

TEST REPORT

Report Number: 3056844.011
Project Number: 3056844
May 11, 2004


Testing performed on the
MFR based Reader Evaluation Kit
Model: S4110R
P/n: 001
FCC ID: A92S4110R
to

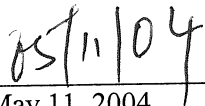
FCC part 15.225

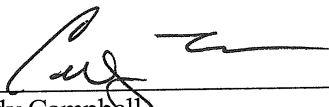
For
Texas Instruments RFID
6550 Chase Oaks Blvd.
Plano, TX 75023

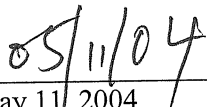
Test Performed at:
Intertek Testing Services, NA. Inc.
420 N Dorothy Drive
Richardson, TX 75081

Test Authorized by:
Texas Instruments RFID
6550 Chase Oaks Blvd.
Plano, TX 75023

Tested/Prepared by: 
Sudesh Kamble
EMC Team Leader

Date: 
May 11, 2004

Reviewed by: 
Candy Campbell
Compliance Investigator

Date: 
May 11, 2004

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1.0 Summary of Tests

| TEST | REFERENCE | RESULT |
|-------------------------------------|----------------------|---|
| Field Strength of Fundamental | 15.225(a) | Complies |
| Radiated Emissions outside the band | 15.225(b), 15.209 | Complies |
| Frequency tolerance of the carrier | 15.225(c) | Complies |
| Line Conducted Emissions | 15.207 | Complies |
| Antenna requirement | 15.203 | Not Applicable. The antenna is permanently connected to the transmitter |

2.0 General Description

2.1 Product Description

A92S4110R is MFR Evaluation kit used as RFID reader.

Overview of the EUT

| | |
|-------------------------------------|--|
| Applicant name & address | Texas Instruments RFID 6550 Chase Oaks Blvd. Plano, TX 75023 |
| Contact info | Mr. Steve Lazar |
| Model No. Part No. | Model No: S4110R Part No: 001 |
| FCC Identifier | A92S4110R |
| Operating Frequency | 13.560 MHz & 134.4 kHz |
| Number of Channels | 1 channel |
| Operating Temperature | -20 ⁰ C to +70 ⁰ C |
| Antenna | Integral antenna, loop type, |

A prototype version of the S4110R was received on April 1, 2004 in good operating condition. As declared by the Applicant, it is identical to production units.

2.2 Related Submittal(s) Grants

This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application.

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All measurements were performed in 3meters FCC accredited Anechoic Chamber. The site attenuation of the chamber is performed as per the procedure detailed in ANSI C63.4-1992-Alternate Test Site and is within the specified tolerance. For each scan, the procedure for maximizing emissions in Appendices D and E were followed.

The chamber contains a 2.5-meter diameter turntable for floor standing equipment, and a wooden table measuring 1 x 1.5 x 0.8 meters for table-top equipment to facilitate testing, also it has heat and air conditioning systems to control environmental test conditions.

Measurements from 9 kHz to 30 MHz are taken with Loop antenna, measurements from 30MHz to 1GHz are taken with Biconilog antenna and measurement above 1GHz was taken by Horn antenna. The mast to support the antennas is capable of a 1 meter to 4-meter height range, which meets CISPR and FCC requirements. The antenna mast is non-conductive and remotely controllable. The height of antenna and azimuth of the equipment was varied to obtain the maximum radiation during the measurement.

Since radiated emissions, and to a lesser extent, conducted emissions, are functions of cable placement, the cable placement is varied to encompass all configurations that an end user would encounter to determine the configuration resulting in maximum emissions. At least one cable for each I/O port type is attached to the EUT. If peripherals or modules are available, at least one of each available type is installed and noted in the report. Generally, only one of each type is used unless good engineering judgment dictates that the use of more will affect emission levels. Excess cable lengths are arranged into a 30 x 40-cm bundle. Cables requiring non-standard lead dress are recorded in the report.

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the EUT's emissions meet the average limit as measured with the quasi-peak detector.

The Test facility is registered with FCC under Registration # 101578.

3.0 System Test Configuration

3.1 Support Equipment and description

System Support Equipment

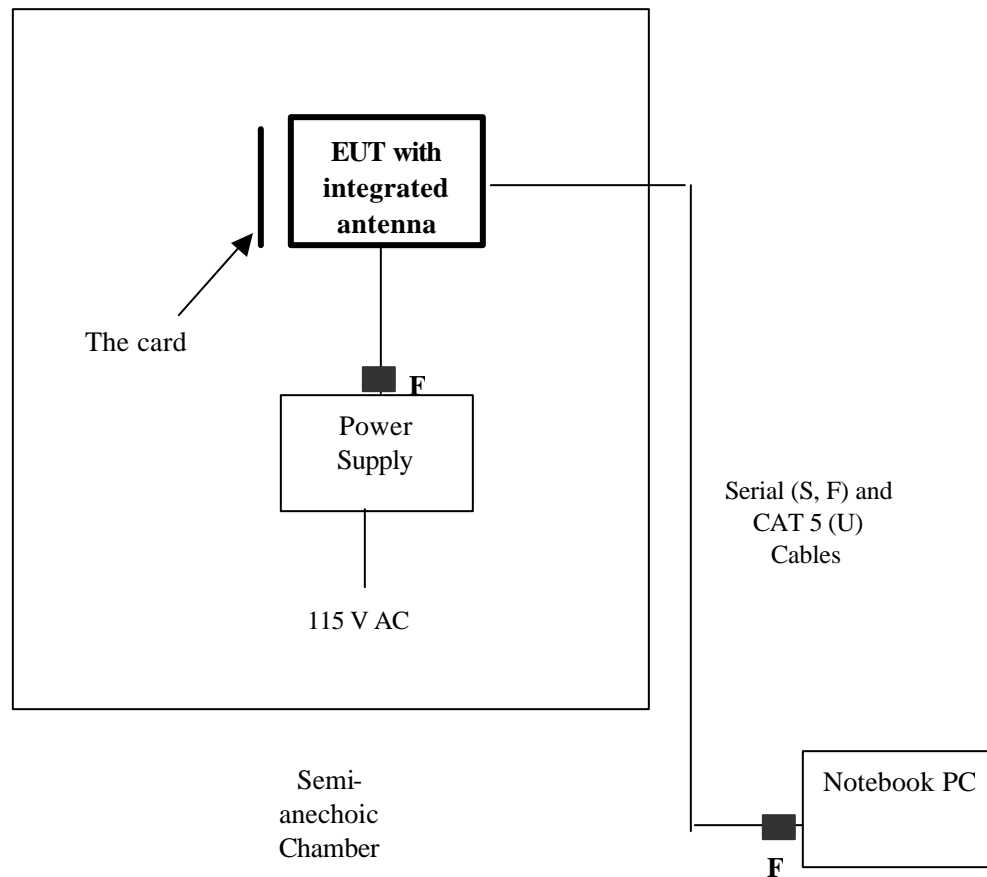
| Description | Manufacturer | Model Number | Serial Number |
|--------------|----------------|---|---------------|
| Power supply | Globetek, Inc. | GT-21089-1509-T3 (p/n: TR9CD1700LCP-Y) | 00243349/03 |
| Notebook PC | Compaq | Armada 7400 | --- |

Cables Associated with EUT

| Description | Length | Shielding | Ferrites | Connection | |
|----------------------------------|-------------------|-----------|------------------|---------------------|--------------------|
| | | | | From | To |
| CAT 5 | 36'' | No | No | EUT | Notebook PC |
| Serial Port DB 9 connector Cable | 44'' | Yes | Yes ¹ | EUT | Notebook PC |
| DC Power Cable | 50'' | No | Yes ² | Power Supply Output | EUT |
| AC power Cable | 18'' ³ | No | No | Mains Supply Source | Power Supply Input |

- Notes:
1. Two turns on ferrite (Ferrite Corp p/n: 0431167281) provided at computer end (4'' from the serial port end) of the serial cable.
 2. Two turns on ferrite (Ferrite Corp p/n: 0431167281) provided at power supply DC output cable (2'' from the power supply body).
 3. AC power cable length was reduced to meet the requirements of radiated emissions; only 18'' cable must be used with the product to comply FCC 15.225 emission requirements.

3.2 Block Diagram of Test Setup



| | |
|-----------------------|-------------------------|
| S = Shielded | F = With Ferrite |
| U = Unshielded | m = Meter |

3.3 Justification

For emission testing, the test procedures, as described in American National Standards Institute C63.4-1992, were employed. The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it).

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. The signal is maximized through rotation and placement in the three orthogonal axes. During testing, all cables were manipulated to produce worst-case emissions.

