



***Test Report No.9712312196***

***Applicant: Mantis Vision Ltd.***

***Equipment Under Test: 3D handheld camera***

***Model: SmartF6***

***Issued by:***

***The Standards Institution of Israel***

***Industry Division***

***Electronics & Telematics Laboratory***

***EMC Branch***



Certificate Number: AT-1359

**Test Report No.:** 9712312196**Page 2 of 52 Pages****Title:** Test on 3D handheld camera **Model:** SmartF6

<b>Applicant:</b>	Mantis Vision Ltd.
<b>Address:</b>	24 Imber St. Petah Tikva 4951158, Israel
<b>Sample for test selected by:</b>	The customer
<b>The date of test:</b>	22/5, 5, 11, 12, 22 & 27/6/2017

**Description of Equipment**

<b>under Test (EUT):</b>	3D handheld camera
<b>Model:</b>	SmartF6
<b>Serial No:</b>	001
<b>Manufactured by:</b>	Mantis Vision Ltd.

**Reference Documents:**

- ❖ EN 55032: 2012+AC/2013  
EN 55032: 2015
  - ❖ CISPR 32: 2015
  - ❖ EN 55024: 2010+A1:2015
  - ❖ CFR 47 FCC:
  - ❖ VCCI-CISPR 32: 2016
  - ❖ EN 61000:
- Electromagnetic Compatibility of multimedia equipment – Emissions requirements.
- Electromagnetic Compatibility of multimedia equipment – Emissions requirements Ed. 2.0.
- “Information technology equipment - Immunity characteristics - Limits and methods of measurement”.
- “Rules and Regulations”: Part 15. “Radio frequency devices”, Subpart B: Unintentional radiators (2015).
- Technical Requirements.
- “Electromagnetic Compatibility (EMC)”; Part 3. “Limits. Section 2. “Limits for harmonic current emissions (equipment input current  $\leq 16A$  per phase” (2014).  
Section 3. “Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $< 16 A$  per phase and not subjected to conditional connection” (2013).

**Test results:**

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

- EN 55032 Class A
- CISPR 32 Class A
- EN 55024
- CFR 47 FCC Part 15 Subpart B Class A
- VCCI-CISPR 32 Class A
- EN 61000-3-2/-3-3

Details see in clause 1.

This Test Report contains 52 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	Class/ Severity level	Test result
<b>Emission</b>			
Conducted emission Freq. range: 150 kHz - 30 MHz	EN 55032/ CISPR32	Class B. 230 VAC mains	Complies
Radiated emission Freq. range: 30 MHz – 6 GHz		Class A	Complies
Conducted emission Freq. range: 150 kHz - 30 MHz	FCC part 15 Subpart B	Class B. 120 VAC mains	Complies
Radiated emission Freq. range: 30 MHz – 6 GHz		Class A	Complies
Conducted emission Freq. range: 150 kHz - 30 MHz	VCCI-CISPR 32	Class B. 100 VAC mains	Complies
Radiated emission Freq. range: 30 MHz – 6GHz		Class A	Complies
Harmonic current emission test	EN 61000-3-2	230VAC mains	Complies
Voltage changes, Voltage fluctuations and Flicker test	EN 61000-3-3	230VAC mains	Complies
<b>Immunity (per EN 55024)</b>			
Immunity from Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact, 8 kV air discharge	Complies
Immunity from radiated electromagnetic fields	IEC 61000-4-3	3.0 V/m 80 MHz ÷ 2.7 MHz; 80% AM 1 kHz	Complies
Immunity from Electrical Fast transient (EFT)	IEC 61000-4-4	AC mains (Charger), AC mains (Laptop PS): ± 1.0 kV Tr/Th – 5/50 ns, 5 kHz	Complies
Immunity from Surge	IEC 61000-4-5	AC mains (Charger): ±1.0 kV DM; Tr/Th – 1.2/50 (8/20) µs	Complies
Immunity from conducted disturbances induced by RF fields	IEC 61000-4-6	AC mains (Charger), AC mains (Laptop PS): 3.0 VRMS 0.15÷80 MHz, 80% AM, 1 kHz	Complies
Immunity from Voltage dips & interruptions	IEC 61000-4-11	AC mains (Charger), AC mains (Laptop PS) 0 % - 10 ms; 70% - 500 ms; 0% - 5sec	Complies

Approved by: Eng. Yuri Rozenberg  
Position: Head of EMC BranchName: Galit Gorodetsky  
Position: Technical WriterElectronics & Telematics  
Laboratory  
July 5, 2017Name: Feldman Michael  
Position: Testing EngineerName: Piter Sapir  
Position: Testing Engineer

## 2. EUT Description

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

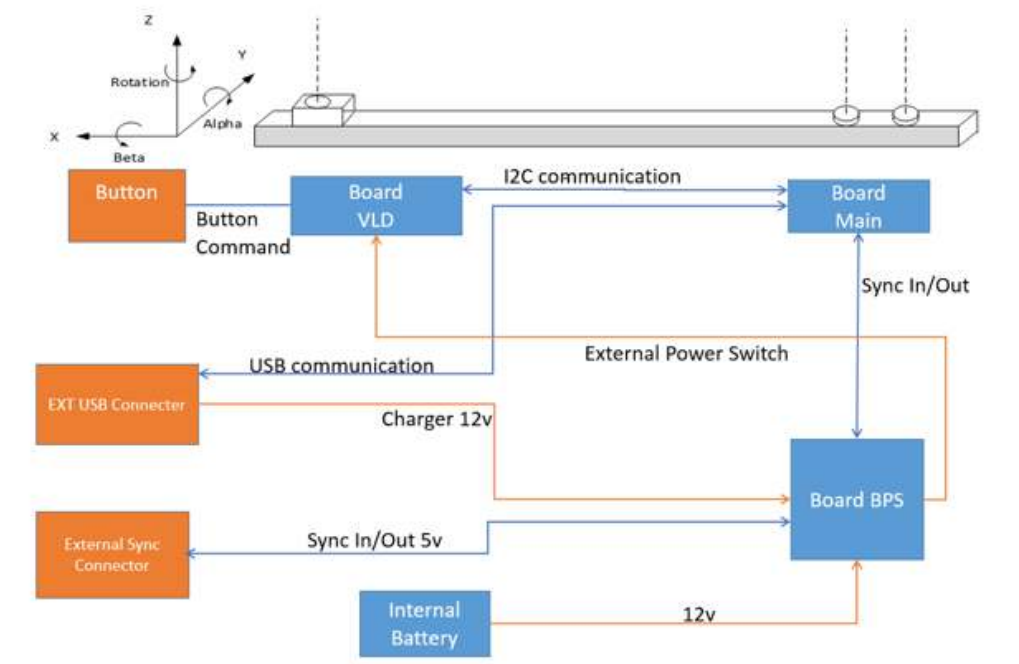
### 2.1. General description:

The Equipment under Test (hereinafter: EUT) is a 3D handheld camera used for 3D model capturing of highly dynamic scenes.

Mantis Visions' proprietary technology enables 3D model capturing of highly dynamic scenes. At its core is a breakthrough signal frame coding method for structured light imaging. The Smart F6 handheld images is capable of automatically capturing a dense 3D point-cloud model of the environment in each frame. Tens of thousands of points are decided while maintaining high accuracy. Tens of thousands of points are decoded while maintaining high accuracy.

Dimensions: 34 cm x 14 cm x 5cm approx.

Power supply: 5VDC @ 500mA.



**Picture # 1. EUT Block diagram**



**Picture # 2. EUT general view**

**2.2. EUT's sub-assemblies list:**

**Table 1. Sub-assemblies list**

Description (function)	Manufacturer	Model
Internal Battery (x3)	Samsung	SDI ICR18650-26F
Battery Charger	FRIWO Germany	FW 7219/LION 3 Input: 100-240V 0.3A/ Output: 11V, 1V 0.8A
	Mascot	2241 3-cell Li-Ion Input: 100-240V 0.35A/ Output: 12.6V, 1.2A
Main Board	Mantis Vision Ltd.	-

**2.3. EUT connector / cable list**

**Table 2. Connector / cable list**

No.	Connector's description	Connector's type	Type of Cable	Length (m)	No. of identical connectors
1	Main Connector	Power/ Communication	USB Cable/ Power Cable	1.8	1
2	Sync Connector	Data connector	NA	NA	NA

**2.4. Auxiliary equipment used during the tests**

**Table 3. Auxiliary equipment list**

Name	MFR	Model
Laptop	ASUS	N551V
AC Adapter	ASUS	PA-1121-28

**2.5. Potential emission sources**

**Table 4. Potential emission sources**

Frequency (MHz)	Location
24	CPU

**2.6. RF Suppression Measures:**

mfr Wurth P/N 742 711 12 on External USB Cable.  
 mfr Wurth P/N 742 716 22S on Internal USB Cable.

**2.7. EUT setup and operation**

EUT Test setup is shown in Fig. 3.

The system has two operations modes:

- - *Operational mode*- In operation mode, the system is connected to a Laptop via USB, providing power to the Main Board , VLD and communicating with the Camera. At that mode there is no charging of the battery.  
The camera acquiring imaging of the filtered scene (at illumination wave length of 850nm) and sent to the Laptop via USB. The camera also provides a synchronous trigger to the Laser driver.  
Providing a trigger from the User Input, the laser driver derives power from the battery through the Power control module in order to activate the projector.
- - *Charge mode* – In charge mode, the system is connected to a charger via USB, charging the battery. At this mode the laser driver and camera are non-operational.

All tests were performed with two chargers:

Charger 1:      mfr FRIWO Type FW 7219/LION 3.

Charger 2:      mfr Mascot Type 2241 3-cell Li-Ion.

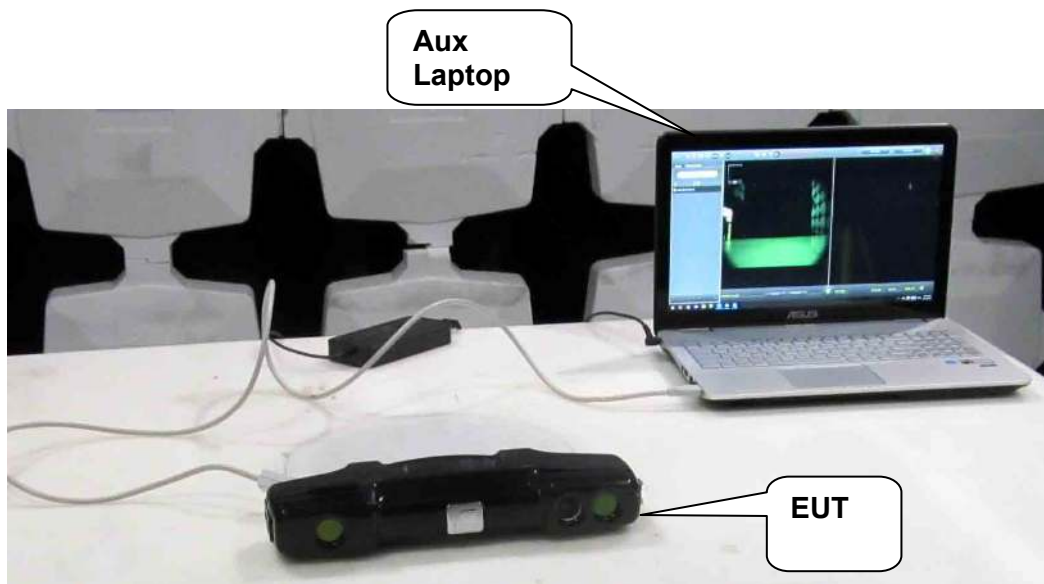
The EUT was powered and tested as detailed in Table 5.

