



Test Report No.9412334723

Applicant:

Shirtal Diacam Ltd.

Equipment Under Test:

360 Photography Scanner for Diamonds

Model: Diacam360

Issued by:

The Standards Institution of Israel

Industry Division

Electronics & Telematics Laboratory

EMC Branch



Certificate Number: AT-1359

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Applicant:	Shirtal Diacam Ltd.
Address:	3 Jabotinsky St., P.O.Box 297, Shimshon Bldg. Suite #1011, Ramat Gan 5252005, Israel
Sample for test selected by:	The customer
The date of test:	19/05/2015

Description of Equipment**Under Test (EUT):** 360 Photography Scanner for Diamonds**Model:** Diacam360**Manufactured by:** Shirtal Diacam Ltd.**Reference Documents:**

- ❖ CFR 47 FCC: Rules and Regulations:
Part 15. "Radio frequency devices",
Subpart B: Unintentional radiators (2010).
- ❖ ICES-003 Issue 5: "Information Technology Equipment (ITE) -
Limits and Methods of Measurement (2010) (Canada).

Test Result:

The EUT was found to be in compliance with the requirements of the following standards:

- FCC Part 15 Subpart B Class A;
- CAN/CSA CISPR 22 - Class A.

For details refer to clause 1.

This Test Report contains 23 pages
and may be used only in its entirety.

This Test Report applies only to the specimen tested and may not
be applied to other specimens of the same product.

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1. Summary of Test Results

Test	Standard	Severity Class	Test result
Continuous disturbance on mains terminals in frequency range: 150 kHz - 30 MHz	FCC part 15 Subpart B section 15.107; CAN/CSA CISPR 22	Class A: 120 VAC mains	Complies
Radiated disturbance in frequency range: 30 - 1000 MHz	FCC part 15 Subpart B section 15.109 CAN/CSA CISPR 22	Class A	Complies

Approved by: Eng. Yuri Rozenberg
Position: Head of EMC Branch

Electronics &
Telematics Laboratory

16 July 2015

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Position: Testing
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Position: Technical Writer

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2. EUT Description

Note: All information in this section was provided by the customer.

2.1. General description:

The Equipment Under Test (hereinafter: EUT) is a 360 Photography Scanner for Diamonds. It is the compact scanner used for scanning/imaging/photographing diamonds up to 20 ct.

The EUT consists of two units, as the follows:

1. The Lower Unit - responsible to provide 24v to the entire DiaCam360 scanner.

The unit contains the power supply and the vacuum air pump. It should always be on the floor.

2. The Upper Unit responsible for the entire scanning operation.

The unit contains the camera and lens, the led strips, the electronic cards (Arduino, Big Easy Driver), the relay and the stepper.

EUT environmental conditions (in normal operation mode to give the confidence of compliance for the affected technical requirements):

Power supply: 120 VAC mains.

Temp. – [25 - +70] °C.

Humidity – [20 - 90] %.

The EUT dimensions: Upper unit: 29 x 81 x 17 cm approx.

Lower unit: 17 x 11 x 16 cm approx.

The EUT's connection diagram (for each unit, separately) is presented in Picture # 1.

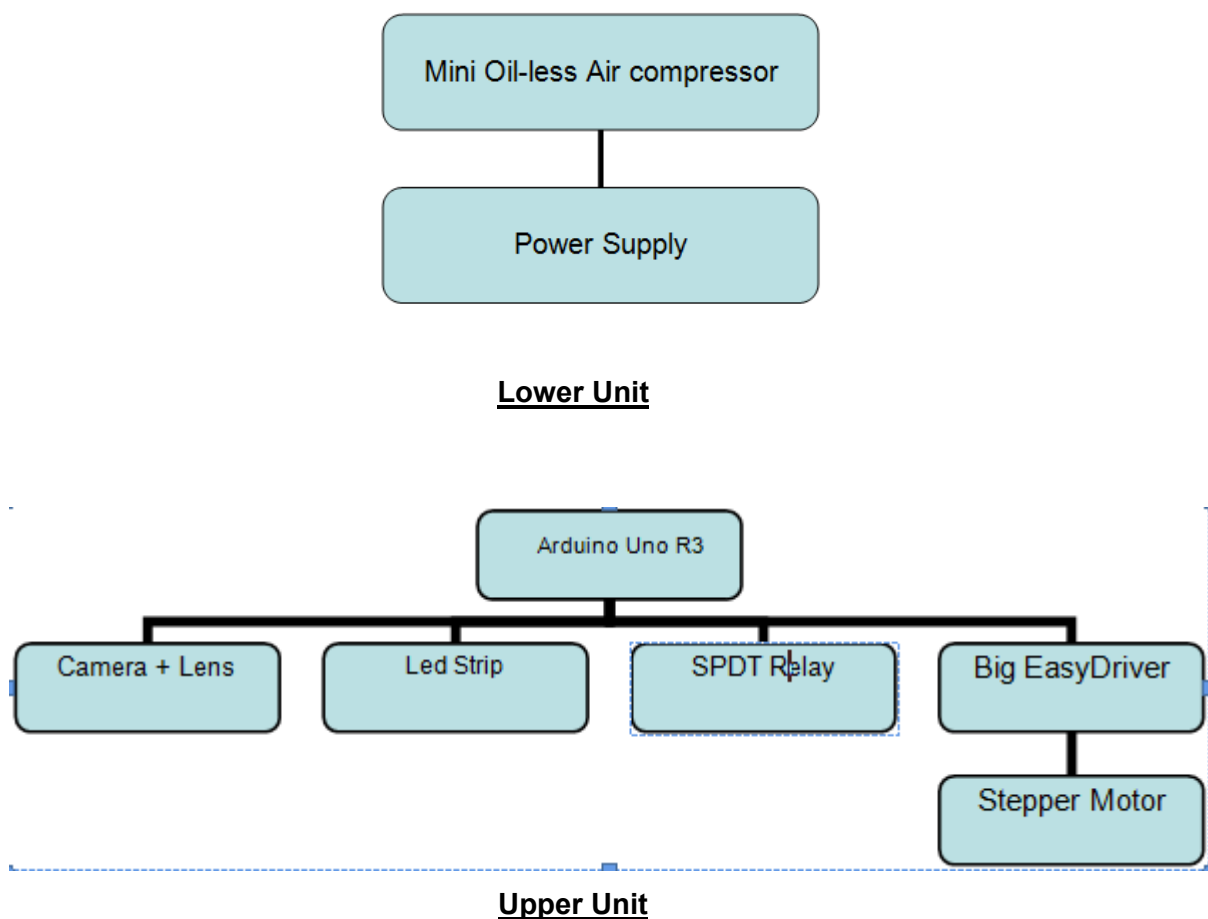
The EUT's views are shown in Appendix 4.