If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT was wired to transmit full power. Care was taken to ensure proper power supply voltages during testing.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

3.5 Mode of operation during test

For radiated and AC line conducted emission tests, the EUT was setup to transmit continuously in self-test mode (worst case emissions). For the occupied bandwidth and out-of-band conducted emission tests, the EUT was setup to transmit in normal operation mode.

3.6 Modifications required for Compliance

Following modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance (Please note that this does not include changes made specifically by Texas Instruments prior to compliance testing).

- i. Two turns on ferrite (Ferrite Corp p/n: 0431167281) provided at computer end (4" from the serial port end) of the serial cable.
- ii. Two turns on ferrite (Ferrite Corp p/n: 0431167281) provided at power supply DC output cable (2" from the power supply body).
- iii. AC power cable length was reduced to meet the requirements of radiated emissions; only 18" cable must be used with the product to comply FCC 15.225 emission requirements.

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

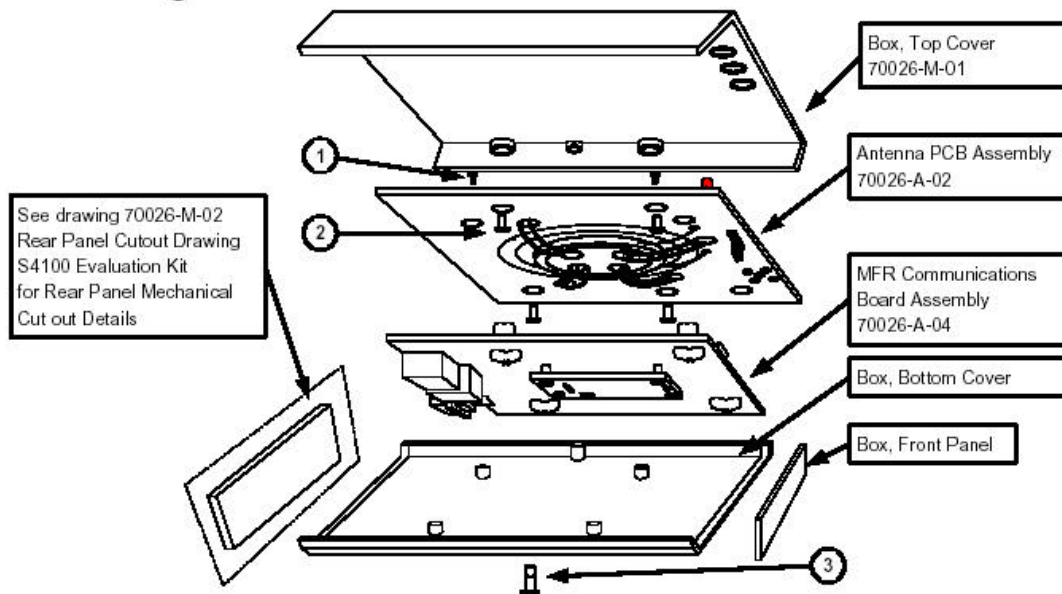
3.8 Test Configurations/Variations in Product.

The product is assembled and tested in two configurations: Box Configuration and SDK Configuration
 The Box and SDK configurations are identical in manufacturing operation and parts list except the antenna location.
 The antenna is located over control PCB in Box configuration as shown in fig. 1

Fig.1 S4110R MFR Evaluation Kit “Box” Configuration

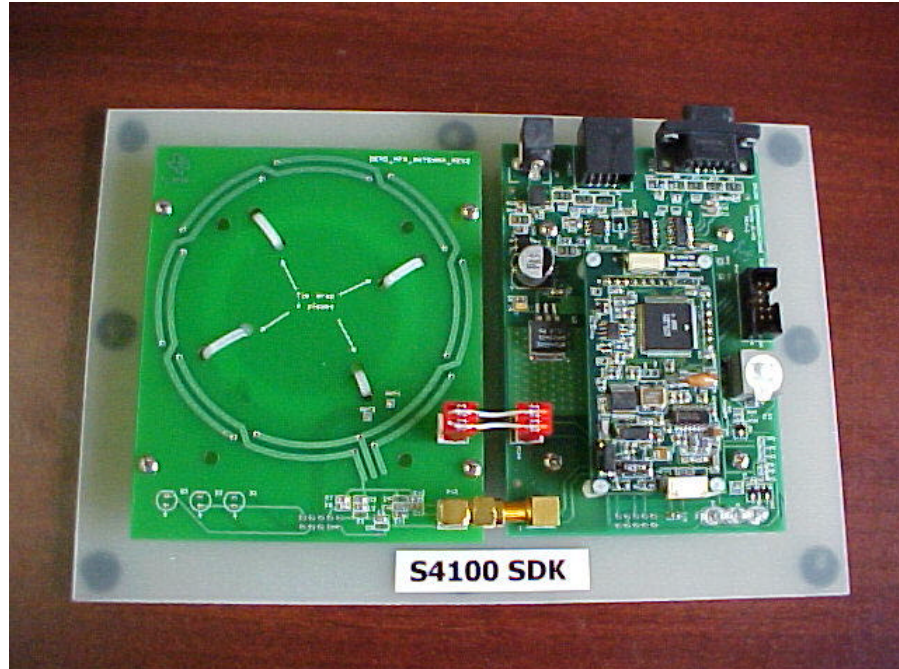


Box Configuration



The antenna is located on side of control PCB in SDK configuration as shown in fig. 2

Fig.2 S4110R MFR Evaluation Kit “SDK” Configuration



4.0 Measurement Results

4.1 Transmitter Radiated Emissions FCC Rules 15.225, 15.209

Requirements

The Field Strength of emissions at fundamental frequency shall not exceed 84 dB ($\mu\text{V}/\text{m}$) at 30m, Emissions radiated outside of the specified frequency band shall not exceed the general radiated emission limits in 15.209.

Procedure

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Radiated emission measurements were performed from 10 MHz to 1 GHz.
Analyzer resolution is:

9 kHz or greater for frequencies 30 MHz and below
100 kHz or greater for frequencies 1000 MHz and below,
For those frequencies quasi-peak value was measured.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in dB ($\mu\text{V}/\text{m}$)

RA = Receiver Amplitude (including preamplifier) in dB (μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

AG = Amplifier Gain in dB

Test Result

The data below shows the significant emission frequencies, the limit and the margin of compliance.

Table 1: Radiated emissions at fundamental frequency

| Configuration Model | Frequency MHz | Antenna Polarization H/V | SA** Reading at 10m dB(uV) | Distance Correct. Factor dB | FS at 30 m dB(uV/m) | FS Limit at 30m dB(uV/m) | Margin dB |
|---------------------|------------------|-----------------------------|-------------------------------------|--------------------------------------|---------------------------|-----------------------------------|--------------|
| BOX | 13.560 | -- | 48.90 | -20.0 | 28.90 | 84.0 | -55.10 |
| SDK | 13.560 | -- | 46.99 | -20.0 | 26.99 | 84.0 | -57.01 |

| Configuration Model | Frequency kHz | Antenna Polarization H/V | SA** Reading at 3m dB(uV) | Distance Correct. Factor dB | FS at 300m dB(uV/m) | FS Limit at 300m dB(uV/m) | Margin dB |
|---------------------|------------------|-----------------------------|------------------------------------|--------------------------------------|---------------------------|------------------------------------|--------------|
| BOX | 134.00 | -- | 69.20 | -80.0 | -10.20 | 25 | -35.20 |
| SDK | 134.00 | -- | 68.85 | -80.0 | -11.15 | 25 | -36.15 |

FS – Field Strength

FS was measured with loop antenna

** : Denotes the corrected reading with Antenna Factor and Cable Loss.

Table 2: Spurious Radiated emissions below 30 MHz

| Configuration Model | Frequency MHz | Antenna Polarization H/V | SA** Reading At 10m dB(uV) | Distance Correct. Factor dB | FS at 30 m dB(uV/m) | FS Limit at 30m dB(uV/m) | Margin dB |
|---------------------|------------------|-----------------------------|-------------------------------------|--------------------------------------|---------------------------|-----------------------------------|--------------|
| BOX | 27.122 | -- | 28.27 | -20.0 | 08.27 | 30 | -21.73 |
| SDK | 27.122 | -- | 27.72 | -20.00 | 07.72 | 30 | -22.28 |

| Configuration Model | Frequency kHz | Antenna Polarization H/V | SA** Reading at 3m dB(uV) | Distance Correct. Factor dB | FS at 300m dB(uV/m) | FS Limit at 300m dB(uV/m) | Margin dB |
|---------------------|------------------|-----------------------------|------------------------------------|--------------------------------------|---------------------------|------------------------------------|--------------|
| BOX | 168.00 | -- | 68.53 | -80.0 | -11.45 | 18 | -29.45 |
| SDK | 268.00 | -- | 67.93 | -80.0 | -12.07 | 18 | -30.07 |

** : Denotes the corrected reading with Antenna Factor and Cable Loss.

All other emissions not reported are noise floor, which is at least 20 dB below the limit.