**Table 5. List of performed tests**

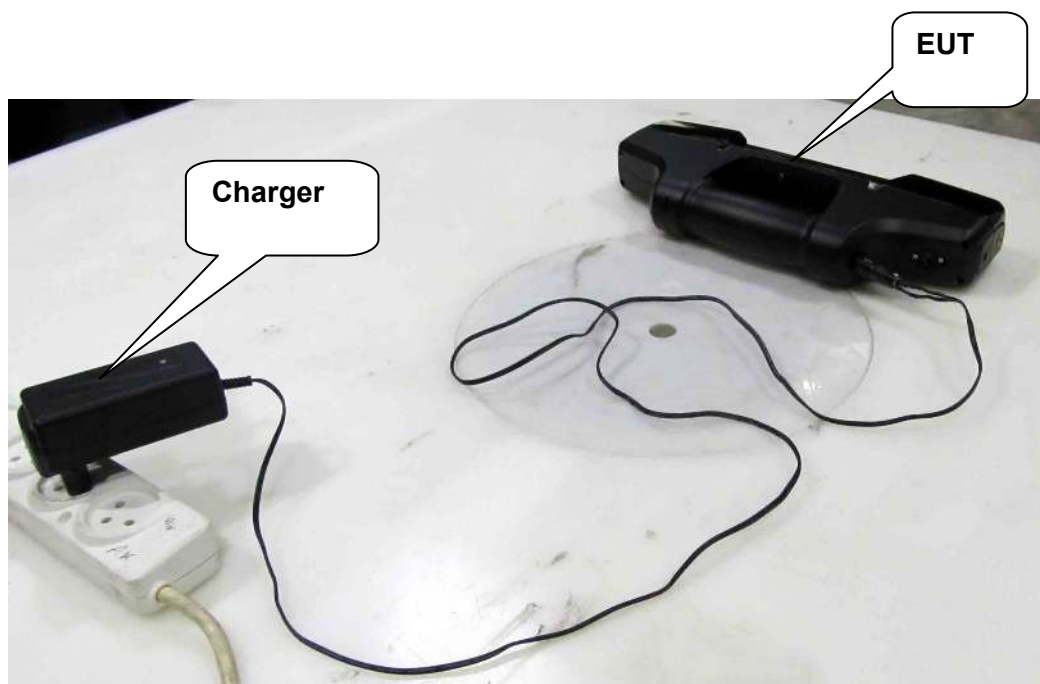
Mains	Emission tests				Immunity tests							
	EN 55032/ CISPR32 FCC Part 15 Subpart B/ VCCI-CISPR 32		EN 61000-3-x		EN 55024 / IEC 61000-4-x							
	Cond.	Rad.	-2	-3	-2	-3	-4	-5	-6	-8	-11	
230 VAC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	✓
120 VAC	✓	✓	N/A		N/A							
100 VAC	✓	✓	N/A		N/A							

**Notes:**

**N/A** - denotes test is not applicable.



Operation mode setup



Charging setup

Picture # 3. EUT test setups



### 3. Test specification, Methods and Procedures

#### Test Specification:

- |  |  |
|--|--|
| ❖ EN 55032: 2012+AC/2013<br>EN 55032: 2015<br>CISPR 32: 2015 | Electromagnetic Compatibility of multimedia equipment – Emissions requirements.<br>Electromagnetic Compatibility of multimedia equipment – Emissions requirements Ed. 2.0.   |
| ❖ CFR 47 FCC:  | “Rules and Regulations”: Part 15. “Radio frequency devices”, Subpart B: Unintentional radiators (2015)   |
| ❖ VCCI–CISPR 32:   | Technical Requirements (2016).   |
| ❖ EN 61000:  | “Electromagnetic Compatibility (EMC)”; Part 3. “Limits.”<br><u>Section 2.</u> “Limits for harmonic current emissions (equipment input current $\leq$ 16A per phase” (2014).<br><u>Section 3.</u> “Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current $<$ 16 A per phase and not subjected to conditional connection” (2013). |
| ❖ EN 55024: 2010+A1:2015                                     | “Information technology equipment - Immunity characteristics - Limits and methods of measurement”.   |

#### Methods and Procedures:

- |  |   |
|--|---|
| ❖ EN 55032: 2012+AC/2013<br>EN 55032: 2015 | Electromagnetic Compatibility of multimedia equipment – Emissions requirements.   |
| ❖ ANSI C63.4:2014                          | "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".  |
| ❖ VCCI–CISPR 32:                           | Technical Requirements (2016).  |
| ❖ EN 61000-3-3:                            | "Electromagnetic Compatibility (EMC)"; Part 3. “Limits.”<br><u>Section 2.</u> “Limits for harmonic current emissions (equipment input current $\leq$ 16A per phase” (2014).<br><u>Section 3.</u> “Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current $<$ 16 A per phase and not subjected to conditional connection” (2013).  |
| ❖ IEC 61000-3-4:                           | Part 4. “Testing and measurement techniques;”<br>Section 2: “Electrostatic discharge immunity tests” Ed. 2.0 (2008).<br>Section 3: “Radiated, radio-frequency, electromagnetic field immunity test”,<br>Ed. 3.1 (2008).<br>Section 4: “Electrical Fast Transient/burst immunity test” Ed.3.0 (2012).”<br>Section 5: “Surge immunity tests” Ed.3.0 (2014).<br>Section 6: “Immunity to conducted disturbances induced by radio-frequency fields” Ed. 4.0 (2013).<br>Section 11: “Voltage dips, short interruptions and voltage variations immunity tests” (2004). |

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#### 4. Additional deviations or exclusions from the test specifications

The tests were performed according to the customer specification.

#### 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. Conducted Emission Summary

#### Test procedure:

#### Tested modes:

1. Operation mode. Tested port: Laptop PS AC input.
2. Charge mode. Tested port: Charger AC input:
  - with Charger FRIWO
  - with Charger Mascot

The tests were performed when the EUT was powered from 230 VAC or 120 VAC or 100 VAC mains via external power supply (according to the requirements of the respective standards).

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 follows:

#### Initial scan:

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

#### Measurements

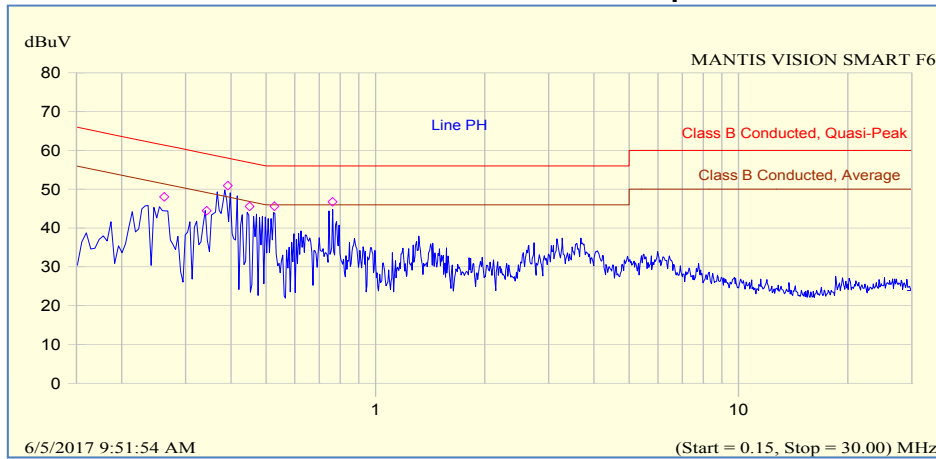
Detector type	Quasi-peak (CISPR)
Bandwidth	9 kHz
Observation	>15 seconds

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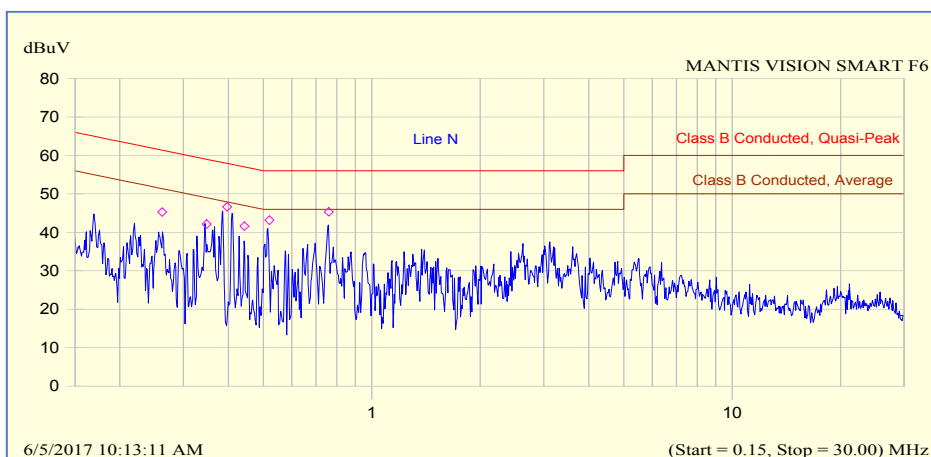
Operation mode	Tested line	Specified standard	Coupling Network	Ref. Plot	Result	Remarks
Operation	230Vac	EN 55032/ CISPR32 Class B	LISN	#1-2	<b>PASS</b>	All QP/Avg emissions are 9 dB at least below QP/Avg limits
	120Vac	FCC Part 15 Subpart B Class B		#3-4	<b>PASS</b>	All QP/Avg emissions are 16 dB at least below QP/Avg limits
	100Vac	VCCI-CISPR 32 Class B		#5-6	<b>PASS</b>	All QP/Avg emissions are 18 dB at least below QP/Avg limits
Charging w. Charger <b>Mascot</b>	230Vac	EN 55032/ CISPR32 Class B		#7-8	<b>PASS</b>	All QP/Avg emissions are 4.6 dB at least below QP/Avg limits
	120Vac	FCC Part 15 Subpart B Class B		#9-10	<b>PASS</b>	All QP/Avg emissions are 6.9 dB at least below QP/Avg limits
	100Vac	VCCI-CISPR 32 Class B		#11-12	<b>PASS</b>	All QP/Avg emissions are 7.8 dB at least below QP/Avg limits
Charging w. Charger <b>FRIWO</b>	230Vac	EN 55032/ CISPR32 Class B		#13-14	<b>PASS</b>	All QP/Avg emissions are 10 dB at least below QP/Avg limits
	120Vac	FCC Part 15 Subpart B Class B		#15-16	<b>PASS</b>	All QP/Avg emissions are 10 dB at least below QP/Avg limits
	100Vac	VCCI-CISPR 32 Class B		#17-18	<b>PASS</b>	All QP/Avg emissions are 11 dB at least below QP/Avg limits

**Results:** Pass  
**Specified standard / Class:** EN 55032 Class B  
**Measured line/port:** 230 VAC mains. PH & N

Plot # 1- Plot # 2. Conducted emission. Operation mode



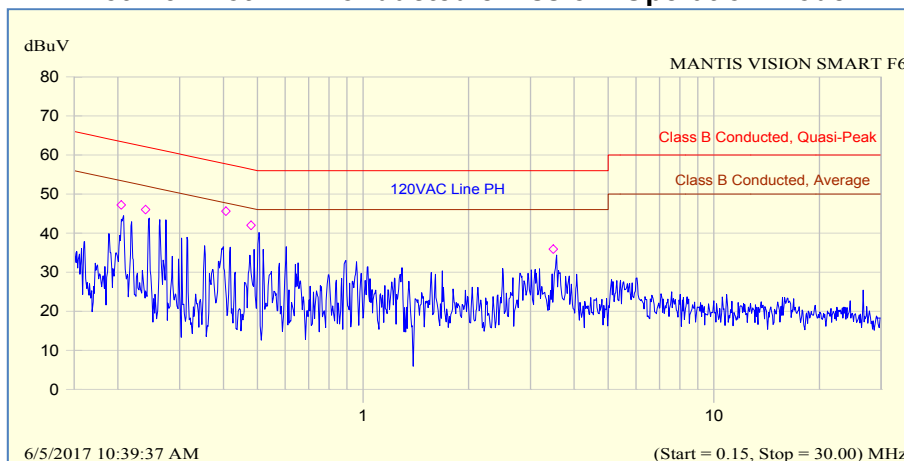
Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.26	48.0	44.5	61.4	-16.8	35.2	51.4	-16.2
0.34	44.5	40.4	59.1	-18.7	26.7	49.1	-22.4
0.39	50.9	48.9	58.0	-9.1	35.6	48.0	-12.4
0.45	45.5	40.7	56.9	-16.1	24.2	46.9	-22.6
0.53	45.6	41.7	56.0	-14.3	29.3	46.0	-16.7
0.76	46.7	41.3	56.0	-14.7	29.4	46.0	-16.6