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Picture # 1. EUT's block diagram

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2.2. EUT sub-assemblies list:

Table 1. Sub-assemblies list

Module	Manufacturer	Model, Number
Upper Unit		
Camera	IDS	UI-3580LE-C-HQ
Camera lens	Tamron	M118FM25
Led Strip	Fine Led	5050-60CW/24V
Stepper Motor	MERCURY Industry CO., Limited	SM-42BYG011-25
Big EasyDriver	SparkFun	SF-ROB-12859
Arduino Uno R3	Arduino	Uno R3 DEV-11021
Basic 2-Channel SPDT Relay Carrier with 5VDC Relays	Pololu	POL-2485
Lower Unit		
Mini Oil-less Air compressor	G&M Tech	25RVS-DF1-24VDC
Power Supply; AC-DC; 24V@3.2A; 115-264V In; Enclosed; Panel Mount; Switching; RS Series	MeanWell	RS-75-24

2.3. EUT connector / cable list:

Table 2. Connector / cable list

No.	Cable description	Connector's type	Type of Cable	Length (m)	Location (from – to)	No. of identical connectors
1	AC mains	AC mains	Standard 3 pins	1.8	Between the AC mains and the Lower Unit	1
2	Interconnection power	Power	LAPP 0034703 UNITRONIC LIYCY 3X0.75 Shielded	1.8	Between Upper and Lower units	1
3	USB2	USB2 M/F	USB2	1.8	Between Upper Unit to auxiliary Laptop	1

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The supporting equipment used during the tests is detailed in Table 3 below.

Table 3. Auxiliary equipment used

Function	Manufacturer	Model
Laptop	HP	HP 250 N3540

2.5. Changes made during the tests:

To withstand the test 4 ferrite beads were added, as the follows:

1. P/N 0443167251 MFR Fair-Rite - on AC mains cable to Lower Unit (see Picture # 5 in Appendix 4).
2. P/N 0443167251 MFR Fair-Rite - on Interconnection power cable between Lower Unit and Upper Unit (see Picture # 4 in Appendix 4).
3. Two ferrite beads 742 727 33 MFR MinZN - inside of the Upper Unit (see Picture # 6 in Appendix 4)

2.6. EUT setup and operation:

The EUT was configured as detailed in Picture # 2 and photos in Appendix 4.

The EUT was powered from 120 VAC mains to the Lower Unit.

Operation mode: The customer's software (DiaCam360.exe) executed on the auxiliary HP laptop. The software controls the upper and lower units.

The software opens and operates of the EUT.

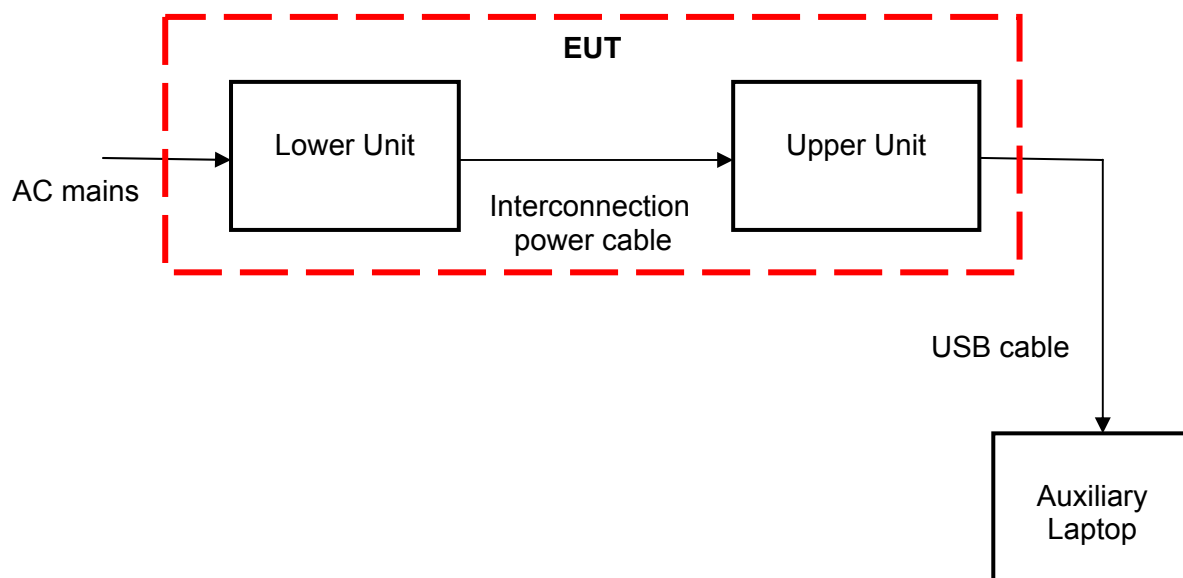
The process was observed on the auxiliary HP laptop via the camera.

