COMPLIANCE ENGINEERING IRELAND LTD

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Project Number: 11E3655-2

Prepared for:

**Biancamed Ltd**

By

Compliance Engineering Ireland Ltd
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**FCC Site Registration: 92592**
**Industry Canada Assigned Code: 8517A**

**Date**

27th October 2011

FCC EQUIPMENT AUTHORISATION
Test Report

**EUT Description**
Motion Sensor

Authorised:

**List of Exhibits**

# Exhibit A – Technical Report

**Biancamed Ltd.,**
**Sleepminder Motion Sensor**

## Applicant Name and Address

The system covered under this authorisation report was designed, manufactured and assembled by Biancamed Ltd. The company's full name and mailing address is given below:

**BiancaMed Limited,**
**NovaUCD,**
**Belfield Innovation Park,**
**Dublin 4,**
**Ireland.**

## Model Name

The model number for the EUT covered under this application report is:

**Sleepminder Sensor**

## Description of Equipment

The EUT was a motion detector module using a short range 10.525 GHz transceiver to detect motion, intended for use in consumer and clinical sleep trials in the volunteers' own home. It comprises a motherboard PCBA, an integral RF PCBA, die cast RF metalwork and a custom plastic anti-tamper enclosure. Events were logged to a data card using a separate logger PCB, which could later be analyzed on a computer using a custom algorithm to distinguish chest movement from background motion (not supplied by the manufacturer during testing).

## Equipment Details

| | |
|---|---|
| **Description:** | Field Disturbance Sensor / Device, Motion Sensor Module |
| **Brand Name:** | SleepMinder Sensor |
| **Model Name or Number:** | BM11 |
| **Serial Number:** | 1000000020 |
| **Hardware Version Number:** | L4 |
| **Software Version Number:** | Ver4 |
| **FCC ID Number:** | YAKBM11 |

| | | |
|---|---|---|
| **Tested Technology:** | Motion Sensor | |
| **Category of Equipment:** | Field Disturbance Sensor | |
| **Type of Equipment:** | Transmitter | |
| **Intended Operating Environment:** | Residential / Commercial | |
| **Highest Internally Generated Clock or Oscillator Frequency:** | 4 MHz | |
| **Modulation Type:** | 50 % duty cycle pulsed wave. Transmit pulse ~1000nS width with PRF of ~500kHz | |
| **Power Supply Requirement:** | DC supply | 12V via mains adaptor |
| **Transmit Frequency Range:** | 10.525 GHz | |
| **Transmit Channels Tested:** | **Channel ID** | **Channel Frequency (GHz)** |
| | Single Channel | 10.525 |

| | |
|---|---|
| PSU Manufacturer: | Friwo |
| Description: | PSU |
| Model Number: | FW7333SM/12 |

## Modifications

There were no modifications incorporated in the EUT.

## Operating Conditions during Test:

Normal Scanning

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## 1.0 EUT Description

The EUT was a motion detector module using a short range 10.525 GHz transceiver to detect motion, intended for use in consumer and clinical sleep trials in the volunteers' own home. It comprises a motherboard PCBA, an integral RF PCBA, die cast RF metalwork and a custom plastic anti-tamper enclosure. Events were logged to a data card using a separate logger PCB, which could later be analyzed on a computer using a custom algorithm to distinguish chest movement from background motion (not supplied by the manufacturer during testing).

## 1.1 EUT Operation

The EUT was tested in normal scanning mode.

## 1.2 Modifications

There were no modifications incorporated in the EUT.

## 1.3 Date of Test

The tests were carried out on the 17th August 2011 and 26th October 2011.

## 2 Electromagnetic Emissions Testing

The guidelines of CISPR 16-4 were used for all uncertainty calculations, estimates and expressions thereof for EMC testing. A copy of Compliance Engineering Ireland Ltd.'s policy for EMC Measurement Uncertainty is available on request.

RF Requirements: Spurious emissions in accordance with FCC CFR 15.209 and 15.245. Tests were carried out to the requirements of CISPR 16-4 and ANSI C63.4-2009.

Final measurements were conducted on the Open Area Test Site.

### 2.2.1 Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for the conducted emissions test was ±3.5 dB.

The measurement uncertainty (with a 95% confidence level) for the radiated emissions test was ±5.3 dB (from 30 to 100 MHz), ±4.7 dB (from 100 to 300 MHz), ±3.9 dB (from 300 to 1000 MHz) and ±3.8 dB (from 1 GHz to 40 GHz).

### 2.3 Test Criteria

The FCC Part 15 Class B conducted limits are given below.

| Frequency of emission (MHz) | Conducted limit (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 | 56 to 46 |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

### 2.4 Conducted Emissions Measurements

### 2.4.1 Test Procedure

The measurements were taken using a Line Impedance Stabilisation Network (LISN). A Rohde and Schwarz ESHS30 Receiver with a bandwidth of 9 kHz was used to measure the conducted emissions. The measurements were carried out using the receiver analysis feature, which uses three detectors; peak, quasi peak and average. Using this mode the voltage emission spectrum was scanned in peak detection mode and the emissions which exceeded a sub range margin relevant to the respective limits were further measured using the quasi peak and average detectors. The live and neutral conductors were examined individually to determine the maximum. The receiver bandwidth was set to 10 kHz. Appendix A shows the plots from the test.

The excess interface cables were bundled in a non-inductive arrangement at the approximate centre of the cable with the bundle 30 to 40 centimetres in length. The conducted emissions were maximised by varying the operating states and configuration of the EUT.

The results of conducted emissions are shown in Appendix A, Figures 1 and 2.

**Result: Pass**

## 3 Radiated Emissions Measurements

Radiated Emissions measurements were made at the Compliance Engineering Ireland Ltd Site located in Ashbourne, Co. Meath, Ireland to determine the radio noise radiated from the EUT. A "Description of Measurement Facilities" has been submitted to the FCC and approved pursuant to Section 2.948 of CFR 47 of the FCC rules.

### 3.2 Test Procedure

The EUT was centred on a motorised turntable, which allows 360 degree rotation. From frequencies between 30 MHz and 1000 MHz, a measurement antenna was positioned at a distance of 10 meters as measured from the closest point of the EUT. The radiated emissions were maximised by configuring the EUT, by rotating the EUT, and by raising and lowering the antenna from 1 to 4 meters.

Emissions above 1 GHz were made at a 3 metre distance. There were no emissions identified between 1 GHz and 55 GHz excepting the intended emission at 10.5 GHz.

A measuring receiver with peak detection was used to find the maximums of the radiated emissions during the variability testing below 1 GHz. All final measurements below 1 GHz were taken using the quasi peak detector with a measurement bandwidth of 120 kHz. At frequencies above 1 GHz a measurement bandwidth of 1 MHz was used and peak detector. A drawing showing the test setup is given as Figure 2.