Table 3: Out of band emissions below 30 MHz (Measured at band edge & fundamental frequencies)
BOX Configuration

| Frequency MHz | SA** Reading at 10 m dB(uV) | Distance Correct. Factor dB | FS at 30 m dB(uV/m) | FS Limit at 30m dB(uV/m) | Margin dB |
|------------------|--------------------------------------|--------------------------------------|---------------------------|-----------------------------------|--------------|
| 13.110 | 16.74 | -20.00 | -3.26 | 40.50 | -43.76 |
| 13.410 | 16.95 | -20.00 | -3.05 | 40.50 | -43.55 |
| 13.553 | 36.83 | -20.00 | 16.83 | 50.50 | -33.67 |
| 13.560 | 48.90 | -20.00 | 28.90 | 84.00 | -55.10 |
| 13.567 | 42.84 | -20.00 | 22.84 | 50.50 | -27.66 |
| 13.710 | 31.20 | -20.00 | 11.20 | 50.50 | -39.30 |
| 14.010 | 18.00 | -20.00 | -2.00 | 40.50 | -42.50 |
| 13.720 | 32.01 | -20.00 | 12.01 | 30.50 | -18.49 |
| 13.556 | 44.19 | -20.00 | 24.19 | 74.00 | -49.81 |
| 27.122 | 28.27 | -20.00 | 8.27 | 40.50 | -32.23 |
| 18.364 | 34.66 | -20.00 | 14.66 | 40.50 | -25.84 |
| 14.438 | 12.99 | -20.00 | -7.01 | 40.50 | -47.51 |
| 13.562 | 47.91 | -20.00 | 27.91 | 84.00 | -56.09 |
| 13.412 | 16.17 | -20.00 | -3.83 | 50.50 | -54.33 |
| 13.356 | 16.06 | -20.00 | -3.94 | 40.50 | -44.44 |
| 13.568 | 39.09 | -20.00 | 19.09 | 50.50 | -31.41 |
| 13.562 | 47.82 | -20.00 | 27.82 | 84.00 | -56.18 |
| 13.552 | 34.20 | -20.00 | 14.20 | 50.50 | -36.30 |
| 13.568 | 36.95 | -20.00 | 16.95 | 50.50 | -33.55 |
| 13.567 | 37.29 | -20.00 | 17.29 | 50.50 | -33.21 |
| 13.553 | 36.90 | -20.00 | 16.90 | 50.50 | -33.60 |
| 13.568 | 37.88 | -20.00 | 17.88 | 50.50 | -32.62 |
| 18.244 | 29.30 | -20.00 | 9.30 | 40.50 | -31.20 |

The emissions on the band-edge frequencies are more than 20 dB below the level on fundamental frequency.

** : Denotes the corrected reading with Antenna Factor and Cable Loss.

All other emissions not reported are noise floor, which is at least 20 dB below the limit.

Table 4: Out of band emissions below 30 MHz (Measured at band edge & fundamental frequencies)
SDK Configuration

| Frequency MHz | SA** Reading at 10 m dB(uV) | Distance Correct. Factor dB | FS at 30 m dB(uV/m) | FS Limit at 30m dB(uV/m) | Margin dB |
|------------------|--------------------------------------|--------------------------------------|---------------------------|-----------------------------------|--------------|
| 13.110 | 18.00 | -20.00 | -2.00 | 40.50 | -42.50 |
| 13.410 | 16.17 | -20.00 | -3.83 | 40.50 | -44.33 |
| 13.553 | 35.91 | -20.00 | 15.91 | 50.50 | -34.59 |
| 13.560 | 46.99 | -20.00 | 26.99 | 84.00 | -57.01 |
| 13.567 | 35.27 | -20.00 | 15.27 | 50.50 | -35.23 |
| 13.710 | 32.05 | -20.00 | 12.05 | 50.50 | -38.45 |
| 14.010 | 18.63 | -20.00 | -1.37 | 40.50 | -41.87 |
| 13.720 | 34.01 | -20.00 | 14.01 | 30.50 | -16.49 |
| 13.556 | 42.23 | -20.00 | 22.23 | 74.00 | -51.77 |
| 27.122 | 27.72 | -20.00 | 7.72 | 40.50 | -32.78 |
| 18.364 | 32.00 | -20.00 | 12.00 | 40.50 | -28.50 |
| 14.438 | 13.51 | -20.00 | -6.49 | 40.50 | -46.99 |
| 13.562 | 46.56 | -20.00 | 26.56 | 84.00 | -57.44 |
| 13.412 | 16.95 | -20.00 | -3.05 | 50.50 | -53.55 |
| 13.356 | 16.06 | -20.00 | -3.94 | 40.50 | -44.44 |
| 13.568 | 35.56 | -20.00 | 15.56 | 50.50 | -34.94 |
| 13.562 | 45.53 | -20.00 | 25.53 | 84.00 | -58.47 |
| 13.552 | 32.80 | -20.00 | 12.80 | 50.50 | -37.70 |
| 13.568 | 34.61 | -20.00 | 14.61 | 50.50 | -35.89 |
| 13.567 | 34.64 | -20.00 | 14.64 | 50.50 | -35.86 |
| 13.553 | 34.81 | -20.00 | 14.81 | 50.50 | -35.69 |
| 13.568 | 33.36 | -20.00 | 13.36 | 50.50 | -37.14 |
| 18.244 | 16.70 | -20.00 | -3.30 | 40.50 | -43.80 |

The emissions on the band-edge frequencies are more than 20 dB below the level on fundamental frequency.

** : Denotes the corrected reading with Antenna Factor and Cable Loss.

All other emissions not reported are noise floor, which is at least 20 dB below the limit.

Date: 05/03/04
 Company: Texas Instruments
 Equipment: MFR based Reader Evaluation Kit Model: S4110R
 Test Engineer: Sudesh Kamble
 Test Standard: FCC 15.209
 Note: The table shows the worst-case radiated emissions.

Table 5: Spurious Radiated emissions (Quasi-peak Reading)
 BOX Configuration

| Frequency MHz | Antenna Polarization H/V | Antenna Height/Azimuth | Detector P/Q-P | FS** at 3m dB(μV/m) | FS Limit at 3m dB(μV/m) | Margin dB |
|------------------|--------------------------------|---------------------------|-------------------|---------------------------|----------------------------------|--------------|
| 40.68 | V | 1.0/-19 | Q-P | 36.52 | 40 | -3.48 |
| 67.80 | V | 1.0/8 | Q-P | 30.92 | 40 | -9.08 |
| 81.36 | V | 1.0/-165 | Q-P | 31.26 | 40 | -8.74 |
| 94.92 | V | 1.0/180 | Q-P | 28.36 | 44 | -15.64 |
| 108.48 | V | 1.0/-165 | Q-P | 39.00 | 44 | -5.00 |
| 108.48 | V | 1.0/-55 | Q-P | 38.46 | 44 | -5.54 |
| 122.04 | V | 1.0/-139 | Q-P | 30.62 | 44 | -13.38 |
| 135.60 | V | 1.0/98 | Q-P | 31.07 | 44 | -12.93 |
| 149.16 | V | 1.0/98 | Q-P | 31.20 | 44 | -12.80 |
| 40.68 | H | 2.07/70 | Q-P | 29.40 | 40 | -10.60 |
| 67.80 | H | 2.3/113 | Q-P | 32.50 | 40 | -7.50 |
| 81.36 | H | 2.3/110 | Q-P | 31.01 | 40 | -8.99 |
| 94.92 | H | 1.9/92 | Q-P | 36.15 | 44 | -7.85 |
| 108.48 | H | 2.2/120 | Q-P | 36.21 | 44 | -7.79 |
| 108.48 | V | 1.0/62 | Q-P | 36.53 | 44 | -7.47 |

FS = Field Strength

P = Peak

Q-P = Quasi-Peak

** : Corrected radiated emission limits with Antenna factor and Cable loss.

The EUT passed the test by 3.5 dB

Date: 05/03/04
 Company: Texas Instruments
 Equipment: MFR based Reader Evaluation Kit Model: S4110R
 Test Engineer: Sudesh Kamble
 Test Standard: FCC 15.209
 Note: The table shows the worst-case radiated emissions.

