

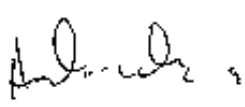


TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: SIRIT Technologies Inc.
SIRIT OEM 410

To: FCC Part 15 Subpart C: 2001
(Intentional Radiators)
Clause 15.225

Test Report Serial No:
RFI/EMCB1/RP43508JD02A

| | |
|--|---|
| <p>This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:</p>  | <p>Checked By:</p>  |
| <p>Tested By:</p>  | <p>Release Version No: PDF02</p> |
| <p>Issue Date: 20 January 2003</p> | <p>Test Dates: 08 October 2002 to 21 October 2002</p> |

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The results in this report apply only to the sample(s) tested.

RADIO FREQUENCY INVESTIGATION LTD.

Radio Performance Group

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TEST REPORT

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1. Client Information

| | |
|----------------------|---|
| Company Name: | SIRIT Technologies Inc |
| Address: | i2R Division Unit 10 Loughborough Technology Centre Epinal Way Loughborough Leicestershire LE11 3GE |
| Contact Name: | Mr G Bishop |

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2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification Of Equipment Under Test (EUT)

| | |
|------------------------------------|---------------------------------|
| Brand Name: | SIRIT UK (formally i2R Limited) |
| Model Name or Number: | OEM 410 |
| Unique Type Identification: | None stated by client |
| Serial Number: | X16000249 |
| Country of Manufacture: | UK |
| FCC ID Number: | Not applicable |
| Date of Receipt: | 08 October 2002 |

2.2. Description Of EUT

Radio Frequency Identification (RFID) module designed for incorporation into OEM printer products. Its specific application is for the identification of special printer papers.

2.3. Modifications Incorporated In EUT

The unit was tested with additional software to provide constant RF ON or continuous RFID read, this was for test purposes. The OEM unit to which the unit is fitted would normally provide these functions externally.

2.4. Additional Information Related To Testing

| | |
|--|---|
| Power Supply Requirement: | Nominal 115 V 60 Hz AC mains supply |
| Intended Operating Environment: | Residential, Commercial, Light Industry, Heavy Industry |
| Weight: | Approx. 31g |
| Dimensions: | Approx. 108 x 68 x 13 mm |
| Interface Ports: | AC Power Port |

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2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

| | |
|-------------------------------|----------------|
| Description: | Power Supply |
| Brand Name: | NEDAP |
| Model Name or Number: | 9884254 |
| Serial Number: | A328354 |
| FCC ID Number: | Not applicable |
| Cable Length And Type: | Not Applicable |
| Connected to Port: | AC Power Port |

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3. Test Specification, Methods And Procedures

3.1. Test Specification

| | |
|-------------------------|---|
| Reference: | FCC Part 15 Subpart C: 2001 (Intentional Radiators). Section 15.225. (Operation within the band 13.553 to 13.567 MHz). |
| Title: | Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Digital Devices. |
| Comments: | A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules. |
| Purpose of Test: | To determine whether the equipment complied with the applicable requirements of the specification for the purposes of certification. |

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1996)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1998)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1 (1999)

Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1. Radio disturbance and immunity measuring apparatus.

3.3. Definition Of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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4. Deviations From The Test Specification

None.

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5. Operation Of The EUT During Testing

5.1. Operating Conditions

During testing, the EUT was powered by a Nominal 115 V 60 Hz AC mains supply.

5.2. Operating Modes

The EUT was tested in the following operating modes.

The EUT was tested in the continuous transmit mode.

The reason for choosing this mode was that the client defined it as being likely to be the worst case with regards EMC/RFI.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

For the purpose of these tests the unit is mounted on a wooden block connected to a typical power supply together with sample tags positioned to read continuously, which verify the correct operation of the module.

The reason for choosing this configuration was that it was defined by the client as being likely to be the worst case with regards EMC/RFI.

NB Section 2 of this report contains a full list of support equipment used and Appendix 3 contains a schematic diagram of the test configuration.

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6. Summary Of Test Results

6.1. Summary Of Test Results

| Range Of Measurements | Specification Reference | Mode Type | Port of Operation | Compliance Status |
|---|------------------------------------|------------------|--------------------------|--------------------------|
| AC Conducted Emissions | C.F.R. 47 FCC Part 15.207: 2001 | Transmit | AC Mains | Complied |
| Radiated Field Strength of Fundamental Emission | C.F.R. 47 FCC Part 15.225(a): 2001 | Transmit | Antenna | Complied |
| Radiated Field Strength of Spurious Emissions | C.F.R. 47 FCC Part 15.225(b): 2001 | Transmit | Antenna | Complied |
| Frequency Tolerance | C.F.R. 47 FCC Part 15.225(c): 2001 | Transmit | Antenna | Complied |

6.2. Location Of Tests

All the measurements described in this report were performed at the premises of Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

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7. Measurements, Examinations And Derived Results

7.1. General Comments

7.1.1. This section contains test results only. Details of the test methods and procedures can be found in Appendix 2 of this report.

7.1.2. Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 8 for details of measurement uncertainties.

