Signify Innovation labs **EMC & Wireless connectivity lab** High Tech Campus 26 5656AE, Eindhoven, The Netherlands Tel. +31 06 43842446 **Email EMC.Testlab@Signify.com**	**EMC TEST REPORT** **iLine F PRO**	EMC-20-TRP-6145-502 Date : 23 September 2020 Page : 1 of 21

Customer : Ovizio imaging systems
Name : Mr. Jonathan Bonnevie
Address : Rue du Bourdon 100/2
Zip / City : 1180 Brussels
Country : Belgium

Equipment Under Test (including peripherals)**:**

Model Name : iLine F PRO
Identification : Product Code: I3TF-MIC-G02-A
Serial Number: 20200313010
Description : The equipment is designed for the in-line monitoring of morphological cellular parameters via a closed loop disposable probe that can be sterilized.

EMC Standards :

FCC part 15B: 2020-04 Class A
ANSI C63.4: 2014

Test result : Passed

Note 1 : The results in this report apply only to the sample(s) and modes tested.
It is the manufacturer's responsibility to assure the continued EMC compliance of production models.

Note 2 : This report replaces and invalidates EMC-20-TRP-6145-501, Editorial changes applied.

Date of receipt of EUT : 18 August 2020
Date(s) of performance of test : 18 August 2020

TESTING
RvA L 315

Eindhoven,
The Netherlands

Wouter Maes
Head of Innovation labs

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1. Responsibilities

EMC Test Engineers:	E-Mail	Signature
Mario van Munster	mario.van.munster@signify.com	

Reviewed by:	E-Mail	Signature
Edwin van Niftrik	edwin.van.niftrik@signify.com	

2. Summary of test results

Test	Standard	Result	Note
Emission			
Conducted emissions	FCC part 15	**Passed**	0.15-30 MHz
Radiated spurious emissions	FCC part 15	**Passed**	30 MHz to 18 GHz

Remarks:

The tested sample fully complies with the requirements set forth in:

FCC part 15B: 2020-04 Class A
ANSI C63.4: 2014

For class A equipment:

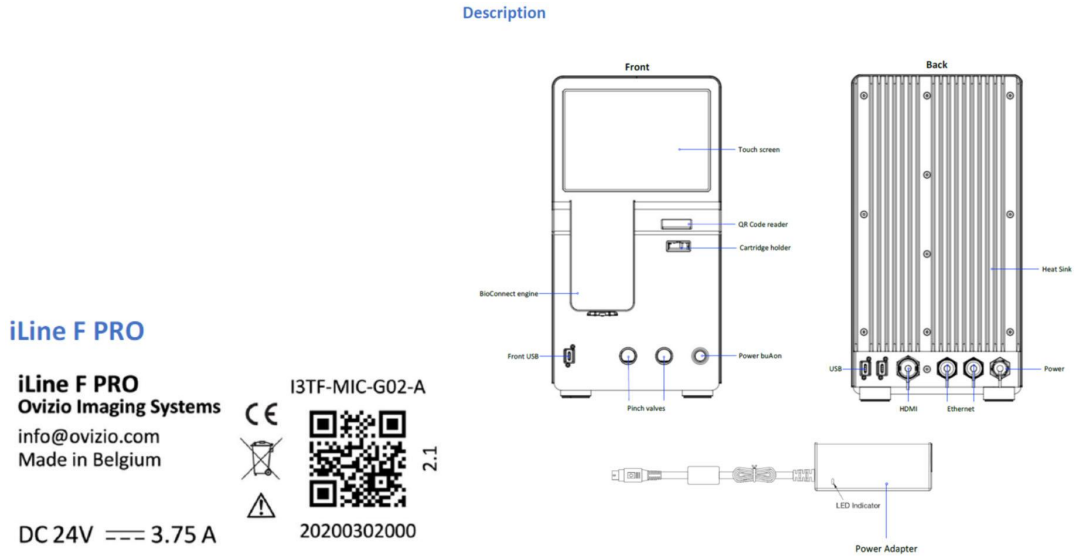
NOTE:
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2.1 Deviations from the standard

None

3. Measurements/tests

3.1 General



3.1.1 Short description of the Equipment Under Test according Customer Specification

The system is designed for the in-line monitoring of morphological cellular parameters via a closed loop disposable probe that can be sterilized.

The iLine F PRO is not classified as a medical device and as such ISO-13485 requirements do not apply. The iLine F is intended to be used standalone, with the delivered power supply unit. Power supply port (used to power the device) and ethernet ports (used for remote control and/or external network storage access) are expected to be always connected during device operation. Device back panel USB ports are intended to be used with USB keyboard and mouse to mainly to ease device configuration and setup during maintenance or debug. Device front panel USB port is intended to be used with USB3 external drive for local backup/transfer of experiments. All of these USB ports are not expected to be used during normal operation but there is no problem to do so if desired. HDMI port is not expected to be used at all and is out of scope here. The BioConnect cartridge interface and BioConnect pump interface available on the iLine F front are intended to be used with a genuine BioConnect sold exclusively by Ovizio Imaging Systems S.A.