Table 6: Spurious Radiated emissions (Quasi-peak Reading)
 SDK Configuration

| Frequency MHz | Antenna Polarization H/V | Antenna Height/Azimuth | Detector P/Q-P | FS** at 3m dB(μV/m) | FS Limit at 3m dB(μV/m) | Margin dB |
|------------------|--------------------------------|---------------------------|-------------------|---------------------------|----------------------------------|--------------|
| 135.60 | V | 1.0/180/0 | Q-P | 38.53 | 44 | -5.47 |
| 122.04 | V | 1.0/0 | Q-P | 32.80 | 44 | -11.20 |
| 108.48 | V | 1.0/0 | Q-P | 31.30 | 44 | -12.70 |
| 94.92 | V | 1.0/0 | Q-P | 40.63 | 44 | -3.37 |
| 81.36 | V | 1.0/0 | Q-P | 32.20 | 40 | -7.80 |
| 67.80 | V | 1.0/0 | Q-P | 32.29 | 40 | -7.71 |
| 40.68 | V | 1.0/0 | Q-P | 35.51 | 40 | -4.49 |
| 40.68 | H | 2.0/153 | Q-P | 28.05 | 40 | -11.95 |
| 67.80 | H | 1.8/78 | Q-P | 28.30 | 40 | -11.70 |
| 81.36 | H | 1.8/80 | Q-P | 28.65 | 40 | -11.35 |
| 94.92 | H | 1.9/82 | Q-P | 33.04 | 44 | -10.96 |
| 108.48 | H | 2.0/89 | Q-P | 32.57 | 44 | -11.43 |
| 122.04 | H | 1.7/90 | Q-P | 29.92 | 44 | -14.08 |
| 135.60 | H | 1.65/90 | Q-P | 33.12 | 44 | -10.88 |
| 311.88 | H | 1.0/0 | Q-P | 38.92 | 46 | -7.08 |
| 325.44 | H | 1.0/0 | Q-P | 36.37 | 46 | -9.63 |
| 339.00 | H | 1.0/0 | Q-P | 38.09 | 46 | -7.91 |

FS = Field Strength

P = Peak

Q-P = Quasi-Peak

** : Corrected radiated emission limits with Antenna factor and Cable loss.

The EUT passed the test by 4 dB

4.2 AC Line Conducted Emission
FCC Rule 15.207

AC line conducted emission test was performed according the ANSI C63.4 standard. The EUT was connected to DC Power Supply, which was connected to AC Line through the LISN.

A complete scan from 150 kHz - 30 MHz was made according to the FCC 02-157 (ET Docket 98-80).

A complete scan from 150 kHz - 30 MHz was made according to the FCC 02-157 (ET Docket 98-80). As emissions at the fundamental frequency of 13.560 was exceeding the limits, the Conducted emission measurements were preformed in two configurations:

Configuration 1: Normal-operating Conditions with Antenna connected to the device.
(Please refer Table 7, 8, 11 and 12 for the results)

Configuration 2: Normal-operating Conditions with Antenna disconnected to the device and the Substituted with equivalent resistive load (50 Ohm).
(Please refer Table 9, 10, 13 and 14 for the results)

From the measurement results it was inferred that the fundamental frequency emissions at 13.560 MHz are coupling through air on the port under measurement and is not conducted through the power cord conductively.

Conducted Emissions (BOX configuration with antenna)

Date: 05/03/04
 Company: Texas Instruments
 Equipment: MFR based Reader Evaluation Kit Model: S4110R
 Test Engineer: Sudesh Kamble
 Test Standard: FCC 15.207

Note: The table shows the worst-case conducted emissions.

Table 7: Line 1

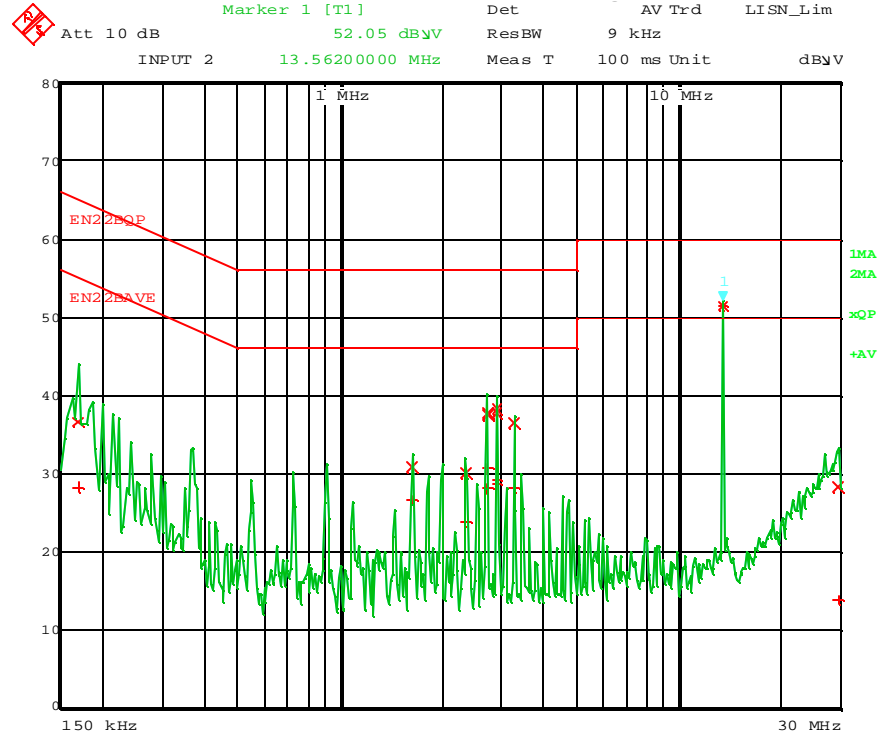
| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.17 | 36.47 | 64.96 | -28.49 | 28.15 | 54.96 | -26.81 |
| 1.64 | 30.70 | 56.00 | -25.30 | 26.52 | 46.00 | -19.48 |
| 2.36 | 29.83 | 56.00 | -26.17 | 23.73 | 46.00 | -22.27 |
| 2.73 | 37.74 | 56.00 | -18.26 | 30.53 | 46.00 | -15.47 |
| 2.73 | 37.37 | 56.00 | -18.63 | 27.82 | 46.00 | -18.18 |
| 2.91 | 38.10 | 56.00 | -17.90 | 29.12 | 46.00 | -16.88 |
| 2.91 | 37.68 | 56.00 | -18.32 | 28.47 | 46.00 | -17.53 |
| 3.27 | 36.33 | 56.00 | -19.67 | 28.01 | 46.00 | -17.99 |
| 13.56 | 51.36 | 60.00 | -8.64 | 51.32 | 50.00 | 1.32 |
| 29.99 | 28.17 | 60.00 | -31.83 | 13.66 | 50.00 | -36.34 |

Table 8: Line 2

| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.17 | 36.04 | 64.96 | -28.92 | 25.64 | 54.96 | -29.32 |
| 0.22 | 29.45 | 62.74 | -33.30 | 18.83 | 52.74 | -33.91 |
| 1.64 | 28.28 | 56.00 | -27.72 | 24.76 | 46.00 | -21.24 |
| 2.00 | 27.93 | 56.00 | -28.07 | 22.57 | 46.00 | -23.43 |
| 2.73 | 30.94 | 56.00 | -25.06 | 23.70 | 46.00 | -22.30 |
| 2.91 | 33.62 | 56.00 | -22.38 | 24.17 | 46.00 | -21.83 |
| 13.56 | 53.40 | 60.00 | -6.60 | 53.36 | 50.00 | 3.36 |
| 29.48 | 28.11 | 60.00 | -31.89 | 12.93 | 50.00 | -37.07 |
| 29.96 | 28.75 | 60.00 | -31.25 | 15.31 | 50.00 | -34.69 |
| 29.99 | 28.58 | 60.00 | -31.42 | 13.45 | 50.00 | -36.55 |