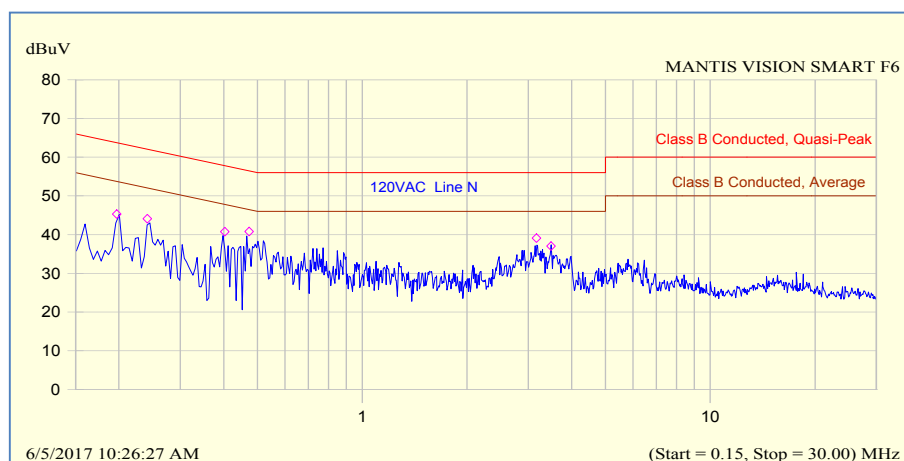
Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.26	45.3	40.9	61.4	-20.4	35.5	51.4	-15.9
0.35	42.1	37.7	59.0	-21.3	31.3	49.0	-17.7
0.40	46.6	44.8	57.9	-13.2	30.3	47.9	-17.6
0.44	41.6	36.3	57.0	-20.7	21.4	47.0	-25.6
0.52	43.1	40.6	56.0	-15.4	30.1	46.0	-15.9
0.76	45.3	41.4	56.0	-14.6	27.4	46.0	-18.6

**Results:** Pass  
**Specified standard / Class:** FCC Part 15 Subpart B Class B  
**Measured line/port:** 120 VAC mains PH & N

Plot # 3- Plot # 4. Conducted emission. Operation mode



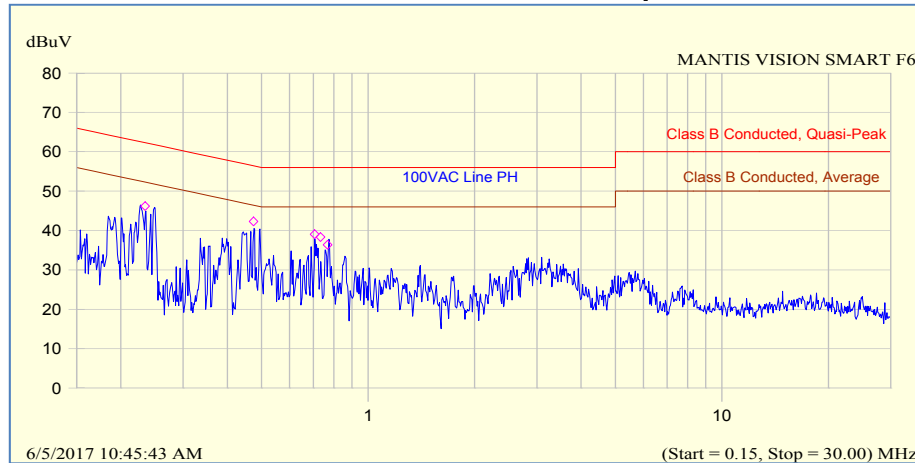
Frequency MHz	Peak dBμV	QP dBμV	QP Lim dBμV	QP-QP Limit dB	Avg dBμV	Avg Lim dBμV	Avg-Avg Limit dB
0.20	47.2	42.8	63.4	-20.6	31.4	53.4	-22.0
0.24	46.0	42.5	62.1	-19.6	31.6	52.1	-20.5
0.41	45.6	39.7	57.7	-18.1	31.2	47.7	-16.5
0.48	42.0	37.8	56.3	-18.6	26.8	46.3	-19.6
3.49	35.9	30.8	56.0	-25.2	23.4	46.0	-22.6



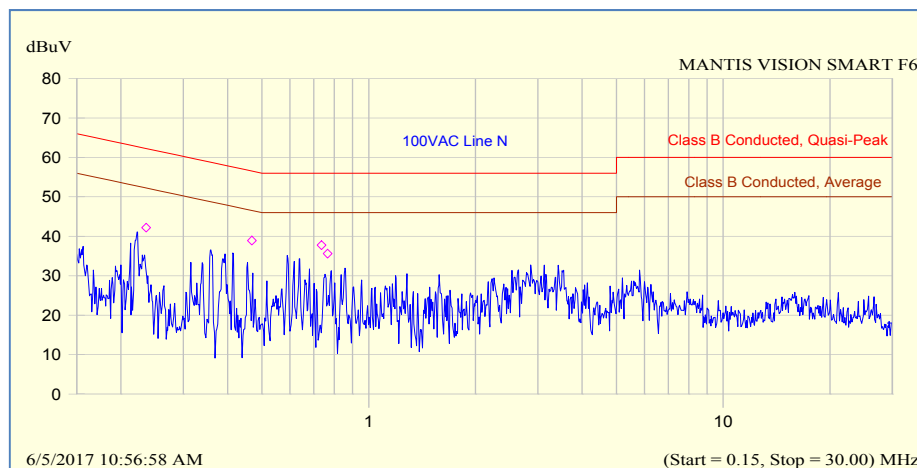
Frequency MHz	Peak dBμV	QP dBμV	QP Lim dBμV	QP-QP Limit dB	Avg dBμV	Avg Lim dBμV	Avg-Avg Limit dB
0.20	45.3	40.3	63.7	-23.4	31.8	53.7	-21.9
0.24	44.1	38.9	62.0	-23.2	30.5	52.0	-21.5
0.40	40.8	35.7	57.8	-22.1	30.5	47.8	-17.3
0.47	40.8	35.2	56.5	-21.2	25.1	46.5	-21.3
3.17	39.1	32.2	56.0	-23.8	24.6	46.0	-21.4
3.49	37.0	32.0	56.0	-24.0	23.7	46.0	-22.3

**Results:** Pass  
**Specified standard / Class:** VCCI-CISPR 32 Class B  
**Measured line/port:** 100 VAC mains PH & N

Plot # 5- Plot # 6. Conducted emission. Operation mode



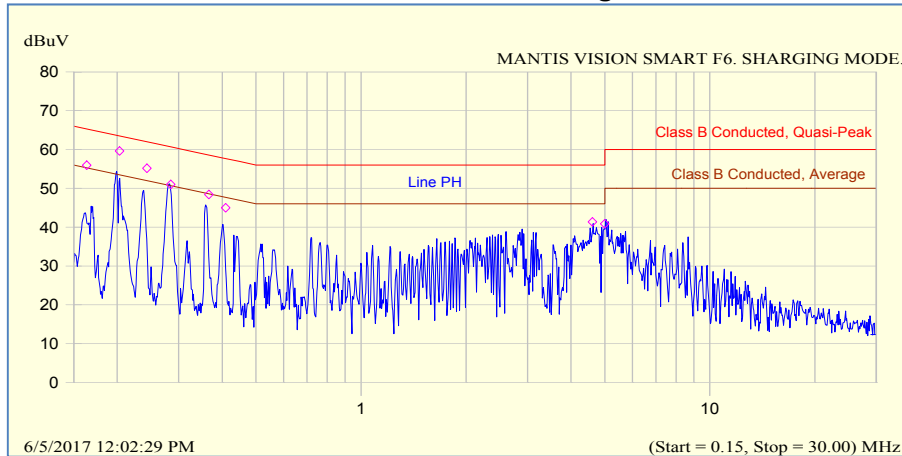
Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.23	46.2	42.7	62.3	-19.6	32.0	52.3	-20.3
0.47	42.3	37.6	56.4	-18.8	24.8	46.4	-21.6
0.71	39.1	33.3	56.0	-22.7	21.5	46.0	-24.5
0.73	38.3	32.6	56.0	-23.4	20.8	46.0	-25.2
0.77	36.4	31.9	56.0	-24.1	20.6	46.0	-25.4



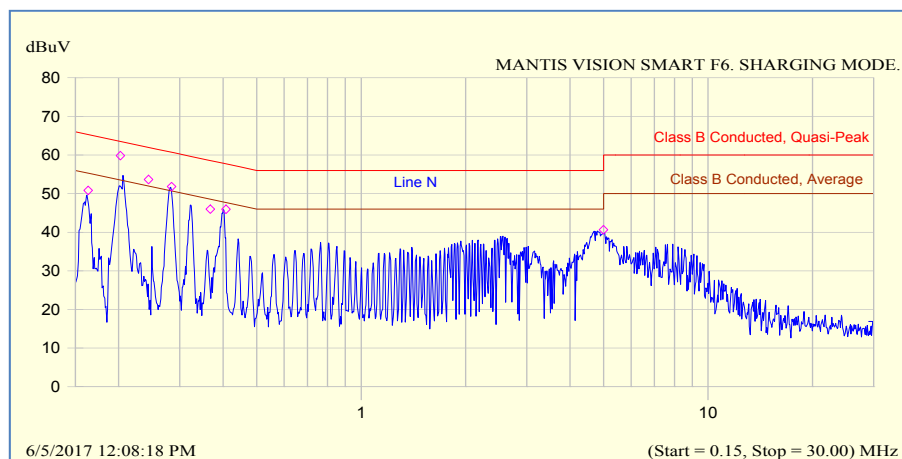
Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.23	42.2	37.7	62.2	-24.5	29.2	52.2	-23.1
0.47	38.9	34.9	56.5	-21.7	24.5	46.5	-22.1
0.74	37.8	31.9	56.0	-24.1	19.7	46.0	-26.3
0.77	35.6	30.8	56.0	-25.2	18.8	46.0	-27.2

**Results:** **Pass**  
**Specified standard / Class:** EN 55032 Class B  
**Measured line/port:** 230 VAC mains. PH & N

**Plot # 7- Plot # 8. Conducted emission. Charge mode. Mascot Charger**



Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.16	55.9	52.1	65.3	-13.2	39.9	55.3	-15.4
0.20	59.6	57.6	63.5	-5.9	46.6	53.5	-6.9
0.24	55.2	53.6	62.0	-8.4	43.7	52.0	-8.3
0.29	51.0	49.9	60.7	-10.7	42.5	50.7	-8.2
0.37	48.4	47.2	58.6	-11.4	37.5	48.6	-11.1
4.61	41.4	39.4	56.0	-16.6	27.8	46.0	-18.2



Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.16	50.8	49.0	65.3	-16.3	38.2	55.3	-17.1
0.20	59.8	58.9	63.5	-4.6	48.4	53.5	-5.1
0.24	53.6	52.6	62.0	-9.4	43.4	52.0	-8.6
0.28	51.8	51.0	60.7	-9.7	42.6	50.7	-8.1
0.37	46.0	44.6	58.6	-14.0	36.0	48.6	-12.6
0.41	45.9	43.5	57.7	-14.2	34.3	47.7	-13.4





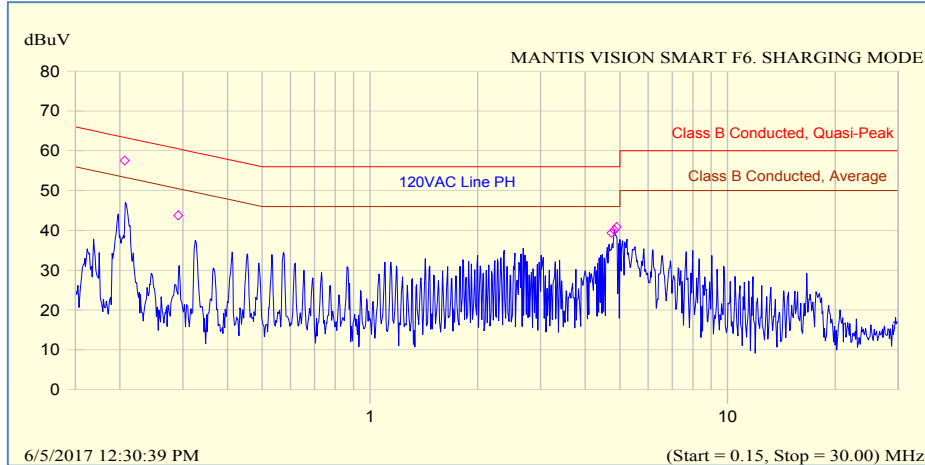
Test Report No.: 9712312196

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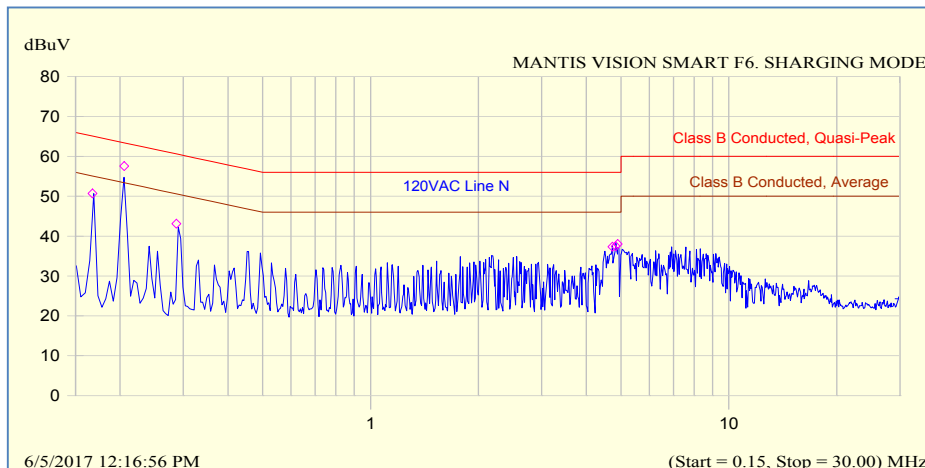
Title: Test on 3D handheld camera Model: SmartF6

**Results:** Pass  
**Specified standard / Class:** FCC Part 15 Subpart B Class B  
**Measured line/port:** 120 VAC mains PH & N

Plot # 9- Plot # 10. Conducted emission. Charge mode. Mascot Charger



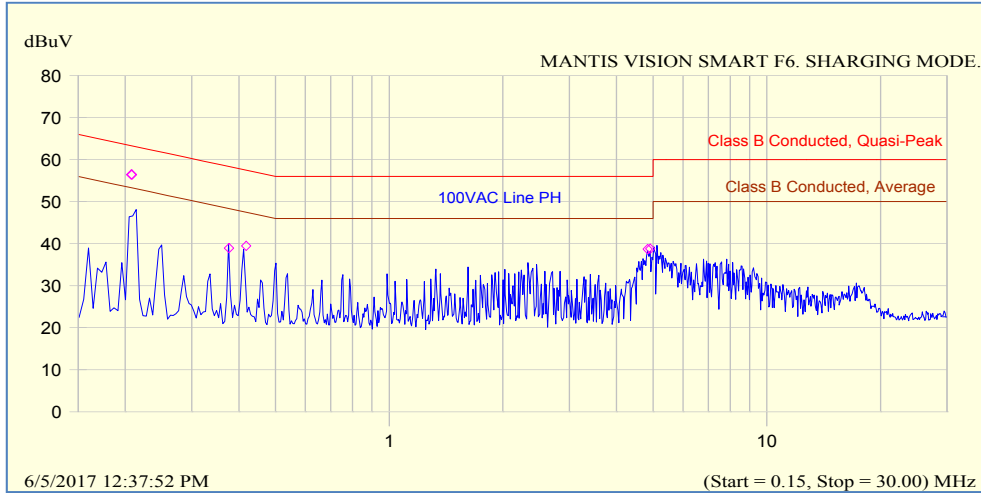
Frequency MHz	Peak dBμV	QP dBμV	QP Lim dBμV	QP-QP Limit dB	Avg dBμV	Avg Lim dBμV	Avg-Avg Limit dB
0.17	47.5	45.7	65.2	-19.5	34.9	55.2	-20.2
0.21	57.5	56.5	63.4	-6.9	45.9	53.4	-7.4
0.29	43.8	42.1	60.5	-18.4	33.1	50.5	-17.4
4.74	39.4	36.6	56.0	-19.4	27.4	46.0	-18.6
4.83	40.1	37.1	56.0	-18.9	23.8	46.0	-22.2
4.90	40.9	37.7	56.0	-18.3	28.0	46.0	-18.0



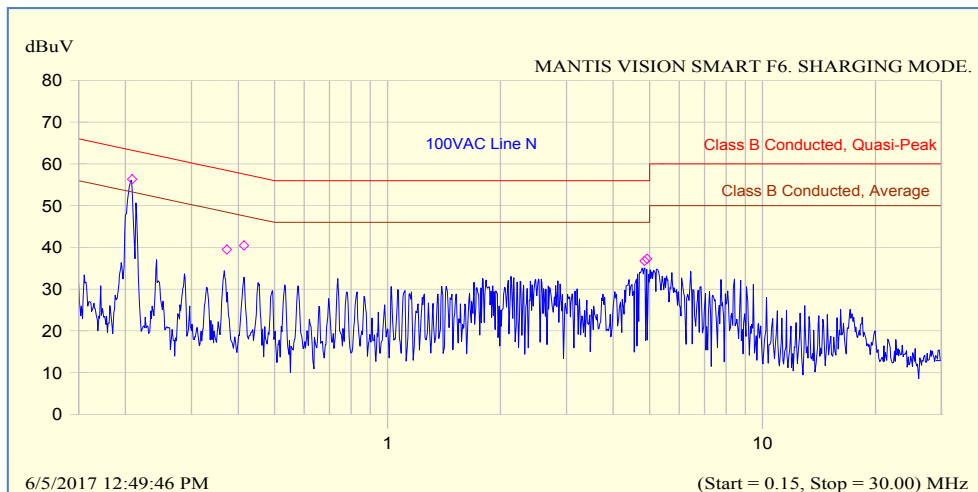
Frequency MHz	Peak dBμV	QP dBμV	QP Lim dBμV	QP-QP Limit dB	Avg dBμV	Avg Lim dBμV	Avg-Avg Limit dB
0.17	50.7	48.4	65.1	-16.7	33.3	55.1	-21.8
0.21	57.6	56.1	63.4	-7.3	44.9	53.4	-8.5
0.29	43.1	41.5	60.6	-19.1	32.1	50.6	-18.5
4.73	37.3	34.9	56.0	-21.1	26.3	46.0	-19.7
4.83	37.5	35.1	56.0	-20.9	22.5	46.0	-23.5
4.89	38.0	36.2	56.0	-19.8	27.5	46.0	-18.5

**Results:** **Pass**  
**Specified standard / Class:** VCCI-CISPR 32 Class B  
**Measured line/port:** 100 VAC mains PH & N

**Plot # 11- Plot # 12. Conducted emission. Charge mode. Mascot Charger**



Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.21	56.4	55.5	63.3	-7.8	45.0	53.3	-8.3
0.38	38.9	36.2	58.4	-22.1	26.5	48.4	-21.9
0.42	39.5	36.7	57.5	-20.8	27.5	47.5	-20.0
4.84	38.7	35.6	56.0	-20.4	25.5	46.0	-20.5
4.92	38.8	35.7	56.0	-20.3	25.7	46.0	-20.3



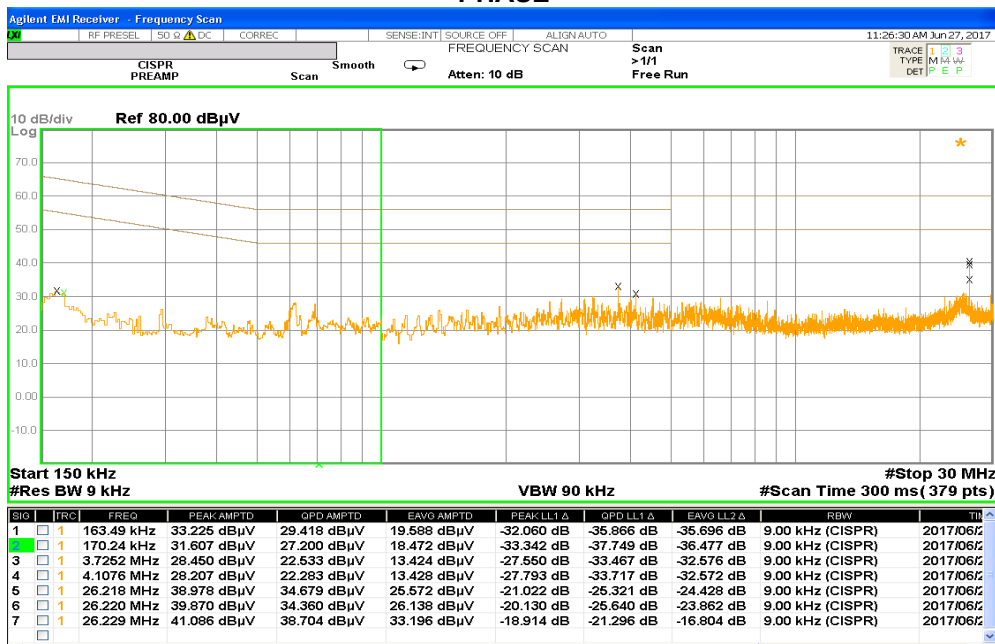
Frequency MHz	Peak dB $\mu$ V	QP dB $\mu$ V	QP Lim dB $\mu$ V	QP-QP Limit dB	Avg dB $\mu$ V	Avg Lim dB $\mu$ V	Avg-Avg Limit dB
0.21	56.3	55.4	63.3	-7.9	44.2	53.3	-9.1
0.37	39.5	37.1	58.4	-21.3	30.3	48.4	-18.1
0.41	40.4	38.1	57.6	-19.4	31.1	47.6	-16.5
4.85	36.8	34.5	56.0	-21.5	24.7	46.0	-21.3
4.92	37.3	34.6	56.0	-21.4	25.5	46.0	-20.5