### 3.3 Test Criteria

The FCC Part 15.209 radiated limits are given below for a measurement distance of 3 meters.

| Frequency (MHz) | Field Strength μV/m | Field Strength (dBμV/m) |
|---|---|---|
| 30-88 | 100 | 40.0 |
| 88-216 | 150 | 43.52 |
| 216-960 | 200 | 46.0 |
| above 960 | 500 | 54.0 |

## 4 Field Strength of Fundamental

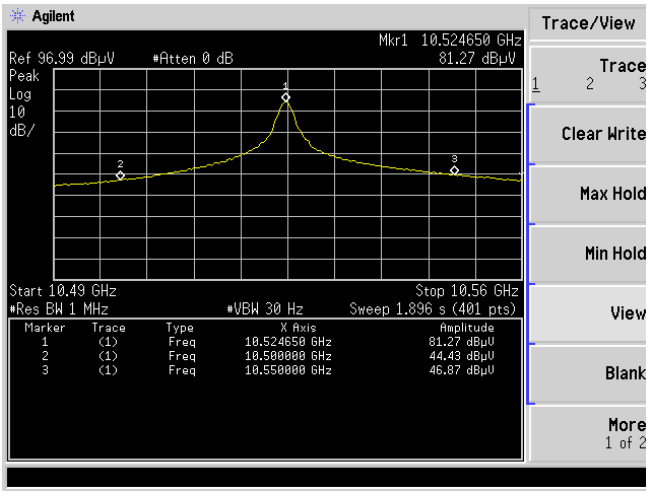
**Test Specification**: FCC PART 15, SECTION 47 CFR 15.209, CFR15.245.

The EUT was set up as described above. The measurement instrumentation used was a Spectrum Analyser with bandwidth parameters as stipulated in ANSI C63.4-2009.

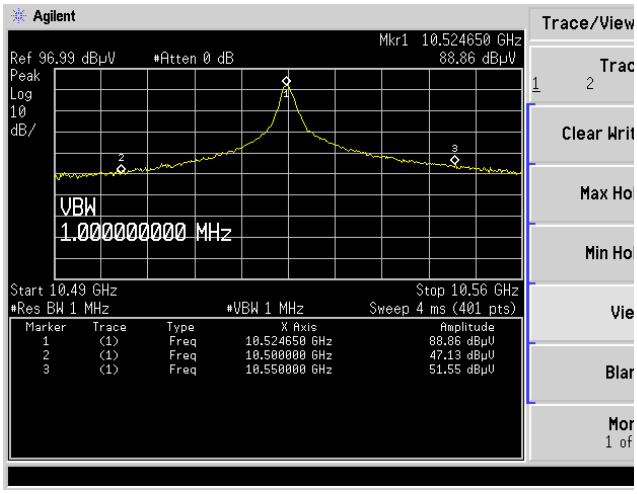
The final measurements were carried out on the open area test site.

### 4.2 Test Data – Field Strength of Fundamental

The measurement plot below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.




**Average**




**Peak**

| Indicated | | Correction | | | Corr | Turntable/Antenna | | | Limit | | Det | EUT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq | Ampl | Ant | Cabl | Amp | Ampl | Ang | Ht | Pol | Ampl | Marg | | Orien |
| GHz | dBµV | dB | dB | dB | dB µV/m | deg | m | V/H | dBµV/m | dB | | |
| 10.500 | 44.43 | 38.3 | 3.5 | 36.8 | 49.43 | 15 | 1.2 | V | 54 | 4.57 | Av | V |
| 10.550 | 46.87 | 38.3 | 3.5 | 36.8 | 51.87 | 15 | 1.2 | V | 54 | 2.13 | Av | V |
| 10.500 | 47.13 | 38.3 | 3.5 | 36.8 | 52.13 | 15 | 1.2 | V | 74 | 21.87 | Pk | V |
| 10.550 | 51.55 | 38.3 | 3.5 | 36.8 | 56.55 | 15 | 1.2 | V | 74 | 17.45 | Pk | V |
| 10.5246 | 86.75 | 38.3 | 3.5 | 36.8 | 91.75 | 15 | 1.1 | H | 128 | 36.25 | Pk | V |
| 10.5246 | 91.81 | 38.3 | 3.5 | 36.8 | 96.81 | 15 | 1.2 | V | 128 | 31.19 | Pk | V |

**The margin is calculated as follows:**
Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyser Amplitude + Cable Loss +Antenna Factor – Pre-Amp Gain.

**Test-Data Summary – Peak Measurement:**

| | | |
|---|---|---|
| **Center Frequency** | = | 105246.5 MHz |
| **Peak Level:** | = | 96.81 dBµV/m |
| **Peak Limit (15.245)** | = | 127.00 dBµV/m |

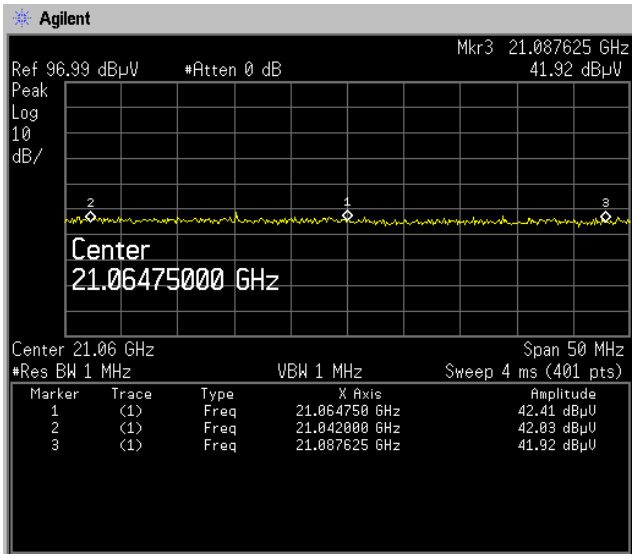
**Conclusion**

Sensor meets the requirements of the test reference for Fundamental Frequency Field Strength per FCC Part 15

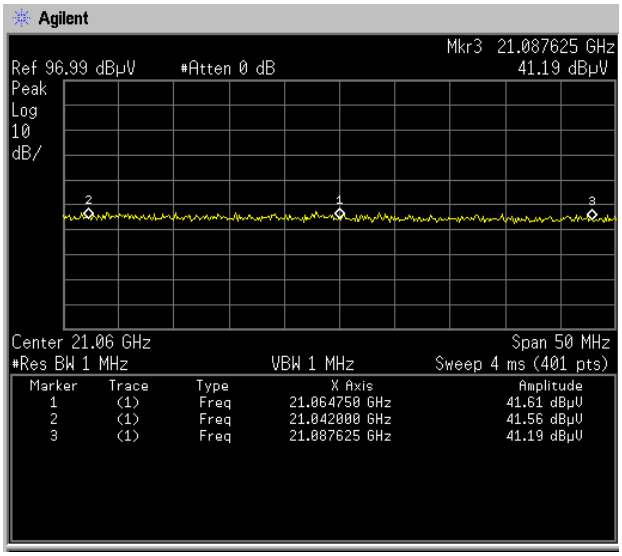
**Result: Pass**

## 5 Field Strength of Harmonics

Harmonics were measured up 55 GHz.




**Horizontal**




**Vertical**

| Indicated | | Correction | | | Corr | Turntable/Antenna | | | Class B | | Det | EUT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq | Ampl | Ant | Cabl | Amp | Ampl | Ang | Ht | Pol | Ampl | Marg | | Orien |
| GHz | dBµV | dB | dB | dB | dB µV/m | deg | m | V/H | dBµV/m | dB | | |
| 21.0648 | 42.41 | 42.0 | 6.7 | -30.8 | 60.31 | 0 | 1.0 | H | 88 | 27.69 | Pk | V |
| 21.0648 | 41.61 | 42.0 | 6.7 | -30.8 | 59.51 | 0 | 1.0 | V | 88 | 28.49 | Pk | V |

**Result: Pass**

## 6 Field Strength of Spurious Radiated Emissions

**Test Specification:** FCC PART 15, SECTION 47 CFR 15.209

For the spurious and harmonics measurements, below 1GHz, the EUT was set up at a 3 meter distance from the receiving antenna, on an Open Area Test Site (OATS), with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT had previously been recorded in a 3m semi anechoic chamber. For measurements above 1GHz, the EUT was set up at a 3 meter distance from the antenna, in a semi-anechoic chamber, with the EUT running in a continuous mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits.