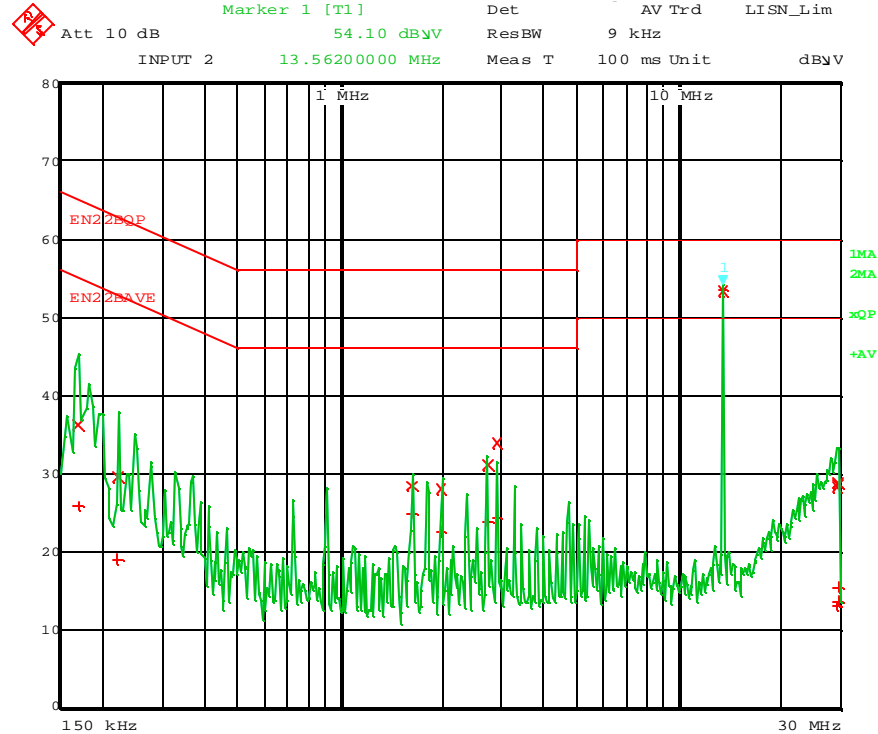
420 N Dorothy Drive, Richardson, TX 75081 Ph: (972) 238-5591 Fax: (972) 238-1860

Graph 1: Conducted Emission Line 1 (BOX configuration with antenna)



Date: 3.MAY.2004 13:25:55

Graph 2: Conducted Emission Line 2 (BOX configuration with antenna)



Date: 3.MAY.2004 13:28:04

Conducted Emissions (BOX configuration with antenna replaced by 50 ohm resistor)

Date: 05/03/04
 Company: Texas Instruments
 Equipment: MFR based Reader Evaluation Kit Model: S4110R
 Test Engineer: Sudesh Kamble
 Test Standard: FCC 15.207

Note: The table shows the worst-case conducted emissions.

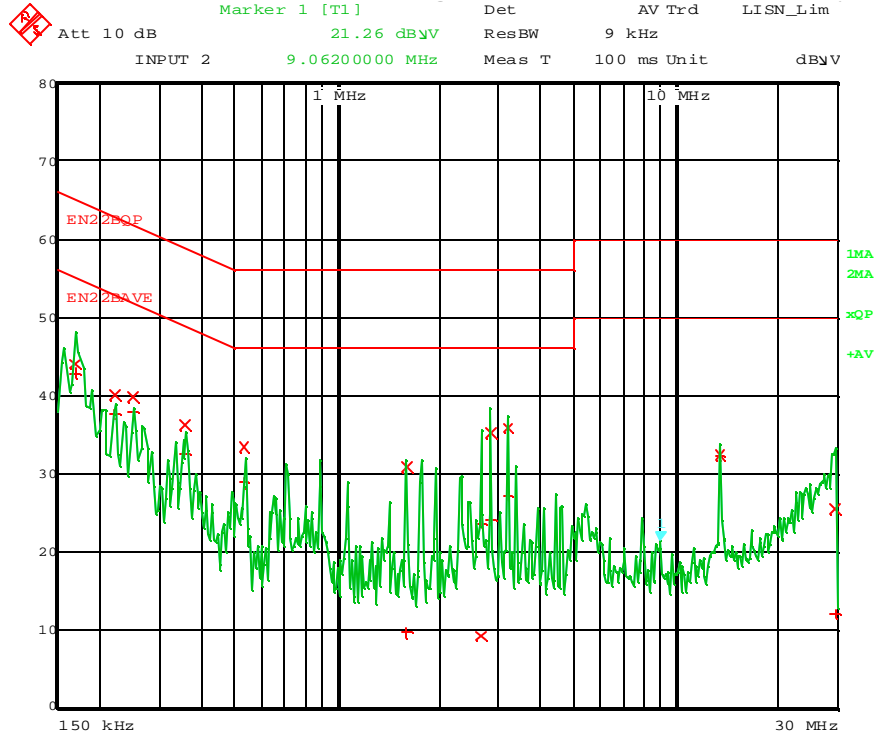
Table 9: Line 1

| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.17 | 43.89 | 64.96 | -21.07 | 42.76 | 54.96 | -12.20 |
| 0.22 | 39.95 | 62.74 | -22.80 | 37.44 | 52.74 | -15.31 |
| 0.25 | 39.72 | 61.76 | -22.04 | 37.76 | 51.76 | -14.00 |
| 0.36 | 36.18 | 58.77 | -22.60 | 32.49 | 48.77 | -16.28 |
| 0.53 | 33.21 | 56.00 | -22.79 | 28.73 | 46.00 | -17.27 |
| 1.60 | 30.70 | 56.00 | -25.30 | 9.57 | 46.00 | -36.43 |
| 2.67 | 9.19 | 56.00 | -46.81 | 23.53 | 46.00 | -22.47 |
| 2.85 | 35.00 | 56.00 | -21.00 | 23.82 | 46.00 | -22.18 |
| 3.21 | 35.71 | 56.00 | -20.29 | 27.10 | 46.00 | -18.90 |
| 13.56 | 32.38 | 60.00 | -27.62 | 32.02 | 50.00 | -17.98 |

Table 10: Line 2

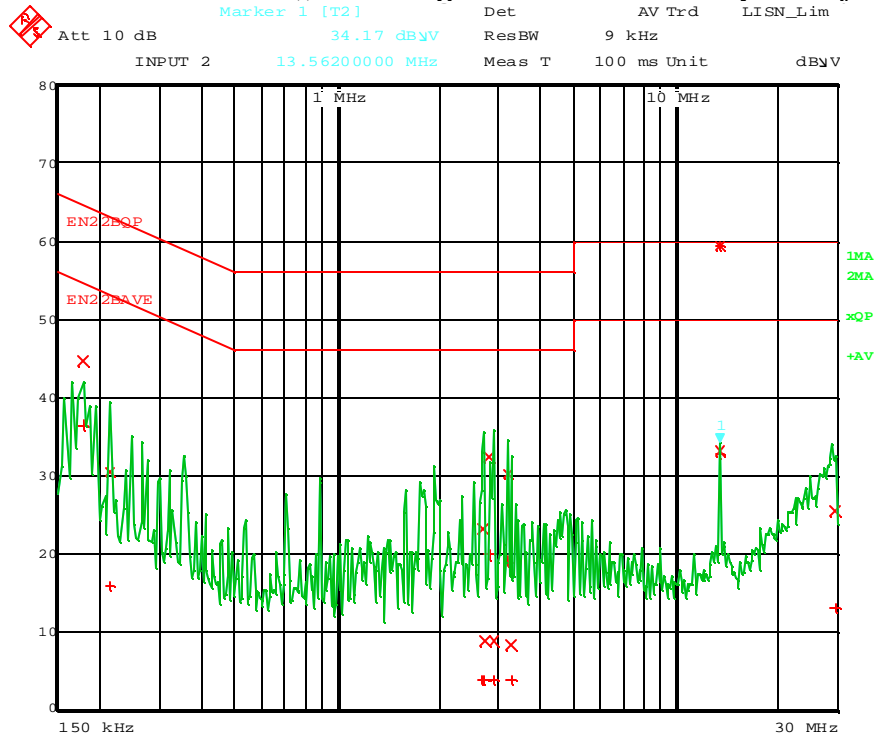
| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.18 | 44.54 | 64.58 | -20.03 | 36.36 | 54.58 | -18.22 |
| 0.21 | 30.28 | 63.05 | -32.77 | 15.77 | 53.05 | -37.28 |
| 2.71 | 23.17 | 56.00 | -32.83 | 3.72 | 46.00 | -42.28 |
| 2.73 | 8.66 | 56.00 | -47.34 | 3.71 | 46.00 | -42.29 |
| 2.84 | 32.36 | 56.00 | -23.64 | 19.62 | 46.00 | -26.38 |
| 2.91 | 8.66 | 56.00 | -47.34 | 3.70 | 46.00 | -42.30 |
| 3.19 | 30.11 | 56.00 | -25.89 | 18.96 | 46.00 | -27.04 |
| 3.27 | 8.10 | 56.00 | -47.90 | 3.64 | 46.00 | -42.36 |
| 13.56 | 33.03 | 60.00 | -26.97 | 32.79 | 50.00 | -17.21 |
| 29.99 | 25.39 | 60.00 | -34.61 | 12.99 | 50.00 | -37.01 |

Graph 3: Conducted Emission Line 1 (BOX configuration with antenna replaced by 50 ohm resistor)



Date: 3.MAY.2004 13:36:23

Graph 4: Conducted Emission Line 2 (BOX configuration with antenna replaced by 50 ohm resistor)



Date: 3.MAY.2004 13:32:23

Conducted Emissions (SDK configuration with antenna)

Date: 05/03/04
 Company: Texas Instruments
 Equipment: MFR based Reader Evaluation Kit Model: S4110R
 Test Engineer: Sudesh Kamble
 Test Standard: FCC 15.207

Note: The table shows the worst-case conducted emissions.