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7.2. Conducted Emissions

7.2.1. Quasi-Peak Detector Measurements On Live And Neutral Lines

7.2.1.1. Plots of the initial scans can be found in Appendix 4.

7.2.1.2. Measurements were performed to the limits specified in FCC Part 15.207.

7.2.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

| Frequency (MHz) | Line | Q-P Level (dBμV) | Q-P Limit (dBμV) | Margin (dB) | Result |
|------------------------|----------------|--|--|--------------------|---------------|
| 0.345450 | Live & Neutral | 47.95 | 59.07 | 11.12 | Complied |
| 2.432830 | Live & Neutral | 38.68 | 56.00 | 17.32 | Complied |
| 3.131670 | Live & Neutral | 40.84 | 56.00 | 15.16 | Complied |
| 4.876610 | Live & Neutral | 39.21 | 56.00 | 16.79 | Complied |
| 16.848100 | Live & Neutral | 42.87 | 60.00 | 17.13 | Complied |
| 19.024030 | Live & Neutral | 47.87 | 60.00 | 12.13 | Complied |

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7.3. Radiated Emissions

7.3.1. Radiated Field Strength Measurement of Fundamental Frequency

7.3.1.1. Plots of the initial scans can be found in Appendix 4.

7.3.1.2. Measurements were performed to the limits specified in FCC Part 15.225(a), for fundamental frequencies between 13.553 and 13.567 MHz, any emissions appearing in this frequency band must not exceed 10,000 $\mu\text{V}/\text{m}$ at 30 meters (80dB $\mu\text{V}/\text{m}$ at 30 meters).

7.3.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector and at a test distance of 3meters (results incorporate antenna factors and cable losses):

7.3.1.4. As the fundamental emission did exceed the measuring receiver noise floor, only the level of the noise floor was recorded.

| Frequency (MHz) | Q-P Level (dB $\mu\text{V}/\text{m}$) | Q-P Limit (dB $\mu\text{V}/\text{m}$) | Margin (dB) | Result |
|-----------------|--|--|-------------|----------|
| 13.56 | 3.73 | 80.00 | 76.27 | Complied |

Note: Due to high levels of ambient signal, final radiated emission measurements were performed with the measurement antenna at a test distance of 3m. The final result was calculated using the square of an inverse linear distance extrapolation factor of (40dB/decade). i.e. $40 \log(d1/d2)$.

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7.3.2. Radiated Field Strength Measurements: 30 to 1000 MHz.

7.3.2.1. The client has stated that the highest clock frequency for the EUT was 13.56MHz. Therefore tests were performed up to 1000 MHz.

7.3.2.2. Plots of the initial scans can be found in Appendix 4.

7.3.2.3. Measurements were performed in to the limits specified in FCC Part 15.209.

7.3.2.4. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector at a test distance of 3m (results incorporate antenna factors and cable losses):

| Frequency (MHz) | Ant. Pol. | Q-P Level (dB μ V/m) | Q-P Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|-----------|--------------------------|--------------------------|-------------|----------|
| 45.174 | Vert. | 34.5 | 40.0 | 5.5 | Complied |
| 95.116 | Vert. | 42.3 | 43.5 | 1.3 | Complied |
| 114.689 | Vert. | 39.6 | 43.5 | 3.9 | Complied |

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7.4. Frequency Stability Measurements

7.4.1. Measurements were performed to determine the frequency stability of the fundamental emission from the EUT, when subjected to variation of ambient temperature and variation of supply voltage.

7.4.1. Variation of Ambient Temperature

7.4.1.1. The ambient temperature was varied from -20°C to +50°C in 10°C steps.

7.4.1.2. The primary supply voltage was varied from 85% to 115% of the stated supply voltage of 110 Volts.

7.4.1.3. During the test the fundamental frequency of the EUT shall be maintained within $\pm 0.01\%$ of the operating frequency.

7.4.1.4. The client has stated that the operating frequency of the EUT is 13.56 MHz. The following frequency limits shall not be exceeded throughout the test.

| | |
|-------------|---------------|
| Lower Limit | 13.558644 MHz |
| Upper Limit | 13.561356 MHz |

Results:

| Temperature (°C) | Input Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (%) | Limit (%) \pm | Margin (MHz) | Result |
|------------------|-------------------|--------------------------|----------------------|---------------------|-----------------|--------------|----------|
| -20 | 93.5 | 13.560501 | 501 | 0.0037 | 0.01 | 0.0063 | Complied |
| | 121.0 | 13.560501 | 501 | 0.0037 | 0.01 | 0.0063 | Complied |
| -10 | 93.5 | 13.560469 | 469 | 0.0035 | 0.01 | 0.0065 | Complied |
| | 121.0 | 13.560469 | 469 | 0.0035 | 0.01 | 0.0065 | Complied |
| 0 | 93.5 | 13.560504 | 504 | 0.0037 | 0.01 | 0.0063 | Complied |
| | 121.0 | 13.560504 | 504 | 0.0037 | 0.01 | 0.0063 | Complied |
| +10 | 93.5 | 13.560423 | 423 | 0.0031 | 0.01 | 0.0069 | Complied |
| | 121.0 | 13.560423 | 423 | 0.0031 | 0.01 | 0.0069 | Complied |
| +20 | 93.5 | 13.560375 | 375 | 0.0028 | 0.01 | 0.0072 | Complied |
| | 121.0 | 13.560375 | 375 | 0.0028 | 0.01 | 0.0072 | Complied |
| +30 | 93.5 | 13.560344 | 344 | 0.0025 | 0.01 | 0.0075 | Complied |
| | 121.0 | 13.560344 | 344 | 0.0025 | 0.01 | 0.0075 | Complied |
| +40 | 93.5 | 13.560344 | 344 | 0.0025 | 0.01 | 0.0075 | Complied |
| | 121.0 | 13.560344 | 344 | 0.0025 | 0.01 | 0.0075 | Complied |
| +50 | 93.5 | 13.560297 | 297 | 0.0022 | 0.01 | 0.0078 | Complied |
| | 121.0 | 13.560297 | 297 | 0.0022 | 0.01 | 0.0078 | Complied |