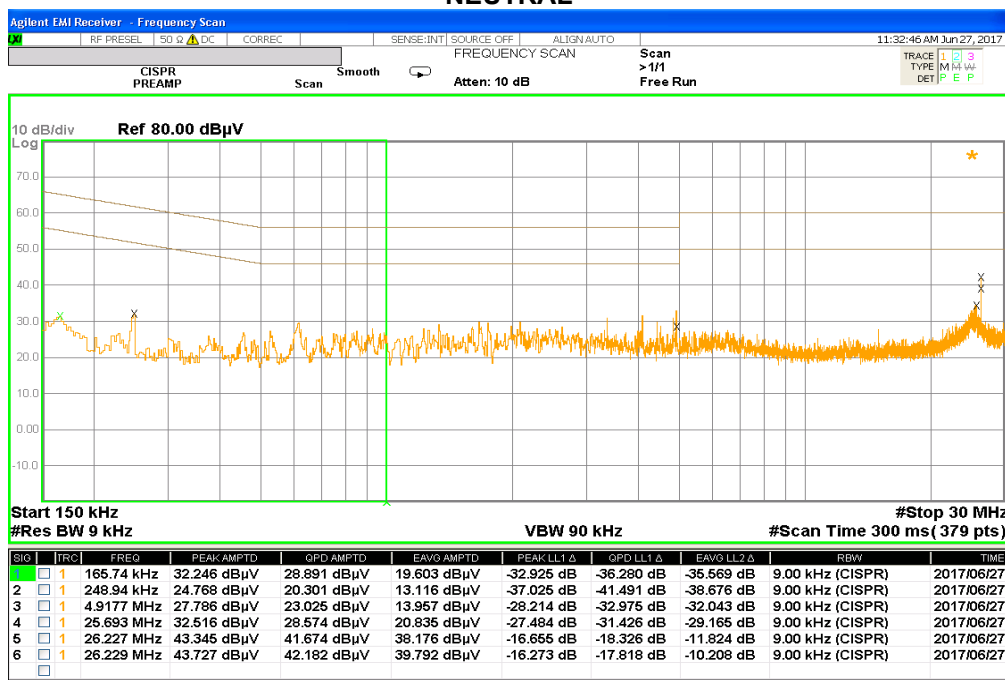
Results: Pass
Specified standard / Class: EN 55032 Class B
Measured line/port: 230 VAC mains. PH & N

Plot # 13- Plot # 14. Conducted emission. Charge mode. FRIWO Charger

PHASE



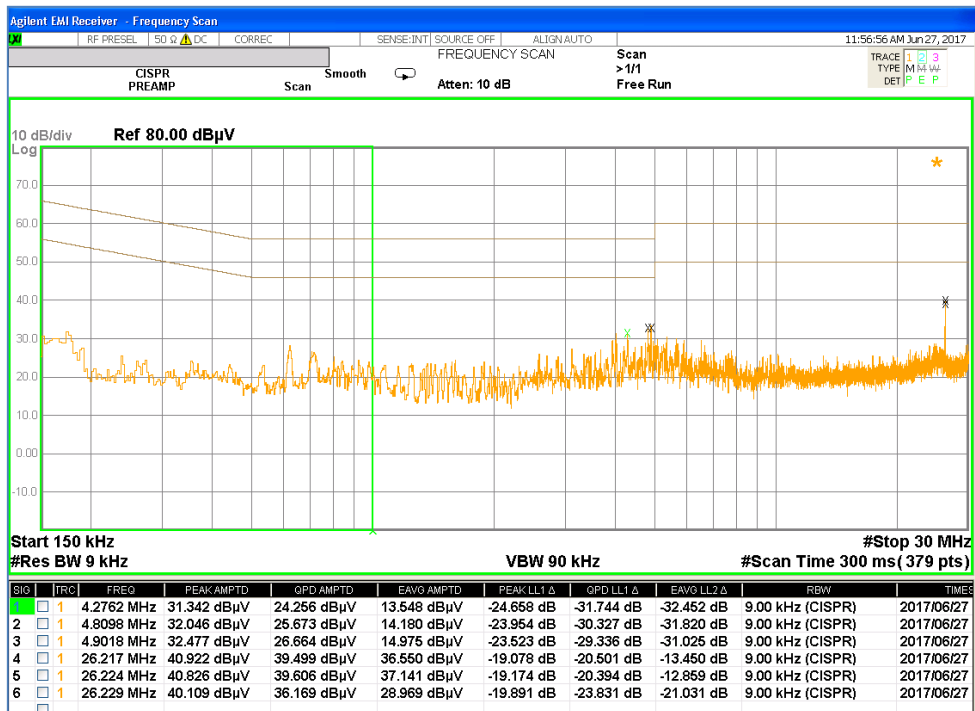
NEUTRAL



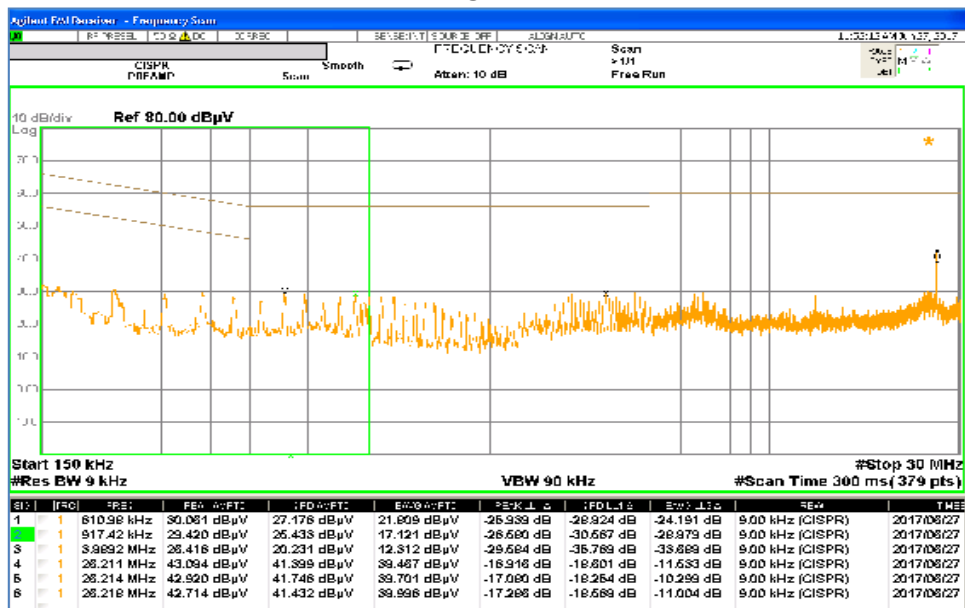


**Results:** Pass  
**Specified standard / Class:** FCC Part 15 Subpart B Class B  
**Measured line/port:** 120 VAC mains PH & N

**Plot # 15- Plot # 16. Conducted emission.  
 Charge mode. FRIWO Charger  
 PHASE**



**NEUTRAL**

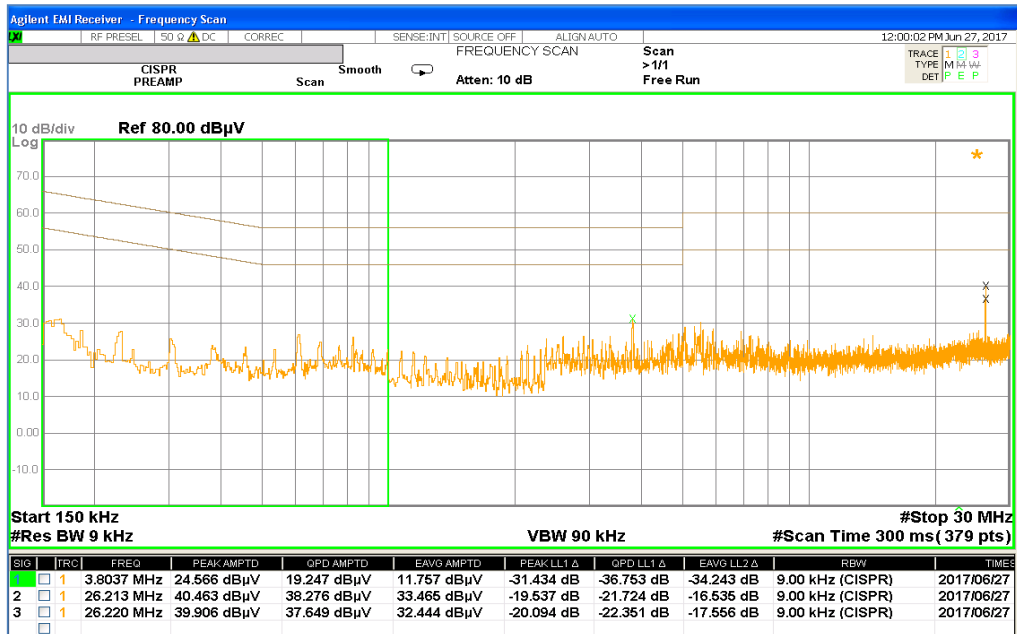




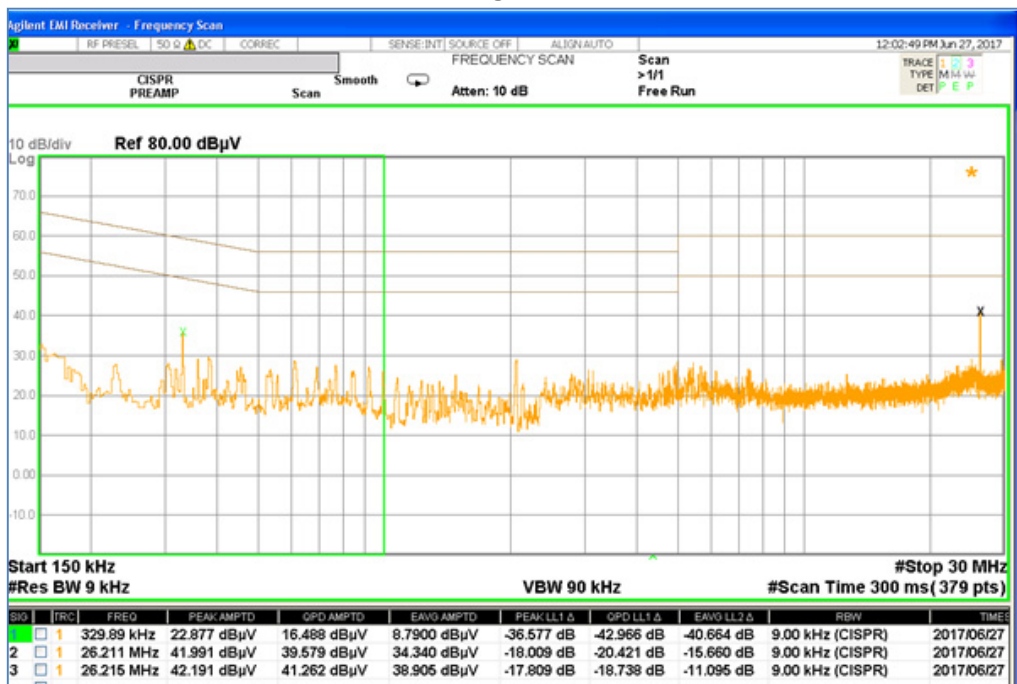
Results: Pass  
 Specified standard / Class: VCCI-CISPR 32 Class B  
 Measured line/port: 100 VAC mains PH & N

Plot # 17- Plot # 18. Conducted emission.  
 Charge mode. FRIWO Charger

PHASE



NEUTRAL



**Test Report No.:** 9712312196**Page 22 of 52 Pages****Title:** Test on 3D handheld camera    **Model:** SmartF6

## 6.2. Radiated Emission Summary

### Test Procedure:

The Radiated emission measurements were conducted in 3-m semi-anechoic chamber. The frequency range from 30 MHz to 6 GHz was investigated.

#### Antennas used:

Biconilog Antenna 20 MHz-2 GHz,  
Double Ridged Waveguide Antenna 1-18 GHz.