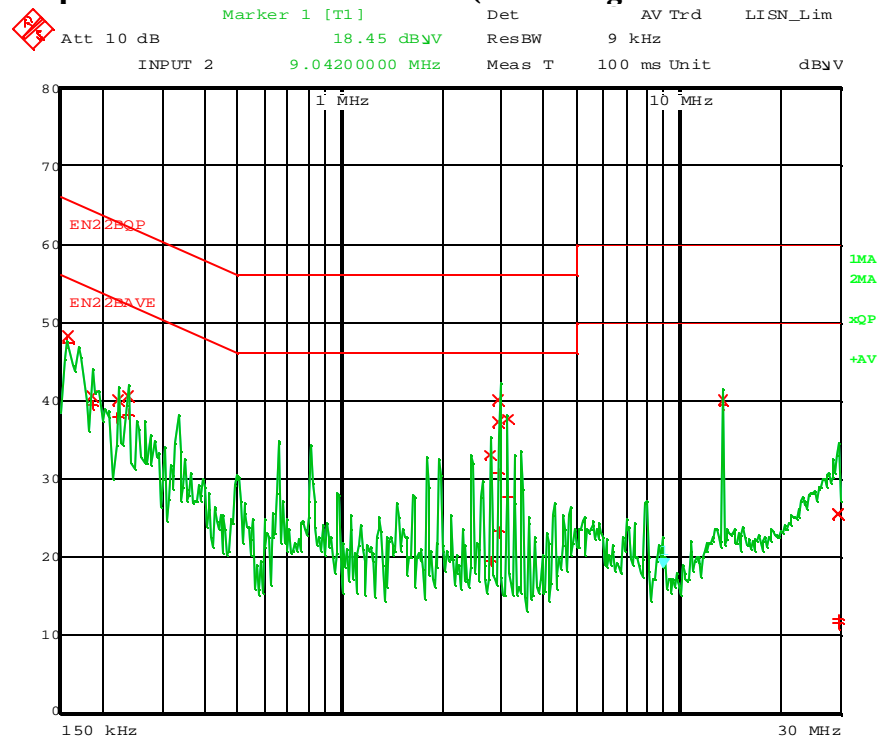
Table 11: Line 1

| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.16 | 48.03 | 65.57 | -17.54 | 47.26 | 55.57 | -8.31 |
| 0.19 | 40.50 | 64.21 | -23.71 | 39.25 | 54.21 | -14.96 |
| 0.22 | 39.96 | 62.74 | -22.78 | 37.73 | 52.74 | -15.02 |
| 0.24 | 40.51 | 62.17 | -21.66 | 38.17 | 52.17 | -14.00 |
| 2.79 | 32.91 | 56.00 | -23.09 | 19.34 | 46.00 | -26.66 |
| 2.95 | 37.13 | 56.00 | -18.87 | 23.20 | 46.00 | -22.80 |
| 2.96 | 39.88 | 56.00 | -16.12 | 30.44 | 46.00 | -15.56 |
| 3.13 | 37.53 | 56.00 | -18.47 | 27.44 | 46.00 | -18.56 |
| 13.56 | 39.86 | 60.00 | -20.14 | 39.31 | 50.00 | -10.69 |
| 29.99 | 25.31 | 60.00 | -34.69 | 11.29 | 50.00 | -38.71 |

Table 12: Line 2

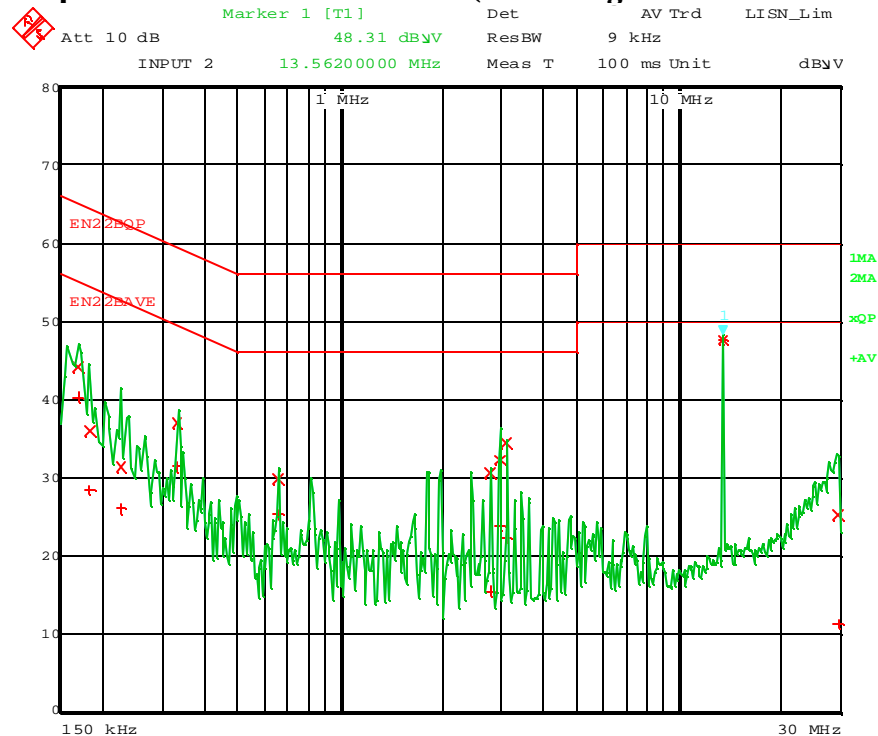
| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.17 | 44.05 | 64.96 | -20.92 | 40.16 | 54.96 | -14.80 |
| 0.18 | 35.98 | 64.39 | -28.41 | 28.25 | 54.39 | -26.14 |
| 0.23 | 31.38 | 62.60 | -31.22 | 25.97 | 52.60 | -26.62 |
| 0.33 | 36.91 | 59.45 | -22.55 | 31.34 | 49.45 | -18.12 |
| 0.66 | 29.65 | 56.00 | -26.35 | 25.05 | 46.00 | -20.95 |
| 2.79 | 30.51 | 56.00 | -25.49 | 15.38 | 46.00 | -30.62 |
| 2.97 | 32.18 | 56.00 | -23.82 | 23.69 | 46.00 | -22.31 |
| 3.12 | 34.35 | 56.00 | -21.65 | 22.09 | 46.00 | -23.91 |
| 13.56 | 47.47 | 60.00 | -12.53 | 47.43 | 50.00 | -2.57 |
| 29.99 | 25.06 | 60.00 | -34.94 | 11.04 | 50.00 | -38.96 |

Graph 5: Conducted Emission Line 1 (SDK configuration with antenna)



Date: 3.MAY.2004 13:42:23

Graph 6: Conducted Emission Line 2 (SDK configuration with antenna)



Date: 3.MAY.2004 13:45:36

Conducted Emissions (SDK configuration with antenna replaced by 50 ohm resistor)

Date: 05/03/04
 Company: Texas Instruments
 Equipment: MFR based Reader Evaluation Kit Model: S4110R
 Test Engineer: Sudesh Kamble
 Test Standard: FCC 15.207

Note: The table shows the worst-case conducted emissions.