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8. Measurement Uncertainty

8.1. No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

8.2. The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

8.3. The uncertainty of the result may need to be taken into account when interpreting the measurement results.

8.4. The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type | Range | Confidence Level | Calculated Uncertainty |
|-------------------------|--------------------|-------------------------|-------------------------------|
| Conducted Emissions | 0.15 MHz to 30 MHz | 95% | ± 3.66 dB |
| Radiated Emissions | 30 MHz to 1000 MHz | 95% | ± 1.78 dB |
| Frequency Tolerance | 13.56 MHz | 95% | ±0.025 ppm |

8.5. The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

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Appendix 1. Test Equipment Used

| RFI No. | Instrument | Maker | Type No. | Serial No. |
|---------|-------------------------------------|-------------------------|-----------------------|-------------|
| A007 | HFH2-Z2 Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 880 458/020 |
| A067 | LISN | Rohde & Schwarz | ESH3-Z5 | 890603/002 |
| A259 | Bilog Antenna | Chase | CBL6111 | 1513 |
| A276 | OATS Positioning Controller | Rohde & Schwarz | HCC | |
| A287 | ESH3-Z2 Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | None |
| A392 | 3 dB attenuator (9) | Suhner | 6803.17.B | None |
| C222 | Cable | Rosenberger | UFA210A-1-1181-70x70 | None |
| C340 | Cable | Andrews | None | None |
| C346 | Coaxial Cable | Rosenberger | UFA210A-1-1181-70x70 | 1932 |
| C362 | Cable | Rosenberger | UFA210A-1-1181-70x70 | 1925 |
| C363 | BNC Cable | Rosenberger | RG142 | None |
| C364 | BNC Cable | Rosenberger | RG142 | None |
| C468 | N-Type Coaxial Cable | Rosenberger | UFA210A-1-3937-504504 | 98L0440 |
| E013 | PCN Environmental Chamber | Sanyo | ATMOS chamber | None |
| M003 | Spectrum Monitor | Rohde & Schwarz | EZM | 883 580/008 |
| M023 | ESVP Receiver | Rohde & Schwarz | ESVP | 872 991/027 |
| M127 | Spectrum Analyser | Rohde & Schwarz | FSEB 30 | 842 659/016 |
| M133 | Temperature/Humidity/Pressure Meter | RS Components | None | None |
| M173 | Turntable Controller | R.H.Electrical Services | RH351 | 3510020 |

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Test Equipment Used (continued)

| RFI No. | Instrument | Maker | Type No. | Serial No. |
|---------|----------------------------------|-------------------|-----------|----------------|
| M198 | Thermal Power Sensor | Rohde & Schwarz | NRV-Z52 | 827 191/003 |
| M199 | Power Meter | Rohde & Schwarz | NRVS | 827023/075 |
| M210 | Thermo/hygro meter | RS Components Ltd | RS212-124 | M210-RS212-124 |
| M243 | Thermometer/Barometer/Hygrometer | Oregon Scientific | BA 116 | None |
| M505 | Analyser Display Unit | Rohde & Schwarz | ESAI-D | 825316/010 |
| M506 | RF unit | Rohde & Schwarz | ESBI-RF | 827060/004 |
| S201 | Site 1 | RFI | 1 | |
| S207 | Site 7 | RFI | 7 | 1932 |
| S209 | Site 9 | RFI | 9 | |

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

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Appendix 2. Measurement Methods

A2.1. AC Mains Conducted Emissions: FCC Part 15

A2.1.1. AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.1.2. The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane and with the EUT powered via a 60 Hz AC mains supply.

A2.1.3. Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

A2.1.4. Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

A2.1.5. The test equipment settings for conducted emissions measurements were as follows:

| Receiver Function | Initial Scan | Final Measurements |
|--------------------------|---------------------|---------------------------|
| Detector Type: | Peak | Quasi-Peak (CISPR)* |
| Mode: | Max Hold | Not applicable |
| Bandwidth: | 10 kHz | 9 kHz |
| Amplitude Range: | 60 dB | 20 dB |
| Measurement Time: | Not applicable | > 1 s |
| Observation Time: | Not applicable | > 15 s |
| Step Size: | Continuous sweep | Not applicable |
| Sweep Time: | Coupled | Not applicable |

* In some instances an Average detector function may also have been used.

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A2.2. Radiated Emissions: FCC Part 15

A2.2.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.2.2. Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

A2.2.3. The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested on the open area test site, at the appropriate distance, using a measuring receivers with a Quasi-Peak detector (below 1000 MHz), where applicable, for measurements above 1000 MHz average and peak detectors were used.