3.1.2 List of tested equipment (Tested configuration of EUT and peripherals)

EUT:

Model name : iLine F PRO
Type number : I3TF-MIC-G02-A
Serial number : 20200313010
HW version : 2.1.1
FW version : 1.1.3
SW version : N/A (stress test applied)
Voltage : Mains: 120 V 60 Hz
Dimensions : 400 mm x 223 mm x 423 mm

Ancillary equipment used:

External power source: AC Power Source/Analyzer (Hewlett&Packard): EMC 9400-0985
Customer laptop (outside chamber) for remote control of the EUT and stimulate EUT ethernet interface

Mode(s) of operation during the test:

Supply voltage	Mode #	Operating mode	Remarks
120 V 60 Hz	*1.*	*Worst-case*	*Used during emission tests.* *Device has been set into a worst case operating mode (by using dedicated stress test software) that would be virtually impossible to reach from the expected Ovizio software (i.e. OsOne) intended for that device. This would ensure that any OsOne versions can be installed without any risk of negative impact on EMI.*

Power Supply

Brand/Model	CUI Inc. SDI90-24-U
Input Cable	The system is delivered with a power input cable suitable for the country of delivery
Input Voltage	100-240VAC ±10% ~50-60Hz ±5%
Input Current	1.2A
Output Voltage	24 V DC
Output Power	90 W

3.1.3 Cable connections made

Port:	Connected to:	Max cable > 3m	Comments
Power Supply	AC power source	> 3 m	3-core: L1, L2 +PE
RJ45 port iLine F Pro	Customer Laptop	> 3 m	Cat5e Unshielded, Customer Laptop outside chamber with clamp on ethernet cable
USB port 1	Keyboard	< 1 m	USB2 compliant keyboard
USB port 2	PC mouse	< 1 m	USB2 compliant mouse
USB port front	USB3 SSD Drive	< 1 m	USB3 compliant drive (e.g. Samsung MZVPV256HDGL 256GB SSD module inside Milipow M.2 NVME SSD Case with USB C - USB 3 cable)

In normal operation the EUT is positioned as table top equipment.

Cable routing is in line with ANSI C63.4 (6.2.5). Excess cable length is draped over the back edge of the table if applicable. Cables which extends closer than 40cm to the ground reference plane, the excess length was bundled in the center in back and forth fashion using 30 to 40 cm lengths. If bundling was not possible due to stiffness, bulk or length, it was draped over the back edge over the table preventing a closer distance than 40cm from the ground reference plane.
The base of the EUT was positioned at 80cm above ground reference plane

See photographs in section 6 for details.

3.1.4 Monitoring of the Equipment Under Test

The iLine F PRO are monitored and powered by U mains = 120 V 60 Hz.

EUT has been set into a worst case operating mode (by using dedicated stress test software) that would be virtually impossible to reach from the expected Ovizio software (i.e. OsOne) intended for that device. This would ensure that any OsOne versions can be installed without any risk of negative impact on EMI. Following stress test software setup has been applied:

- *ohmt v1.1.0 (using OHW API 1.3.0) has been used to control the device hardware (i.e. high power light source, stepper motors, pinch valve, ...) in the worst operating mode by using the following configuration:*

  polling-interval=1
  light-enabled=true
  light-current=700
  light-on-duration=100
  light-off-duration=100
  objective-enabled=true
  objective-small-count=0
  pump-enabled=true
  pump-push-current=1000
  pump-pull-current=1000
  pump-stroke=12.0
  pump-push-speed=3.0
  pump-pull-speed=2.0
  pump-push-sleep=1
  pump-pull-sleep=1
  valve-enabled=true
  valve-stallguard-enabled=false

valve-close-duration=100
valve-open-duration=100
NOTE: the device pump has to be set into "TEST" mode before running that stress test to be able to operate the pinch valve continuously. BCD tubing should be removed from the pinch valve and small tubing with free air must be inserted instead to avoid stall during pump push.