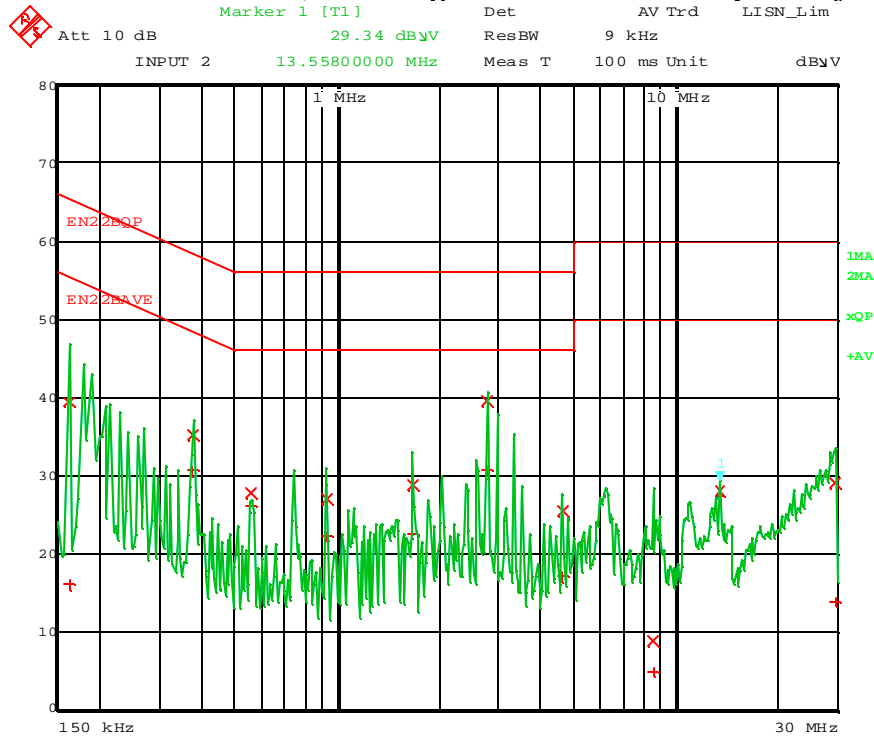
Table 13: Line 1

| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.16 | 39.29 | 65.36 | -26.07 | 16.00 | 55.36 | -39.36 |
| 0.37 | 35.02 | 58.41 | -23.40 | 30.47 | 48.41 | -17.94 |
| 0.56 | 27.69 | 56.00 | -28.31 | 25.94 | 46.00 | -20.06 |
| 0.93 | 26.86 | 56.00 | -29.14 | 22.10 | 46.00 | -23.90 |
| 1.68 | 28.62 | 56.00 | -27.38 | 22.50 | 46.00 | -23.50 |
| 2.78 | 39.56 | 56.00 | -16.44 | 30.59 | 46.00 | -15.41 |
| 4.65 | 25.34 | 56.00 | -30.66 | 17.00 | 46.00 | -29.00 |
| 8.61 | 8.70 | 60.00 | -51.30 | 4.74 | 50.00 | -45.26 |
| 13.56 | 27.93 | 60.00 | -32.07 | 27.28 | 50.00 | -22.72 |
| 29.91 | 28.91 | 60.00 | -31.09 | 13.74 | 50.00 | -36.26 |

Table 14: Line 2

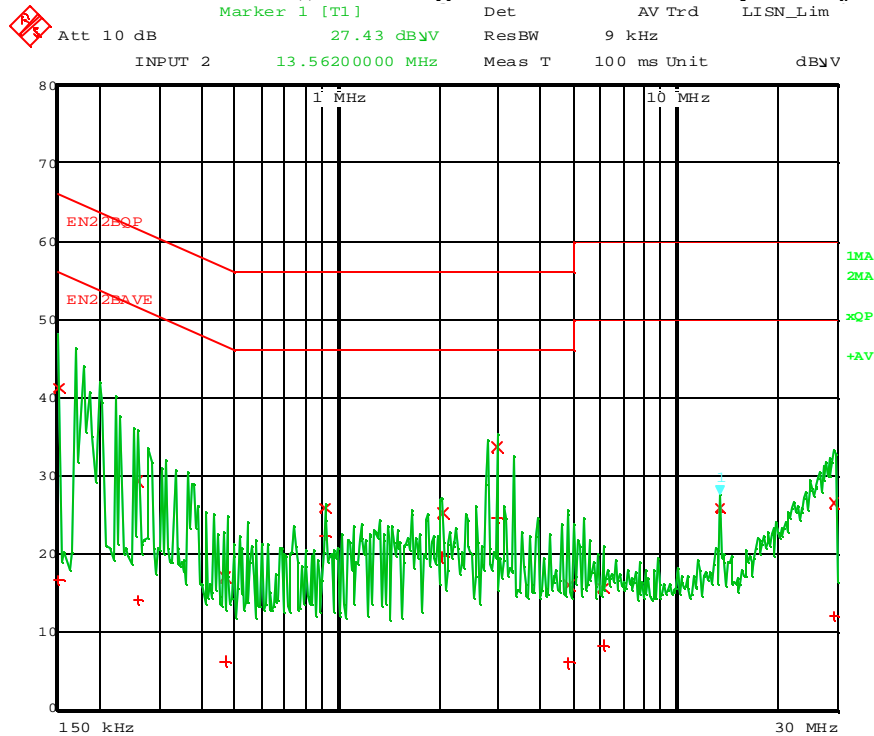
| Frequency MHz | QP Reading dBμV | QP Limit dBμV | QP Margin dBμV | Ave Reading dBμV | Ave Limit dBμV | Ave Margin dBμV |
|---------------|-----------------|---------------|----------------|------------------|----------------|-----------------|
| 0.15 | 41.01 | 66.00 | -24.99 | 16.46 | 56.00 | -39.54 |
| 0.26 | 29.16 | 61.50 | -32.34 | 13.88 | 51.50 | -37.62 |
| 0.47 | 16.97 | 56.51 | -39.54 | 6.11 | 46.51 | -40.41 |
| 0.93 | 25.71 | 56.00 | -30.29 | 22.16 | 46.00 | -23.84 |
| 2.05 | 25.17 | 56.00 | -30.83 | 19.42 | 46.00 | -26.58 |
| 2.97 | 33.43 | 56.00 | -22.57 | 24.51 | 46.00 | -21.49 |
| 4.85 | 15.95 | 56.00 | -40.05 | 5.90 | 46.00 | -40.10 |
| 6.13 | 15.48 | 60.00 | -44.52 | 8.08 | 50.00 | -41.92 |
| 13.56 | 25.76 | 60.00 | -34.24 | 25.06 | 50.00 | -24.94 |
| 29.52 | 26.32 | 60.00 | -33.68 | 11.91 | 50.00 | -38.09 |

Graph 7: Conducted Emission Line 1 (SDK configuration with antenna replaced by 50 ohm resistor)



Date: 5.MAY.2004 09:29:34

Graph 8: Conducted Emission Line 2 (SDK configuration with antenna replaced by 50 ohm resistor)

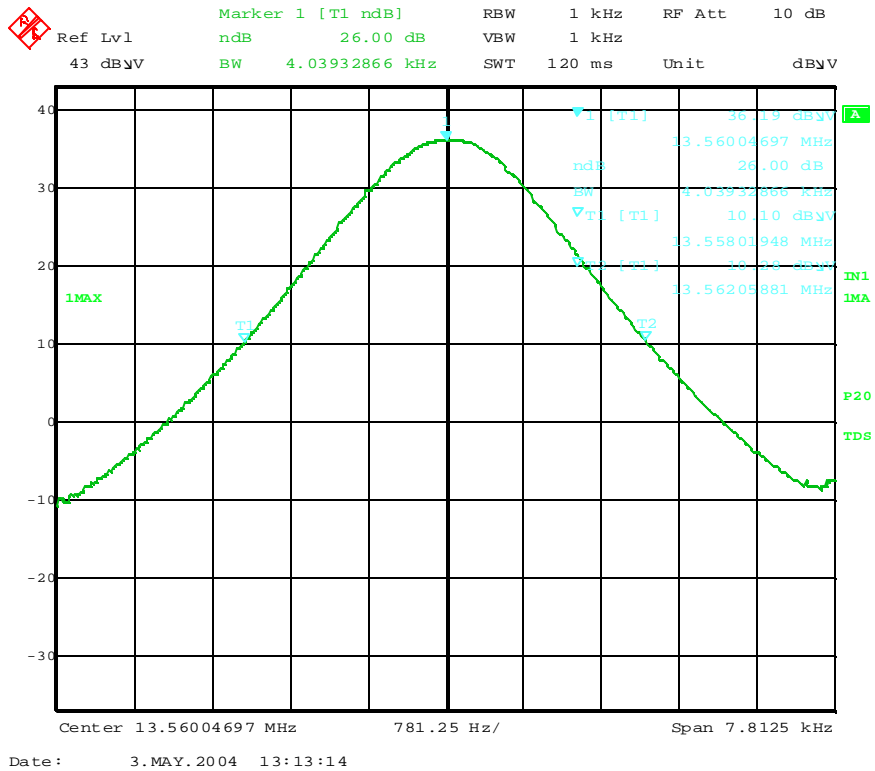


Date: 5.MAY.2004 09:31:16

4.3 Occupied Bandwidth

The EUT was setup to transmit in normal operating condition with continuous transmission for testing purpose. The following plots show the occupied bandwidth.

Graph # 9: 26 dB Bandwidth in In-Band Emission, RBW = 1 kHz



The 26-dB bandwidth is 4.0393 kHz.