A2.2.4. For the main (final) measurements the EUT was arranged on a non-conducting table on an open area test site, as detailed in the specification.

A2.2.5. All measurements on the open area test site were performed using broadband antennas.

A2.2.6. On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

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A2.2.7. The test equipment settings for radiated emissions measurements were as follows:

| Receiver Function | Initial Scan (Below 30 MHz) | Final Measurements (Below 30 MHz) |
|-------------------|--------------------------------|--------------------------------------|
| Detector Type: | Peak | Quasi-Peak (CISPR) or Average |
| Mode: | Max Hold | Not applicable |
| Bandwidth: | 9 kHz | 9 kHz |
| Amplitude Range: | 60 dB | 20 dB |
| Measurement Time: | Not applicable | > 1 s |
| Observation Time: | Not applicable | > 15 s |
| Step Size: | Continuous sweep | Not applicable |
| Sweep Time: | Coupled | Not applicable |

| Receiver Function | Initial Scan (30 to 1000 MHz) | Final Measurements (30 to 1000 MHz) |
|-------------------|----------------------------------|--|
| Detector Type: | Peak | Quasi-Peak (CISPR) |
| Mode: | Max Hold | Not applicable |
| Bandwidth: | 100 kHz | 120 kHz |
| Amplitude Range: | 60 dB | 20 dB |
| Measurement Time: | Not applicable | > 1 s |
| Observation Time: | Not applicable | > 15 s |
| Step Size: | Continuous sweep | Not applicable |
| Sweep Time: | Coupled | Not applicable |

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A2.2. Frequency Stability

A.2.2.1. Tests were performed to determine the frequency stability of the EUT under varied ambient temperatures, and varied supply voltages.

A.2.2.2. For extreme temperature testing the EUT was placed in an environmental test chamber in close proximity to a test antenna. The test antenna was connected to a measurement analyser where the frequency tolerance could be measured.

A.2.2.3. The test chamber was set to acclimatise at the lowest temperature out of the range -20°C to 50°C.

A.2.2.4 The EUT was then switched on and the fundamental frequency was measured for the voltage range, 85% to 115% of the rated supply voltage.

A.2.2.5. The test chamber was then set to the next temperature setting in the temperature range and the above procedure repeated.

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Appendix 3. Test Configuration Drawings

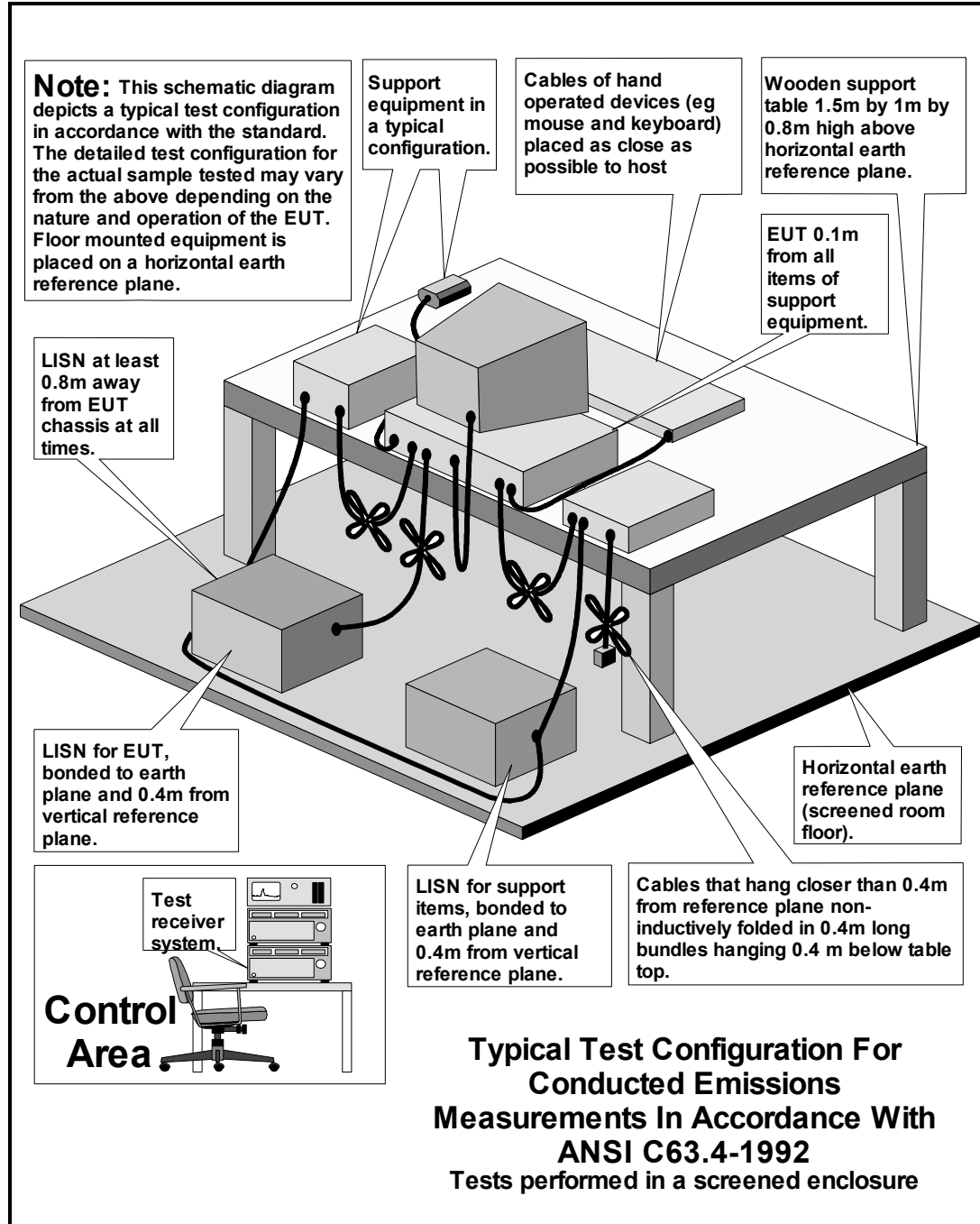
This appendix contains the following drawings:

