer: Jack Liu
 Test Location: FT7

Config. Used: 1
 Config Change: None
 EUT Voltage: 120/60Hz

General Test Configuration

For tabletop equipment, the EUT and power source were located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment. Remote support equipment was located outside of the semi-anechoic chamber. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

| | |
|----------------|-------|
| Temperature: | 25 °C |
| Rel. Humidity: | 35 % |

Summary of Results

| Run # | Test Performed | Limit | Result | Margin |
|-------|-------------------------|--------|--------|---------------------------------------|
| 1 | CE, AC Power, 120V/60Hz | 15.209 | Pass | 47.0 dB μ V @ 0.507 MHz (-9.0 dB) |

Modifications Made During Testing

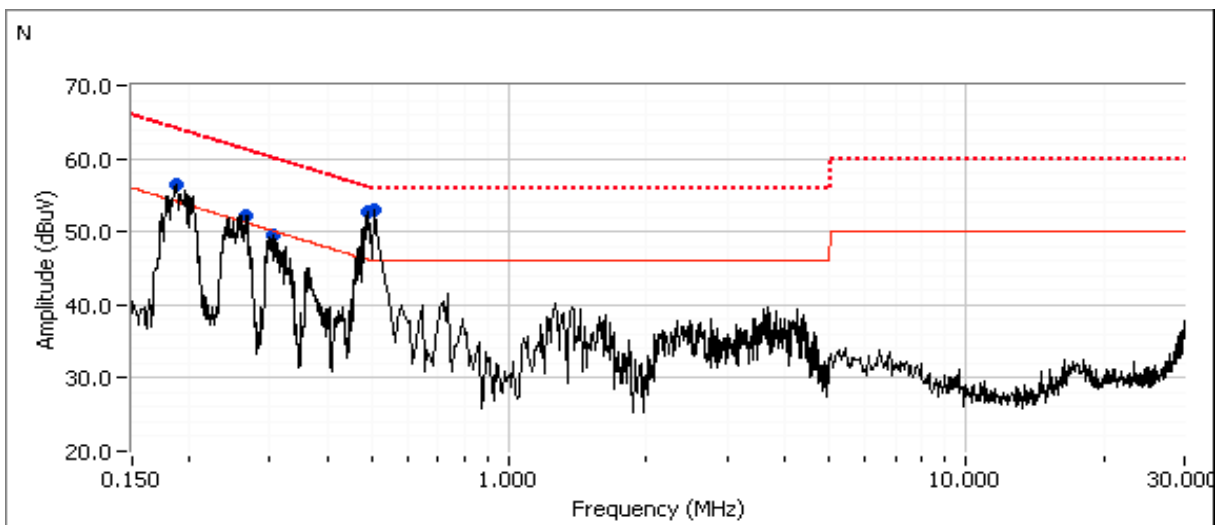
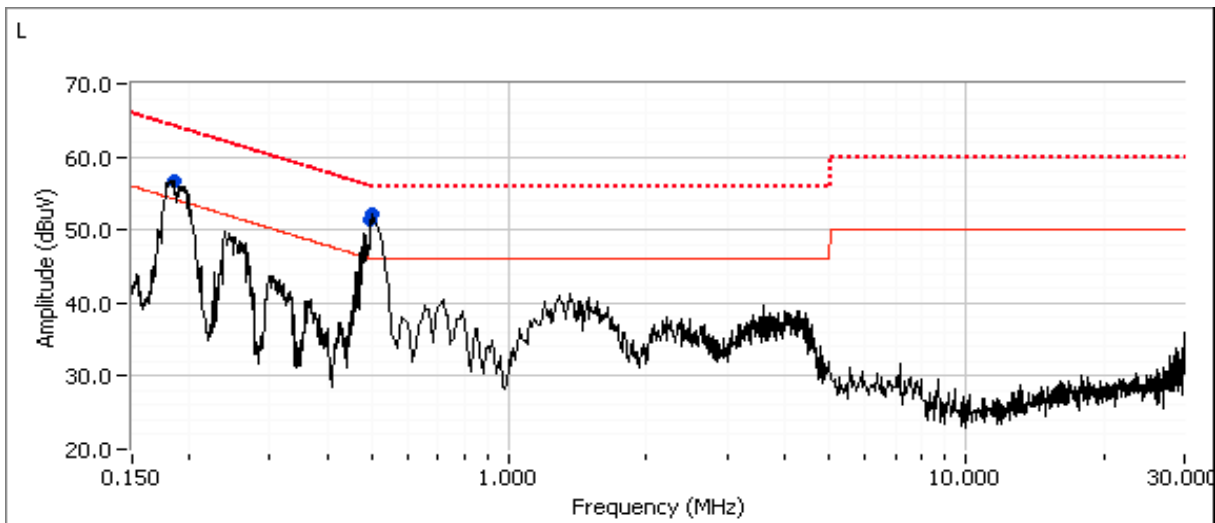
No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