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Picture # 2. Test setup

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3. Test specification, Methods and Procedures

Test Specification:

- | | |
|---------------------|---|
| ❖ CFR 47 FCC: | Rules and Regulations:
Part 15. "Radio frequency devices",
Subpart B: Unintentional radiators (2010). |
| ❖ ICES-003 Issue 5: | "Information Technology Equipment (ITE) -
Limits and Methods of Measurement (2010) (Canada). |

Methods and Procedures:

- | | |
|---------------------|--|
| ❖ CAN/CSA CISPR 22: | "Information Technology Equipment -
Radio Disturbance Characteristics -
Limits and Methods of Measurement" (2010). |
| ❖ ANSI C63.4:2009: | "American National Standard for Method of Measurement
of Radio Noise Emissions from Low Voltage Electrical and Electronic
Equipment in the Range 9 kHz to 40 GHz". |

4. Additional deviations or exclusions from the test specifications

Not applicable

5. General conditions

5.1. Location of the Test Site:

All tests were conducted at the EMC Laboratory of the Standards Institution of Israel in Tel-Aviv.

5.2. Emission tests:

- * For both radiated and conducted measurements, initial scans were made using a peak detector but still using the appropriate CISPR 16 (Quasi-Peak) detector IF bandwidth.
- * For conducted emissions, a tolerance limit was set 6 dB below the specification limit. Levels above the tolerance limit were retested using the Quasi-Peak detector or an average detector.
- * For radiated emissions, a tolerance limit was set 10 dB below the specification limit. Levels above the tolerance limit were retested using the Quasi-Peak detector.

5.3. Initial visual check and functional test:

Initial visual check and brief built-in test of the EUT was performed before testing.
- No external damages were found.

The test on the EUT passed successfully.

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6. Emissions

6.1. Radiated Emission Summary

Test procedure:

1. The radiated emission measurements were performed in operation mode as detailed in section 2.6.
2. The radiated emission measurements were conducted in 3-m semi-anechoic chamber. The frequency range from 30 MHz to 1000 MHz was investigated.
3. The Biconilog Antenna (20 MHz - 6000 MHz) was used during the test.
4. The measurements were performed at each frequency where the signal was 10 dB below the limit or less.
5. The levels were maximized by changing antenna polarization from vertical to horizontal, rotating turntable through 360 degree, varying antenna height from 1m to 4m and rerouting EUT cables.
6. Power supply - 120 VAC mains.

Measuring equipment settings:

Initial scan:

Detector type	Peak
Mode	Max hold
Bandwidth	120 kHz (30-1000 MHz)
Step size	Continuous sweep
Sweep time	>1 seconds/MHz

Measurements

Detector type	Quasi-peak (CISPR)
Bandwidth	120 kHz (30-1000 MHz)
Observation	>15 seconds
Measurement time	20 seconds/MHz

Test results:

Table 4. Radiated emission test results (summarized)

Specified Standard	Frequency range	Polariz.	Table/ Plot	Result	Remarks
FCC Part 15 Subpart B Class A	30 MHz – 1.0 GHz	V/H	Table 5	PASS	Max. emission = 2.0 dB below limit at 31.9 MHz
CAN/CSA CISPR 22 Class A	30 MHz – 1.0 GHz	V/H	Table 6	PASS	Max. emission = 3.0 dB below limit at 31.9 MHz

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Results: Pass
Specified standard / Class: FCC Part 15 Subpart B Section 15.109
Class A
Frequency range: 30 MHz – 1 GHz
EUT operation mode: Section 2.6
Measured distance: 3 m

Table 5. Radiated emission test results

No.	Frequency (MHz)	Antenna Polariz. V/H	Antenna Height (m)	Turn- table Angle (°)	Emission Level (dB μ V/m)	Limit @ 3 m (Note 2) (dB μ V/m)	Margin (dB)	Results
1	31.9	V	1.00	280	47.0	49.0	-2.0	Complies
2	42.7	V	1.00	197	40.3	49.0	-8.7	Complies
3	120.0	V	1.00	75	38.3	53.5	-15.2	Complies
4	192.0	H	1.00	165	34.5	53.5	-19.0	Complies
5	240.0	H	1.00	130	36.0	56.5	-20.5	Complies

Note 1: Emission level = E Reading (dB μ V) + Cable loss (dB) + Antenna Factor (dB/m)
For Cable Loss and Antenna Factor refer to Appendix 3.