| Drawing Reference Number | Title |
|---------------------------------|--|
| DRG\43508JD02\EMICON | Test configuration for measurement of conducted emissions |
| DRG\43508JD02\EMIRAD | Test configuration for measurement of radiated emissions |
| DRG\43508JD02\001 | Schematic diagram of the EUT, support equipment and interconnecting cables used for the test |

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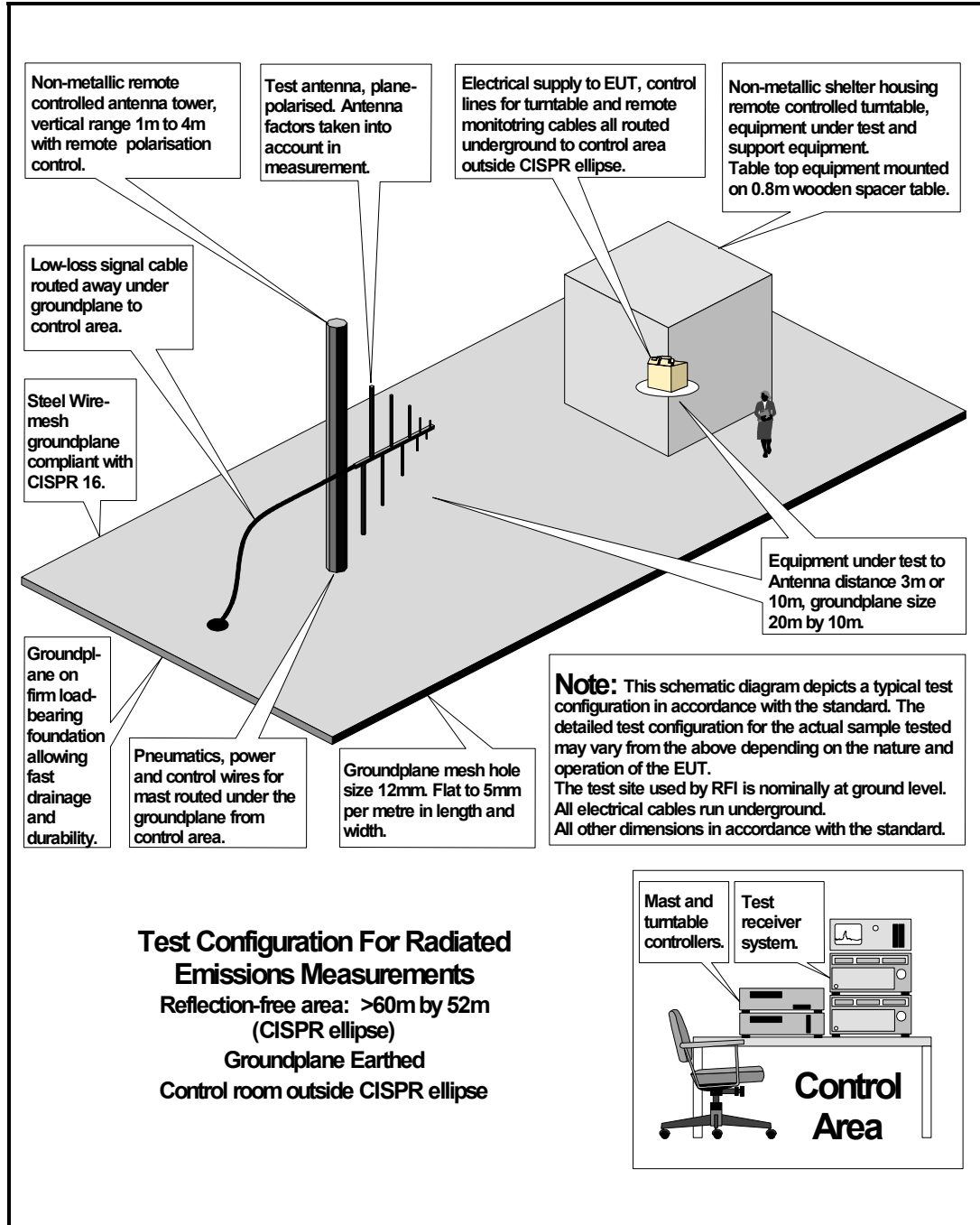
DRG\43508JD02\EMICON