Appendix A shows the results of the measurements in the anechoic chamber.

**Result: Pass**

## 7 List of Test Equipment

| Instrument | Mftr. | Model | Calibration Due |
|---|---|---|---|
| Measuring Receiver | Rohde and Schwarz | ESVS30 | 07/04/12 |
| Bilog Antenna | Chase | CBL6111 | 16/09/12 |
| Spectrum Analyser | Agilent | 8565EC | 10/2/12 |
| Measuring Receiver | Rohde and Schwarz | ESHS30 | 27/10/11 |
| LISN | Rohde and Schwarz | ESH3-Z5 | 13/08/12 |
| Spectrum Analyser | Agilent | E4408B | 05/08/12 |
| Spectrum Analyser | Agilent | 8565EC | 15/2/12 |
| Horn Antenna | EMCO | 3116 | 14/5/12 |
| External Mixer | Agilent | 11970U | 11/8/12 |
| Horn Antenna | EMCO | 3115 | 05/11/12 |
| Preamplifier | Hewlett Packard | 83017A | 23/09/12 |
| Crystal Detector | Hewlett Packard | 8470B | 29/04/12 |
| Oscilloscope | Tektronix | 794D | 30/04/12 |

## Appendix A
## Test Results

### Table 1 - Radiated Emissions on OATS

Horizontal and Vertical Maximum

Antenna Distance: 3m
Frequency Range: 30 MHz - 1000 MHz
Detector Type: Quasi peak

| Frequency (MHz) | Q.P. Level dB(µV/m) | Q.P. Limit dB(µV/m) | Polarisation | Antenna Height (m) | Margin dB(µV/m) |
|---|---|---|---|---|---|
| 48.10 | 20.0 | 40 | Vertical | 1 | -20 |
| 53.28 | 18.7 | 40 | Vertical | 1 | -21.3 |
| 72.53 | 20.3 | 40 | Vertical | 1 | -19.7 |
| 181.14 | 24.2 | 43.52 | Horizontal | 1.2 | -19.32 |

Corrected Level = Recorded Level + Antenna Factor + Cable Loss

**COMMENT: PASS**

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17 Aug 2011 13:35

Conducted Emissions

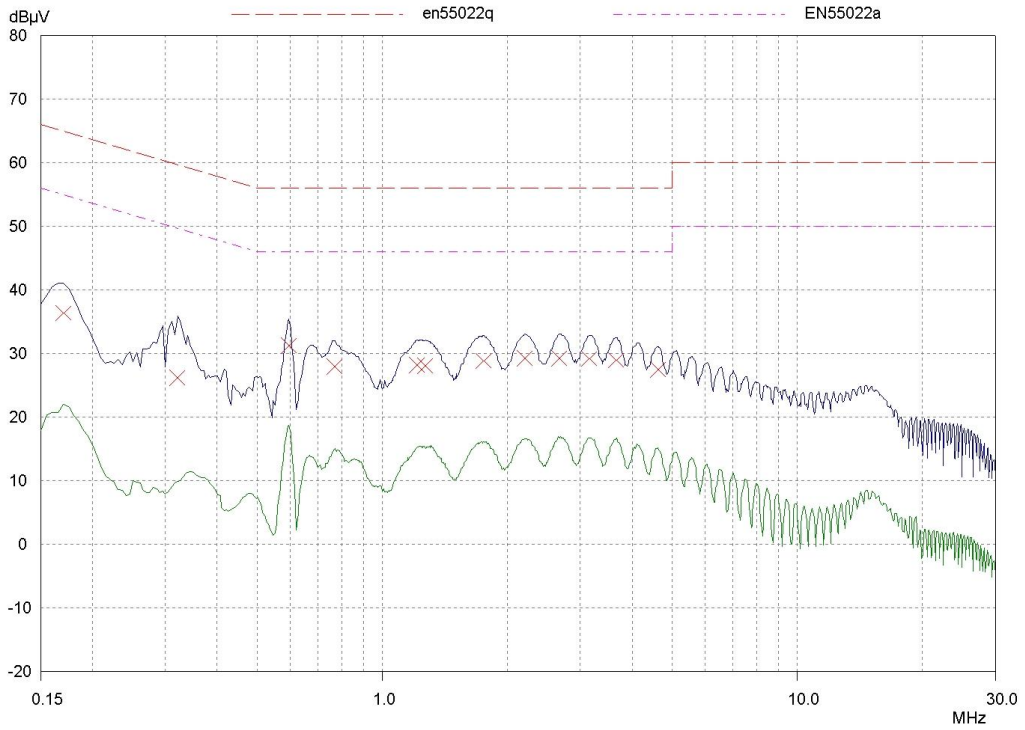
| | |
|---|---|
| EUT: | BM11 |
| Manuf: | BiancaMed |
| Op Cond: | Normal |
| Operator: | M Kirby |
| Test Spec: | FCC Part15 |
| Comment: | Live |

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | |
|---|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 150kHz | 30MHz | 5kHz | 10kHz | PK+AV | 20msec | Auto | OFF | 60dB |

Final Measurement:

| | |
|---|---|
| Detectors: | X QP / + AV |
| Meas Time: | 1sec |
| Subranges: | 25 |
| Acc Margin: | 20 dB |