- *FLIR SpinSimpleGUI_WPF software is used for Camera acquisition at full speed i.e. more than 30 FPS at 2048x2048 image size.*
- *A first instance of HeavyLoad 64 bits computer stress test software is used to write data continuously to the internal SSD hard drive at high rate and to load the RAM as high as possible*
- *A second instance of HeavyLoad 64 bits computer stress test software is used to write data continuously to the external USB 3 SSD hard drive at high rate*
- *Remote control screen sharing is used to control the device remotely and check its running status. Also a continuous ping (8000 bytes at 1ms interval) is applied to maintain about 64 Mbps of data rate on the corresponding ethernet interface to simulate end user remote control operation at high data rate.*
- *The CPU is set to run continuously at 100% usage and high frequency thanks to the previously described test software setup. NOTE: HeavyLoad can also be used to ensure 100% CPU usage in case previous test software setup doesn't reach that point.*
- *Windows Task Manager is used to asses that computer is stressed accordingly.*

3.1.5 Clock frequencies / highest frequency used in the Equipment Under Test

Clock frequencies	
Frequency	**Description**
3 GHz	*Absolute maximum clock frequency of the embedded computer integrated inside the EUT. This is also the maximum EUT clock frequency.*

Upper frequency measuring table	
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	**Upper frequency of measurement range (MHz)**
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

The highest frequency within the system is 3.0 GHz which requires emission measurements up to 15 GHz. Special request from the customer has been tested up to and including 18 GHz instead of 15 GHz

3.1.6 Modifications to achieve compliance / Declaration of customer

No modifications have been made to the equipment under test.
As such no declaration of the applicant is required to have modifications incorporated into the product.

3.2 Conducted emissions

Conducted emissions
FCC part 15

Operating conditions EUT: Device has been set into a worst case operating mode (by using dedicated stress test software) that would be virtually impossible to reach from the expected Ovizio software (i.e. OsOne) intended for that device. This would ensure that any OsOne versions can be installed without any risk of negative impact on EMI.

U mains = 120 V 60 Hz

Limits:
Class A:

Frequency range MHz	Limits dB (µV)	
	Quasi peak	Average
0.15 to 0.50	79	66
0.5 to 30	73	60
Notes The lower limit shall apply at the transition frequencies		

Class B:

Frequency range MHz	Limits dB (µV)	
	Quasi peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linear with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

Test result:

: Passed, Class A limits

Remarks:

Emissions have been observed using an observation time of 15s. A resolution bandwidth of 9 kHz and a step size of 2.25 kHz has been applied using the TD option of the measurement receiver. Peak, Quasi-peak and average detectors have been applied to obtain the required results.

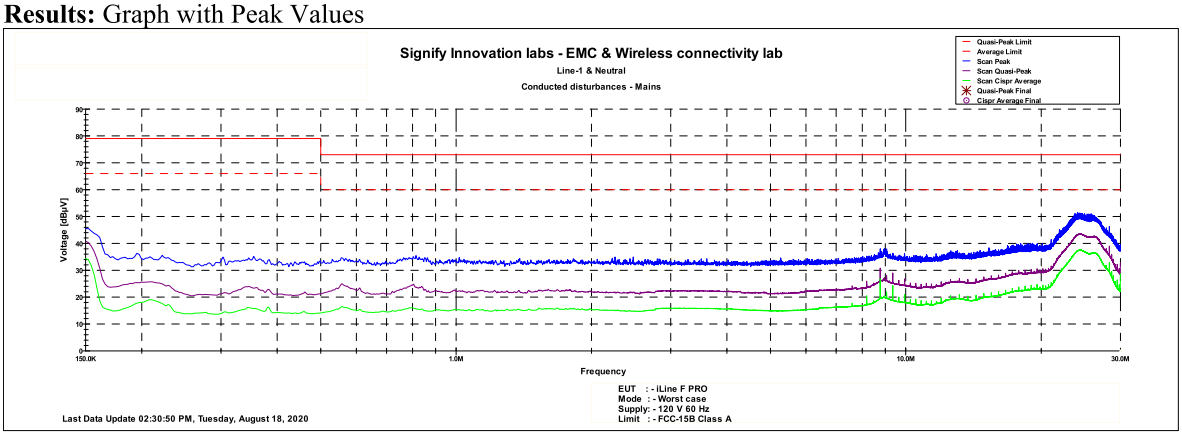
Measured in: SAR-3

Date of Test : 18 August 2020

Test Engineer : Mario van Munster

Conducted emissions FCC part 15
Line and Neutral

Results: Graph with Peak Values



Results: Table with Peak, Quasi Peak and Average values

Tabulated results Line(s) & Neutral 2020 August 18

EUT/Mode: iLine F PRO / Worst case

Frequency MHz	Level Peak dBµV	QP limit dBµV	Level QP dBµV	QP margin dB	Avg limit dBµV	Level AVG dBµV	AVG margin dB	Terminal Lx / N	Correction dB

No maximised peaks

*No emissions are within 20 dB from the applicable limit.

3.3 Radiated spurious emissions

Radiated spurious emissions
FCC part 15

Operating conditions EUT: Device has been set into a worst case operating mode (by using dedicated stress test software) that would be virtually impossible to reach from the expected Ovizio software (i.e. OsOne) intended for that device. This would ensure that any OsOne versions can be installed without any risk of negative impact on EMI.