Note 2: Measurements were performed at 3 m distance.
An inverse proportionality factor of 20 dB per decade was used to normalize the specified limit on 10 m to specified distance for determining compliance.

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Results: Pass
Specified standard / Class: CAN/CSA CISPR 22 Class A
Frequency range: 30 MHz – 1 GHz
EUT operation mode: Section 2.6
Measured distance: 3 m

Table 6. Radiated emission test results

No.	Frequency (MHz)	Antenna Polariz. V/H	Antenna Height (m)	Turn- table Angle (°)	Emission Level (dB μ V/m)	Limit @ 3 m (Note 2) (dB μ V/m)	Margin (dB)	Results
1	31.9	V	1.00	280	47.0	50.0	-3.0	Complies
2	42.7	V	1.00	197	40.3	50.0	-9.7	Complies
3	120.0	V	1.00	75	38.3	50.0	-11.7	Complies
4	192.0	H	1.00	165	34.5	50.0	-15.5	Complies
5	240.0	H	1.00	130	36.0	57.0	-21.0	Complies

Note 1: Emission level = E Reading (dB μ V) + Cable loss (dB) + Antenna Factor (dB/m)
For Cable Loss and Antenna Factor refer to Appendix 3.

Note 2: Measurements were performed at 3 m distance.
An inverse proportionality factor of 20 dB per decade was used to normalize the specified limit on 10 m to specified distance for determining compliance.

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6.2. Conducted Emission Summary

Test procedure:

All measurements were performed in the operation mode, as detailed in section 2.6.

The test was started with an initial scan. Final measurements were performed at the peaks, exceeded the tolerance limit.

Test equipment (EMI receiver) setup was as follow:

Initial scan:

Detector type	Peak
Mode	Max hold
Bandwidth	9 kHz
Step size	Continuous sweep
Sweep time	>100 msec

Measurements

Detector type	Quasi-peak (CISPR)
Bandwidth	9 kHz
Observation	>15 seconds

Test results:

Table 7. Conducted emission test results (summarized)

Line Description	Specified standard	Meas. equipment	Ref. Plot	Result	Remarks
120 VAC mains	FCC Part 15 Subpart B Class A; CAN/CSA CISPR 22 Class A	LISN	Plot # 1, Plot # 2	PASS	Worst result =10.0 dB below limit @ 13.24 MHz. (Ph, QP detector vs QP limit).

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Conducted Emission Summary (Continued)

Results: Pass

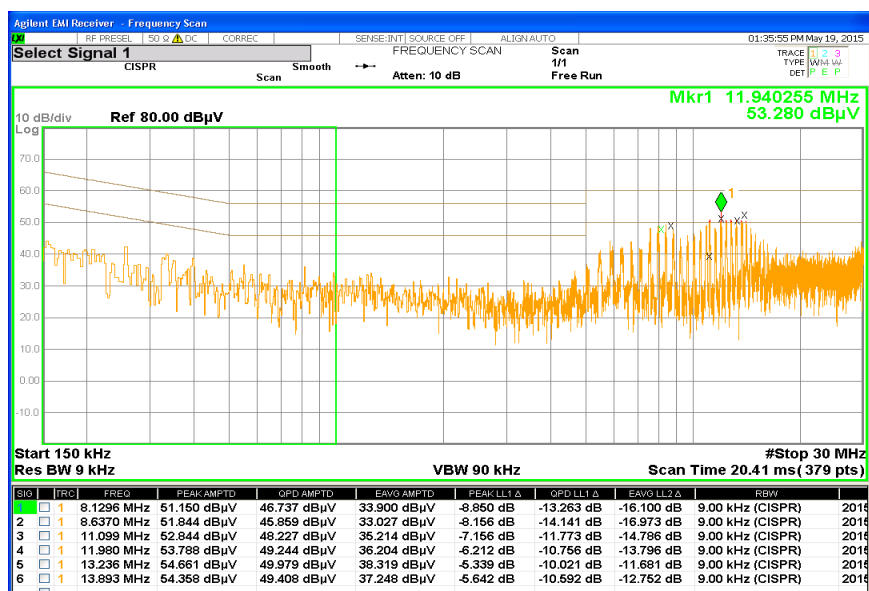
Specified standard / Class: FCC part 15 Subpart B section 15.107 Class A;
CAN/CSA CISPR 22 Class A