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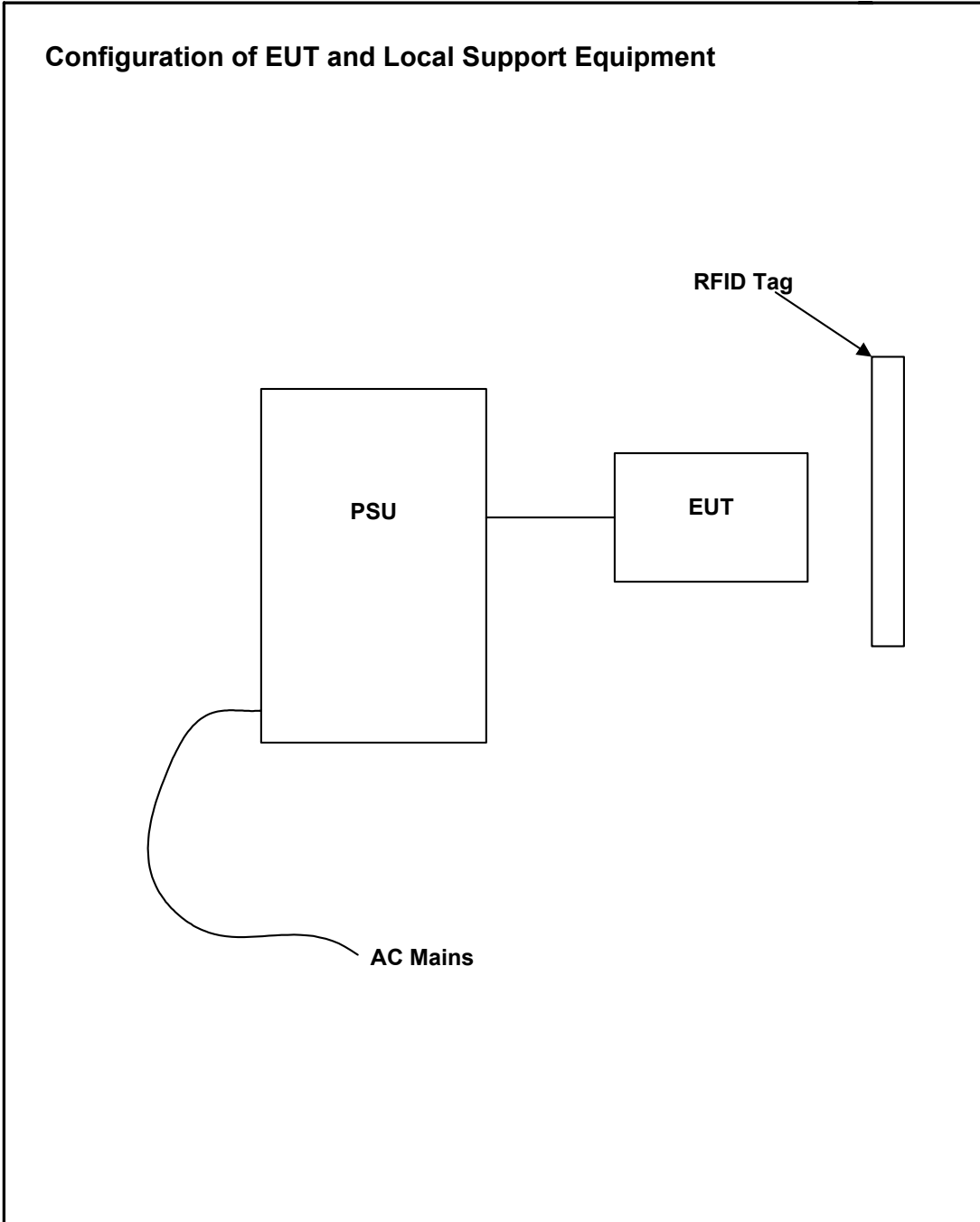
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Appendix 4. Graphical Test Results