U mains = 120 V 60 Hz

Limits:

Frequency range (MHz)	Class A at 10 m (dBµV/m)	Class B at 3 m (dBµV/m)
30 – 88	39 Quasi Peak	40.0 Quasi Peak
88 – 216	43.5 Quasi Peak	43.5 Quasi Peak
216 – 960	46.5 Quasi Peak	46.0 Quasi Peak
960 – 1000	49.5 Quasi Peak	54.0 Quasi Peak
Above 1000	49.5 Average	54.0 Average

Upper frequency measuring table	
Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	**Upper frequency of measurement range (MHz)**
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

fx = 3 GHz, 5th harmonic x 3 GHz = 15 GHz. On request tested to 18 GHz.

For class A measurements at 3m, a conversion is applied of 10.45 dB to the limit.

Test result:

: Passed, Class A limits

Remarks:

: Measuring distance at 3 meter from antenna to EUT boundary

Pre-scan measurements in are executed over 360 degrees azimuth at several antenna heights to obtain the EUT's emission spectrum. Peaks closed to the limit are selected for maximisation of the emissions by fine-tuning to frequency, azimuth and antenna height (1-4m). Final observation time 15s using a RBW of 120kHz using a quasi-peak detector in the frequency range 30 – 1000MHz and an RBW of 1 MHz using a peak and average detector in the frequency range above 1 GHz.
Measurements are executed in a semi-anechoic room (30-1000MHz) equipped with additional floor absorbers when applicable (1GHz-18GHz).

Measured in: SAR-3

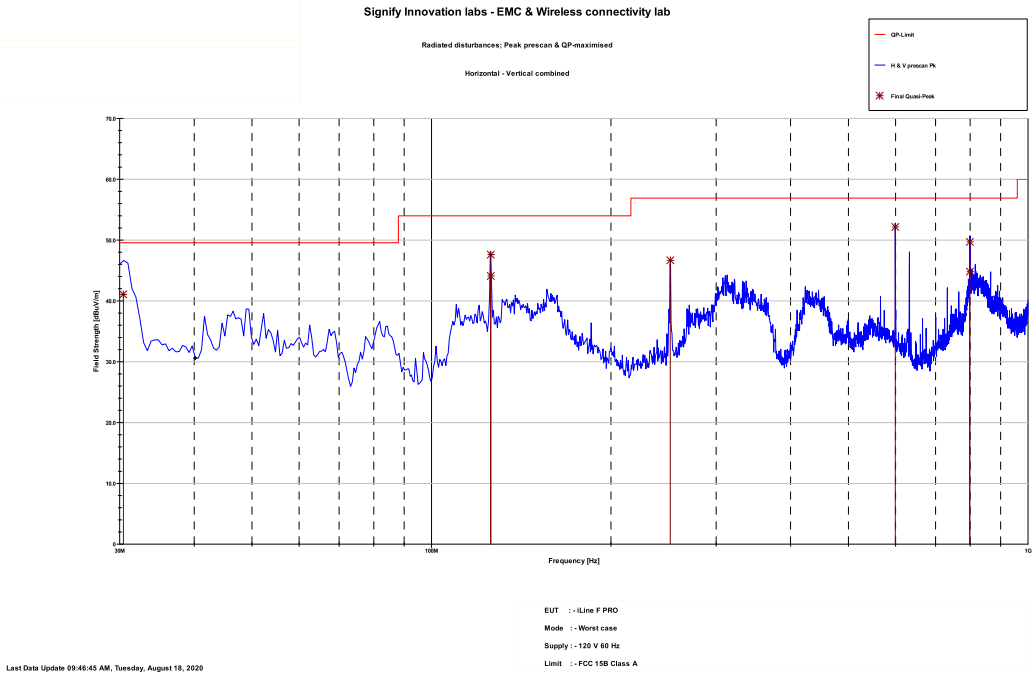
Date of Test : 18 August 2020

Test Engineer : Mario van Munster

For detailed measurement results see next page.

Radiated spurious emissions 30 -1000 MHz
FCC part 15

Result Pre-test: Graph with peak values (combined horizontal and vertical polarisation)



Maximised Signals: Table with Peak and Quasi Peak values

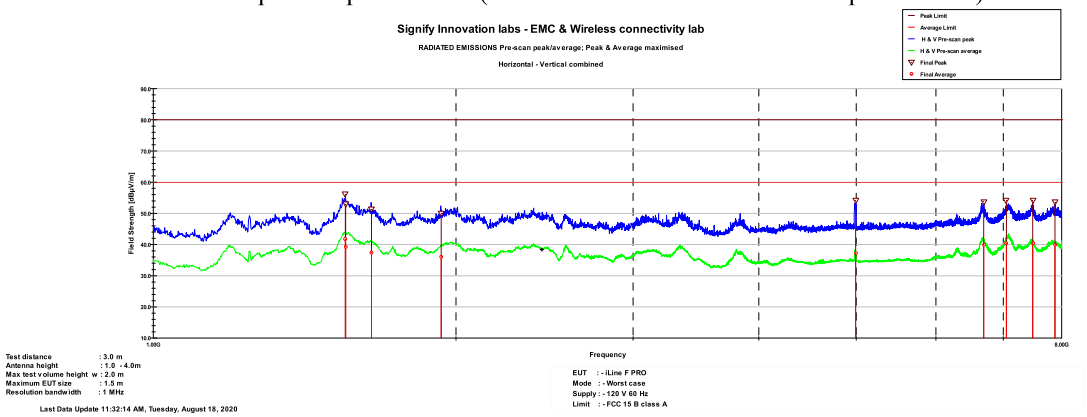
Tabulated Results for Radiated Disturbance 2020 August 18