EUT operation mode: Section 2.6

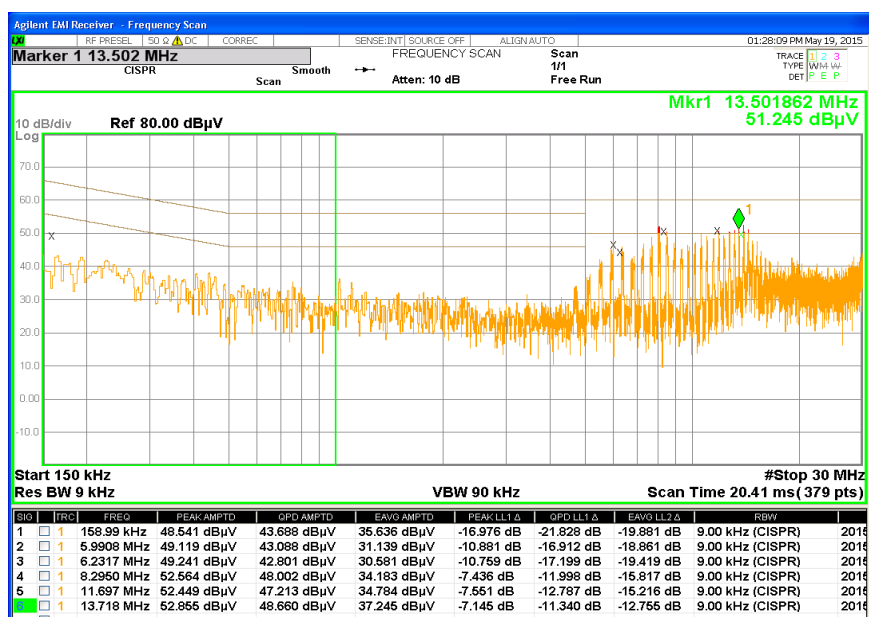
Frequency range: 0.15 MHz – 30 MHz

Tested line: 120 VAC mains

Plot # 1. Conducted emission – Phase



Plot # 2. Conducted emission – Neutral



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7. Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding once a year.

Instrument	Manufacturer	Model	SII No.	Last calibration date	Next calibration date
EMI Receiver 9 kHz - 6.5 GHz	HP	8546A+85460A	4068	06/14	06/15
EMI Test Receiver 20 Hz – 40 GHz	ROHDE & SCHWARZ	R&S®ESU40	5911	11/14	11/15
MXE EMI Analyzer 20 Hz - 26.5 GHz	Agilent Techn	N9038A	6501147	03/15	03/16
EMI Analyzer 10 kHz - 26.5 GHz	HP	E7405A	4944	05/14; 06/15	05/15; 06/16
LISN 9 kHz – 30 MHz	Fischer Custom	FCC - LISN -50-25- 2	4025	01/15	01/16
Line Impedance Stabilization Network (LISN) 9 kHz-30 MHz, 4X32(50)A, 230/400V	Schwarbeck Mess- Elektronik	NSLK 8128	6677	01/15	01/16
Transient limiter 0.009-200 MHz	Agilent Techn	11947A	3107A03104	08/14	08/15
Biconilog Antenna 20 MHz - 6000 MHz	ETS LINDGREN	3142D- SN:00146490	--	01/15	01/16
Software	Agilent	E7415A	SW version 1.00.1	N/A	N/A

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8. Appendix 2: Measurement uncertainty

The test equipment has been calibrated according to its recommended procedures and is within the manufacturer's published limit of error.

The laboratory calibrates its standards by a third party (traceable to NIST, USA) on a regular basis according to equipment manufacturer requirements.

In the following table the uncertainty calculation is given.

Calculated uncertainty U_{LAB} are less than U_{CISPR} , therefore compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit.

Type of disturbance Test description	Calculated uncertainty U_{LAB}	U_{CISPR}
Conducted disturbance at mains port (9 kHz to 150 kHz)	3.3 dB	3.8 dB
Conducted disturbance at mains port (150 kHz to 30 MHz)	2.8 dB	3.4 dB
Disturbance power (30 MHz to 300 MHz)	3.3 dB	4.5 dB
Radiated disturbance (electric field strength at an OATS at 10 m distance) (30 MHz to 1 000 MHz)	4.18 dB	6.3 dB
Radiated disturbance (electric field strength in a SAR at 3 m distance) (30 MHz to 1 000 MHz)	4.32 dB	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	4.47 dB	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	4.47 dB	5.5 dB

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by coverage factor of 2.

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9. Appendix 3: Antenna Factor and Cable Loss

Cable Loss (RG214 (6 m) + 5005 (3.8 m))