PAGE 1

**Figure 1: Conducted Emissions (Live)**

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17 Aug 2011 13:53

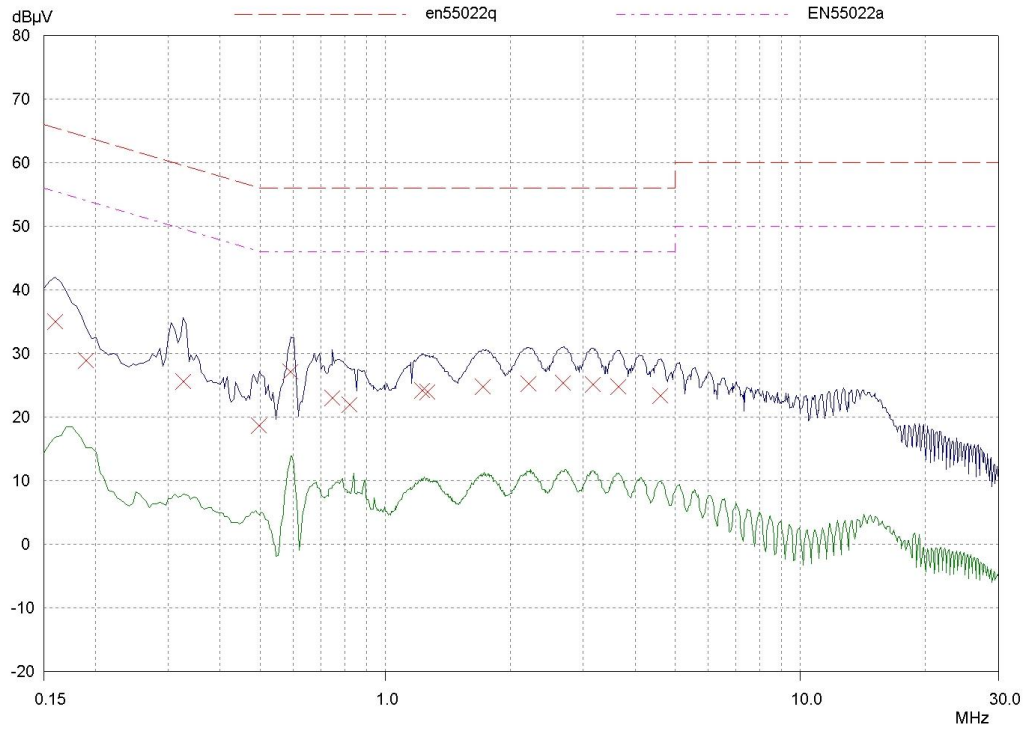
Conducted Emissions

| | |
|---|---|
| EUT: | BM11 |
| Manuf: | BiancaMed |
| Op Cond: | Normal |
| Operator: | M Kirby |
| Test Spec: | FCC Part15 |
| Comment: | Neutral |

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | | |
|---|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 150kHz | 30MHz | 5kHz | 10kHz | PK+AV | 20msec | Auto | OFF | 60dB |

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 20 dB




PAGE 1

**Figure 2: Conducted Emissions (Neutral)**

**RADIATED EMISSIONS** **17. Aug 11 11:54**

**Op Cond:** **Normal**

**Scan Settings (1 Range)**

| Frequencies | | | Receiver Settings | | | | | |
|---|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 30M | 1000M | 120k | 120k | PK | 20ms | 0dB | LN OFF | 60dB |

**Final Measurement: x Hor-Max / + Vert-Max**
**Meas Time: 1 s**
**Subranges: 8**
**Acc Margin: 0dB**

| Transducer No. | Start | Stop | Name |
|---|---|---|---|
| 3 9 | 20M | 1000M | CEIL615 |
| 19 | 30M | 1000M | BILOG |

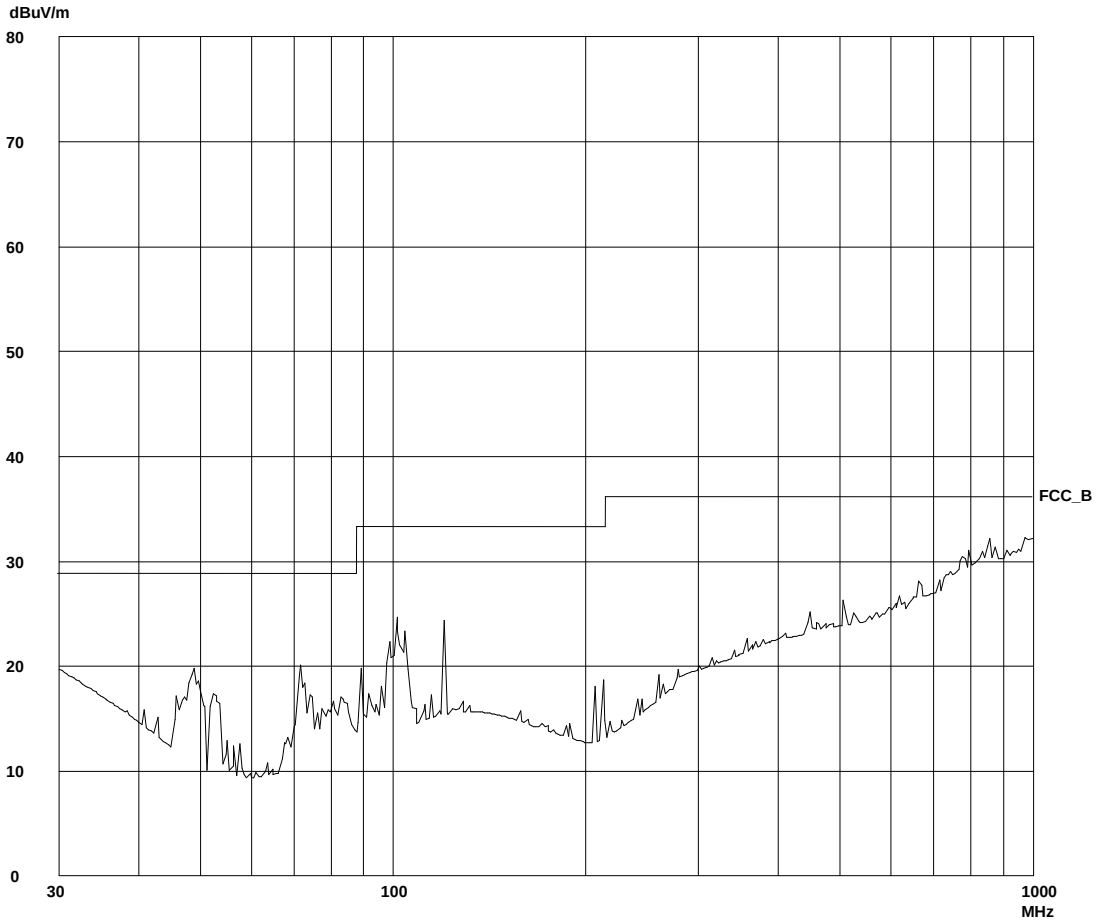



**Figure 3: 10m scan from 30 MHz to 1000 MHz in anechoic chamber (vertical)**

## RADIATED EMISSIONS

17 Aug 11 12:09

**Op Cond:** Normal

**Scan Settings (1 Range)**

| Frequencies | | | Receiver Settings | | | | | |
|---|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 30M | 1000M | 120k | 120k | PK | 20ms | 0dB | LN OFF | 60dB |

**Final Measurement:** x Hor-Max / + Vert-Max
Meas Time: 1 s
Subranges: 8
Acc Margin: 0dB

| Transducer No. | Start | Stop | Name |
|---|---|---|---|
| 3 | 20M | 1000M | CEIL615 |
| 9 | 30M | 1000M | BILOG |