EUT/Mode: **iLine F PRO / Worst case**

Frequency MHz	Limit dBµV/m	Pk Level dBµV/m	QP Level dBµV/m	QP Margin dB	Height cm	Angle degrees	Polarity H / V	Correction dB
30.44	49.54	46.96	41.09	-8.45	105	282	V	20.19
125.67	53.98	46.55	44.06	-9.92	100	87	V	14.97
125.74	53.98	49.18	47.62	-6.36	204	226	H	13.29
251.38	56.90	48.94	46.63	-10.27	136	354	H	14.44
599.27	56.90	55.31	52.11	-4.79	132	324	V	22.60
798.87	56.90	49.88	44.79	-12.11	100	317	H	23.24
798.94	56.90	52.51	49.64	-7.26	168	344	V	23.90

Radiated spurious emissions 1-8 GHz
FCC part 15

Result Pre-test: Graph with peak values (combined horizontal and vertical polarisation)



Maximised Signals: Table with Peak and Quasi Peak values

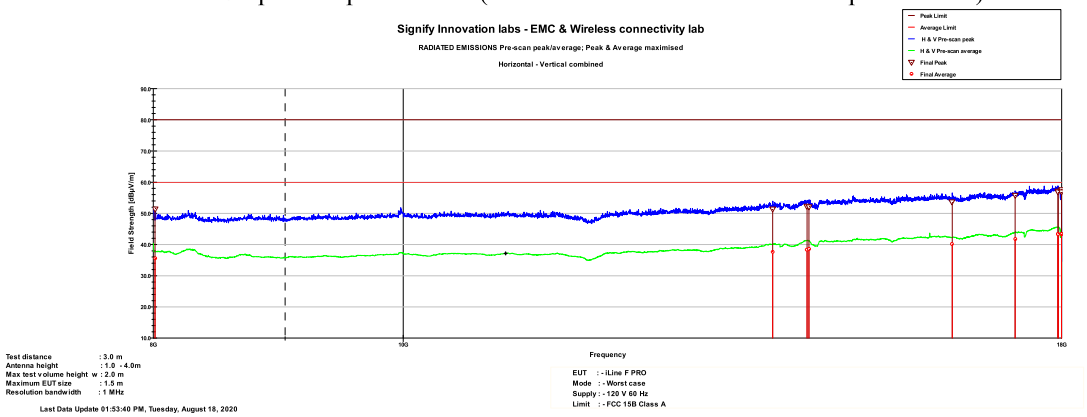
Tabulated results for Radiated Disturbances 2020 August 18

EUT / Mode : iLine F PRO / Worst case

Frequency MHz	Pk Limit dBµV/m	Pk Level dBµV/m	Pk Margin dB	Avg Limit dBµV/m	Avg Level dBuV/m	Avg Margin dB	Height cm	Angle degrees	Polarity H/V	Correction dB
1.55	80.00	56.11	-23.89	60.00	41.80	-18.20	100	325	H	-8.49
1.55	80.00	52.98	-27.02	60.00	39.26	-20.74	400	1	V	-8.49
1.65	80.00	51.34	-28.66	60.00	37.55	-22.45	174	329	H	-8.01
1.93	80.00	50.11	-29.89	60.00	36.15	-23.85	205	307	H	-5.84
4.99	80.00	54.09	-25.91	60.00	37.20	-22.80	100	58	H	6.41
6.69	80.00	53.65	-26.35	60.00	39.93	-20.07	100	73	H	8.45
7.05	80.00	54.08	-25.92	60.00	40.38	-19.62	100	324	V	8.93
7.49	80.00	54.16	-25.84	60.00	40.31	-19.69	100	320	V	9.17
7.88	80.00	53.53	-26.47	60.00	40.04	-19.96	100	345	V	9.57

Radiated spurious emissions 8-18 GHz
FCC part 15

Result Pre-test: Graph with peak values (combined horizontal and vertical polarisation)