No.	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)	Frequency (MHz)	Attenuation (dB)
1	0.100000	-0.1	1.613578	0.0	26.036350	0.3	420.116889	1.5
2	0.105000	-0.1	1.694257	0.1	27.338167	0.3	441.122734	1.5
3	0.110250	0.0	1.778970	0.0	28.705075	0.3	463.178870	1.6
4	0.115762	-0.1	1.867919	0.0	30.140329	0.3	486.337814	1.6
5	0.121551	-0.1	1.961315	0.1	31.647346	0.3	510.654704	1.7
6	0.127628	0.0	2.059380	0.1	33.229713	0.3	536.187440	1.7
7	0.134010	0.0	2.162349	0.1	34.891199	0.4	562.996812	1.8
8	0.140710	0.0	2.270467	0.1	36.635758	0.4	591.146652	1.8
9	0.147746	0.0	2.383990	0.1	38.467546	0.4	620.703985	1.9
10	0.155133	-0.1	2.503190	0.0	40.390924	0.4	651.739184	1.9
11	0.162889	0.0	2.628349	0.1	42.410470	0.4	684.326143	2.0
12	0.171034	0.0	2.759766	0.1	44.530993	0.4	718.542450	2.0
13	0.179586	0.0	2.897755	0.1	46.757543	0.4	754.469573	2.1
14	0.188565	0.1	3.042643	0.1	49.095420	0.4	792.193052	2.1
15	0.197993	0.0	3.194775	0.1	51.550191	0.4	831.802704	2.2
16	0.207893	0.0	3.354513	0.1	54.127701	0.4	873.392839	2.3
17	0.218287	0.0	3.522239	0.1	56.834086	0.5	917.062481	2.3
18	0.229202	0.0	3.698351	0.1	59.675790	0.5	962.915605	2.4
19	0.240662	-0.1	3.883269	0.1	62.659580	0.5	1011.061386	2.5
20	0.252695	0.1	4.077432	0.1	65.792559	0.5	1061.614455	2.6
21	0.265330	0.0	4.281304	0.1	69.082187	0.5	1114.695178	2.6
22	0.278596	0.0	4.495369	0.1	72.536296	0.5	1170.429937	2.7
23	0.292526	-0.1	4.720137	0.1	76.163111	0.6	1228.951434	2.8
24	0.307152	0.0	4.956144	0.1	79.971266	0.6	1290.399005	2.9
25	0.322510	0.0	5.203951	0.1	83.969830	0.6	1354.918955	3.0
26	0.338635	0.0	5.464149	0.1	88.168321	0.6	1422.664903	3.1
27	0.355567	0.0	5.737356	0.1	92.576737	0.6	1493.798148	3.2
28	0.373346	0.0	6.024224	0.1	97.205574	0.6	1568.488056	3.3
29	0.392013	0.0	6.325435	0.1	102.065853	0.7	1646.912459	3.4
30	0.411614	0.0	6.641707	0.1	107.169145	0.7	1729.258082	3.5
31	0.432194	0.0	6.973792	0.1	112.527603	0.7	1815.720986	3.6
32	0.453804	-0.1	7.322482	0.1	118.153983	0.7	1906.507035	3.7
33	0.476494	0.0	7.688606	0.1	124.061682	0.7	2001.832387	3.9
34	0.500319	0.0	8.073037	0.1	130.264766	0.8	2101.924006	4.0
35	0.525335	0.0	8.476688	0.2	136.778004	0.8	2207.020206	4.1
36	0.551602	0.0	8.900523	0.1	143.616904	0.8	2317.371217	4.2
37	0.579182	0.0	9.345549	0.2	150.797750	0.8	2433.239777	4.4
38	0.608141	0.0	9.812826	0.2	158.337637	0.8	2554.901766	4.6
39	0.638548	0.0	10.303468	0.2	166.254519	0.9	2682.646855	4.8
40	0.670475	0.0	10.818641	0.2	174.567245	0.9	2816.779197	4.9
41	0.703999	0.0	11.359573	0.2	183.295607	0.9	2957.618157	5.0
42	0.739199	0.0	11.927552	0.2	192.460387	0.9	3105.499065	5.1
43	0.776159	0.0	12.523929	0.2	202.083407	1.0	3260.774018	5.2
44	0.814967	0.0	13.150126	0.2	212.187577	1.0	3423.812719	5.2
45	0.855715	0.0	13.807632	0.2	222.796956	1.0	3595.003355	5.4
46	0.898501	0.0	14.498014	0.2	233.936804	1.1	3774.753523	5.5
47	0.943426	0.0	15.222914	0.2	245.633644	1.1	3963.491199	5.6
48	0.990597	0.0	15.984060	0.2	257.915326	1.1	4161.665759	6.0
49	1.040127	0.0	16.783263	0.2	270.811093	1.2	4369.749047	6.1
50	1.092133	0.0	17.622426	0.2	284.351647	1.2	4588.236499	6.4
1	1.146740	0.0	18.503548	0.3	298.569230	1.2	4817.648324	6.8
2	1.204077	0.0	19.428725	0.2	313.497691	1.2	5058.530740	6.9
3	1.264281	0.0	20.400161	0.3	329.172576	1.3	5311.457277	6.9
4	1.327495	0.0	21.420169	0.3	345.631204	1.3	5577.030141	7.2
5	1.393870	0.0	22.491178	0.3	362.912765	1.4	5855.881648	7.2
6	1.463563	0.0	23.615737	0.3	381.058403	1.4	6000.000000	7.0
7	1.536741	0.0	24.796523	0.3	400.111323	1.5		

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3 m distance**

No.	f / MHz	AF / dB/m	f / MHz	AF / dB/m	f / MHz	AF / dB/m
1	30	18.7	250	12.0	2750	31.0
2	35	15.7	300	13.8	3000	31.2
3	40	12.9	400	16.2	3250	32.7
4	45	10.6	500	18.6	3500	34.5
5	50	9.0	600	20.2	3750	34.3
6	60	7.3	700	21.8	4000	34.5
7	70	7.7	800	22.9	4250	35.3
8	80	8.2	900	24.1	4500	35.5
9	90	9.2	1000	24.8	4750	36.1
10	100	9.4	1250	26.9	5000	37.4
11	120	8.5	1500	30.2	5250	38.4
12	140	8.5	1750	28.5	5000	39.9
13	160	9.1	2000	28.9	5750	38.2
14	180	10.5	2250	29.8	6000	39.1
15	200	10.9	2500	32.5		