5.0 Frequency Tolerance

Requirement

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of $+20^{\circ}\text{C}$.

Procedure

The EUT was placed in the temperature chamber and set to transmit unmodulated carrier. The transmitter was powered from a DC power supply Adapter (Rated 120 VAC Input). The Frequency Counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded. In addition, the carrier frequency was recorded when the power was set to 138 VAC (115% of the maximum specified voltage 120 VAC) and to 97.75 VAC (85% of the minimum specified voltage 120 VAC).

Result

Nominal Frequency: 13.560 092MHz @ 20 deg C.

| Temperature, $^{\circ}\text{C}$ | Measured Frequency, MHz | Measured Frequency, MHz | Measured Frequency, MHz | Maximum difference, Hz |
|---------------------------------|-------------------------|-------------------------|-------------------------|------------------------|
| | 120 VAC | 138 VAC | 97.75 VAC | |
| +50 | 13.560 092 | 13.560 093 | 13.560 089 | -03 |
| +20 | 13.560 120 | 13.560 119 | 13.560 118 | +28 |
| +10 | 13.560 136 | 13.560 135 | 13.560 136 | +44 |
| -20 | 13.560 129 | 13.560 130 | 13.560 129 | +28 |

The frequency tolerance is within $\pm 0.01\%$.

6.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Receivers/Spectrum Analyzers

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|------------|----------|---------|------|
| Agilent Technologies, E7405A, HP EMC System | US40240235 | 11/03 | 11/04 | |
| R&S, ESI07, EMI Receiver | 1088-7490 | 9/03 | 9/04 | X |
| Pacific 140TMX Power Source/Harmonic Analyser | 00724/0248 | 6/03 | 6/04 | X |
| HP 5335A, Universal Frequency Counter | 2044A00559 | 8/03 | 8/04 | X |

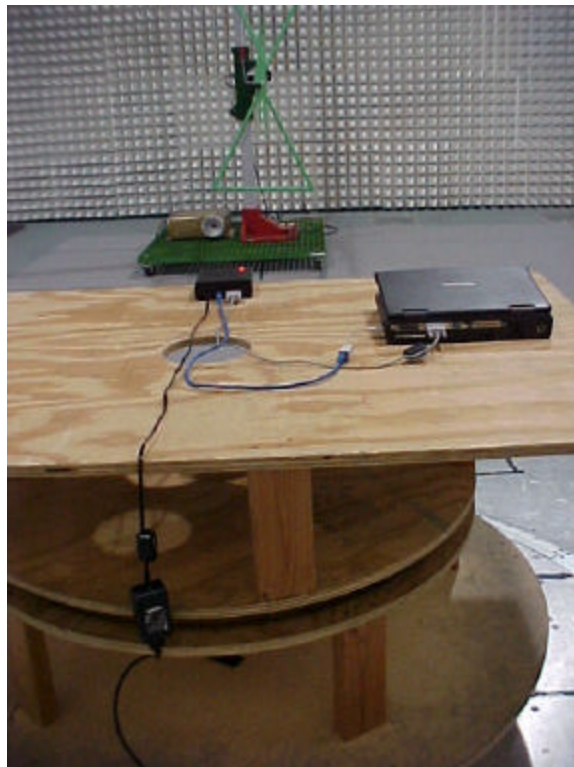
Antennas

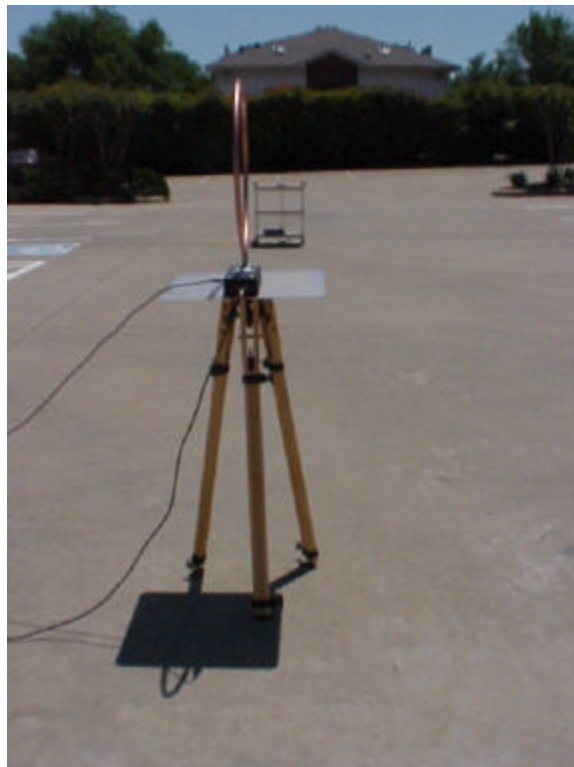
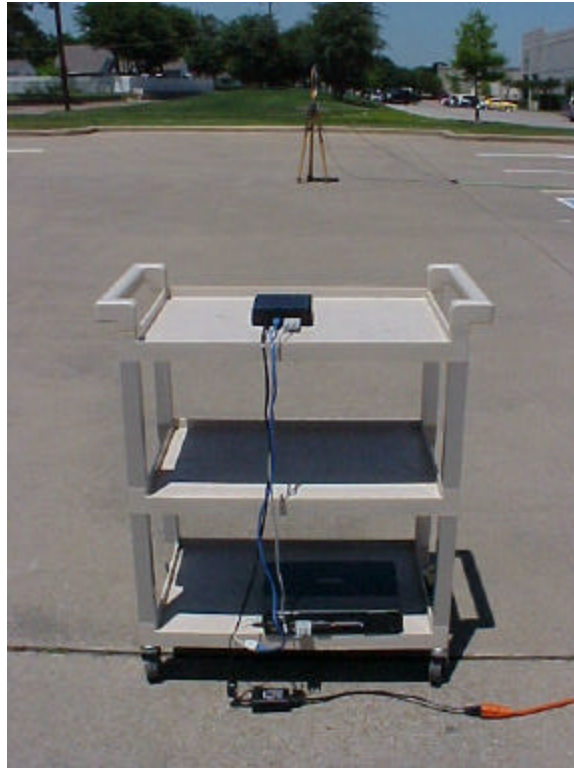
| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---|------------|----------|---------|------|
| Schaffner, CBL6112B, Log Periodic Antenna | 2726 | 5/15/03 | 5/15/04 | X |
| A H Systems, SAS-571, Horn Antenna | 411 | 5/15/03 | 5/15/04 | |
| A H Systems, SAS-562, Loop antenna | 152 | 5/15/03 | 5/15/04 | X |

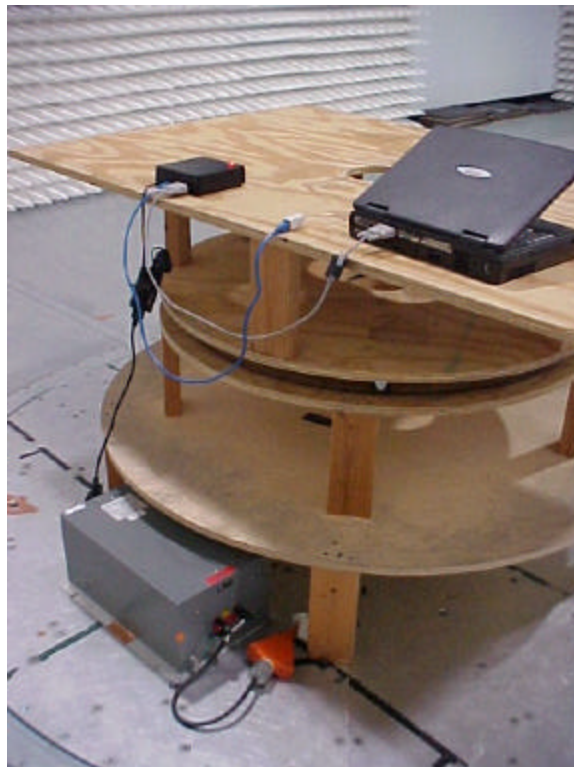
Artificial Mains Networks/Absorbing Clamps

| DESCRIPTION | SERIAL NO. | LAST CAL | CAL DUE | USED |
|---------------------|------------|----------|---------|------|
| FCC-LISN-50-25-2-01 | 01021 | 5/15/03 | 5/15/04 | X |
| FCC-LISN-50-50-4-02 | 01024 | 5/15/03 | 5/15/04 | |
| FCC-LISN-50-25-2-01 | 01020 | 5/15/03 | 5/15/04 | |
| AMZ 41 | 15957 | 5/15/03 | 5/15/04 | |

**Test Set Up
BOX Configurations**







**Test Set Up
SDK Configurations**