Maximised Signals: Table with Peak and Quasi Peak values

Tabulated results for Radiated Disturbances 2020 August 18

EUT / Mode : **iLine F PRO / Worst case**

Frequency MHz	Pk Limit dBµV/m	Pk Level dBµV/m	Pk Margin dB	Avg Limit dBµV/m	Avg Level dBuV/m	Avg Margin dB	Height cm	Angle degrees	Polarity H/V	Correction dB
8.01	80.00	51.43	-28.57	60.00	35.69	-24.31	107	345	V	9.72
13.91	80.00	51.26	-28.74	60.00	37.76	-22.24	152	129	H	17.07
14.34	80.00	52.18	-27.82	60.00	38.35	-21.65	127	315	H	17.71
14.37	80.00	52.09	-27.91	60.00	38.46	-21.54	102	43	V	17.76
16.33	80.00	53.61	-26.39	60.00	40.11	-19.89	362	188	V	19.55
17.27	80.00	55.63	-24.37	60.00	41.73	-18.27	296	149	V	21.30
17.94	80.00	57.10	-22.90	60.00	43.43	-16.57	211	96	H	23.29
17.95	80.00	56.84	-23.16	60.00	43.43	-16.57	335	95	V	23.29
18.00	80.00	57.56	-22.44	60.00	43.40	-16.60	389	11	V	23.36
18.00	80.00	56.78	-23.22	60.00	43.40	-16.60	100	348	H	23.36

4. Equipment list

No.	Type	Instrument	Manufacturer	Cal. date	Due date
Conducted emission Mains					
GFC-1					
6201 9931	ESW	EMI Test Receiver 2 Hz –8 GHz	Rhode & Schwarz	2020-02-26	2021-02-26
9400 0845	ENV 216	LISN 240V/16A	Rohde & Schwarz	2020-04-07	2021-04-07
Test software		Tile! ESW Mains 9kHz-30MHz Multi-Phase			
Radiated emission					
SAR-3					
9400 0291	ESIB 26	EMI Test Receiver 20 Hz – 26.5 GHz	Rhode & Schwarz	2020-04-08	2021-04-08
9400 1050	ESU 8	EMI Test receiver 20 Hz – 8 GHz	Rhode & Schwarz	2020-05-05	2021-05-05
9400 0381	RFDS-F/A-100	Semi Anechoic chamber	ETS Lindgren NSA Svswr	 2020-02-25 2020-03-02	 2021-02-25 2021-03-02
9400 3046	CBL6112D	Bilog antenna	Teseq	2020-01-10	2021-01-10
9400 3023	HF907	Horn antenna (1-18 GHz)	Rohde & Schwarz	2019-02-01	2022-02-01
5701 0055	83017A	Pre-amplifier 0.5 –26.5 GHz	Hewlett Packard	2020-08-03	2021-08-03
-	MT25/MT30	Floor absorbers	DMAS	N.A.	N.A.
Test software		Tile! RE_SAR3 30-1000MHz ESxx			
		Tile! RE_SAR3_ESxx_1-8_GHz_FCC			
		Tile! RE_SAR3_ESIB_8-18_GHz_FCC			
Auxiliary equipment					
9400-0985	6811A	AC Power Source/Analyzer	Hewlett @ Packard	2019-10-31	2020-10-31

5. Measurement uncertainties

A measurement result only approximates the value of the measurand, because uncertainties in quantities that influence the measurement give rise to uncertainty in that result. The measurement uncertainty U describes an interval about the measurement result within which the value of the measurand is believed to lie with a specified level of confidence.

Accuracy of measurement
The reported expanded uncertainty is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

A lack of reproducibility caused by different interpretations of an ambiguous or incomplete test method, is not a contributor to the reported measurement uncertainty.

CISPR 16-4-2 uncertainty values (U_{cispr})
U_{cispr}, is a measurement uncertainty achievable using well-calibrated quality test equipment which meets CISPR 16-1 specifications, and applying good engineering practice.

If the measurement uncertainty U is less than or equal to U_{cispr}, compliance is deemed to occur provided no measured emission exceeds the emission limits.

If the measurement uncertainty U is greater than U_{cispr}, compliance is deemed to occur provided no measured emission, increased by (U - U_{cispr}), exceeds the emission limit.

Measurement		Standard		Measurement	
EMISSION				$U_{test\ lab}$	U_{cispr}
Mains terminal disturbance voltage 0.15 – 30 MHz		CISPR 11/13/15/32	FCC 15/18	3.4	3.4
Disturbance radiation 30 - 1000 MHz	3m 10m	CISPR 11/32/15	FCC 15/18	5.7 5.2	6.3
Disturbance radiation 1000 - 6000 MHz		CISPR 11/32	FCC 15/18	4.7	5.2
Disturbance radiation 6 - 15 GHz		CISPR 11	FCC 15/18	5.0	5.5.
Disturbance radiation 15 - 18 GHz		CISPR 11	FCC 15/18	5.1	5.5