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.

Tested modes:

1. Operation mode
2. Charge mode.
  - with Charger FRIWO
  - with Charger Mascot

Power voltage used: the measurements were performed on three power voltages: 230Vac (Europe), 120Vac (USA) or 100Vac (Japan) the maximum result is presented.

Unless stated otherwise, the measuring equipment settings were:

#### Initial scan:

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

#### Measurements

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

**Test Report No.: 9712312196****Page 23 of 52 Pages****Title: Test on 3D handheld camera    Model: SmartF6****Test Results:**

Tested mode	Specified Standard	Polariz.	Table/ Plot	Result	Remarks	
Operation	EN 55032 / CISPR32 Class A	V/H	Tab.6, Plot 19	<b>PASS</b>	All emissions are 1.2 dB at least below limit	
	VCCI-CISPR 32 Class A		Tab.6, Plot 19	<b>PASS</b>	All emissions are 1.2 dB at least below limit	
	FCC Part 15 Subpart B Class A		Tab.7, Plot 19	<b>PASS</b>	All emissions are 4.7 dB at least below limit	
Charging w. Charger Mascot	EN 55032 / CISPR32 Class B		Plot 20		<b>PASS</b>	All Peak emissions are 10 dB at least below QP limit
	VCCI-CISPR 32 Class B				<b>PASS</b>	
	FCC Part 15 Subpart B Class B				<b>PASS</b>	
Charging w. Charger FRIWO	EN 55032 / CISPR32 Class B		Tab.8		<b>PASS</b>	All emissions are 3.2dB at least below limit
	VCCI-CISPR 32 Class B		Tab.8		<b>PASS</b>	All emissions are 3.2dB at least below limit
	FCC Part 15 Subpart B Class B		Tab.9		<b>PASS</b>	All emissions are 4.6dB at least below limit

**Note .** Test PASSED with ferrites, see sec.2.6.

**Test Report No.:** 9712312196

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**Title:** Test on 3D handheld camera      **Model:** SmartF6

**Results:** **Pass**  
**Specified standard / Class:** EN 55032/ VCCI-CISPR 32 Class A  
**Frequency range:** 30 MHz – 6 GHz  
**Measured distance:** 3 m

**Table 6: Radiated emission test results in 30MHz – 1GHz range  
Operation mode**

No.	Frequency (MHz)	Antenna Polarization	Antenna Height (m)	Turntable angle (°)	Emission Level (dB $\mu$ V/m)	Limit @ 3 m (dB $\mu$ V/m)	Margin (dB)	Results
1	106.0	H	2.5	331	35.4	50	-14.6	Complies
2	135.3	H	1.5	251	44.0	50	-6.0	Complies
3	142.4	H	1.8	239	46.6	50	-3.4	Complies
4	158.9	H	1.9	64	46.7	50	-3.3	Complies
5	166.0	H	2.2	151	45.6	50	-4.4	Complies
6	168.4	H	2.0	335	48.8	50	-1.2	Complies

**Results:** **Pass**  
**Specified standard / Class:** FCC Part 15 Class A  
**Frequency range:** 30 MHz – 1 GHz  
**Measured distance:** 3 m

**Table 7: Radiated emission test results in 30MHz – 1GHz range  
Operation mode**

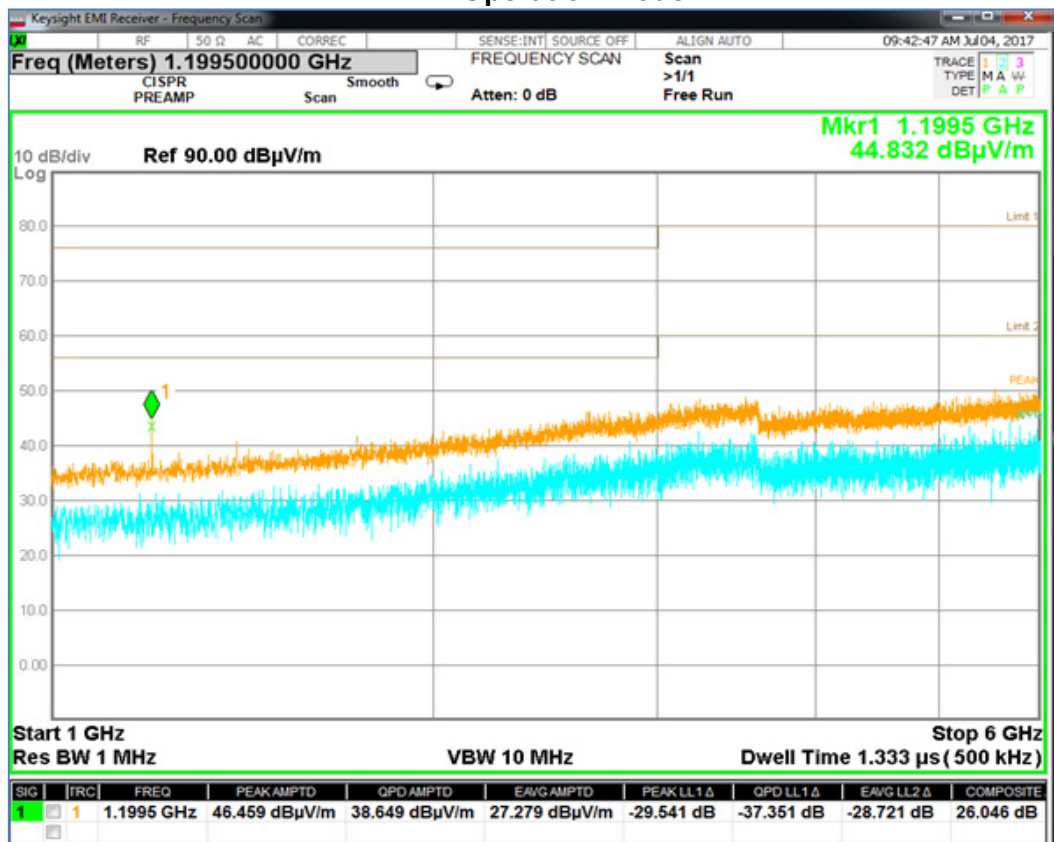
No.	Frequency (MHz)	Antenna Polarization	Antenna Height (m)	Turntable angle (°)	Emission Level (dB $\mu$ V/m)	Limit @ 3 m (dB $\mu$ V/m)	Margin (dB)	Results
1	106.0	H	2.5	331	35.4	53.5	-18.1	Complies
2	135.3	H	1.5	251	44.0	53.5	-9.5	Complies
3	142.4	H	1.8	239	46.6	53.5	-6.9	Complies
4	158.9	H	1.9	64	46.7	53.5	-6.8	Complies
5	166.0	H	2.2	151	45.6	53.5	-7.9	Complies
6	168.4	H	2.0	335	48.8	53.5	-4.7	Complies

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



**Results:** Pass  
**Specified standard / Class:** EN 55032/ VCCI-CISPR 32/ FCC P.15 Class A  
**Frequency range:** 1GHz – 6 GHz  
**Measured distance:** 3 m

Plot # 19. Radiated emission test results in 1GHz - 6GHz range  
Operation mode



No	Frequency (GHz)	Emission Level (dBμV/m)		EN Lim Class A (dBμV/m)		Margin (dB)	
		Peak	Avg	Peak	Avg	Peak	Avg
1	1.20	46.5	27.3	76	56	-29.5	-28.7

No	Frequency (GHz)	Emission Level (dBμV/m)		FCC Lim Class A (dBμV/m)		Margin (dB)	
		Peak	Avg	Peak	Avg	Peak	Avg
1	1.20	46.5	27.3	80	60	-33.5	-32.5



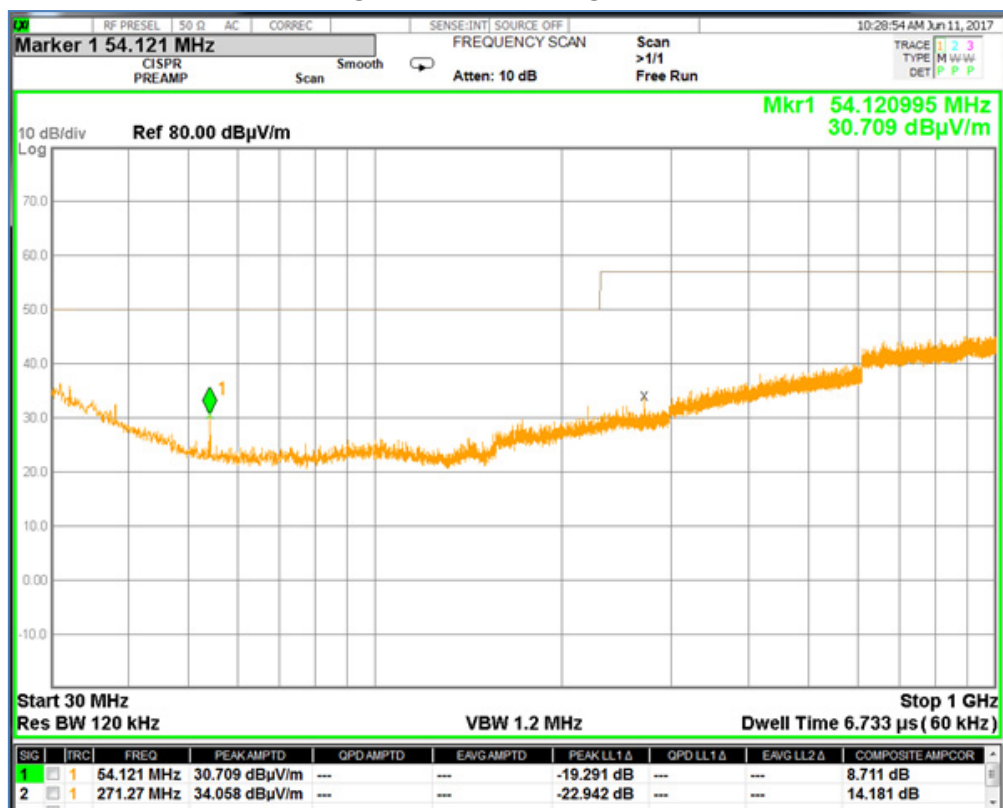
Test Report No.: 9712312196

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Title: Test on 3D handheld camera Model: SmartF6

Results: Pass  
 Specified standard / Class: EN 55032/ VCCI-CISPR 32/ FCC P.15 Class B  
 Frequency range: 30 MHz – 1 GHz  
 Measured distance: 3 m

Plot # 20 Radiated emission test results in 30MHz – 1GHz range Charge mode w. Charger Mascot



No	Frequency (GHz)	Emission Level (dBμV/m)	Lim Class B EN/VCCI (dBμV/m)	Lim Class B FCC (dBμV/m)
		Peak	QPeak	QPeak
1	54.1	30.7	40	40
2	271.3	34.1	47	46

**NOTE:**

All detected Peak emissions are 10 dB at least below QP Limit. So. The measurements with QP detector were not performed.