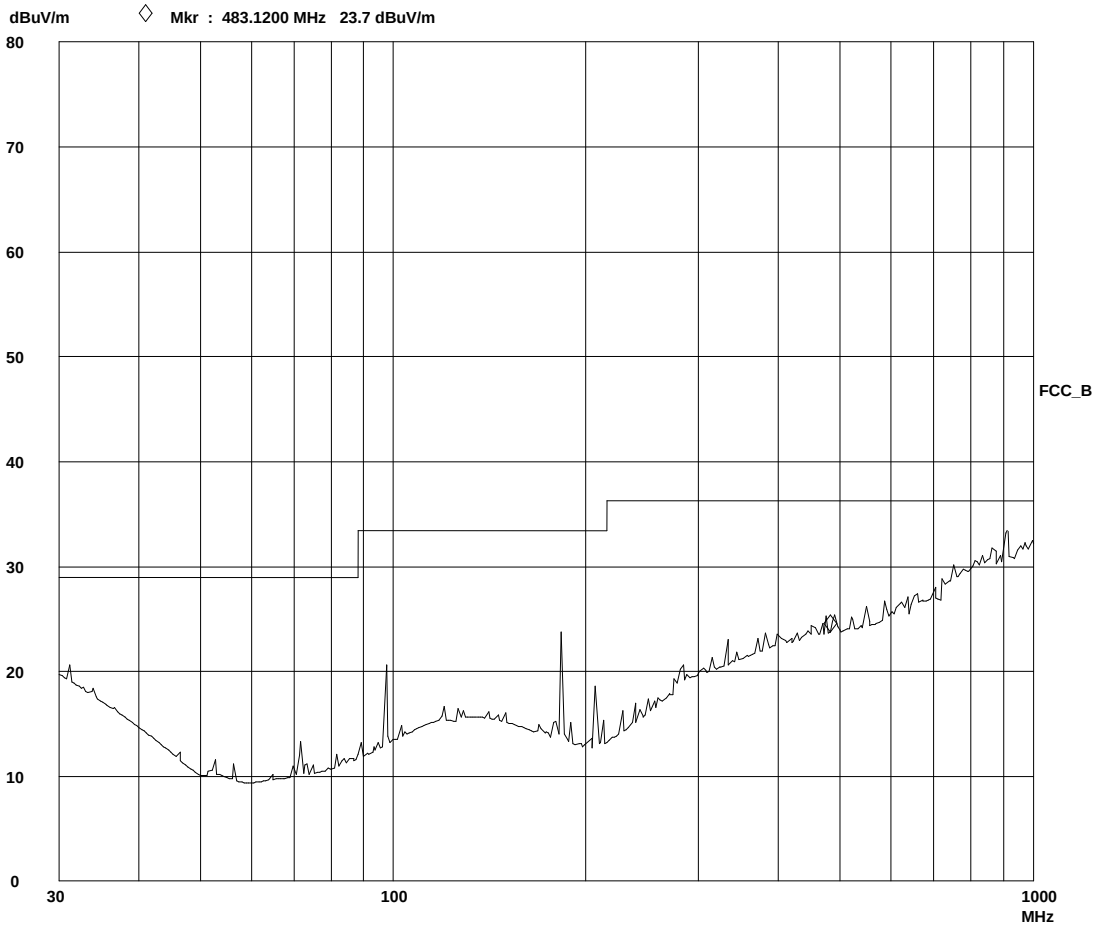



**Figure 4: 10m scan from 300 MHz to 1000 MHz in anechoic chamber (horizontal)**

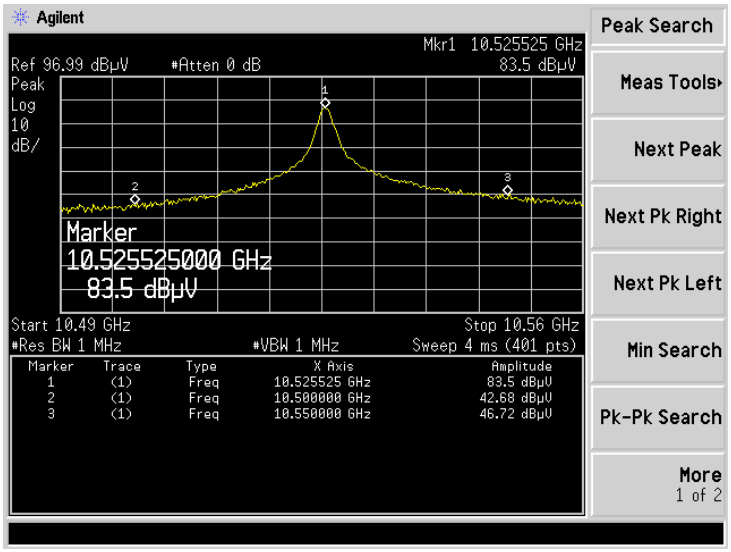



**Figure 5: Occupied Bandwidth**

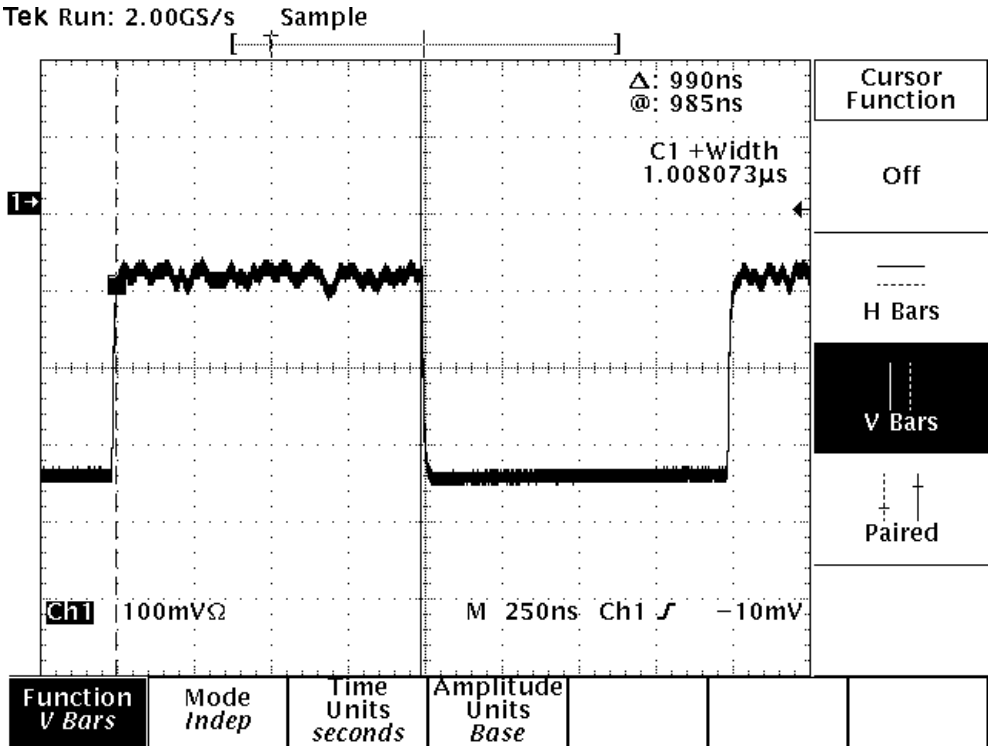
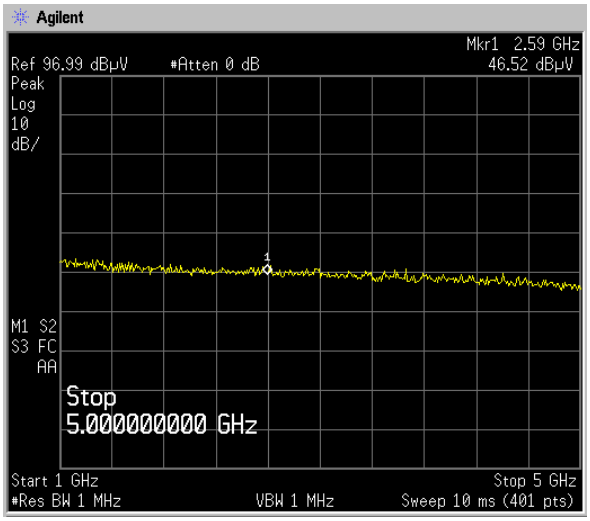