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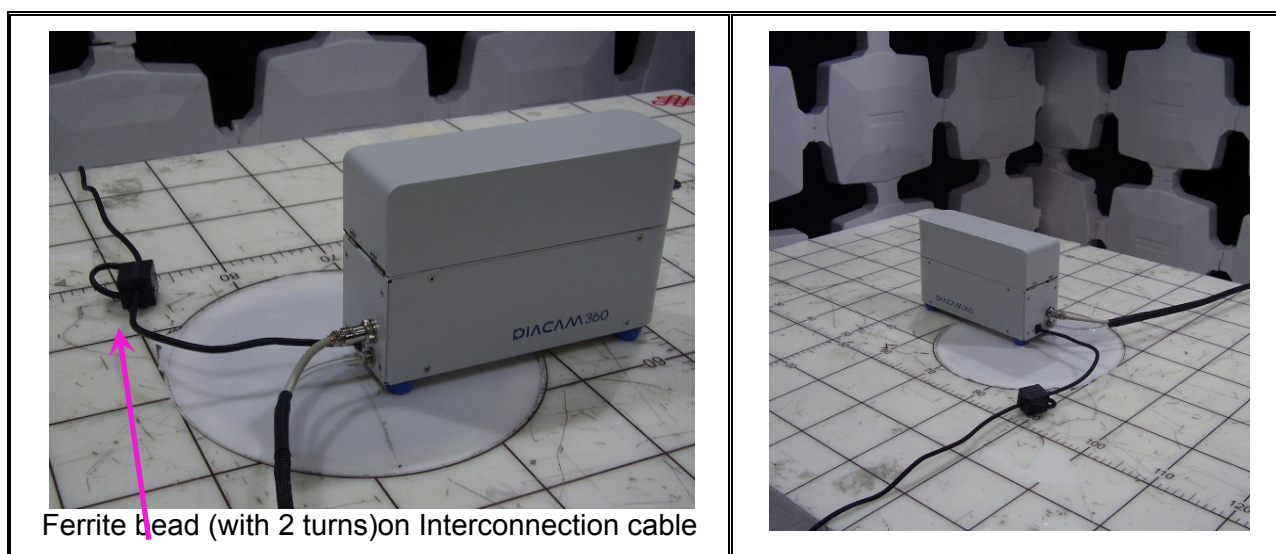
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10. Appendix 4: Test illustrations



**Picture # 3. Radiated emission test setup
Front and rear views**



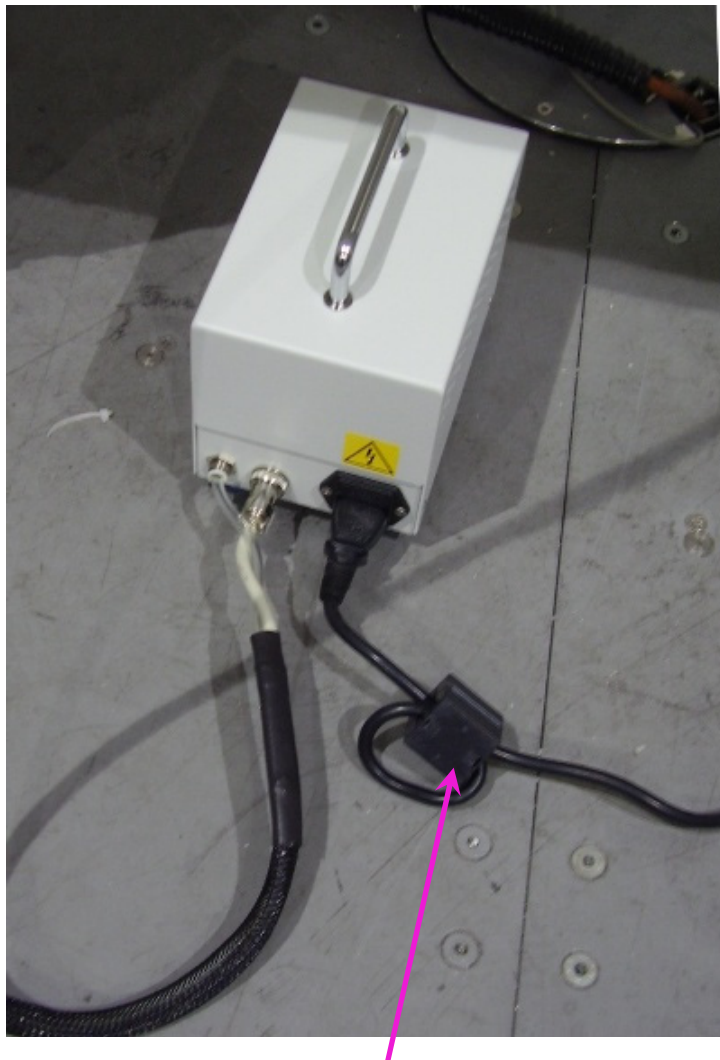
**Picture # 4. Radiated emission test setup
Upper Unit views**

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Ferrite bead (with 2 turns) on AC mains cable