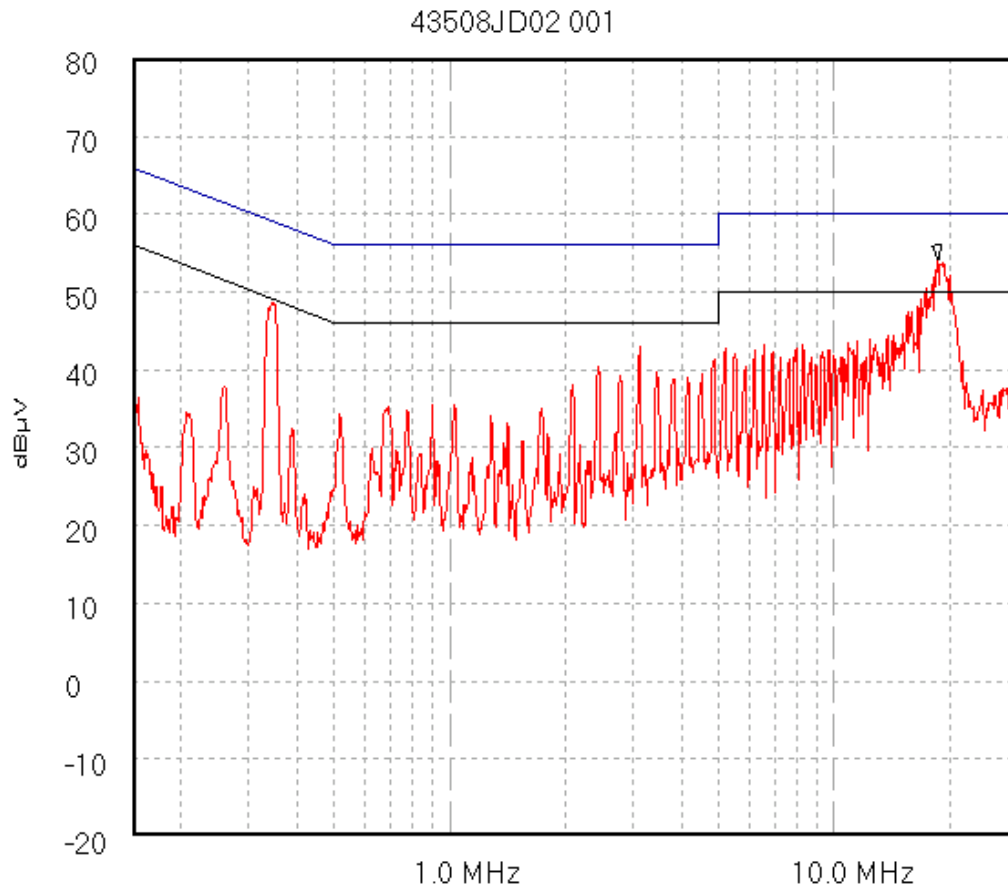
This appendix contains the following graphs:

| Graph Reference Number | Title |
|-------------------------------|---------------------|
| GPH\43508JD02\001 | Conducted Emissions |
| GPH\43508JD02\002 | Radiated Emissions |
| GPH\43508JD02\003 | Radiated Emissions |

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GPH\43508JD02\001



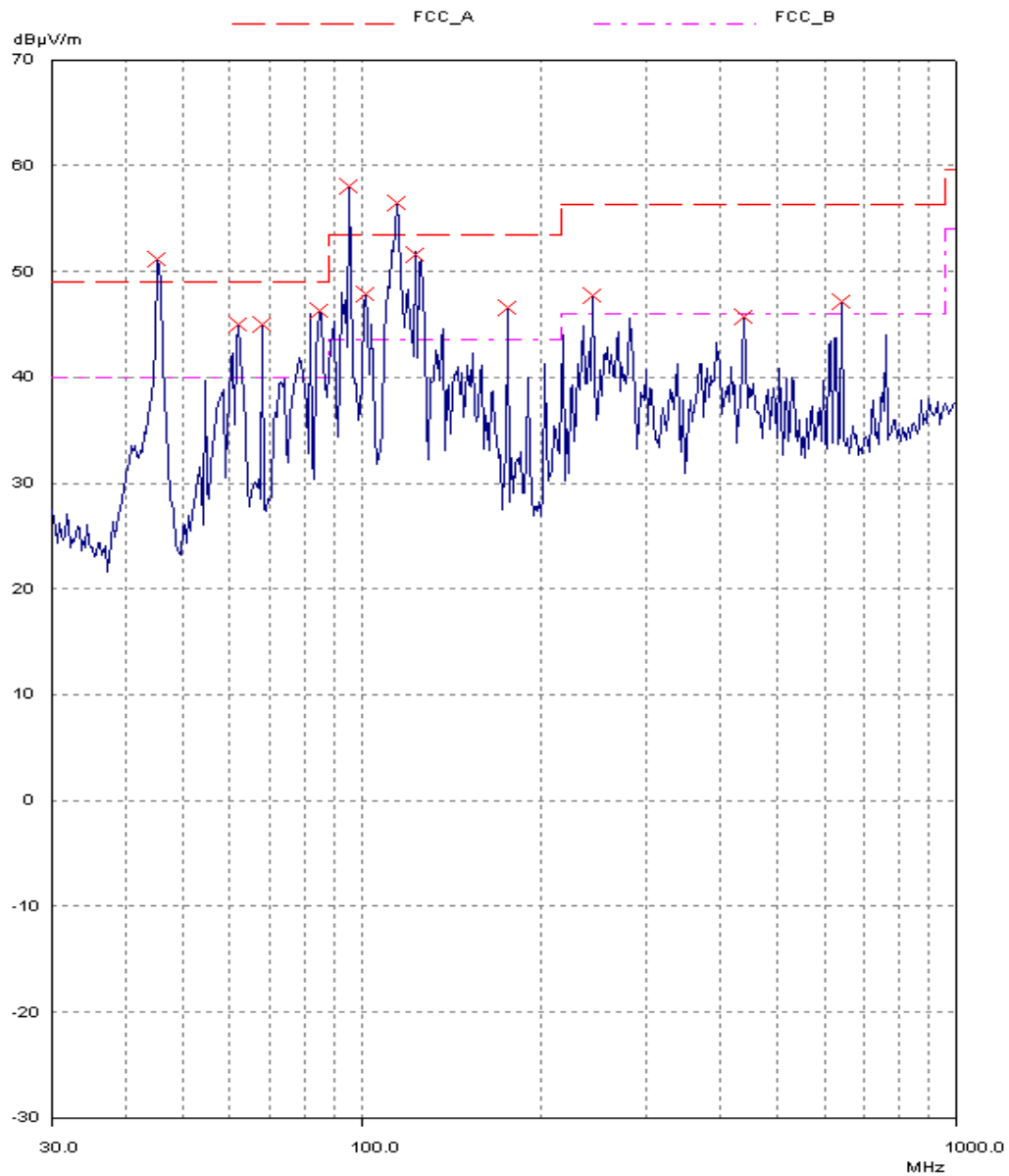
Trace 1
FCC_B_QP — FCC_B_Av

Start 150.0 kHz; Stop 30.0 MHz - Log Scale
Ref 80 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 9.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 1.94 S
Peak 18.732 MHz, 54.1 dBµV
Limit/Mask: FCC_B_QP; FCC_B_Av; ; Limit Test Failed
21/10/2002 10:56:32