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**Title:** Test on 3D handheld camera      **Model:** SmartF6

**Results:** Pass  
**Specified standard / Class:** EN 55032/ VCCI-CISPR 32 Class B  
**Frequency range:** 30 MHz – 1 GHz  
**Measured distance:** 3 m

**Table 8: Radiated emission test results in 30MHz – 1GHz range  
 Charge mode w. Charger FRIWO**

No.	Frequency (MHz)	Antenna Polarization	Antenna Height (m)	Turntable angle (°)	Emission Level (dB $\mu$ V/m)	Limit @ 3 m (dB $\mu$ V/m)	Margin (dB)	Results
1	52.5	H	4.0	360	35.4	40	-4.6	Complies
2	118.1	H	2.8	65	35.3	40	-4.7	Complies
3	121.3	H	1.6	300	32.9	40	-7.1	Complies
4	121.4	V	1.1	275	34.6	40	-5.4	Complies
5	123.8	V	1.0	290	35.6	40	-4.4	Complies
6	144.2	H	1.6	205	34.5	40	-5.5	Complies
7	187.0	H	1.7	80	36.8	40	-3.2	Complies
8	196.8	H	1.0	257	31.0	40	-9.0	Complies

**Results:** Pass  
**Specified standard / Class:** FCC Part 15 Class B

**Table 9: Radiated emission test results in 30MHz – 1GHz range  
 Charge mode w. Charger FRIWO**

No.	Frequency (MHz)	Antenna Polarization	Antenna Height (m)	Turntable angle (°)	Emission Level (dB $\mu$ V/m)	Limit @ 3 m (dB $\mu$ V/m)	Margin (dB)	Results
1	52.5	H	4.0	360	35.4	40	-4.6	Complies
2	118.1	H	2.8	65	35.3	43.5	-8.2	Complies
3	121.3	H	1.6	300	32.9	43.5	-10.6	Complies
4	121.4	V	1.1	275	34.6	43.5	-8.9	Complies
5	123.8	V	1.0	290	35.6	43.5	-7.9	Complies
6	144.2	H	1.6	205	34.5	43.5	-9.0	Complies
7	187.0	H	1.7	80	36.8	43.5	-6.7	Complies
8	196.8	H	1.0	257	31.0	43.5	-12.5	Complies

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

**Test Report No.:** 9712312196**Page 28 of 52 Pages****Title:** Test on 3D handheld camera **Model:** SmartF6**6.3. Harmonic current emission summary:**

**Results:** **PASS**  
**Ref. Standard:** EN 61000-3-2  
**Mains:** 230VAC

**Table 10.**  
**Harmonic current emission data. Charger FRIWO**

Product:	F6				
Serial No:					
Description:					
Voltech IEC61000-3 Windows Software 1.24.12	Test Date:	2017 Mar 23 09:24			
Result:	MANTIS VISION F6				
Type of Test:	EN61000:2006 Harmonics inc. interharmonics to EN61000-4-7:2002				
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6				
AC Source:	Mains / Manual Source				
Overall Result	NONE				
Notes:					
Class:	A				
Test Parameter Details	User Entered	Measured			
Specified Power		2.3959			
Fundamental Current		0.0105			
Power Factor		0.3244			
Average Input Current		0.0283			
Maximum POHC		0.0092			
POHC Limit		0.2514			
Maximum THC		0.0276			
Minimum Power	75				
Class Multiplier:	1				
Test Duration:	0:02:30				

**Note:**

Measured power consumption is equal to 2.4 Watt (see table above).

This amount is less, then the minimal power of 75Watt, specified in the reference standard IEC 61000-3-2.

**Conclusion:** The EUT power supply is out of scope of the reference standard, the test is NA.

**Test Report No.:** 9712312196**Page 29 of 52 Pages****Title:** Test on 3D handheld camera **Model:** SmartF6

**Results:** **PASS**  
**Ref. Standard:** EN 61000-3-2  
**Mains:** 230VAC

**Table 11.**  
**Harmonic current emission data. Charger Mascot**

Product:	<b>SMART F6 (PS: Mascot)</b>			
Serial No:				
Description:	<b>PS: Mascot</b>			
Voltech IEC61000-3 Windows Software 1.24.12	Test Date:	2017 Jun 12 10:12		
Result:	MANTIS VISION F6 PS			
Type of Test:	EN61000:2006 Harmonics inc. interharmonics to EN61000-4-7:2002			
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6			
AC Source:	Mains / Manual Source			
Overall Result	NONE			
Notes:				
Class:	A			
Test Parameter Details	User Entered	Measured		
Specified Power		4.8746		
Fundamental Current		0.023		
Power Factor		0.4412		
Average Input Current		0.0467		
Maximum POHC		0.0265		
POHC Limit		0.2514		
Maximum THC		0.0616		
Minimum Power	75			
Class Multiplier:	1			
Test Duration:	0:02:30			

**Note:**

Measured power consumption is equal to 4.9 Watt (see table above).

This amount is less, then the minimal power of 75Watt, specified in the reference standard IEC 61000-3-2.

**Conclusion:** The EUT power supply is out of scope of the reference standard, the test is NA.

**Test Report No.: 9712312196****Page 30 of 52 Pages****Title: Test on 3D handheld camera    Model: SmartF6****6.4. Voltage changes, Voltage fluctuations and Flicker summary**

<b>Results:</b>	<b>Pass</b>
<b>Specified standard:</b>	EN 61000-3-3
<b>EUT operation mode:</b>	Section 2.7

**Table 12.**  
**Voltage changes, Voltage fluctuations and Flicker results**  
**Charger FRIWO**

Product:	<b>F6</b>			
Serial No:				
Description:				
Voltech IEC61000-3 Windows Software 1.24.12	Test Date:	2017 Mar 23 09:52		
Result:	MANTIS VISION F6			
Type of Test:	Flickermeter Test - Table			
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6			
AC Source:	Mains / Manual Source			
Overall Result	PASS			
Notes:	Plt test duration only 20 minutes Measurement method - Voltage			
	Plt			
Limit	0.65			
Reading	0.046			
	Pst	dc(%)	dmax(%)	d(t)>3.3%(ms)
Limit	1	3.3	4	500
Reading 1	0.083	0	0	0
Reading 2	0.083	0	0	0

**Test Report No.:** 9712312196**Page 31 of 52 Pages****Title:** Test on 3D handheld camera **Model:** SmartF6

**Results:** **Pass**  
**Specified standard:** EN 61000-3-3  
**EUT operation mode:** Section 2.7

**Table 13.**  
**Voltage changes, Voltage fluctuations and Flicker results**  
**Charger Mascot**

Product:	<b>SMART F6 (PS Mascot)</b>			
Serial No:				
Description:	PS: Mascot			
Voltech IEC61000-3 Windows Software 1.24.12	Test Date:	2017 Jun 12 10:28		
Result:	MANTIS VISION F6 PS			
Type of Test:	Flickermeter Test - Table			
Power Analyzer:	Voltech PM6000 SN: 200006700333 Firmware version: v1.22.07RC6			
AC Source:	Mains / Manual Source			
Overall Result	<b>PASS</b>			
Notes:	Plt test duration only 20 minutes Measurement method - Voltage			
	Plt			
Limit	0.65			
Reading	0.046			
	Pst	dc(%)	dmax(%)	d(t)>3.3%(ms)
Limit	1	3.3	4	500
Reading 1	0.083	0	0	0
Reading 2	0.083	0	0	0



**Test Report No.:** 9712312196

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**Title:** Test on 3D handheld camera    **Model:** SmartF6

## 7. Immunity Tests

### 7.1. Performance criteria per EN 55024:

#### **Performance criteria A**

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

#### **Performance criteria B**

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended.

During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test.

#### **Performance criteria C**

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.



**7.2. Electrostatic Discharge (ESD)**

**Results:** Pass  
**Specified standard:** EN 55024 (Table 1)  
**Test procedure:** IEC 61000-4-2  
**EUT operation mode:** See section 2.7  
**Temperature:** 21.3° C  
**Relative humidity:** 59 %  
**Atmosphere pressure:** 1010 mbar

**Table 14. ESD Results. EUT w. charger FRIWO**

ESD type	Test points	Test Voltage (kV)	Number of pulses	EUT performance during test	Performance criteria	Results
Air	Plastic parts	2, 4, 8	± (8*10)	A	B	PASS
	Cables	2, 4, 8	± (2*10)	A		PASS
Contact	Screws	2, 4	± (8*10)	A		PASS
	Painted parts	2, 4	± (6*10)	A		PASS
	HCP	2, 4	± (4*10)	A		PASS
	VCP	2, 4	± (4*10)	A		PASS

**Table 15. ESD Results. EUT w. charger Mascot**

ESD type	Test points	Test Voltage (kV)	Number of pulses	EUT performance during test	Performance criteria	Results
Air	Plastic parts	2, 4, 8	± (8*25)	A	B	PASS
	Cables	2, 4, 8	± (2*25)	A		PASS
Contact	Screws	2, 4	± (8*25)	A		PASS
	Painted parts	2, 4	± (6*25)	A		PASS
	HCP	2, 4	± (4*25)	A		PASS
	VCP	2, 4	± (4*25)	A		PASS

**NOTE:** Tested modes: Operational and Charge.

**Test Report No.:** 9712312196**Page 34 of 52 Pages****Title:** Test on 3D handheld camera    **Model:** SmartF6

### 7.3. Radiated Immunity Test

**Results:** Pass  
**Specified standard:** EN 55024 (Table 1)  
**Test procedure:** IEC 61000-4-3  
**EUT operation mode:** See section 2.7  
**Temperature:** 21.3° C  
**Relative humidity:** 59 %  
**Atmosphere pressure:** 1010 mbar

**Table 16. Radiated immunity Results.  
EUT w. chargers FRIWO & Mascot**

EUT configuration with respect to antenna	Severity level, V/m rms. unmodulated	Modulation	EUT performance during test	Performance criteria	Result
80 MHz -2.7 GHz	3.0	80 % AM, 1 kHz	A	A	PASS

**NOTE:** Tested modes: Operational and Charge.

**Test Report No.:** 9712312196**Page 35 of 52 Pages****Title:** Test on 3D handheld camera **Model:** SmartF6**7.4. Electrical Fast Transients (EFT) test**

**Results:** Pass  
**Specified standard:** EN 55024 (Tables 4 & 2)  
**Test procedure:** IEC 61000-4-4  
**EUT operation mode:** See section 2.7  
**Temperature:** 21.3° C  
**Relative humidity:** 59 %  
**Atmosphere pressure:** 1010 mbar

**Table 17. EFT Results. EUT w. charger FRIWO**

No.	Cable Description	Type of coupling	Test Voltage kV	Impulse	EUT performance during test	Performance criteria	Results	Note
1	AC mains (Charger)	CDN	± 1.0	Tr/Th – 5/50 ns, 5 kHz	A	B	PASS	Charge mode

**Table 18. EFT Results. EUT w. charger Mascot**

No.	Cable Description	Type of coupling	Test Voltage kV	Impulse	EUT performance during test	Performance criteria	Results	Note
1	AC mains (Charger)	CDN	± 1.0	Tr/Th – 5/50 ns, 5 kHz	A	B	PASS	Charge mode
2	AC mains (Laptop PS))	CDN	± 1.0	Tr/Th – 5/50 ns, 5 kHz	B		PASS	Normal operational mode

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### 7.5. Surge test

<b>Results:</b>	<b>Pass</b>
<b>Specified standard:</b>	EN 55024 (Tables 4 & 2)
<b>Test procedure:</b>	IEC 61000-4-5
<b>EUT operation mode:</b>	See section 2.7
<b>Temperature:</b>	21.3° C
<b>Relative humidity:</b>	59 %
<b>Atmosphere pressure:</b>	1010 mbar

**Table 19. Surge Results. EUT w. chargers FRIWO/ Mascot**

No.	Cable Description	Test Voltage, kV	Type of coupling	Type of Surge, $\mu$ s	Number pulses	EUT performance during test	Performance criteria	Results
1	AC mains (Charger)	1.0 DM	CDN	1.2/50 (8/20)	$\pm 5$	A	B	PASS

**Notes:**

1. DM - Differential mode, line – to - line
2. Tested in Charge mode

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<b>Results:</b>	<b>Pass</b>
<b>Specified standard:</b>	EN 55024 (Tables 4 & 2)
<b>Test procedure:</b>	IEC 61000-4-6
<b>EUT operation mode:</b>	See section 2.7
<b>Temperature:</b>	21.3° C
<b>Relative humidity:</b>	59 %
<b>Atmosphere pressure:</b>	1010 mbar