**Figure 6: Repetition Rate (measured using crystal detector)**



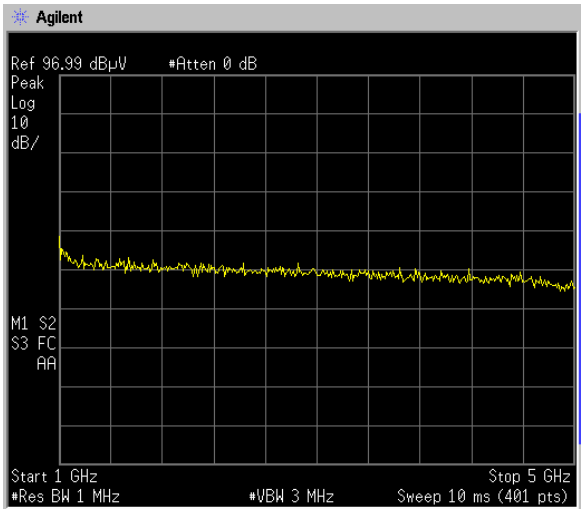
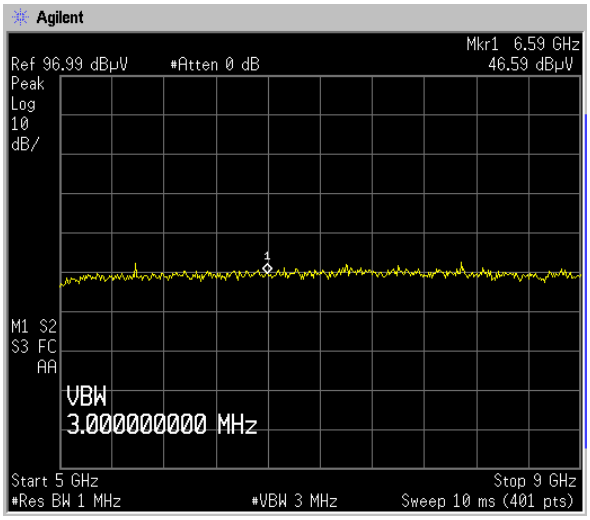




**Figure 8: 1 GHz – 5 GHz**



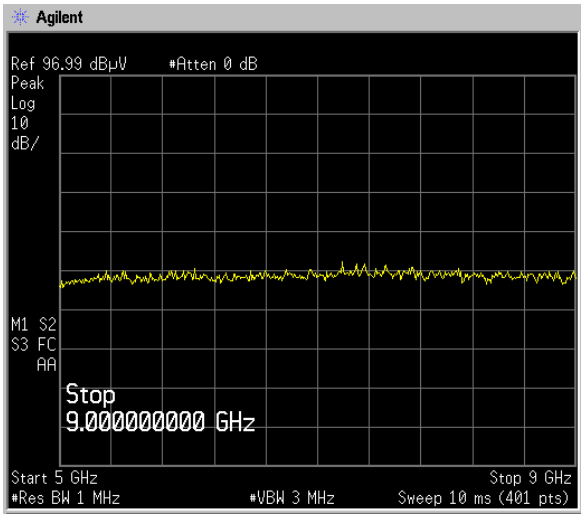
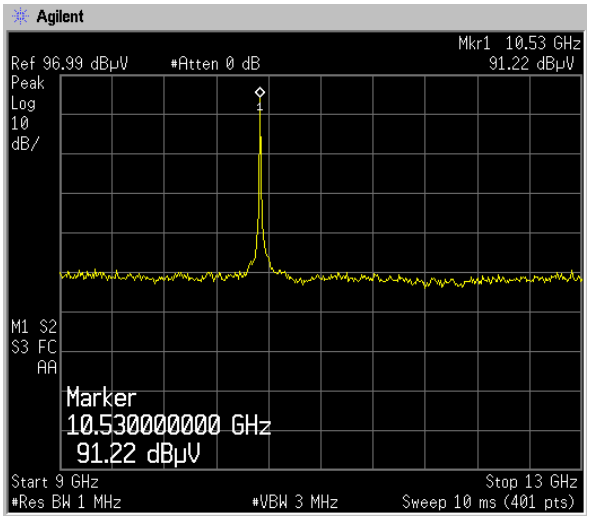




**Figure 9: 5 GHz to 9 GHz**



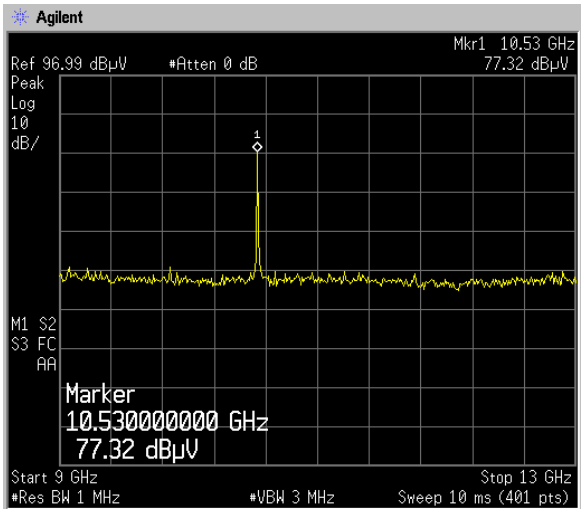
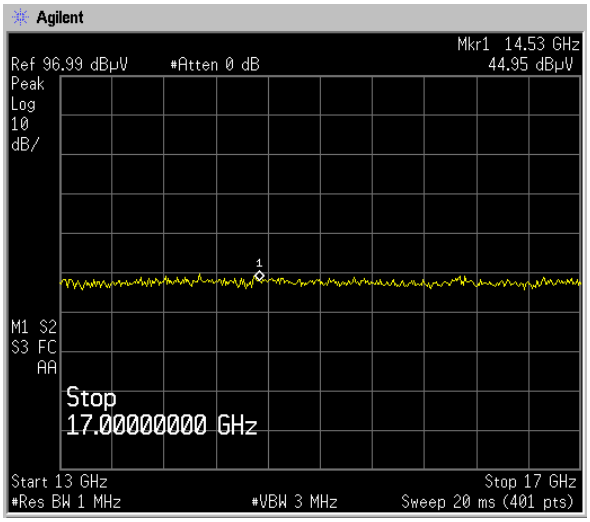




**Figure 10: 9 GHz to 13 GHz**



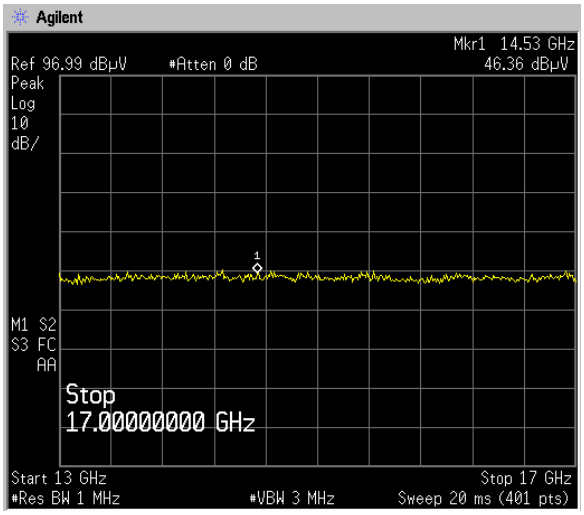
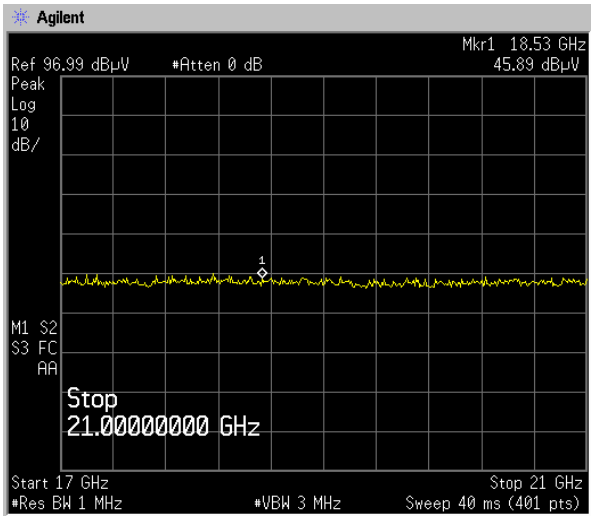