u.c. = under consideration

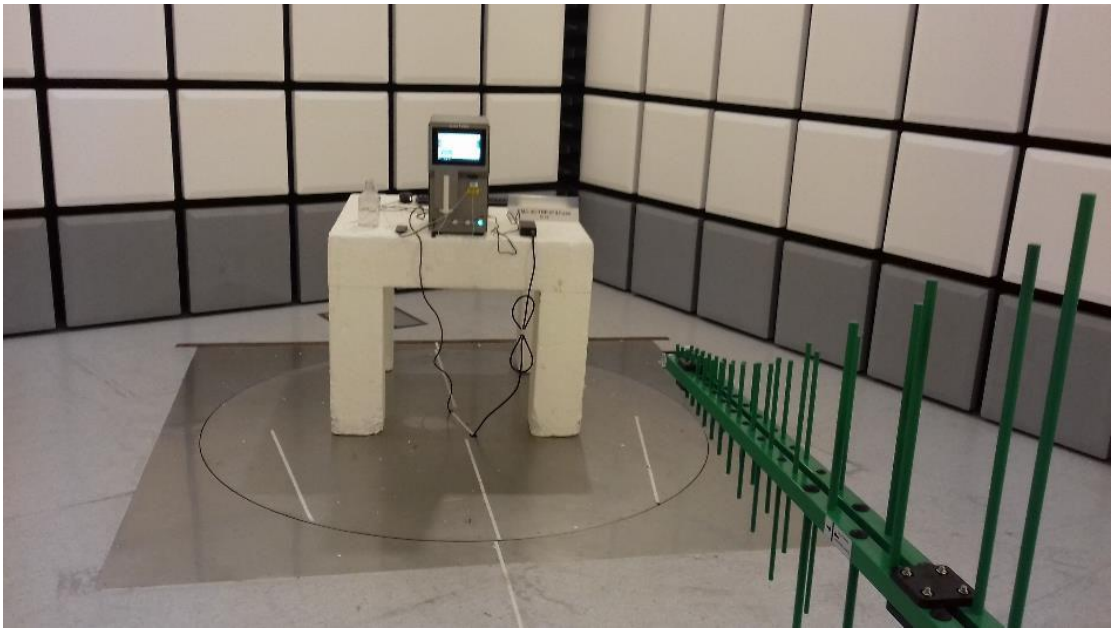
6. Photographs of test set-ups

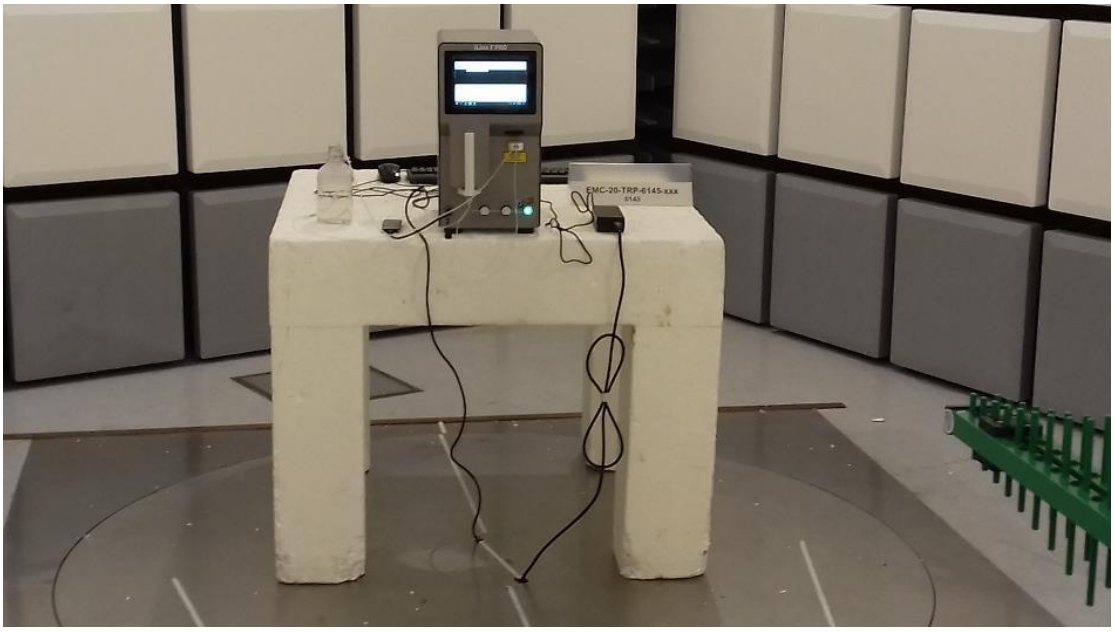
6.1 Conducted emissions

Photograph of conducted emissions test set-up.