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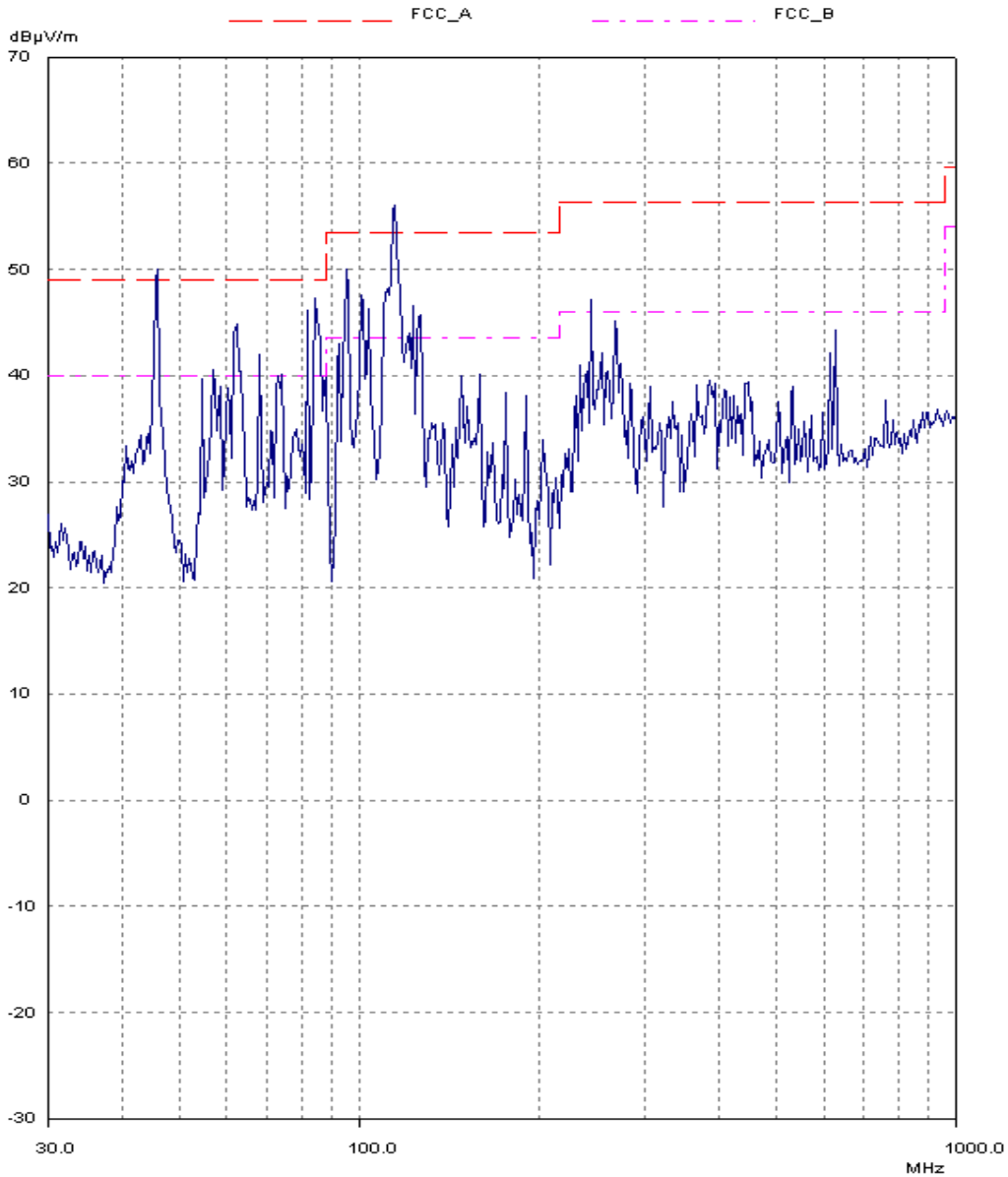
GPH\43508JD02\002



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GPH\43508JD02\003



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Appendix 5. Photographs of EUT

This appendix contains the following photographs:

| Photo Reference Number | Title |
|-------------------------------|-----------------------------------|
| PHT/43508JD02/001 | Front View of Conducted Emissions |
| PHT/43508JD02/002 | Rear View of Conducted Emissions |
| PHT/43508JD02/003 | Front View of Radiated Emissions |
| PHT/43508JD02/004 | Rear View of Radiated Emissions |

These pages are not included in the total number of pages for this report.

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PHT/43508JD02/003 Radiated Emissions , Front View of EUT



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