**Figure 11: 13 GHz to 17 GHz**



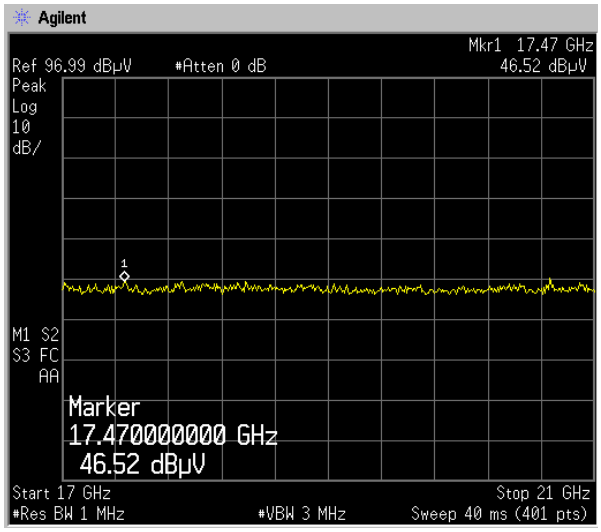
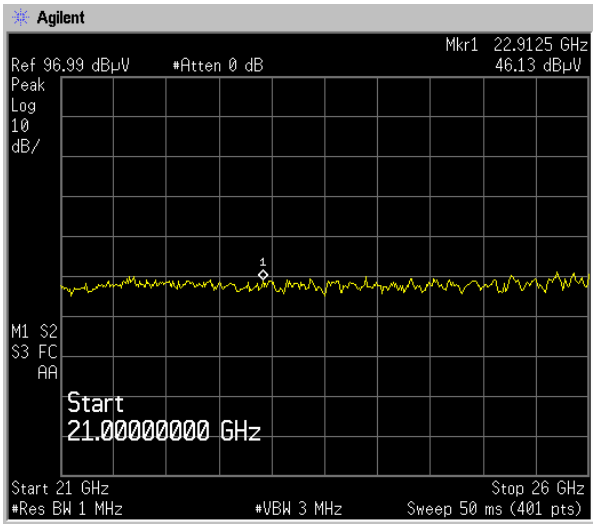




**Figure 12: 17 GHz to 21 GHz**



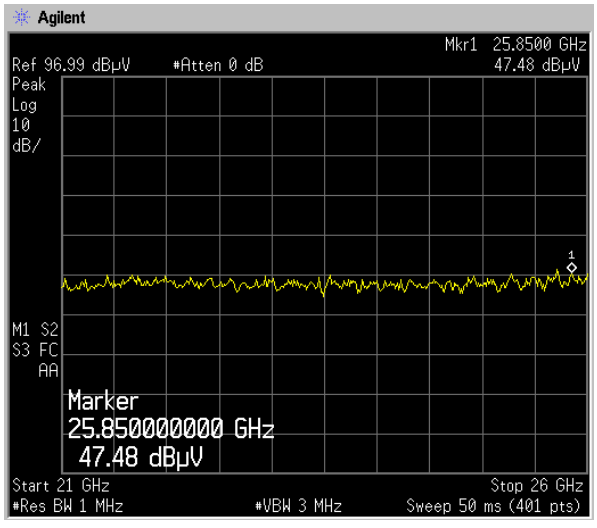
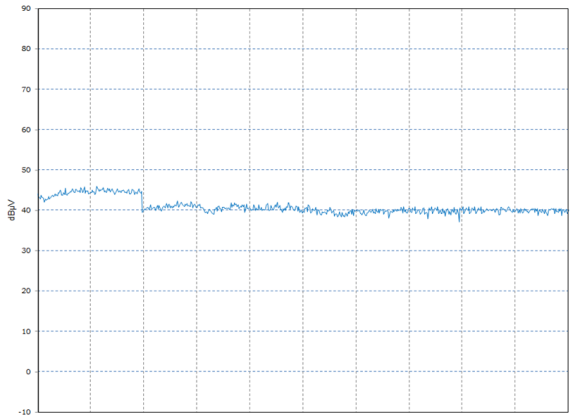



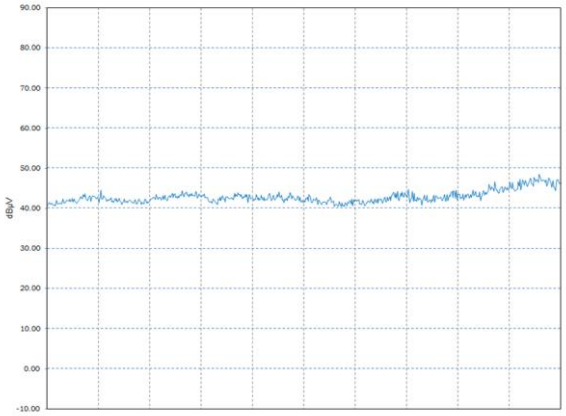

**Figure 13: 21 GHz to 26 GHz**




Start 26 GHz; Stop 30 GHz

Ref 90 dBµV; 10 dB/div

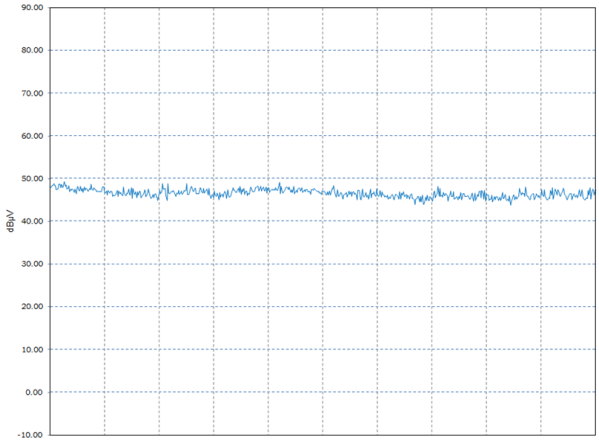
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 180 mS




Start 30 GHz; Stop 40 GHz

Ref 90 dBµV; 10 dB/div

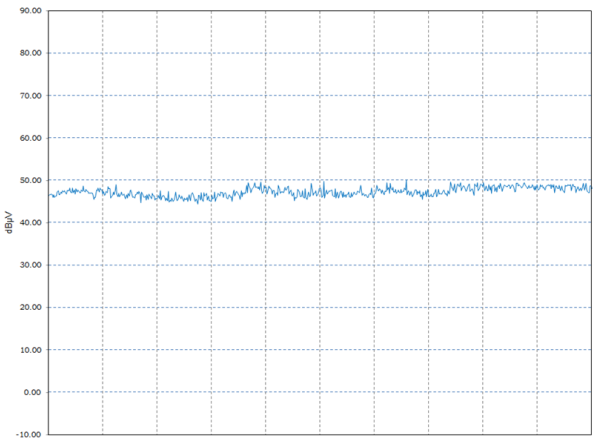
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 180 mS