**Table 20. RF Conducted Immunity Results. E**  
**UT w. chargers FRIWO/ Mascot**

No.	Cable Description	Type of coupling	Freq. range, MHz	Severity level, V rms	Modulation	EUT perform. during test	Performance criteria	Result	Note
1	AC mains (Charger)	CDN	0.15 ÷ 80	3.0	AM 80%, 1 kHz	A	A	PASS	Charge mode
2	AC mains (Laptop PS)	CDN				A		PASS	Normal operational mode

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<b>Results:</b>	<b>Pass</b>
<b>Specified standard:</b>	EN 55024 (Table 4)
<b>Test procedure:</b>	IEC 61000-4-11
<b>EUT operation mode:</b>	See section 2.7
<b>Temperature:</b>	21.3° C
<b>Relative humidity:</b>	59 %
<b>Atmosphere pressure:</b>	1010 mbar

**Table 21. Voltage dips, short interruptions and voltage variations results  
EUT w. chargers FRIWO/ Mascot**

No.	Voltage dips and interruption, (% Level)	Time duration, ms	EUT performance during test		Required criteria	Results
			Charge	Normal Operation		
1	0	10.0	A	A	B	Pass
2	70	500.0	A	A	C	Pass
3	0	5000.0	B	A	C	Pass

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## 8. Appendix 1: Test equipment used

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

Instrument	Manufacturer	Model	SII No.	Last calibration date	Next calibration date
<b>EN 55032 / FCC Part 15 Subpart B / VCCI</b>					
EMI Receiver 9 kHz - 6.5 GHz	HP	8546A+85460A	4068	07/16	07/17
Transient limiter 0.009-200 MHz	Agilent Techn	11947A	3107A03104	08/16	08/17
EMI Analyzer 10 kHz - 26.5 GHz	HP	E7405A	4944	07/16	07/17
LISN 9 kHz – 30 MHz	FCC	LISN- 50/250-32-4-16	5023	02/17	02/18
Impedance stabilization network	Schaffner	ISN T8	5804	01/17	01/18
Biconilog Antenna 30 – 2000 MHz	Schaffner	CBL6112D	5866	02/17	02/18
Double Ridged Waveguide Antenna 1-18 GHz	EMCO	3115	4873	02/17	02/18
Software	Agilent	E7415A	SW version 1.00.1	N/A	N/A
Software	ROHDE & SCHWARZ	EMC32	Release 8.53.0	N/A	N/A
<b>EN 61000-3-2 / EN 61000-3-3</b>					
AC Power Supply Phase	Elgar	SW 5250A	4684	N/A	N/A
Universal Power Analyzer 230 VAC, 3ph, 30A	Voltech	PM 6000	6501179	08/16	08/17
Software	Voltech	IEC 1000-3	Version 1.24.12	N/A	N/A

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Instrument	Manufacturer	Model	SII No.	Last calibration date	Next calibration date
<b>IEC 61000-4-2</b>					
Simulator, Contact Disch.: $\pm 0.5$ to $\pm 8$ kV, Air Discharge: $\pm 0.5$ to $\pm 15$ kV	Teseq AG	NSG.435	606332	07/16	07/17
<b>IEC 61000-4-3</b>					
Spectrum Analyzer 9 kHz - 6 GHz	ROHDE & SCHWARZ	R&S@FSL6	5912	07/16	07/17
MXG Analog Microwave Signal generator 100 KHz - 20 GHz	Agilent	N5183A	6501148	09/16	09/17
RF power amplifier 80-1000 MHz, 100W	Amplifier Research	100W1000M1	4883	N/A	N/A
Biconilog Antenna 30 – 2000 MHz	Schaffner	CBL 6112B	5119	12/16	12/17
Horn Antenna High-Gain 0.8 – 4.2 GHz; 20 W	Amplifier Research	AT4002A	4966	N/A	N/A
RF Power Amplifier 0.8 - 4.2 GHz; 25 W	Amplifier Research	25S1G4A	4991	N/A	N/A
Electric Field Probe 100 kHz - 3000 MHz	PMM	EP 330	5448	02/17	02/18
Anechoic chamber	Chase	Euroshield	4806	N/A	N/A
Software for EMC measurements	ROHDE & SCHWARZ	EMC32	Release 8.53.0	N/A	N/A
<b>IEC 61000-4-4</b>					
Set Multifunction Generator CDN, 1 Phase	Teseq	NSG-3060 CDN- 3061	6502113	11/16	11/17
Coupling Network, 3 PH 32 A	Teseq	NSG 3063	6502116	11/16	11/17
Capacitive coupling clamp	Teseq	CDN-3425	6502117	10/16	10/17
Software	Teseq	WIN 3000 SDR	Ver. 1.3.2	N/A	N/A
<b>IEC 61000-4-5</b>					
Set Multifunction Generator CDN, 1 Phase	Teseq	NSG-3060 CDN- 3061	6502113	11/16	11/17
Coupling Network, 3 PH 32 A	Teseq	NSG 3063	6502116	11/16	11/17
Telecom Surge Pulse Generator (10 x 700 $\mu$ s)	Teseq	NSG-3060 Telocom	6502114	10/16	10/17
Software	Teseq	WIN 3000 SDR	Ver. 1.3.2	N/A	N/A



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Instrument	Manufacturer	Model	SII No.	Last calibration date	Next calibration date
<b>IEC 61000-4-6</b>					
RF Generator 100 kHz - 20 GHz	Agilent	N5183A	6501148	09/16	09/17
RF Generator 10 kHz - 1050 MHz	Fluke	6060B	2384	05/16	05/17
RF power amplifier 10 kHz - 250 MHz; 75 W	Ampl Research	75A250	4847	N/A	N/A
RF power amplifier 250 kHz - 150 MHz; 150 W	ENI	3100LA - 11401	3758	N/A	N/A
RF power amplifier 150 kHz - 300 MHz; 10 W	ENI	411LA	SII 3757 SN: 797F	N/A	N/A
Oscilloscope 300 MHz	Lecroy	9361	4009	03/17	03/18
CDN 150 kHz – 230 MHz	Schaffner	CDN M325	5122	01/17	01/18
CDN 150 kHz – 230 MHz	Schaffner	CDN T002	5123	01/17	01/18
Attenuator 6 dB, 50W	Huber- Suhner AG	5906.17.0005	6502577	05/16	05/17
Bulk Current Injection Probe 10 kHz – 230 MHz	FCC	F-120-9A	53923	01/17	01/18
<b>IEC 61000-4-11</b>					
Set Multifunction Generator CDN, 1 phase StepTransformer	Teseq	NSG-3060 CDN- 3061 INA-6502	6502113	11/16	11/17
Software	Teseq	WIN 3000 SDR	Ver. 1.3.2	N/A	N/A
Immunity Test System , 1 Phase	HAEFELY TEST AG	AXOS 5	6502105	12/16	12/17

## 9. 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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## 10. Appendix 3: Antenna Factor and Cable Loss

## Cable Loss (RG214 ( 6 m ) + 5005 ( 3.8 m ) + 5005 ( 3 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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## 11. Appendix 4: Test illustrations



**Picture # 4.**  
**Radiated emission test setup. Normal operation**

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**Picture # 5.**  
**Radiated emission test setup. Normal operation**

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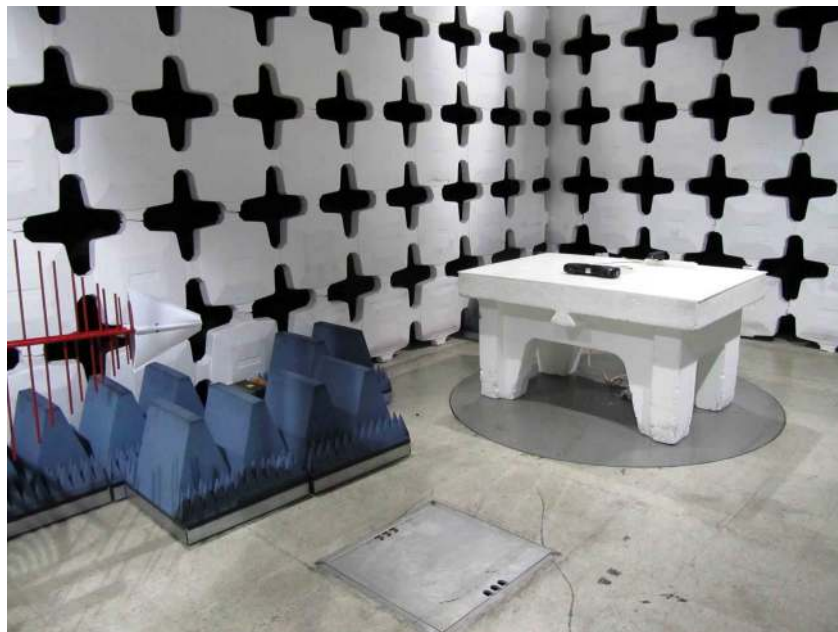


**Picture # 6.**  
**Normal operation. Ferrite on external USB cable**

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**Picture # 7.**  
**Radiated emission test. Charging w. Mascot Charger**



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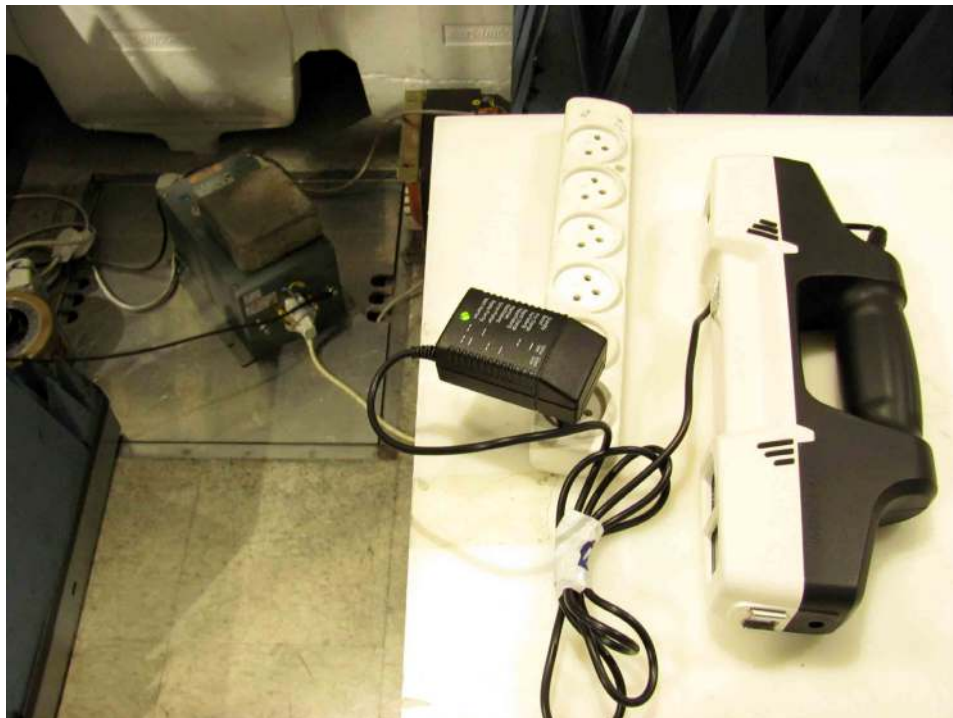


**Picture # 8.**  
**Radiated emission test. Charging w. FRIWO Charger**

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**Picture # 9.**  
**Conducted emission test. Charging w. FRIWO  
Charger**

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**Picture # 10. Immunity test setup.**

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**Picture # 11. Laptop AC Adapter**

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