| | |
|------------------------------|-----------------------------------|
| Client: Systech Corporation | Job Number: J87687 |
| Product: SLZW0001 Module | T-Log Number: T87722 |
| Contact: Zen Barelka | Account Manager: Chrstine Krebill |
| Standard: FCC 15.249/FCC 15b | Class: B |

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz
 Power source connected to AC Mains





EMC Test Data

| | | | |
|-----------|---------------------|------------------|-------------------|
| Client: | Systech Corporation | Job Number: | J87687 |
| Product: | SLZW0001 Module | T-Log Number: | T87722 |
| Contact: | Zen Barelka | Account Manager: | Chrsitine Krebill |
| Standard: | FCC 15.249/FCC 15b | Class: | B |

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

| Frequency MHz | Level dB μ V | AC Line | FCC 15.209 | | Detector QP/Ave | Comments |
|------------------|---------------------|------------|------------|--------|--------------------|----------|
| | | | Limit | Margin | | |
| 0.182 | 56.7 | Line 1 | 54.3 | 2.4 | Peak | |
| 0.498 | 51.5 | Line 1 | 46.0 | 5.5 | Peak | |
| 0.500 | 52.1 | Line 1 | 46.0 | 6.1 | Peak | |
| 0.185 | 56.4 | Neutral | 54.2 | 2.2 | Peak | |
| 0.266 | 52.2 | Neutral | 51.2 | 1.0 | Peak | |
| 0.310 | 49.4 | Neutral | 50.1 | -0.7 | Peak | |
| 0.492 | 52.8 | Neutral | 46.1 | 6.7 | Peak | |
| 0.507 | 52.9 | Neutral | 46.0 | 6.9 | Peak | |

Final quasi-peak and average readings

| Frequency MHz | Level dB μ V | AC Line | FCC 15.209 | | Detector QP/Ave | Comments |
|------------------|---------------------|------------|------------|--------|--------------------|-------------|
| | | | Limit | Margin | | |
| 0.507 | 47.0 | Neutral | 56.0 | -9.0 | QP | QP (1.00s) |
| 0.492 | 46.2 | Neutral | 56.1 | -9.9 | QP | QP (1.00s) |
| 0.507 | 35.6 | Neutral | 46.0 | -10.4 | AVG | AVG (0.10s) |
| 0.500 | 44.6 | Line 1 | 56.0 | -11.4 | QP | QP (1.00s) |
| 0.498 | 44.2 | Line 1 | 56.0 | -11.8 | QP | QP (1.00s) |
| 0.492 | 33.6 | Neutral | 46.1 | -12.5 | AVG | AVG (0.10s) |
| 0.500 | 32.2 | Line 1 | 46.0 | -13.8 | AVG | AVG (0.10s) |
| 0.498 | 31.9 | Line 1 | 46.0 | -14.1 | AVG | AVG (0.10s) |
| 0.185 | 49.3 | Neutral | 64.3 | -15.0 | QP | QP (1.00s) |
| 0.182 | 49.2 | Line 1 | 64.4 | -15.2 | QP | QP (1.00s) |
| 0.266 | 43.5 | Neutral | 61.2 | -17.7 | QP | QP (1.00s) |
| 0.310 | 42.1 | Neutral | 60.0 | -17.9 | QP | QP (1.00s) |
| 0.310 | 31.7 | Neutral | 50.0 | -18.3 | AVG | AVG (0.10s) |
| 0.185 | 35.9 | Neutral | 54.3 | -18.4 | AVG | AVG (0.10s) |
| 0.182 | 34.6 | Line 1 | 54.4 | -19.8 | AVG | AVG (0.10s) |
| 0.266 | 30.7 | Neutral | 51.2 | -20.5 | AVG | AVG (0.10s) |

End of Report

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