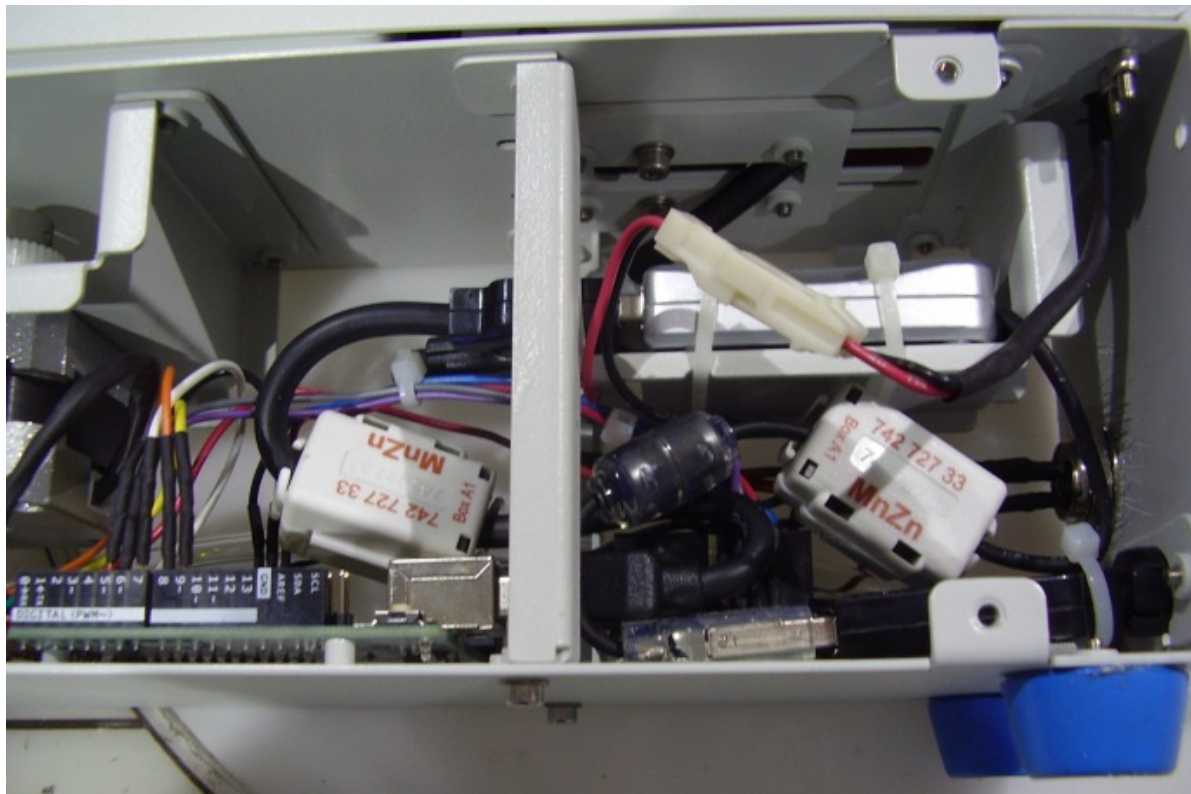
**Picture # 5. Radiated emission test setup
Lower Unit overall view**

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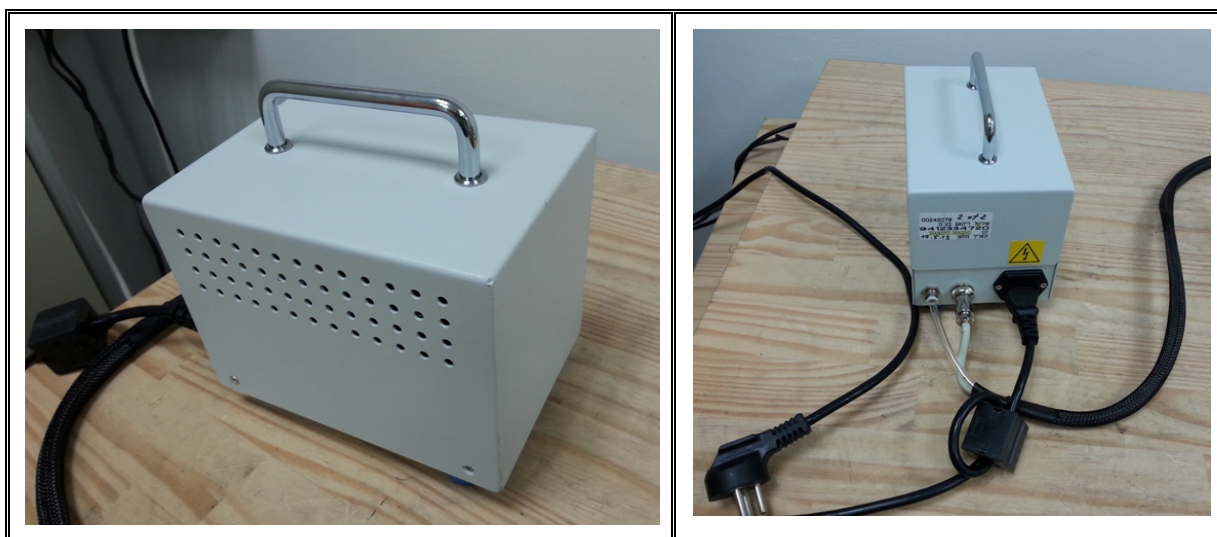
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**Picture # 6. Upper unit -
internal view with ferrite beads**



Picture # 7. EUT: Lower Unit

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Picture # 8. EUT: Upper Unit (closed and opened)