Start 40 GHz; Stop 50 GHz

Ref 90 dBµV; 10 dB/div

RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 180 mS




Start 50 GHz; Stop 55 GHz

Ref 90 dBµV; 10 dB/div

RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 270 mS

## Appendix B
## Test Setups

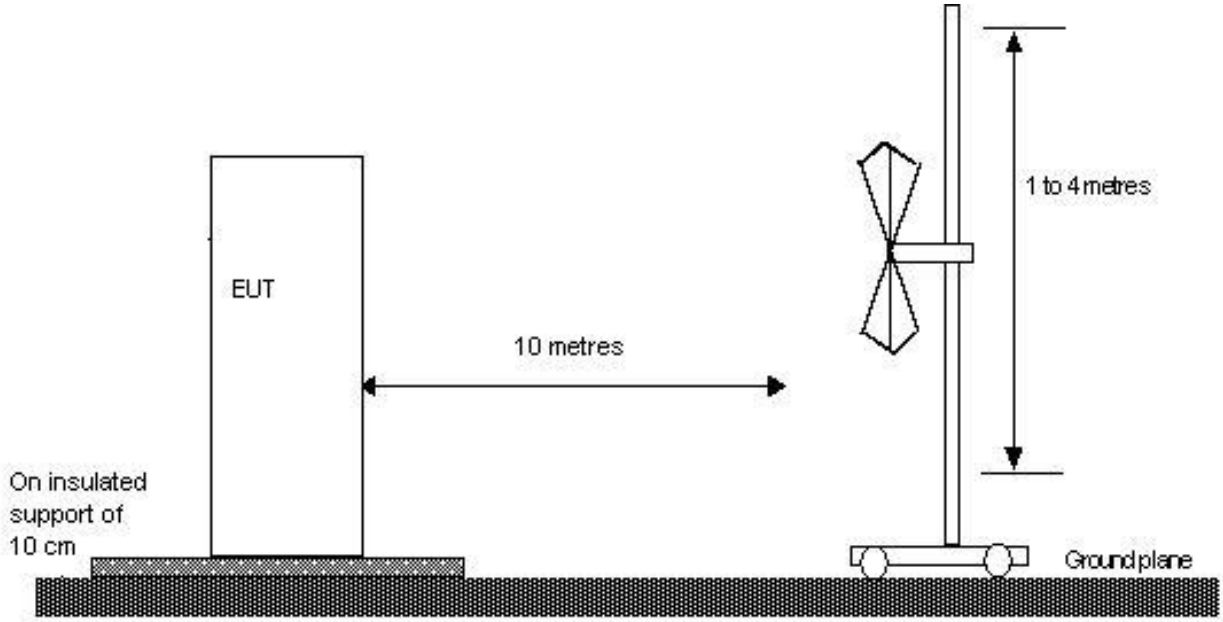
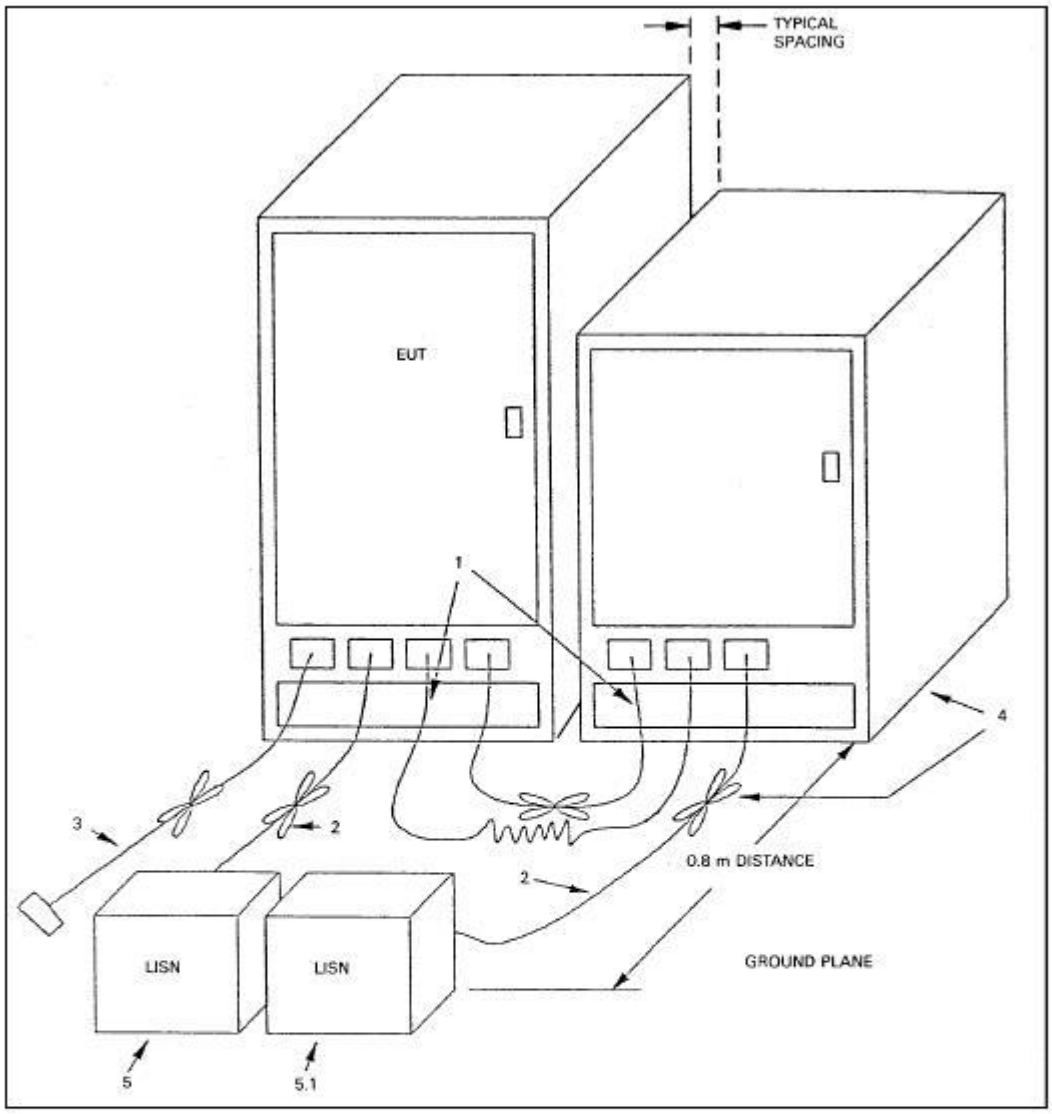



**FIGURE 1: Radiated Emissions Test Setup – Test Distance 10m**




LEGEND:

1) Excess I/O cables shall be bundled in the center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bundling shall not exceed 40 cm in length (see 6.1.4 and 11.2.4).
2) Excess power cords shall be bundled in the center or shortened to appropriate length (see 7.2.1).
3) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion (see 6.1.4).
4) EUT and all cables shall be insulated, if required, from the groundplane by up to 12 mm of insulating material (see 6.1.4 and 6.2.2).
5) EUT connected to one LISN. LISN can be placed on top of, or immediately beneath, the groundplane.
   5.1) All other equipment powered from a second LISN or additional LISN(s) (see 5.2.3 and 7.2.1).
   5.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

**FIGURE 2: Conducted Emissions Test Setup**