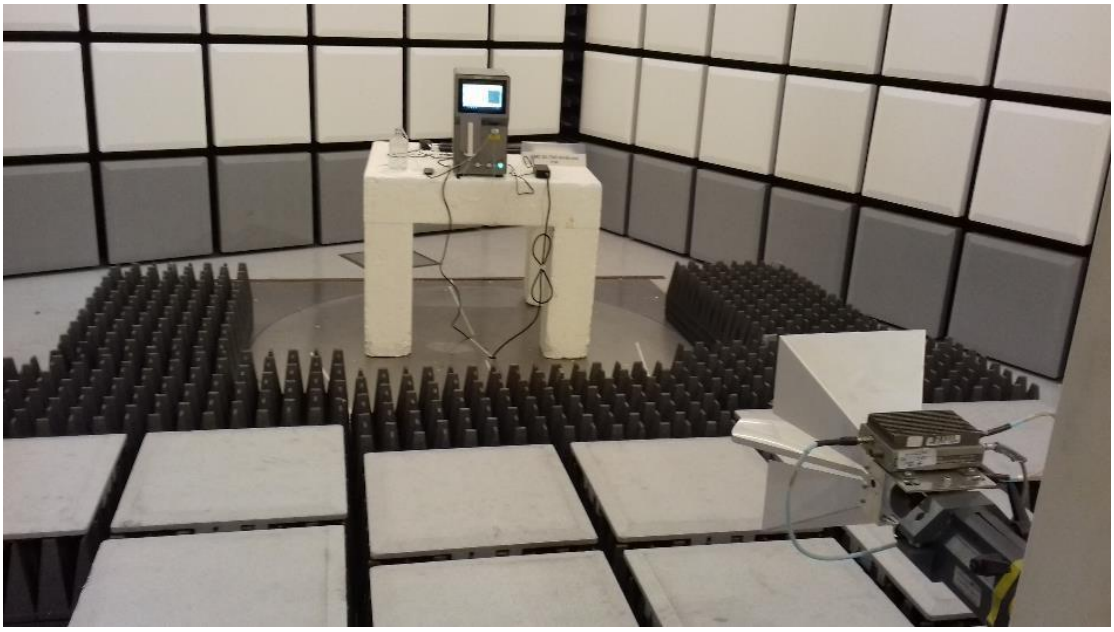
6.2 Radiated emissions

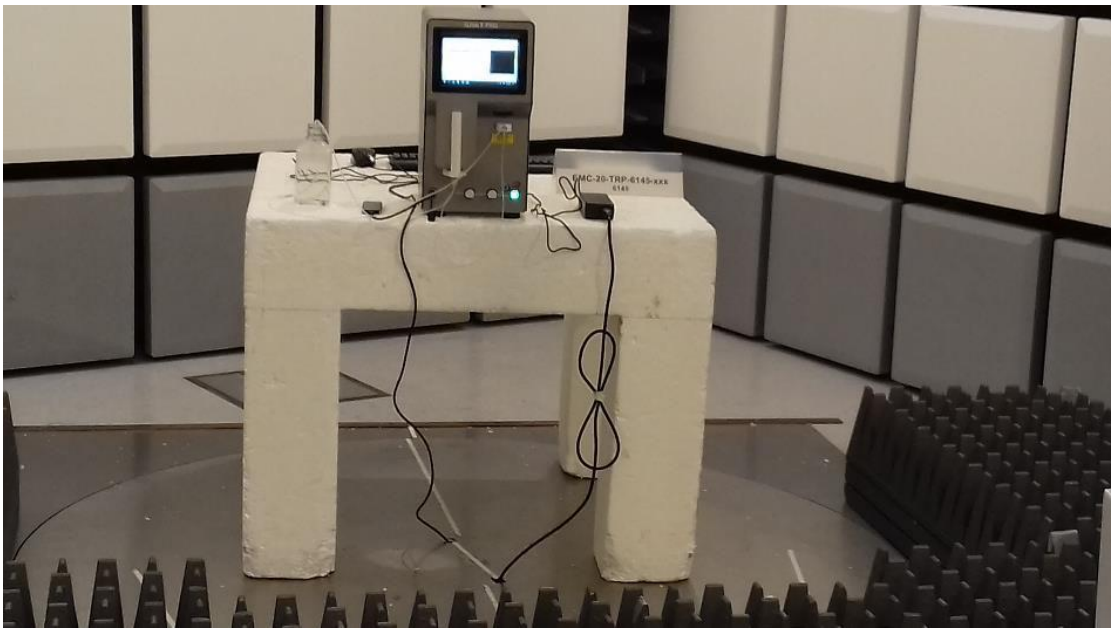
Photograph of radiated emissions test set-up.





Photograph of radiated emissions test set-up.





6.3 Photograph of EUT label

Photograph of EUT label.

6.4 Ancillary equipment

Photograph of ancillary equipment.

7. References

FCC part 15B: 2020-04
Radio frequency devices

ANSI C63.4: 2014
Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz