



IST Co., Ltd.

TEST REPORT NO. : 14-IST-0575

CERTIFICATION TEST REPORT

CFR 47 Part 15 Subpart B

Test Report File No.	14-IST-0575	<input checked="" type="checkbox"/> Basic	<input type="checkbox"/> Alternate
Date of Receipt	Sep. 04, 2014	Begin of test date	Oct. 01, 2014
Date of Issue	Oct. 17, 2014	End of test date	Oct. 02, 2014

Kind of Product	Action Camera
FCC Model(s)	360FLYBLK
IC Model(s)	360FLYBLK
FCC ID	2ADDK-360FLYBLK
IC ID	12404A-360FLYBLK

Applicant	360fly, Inc.
Address	1000 Town Center Way, Suite 200 Canonsburg PA 15317, USA.
Manufacturer	WOOJEON&HANDAN CO., LTD.
Address	569-12 Kasan-dong, Kumchon-ku, Seoul, Korea, 153-803

Standard	Section 15.107, Section 15.109 [Class B Equipment] ICES-003, Section 3
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Test Result

 Positive Negative

Tested By

B.O. KO.

Reviewed By

S.J. CHO

Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart B - Unintentional Radiators, Class B.
- The test report with appendix consists of 20 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST EMC Laboratory.
- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4





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■ Test Conditions and Data - Emissions

◆ Conducted Emissions	0.15 MHz - 30 MHz	Applicable
Test Conditions / Data and Plots		11~13
◆ Radiated Emissions(Limits Below 1 GHz)	30 MHz - 1 GHz	Applicable
Test Conditions / Data and plots		14~15
◆ Radiated Emissions(Limits Above 1 GHz)	Above 1GHz	Applicable
Test Conditions / Data and plots		16~18
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INFORMATIONS OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd.

52-20, Sinjeong-ro 41beon-gil, Giheung-gu,
Gyeonggi-do, Korea.

TEL : +82 31 326 6700 FAX : +82 31 326 6797

KOLAS Testing No. : KT118
RRA & FCC(DoC) Designation No. : KR0018
FCC Registration No. : 400603
VCCI Member No. : 1739



Measurement Uncertainty

Conducted Emissions (#2)	$U = 2.59$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions 30 MHz - 1000 MHz (Antenna - Horizontal)	$U = 3.02$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions 30 MHz - 1000 MHz (Antenna - Vertical)	$U = 3.68$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions 1 GHz - 6 GHz	$U = 4.20$ [dB] (Confidence level approximately 95 %, $k = 2$)



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PRODUCT INFORMATION

Recording	
Video Format	H.264
Video Mode(Resolution)	1504 x 1504 @ 30fps
Video Actual (Pixel)	Approximately 2.300K
Video Bit rate	Approximately 12 Mbps
Audio Format	AAC 2-Ch, Sample rate : 48 KHz, Sample rate : 64 kbps
Lens	
f-stop	f 2.50
Field of view	204°
Interface	
WIFI	IEEE 802.11 b/g/n(2.4 GHz band) for RTSP
Bluetooth	BT 4.0 LE
USB	USB OTG 2.0
Environmental	
Water-proof	5ATM (With Microphone Plug)
Water-resistant	IP6X (Without Microphone Plug)
Operating Temperature	-4° to 140°F / -20° to 60°C
Power	
Power Source	Built-In Li-Polymer battery (1600mA), DC 3.7 V
Charging Method	Through Power Cradle using bundled USB cable
Full Charging Time	Approx. 3hrs 30min @ 500mA, 2hr 10min @ 1A
Size & Weight	
Dimensions (Approx.)	Main Device (61mm (Diameter) x 59.5mm(H)) Power Cradle (45.6mm(Dia) x 12.3mm(H)) TiltMount (50mm(Dia) x 25.8mm(H))
Weight (Approx.)	Main Device (138g) Power Cradle – TBD TiltMount (30.6g)

- EMC suppression device is not used during the test.
- Please refer to user's manual.



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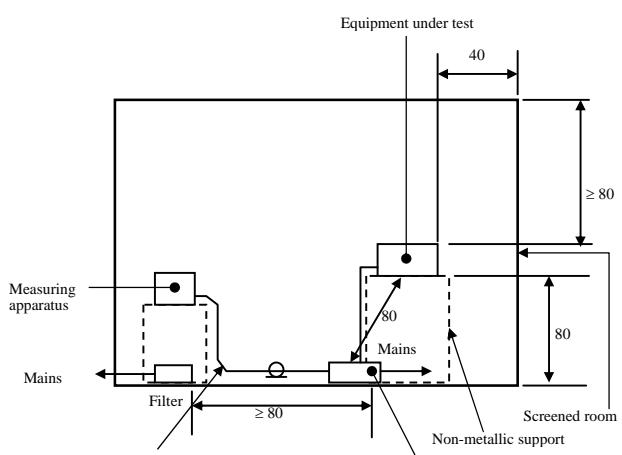
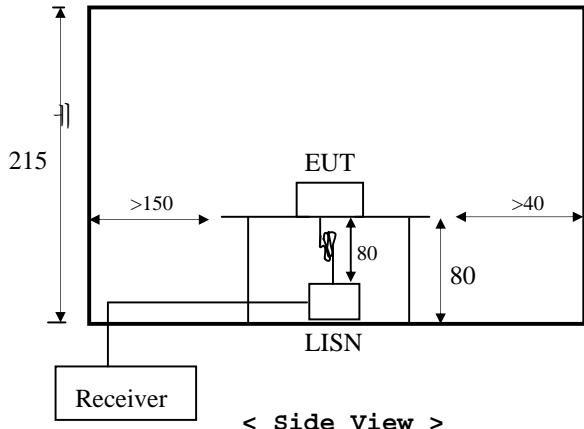
DESCRIPTIONS OF TEST

Conducted Emissions:

The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a $50 \Omega/50\mu H$ LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" & "Average" within a bandwidth of 9 KHz.

-Procedure of Test

The line-conducted facility is located inside a shielded room No.2. A 1 m X 1.5 m wooden table 80 cm height is placed 40 cm away from the vertical wall and 1.5 m away from the other wall of the shielded room. The R/S ESH3-Z5 and Hyup-Rip KNW-407 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80 cm from the LISN and powered from the Hyup-Rip LISN. The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Hyup-Rip LISN. All interconnected cables more than 1 m were shortened by non-inductive bundling to a 1 m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30 MHz. The bandwidth of the receiver was set to 10 kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.





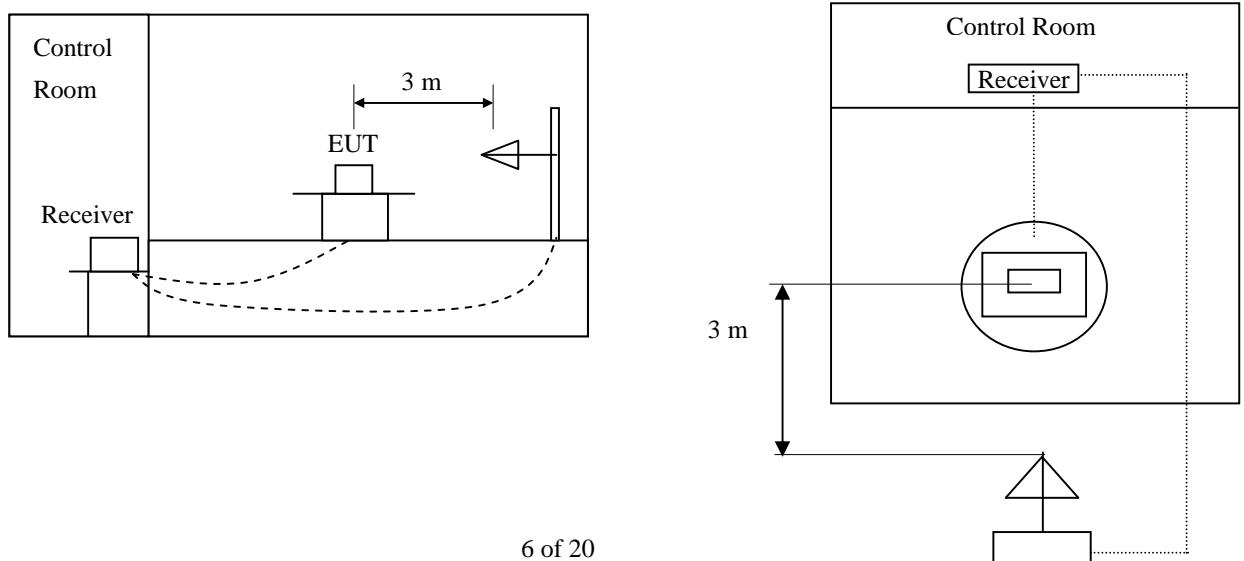
DESCRIPTION OF TEST

Radiated Emissions:

The measurement was performed over the frequency range of 30 MHz to 1 GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120 kHz.

- Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 MHz to 1000 MHz using S/B bi-log antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using S/B bi-log antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.





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Equipment Under Test

EUT Type :

- Table-Top.
- Floor-Standing.
- Table-Top and Floor-Standing(Combination).

Operation - mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

- Standby Mode
- Operational Condition : Charging + File Up&Down

Configuration of the equipment under test :

Following peripheral devices and interface cables were connected during the measurement :

Equipment	Type	Brand	Serial No.
Action Camera	360FLYBLK	360fly, Inc.	1409000065200159 80
Laptop	LG15N53	LG ELECTRONICS	404QCPY560240
Adapter(Laptop)	ADP-65JH BB	DELTA ELECTRONICS, INC.	69IW43403WP
I phone	A1387	Apple Inc.	DQGJX0TLDTDF

Connecting Interface Cables :

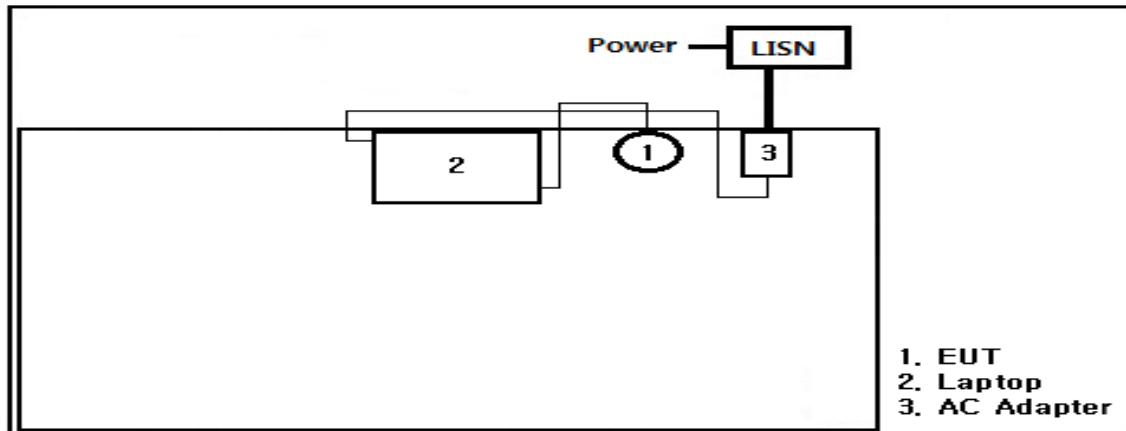
AC Power Cable : 1.2 m (Unshielded)

USB Cable(Micro 5pin to USB) : 0.5 m (Unshielded)

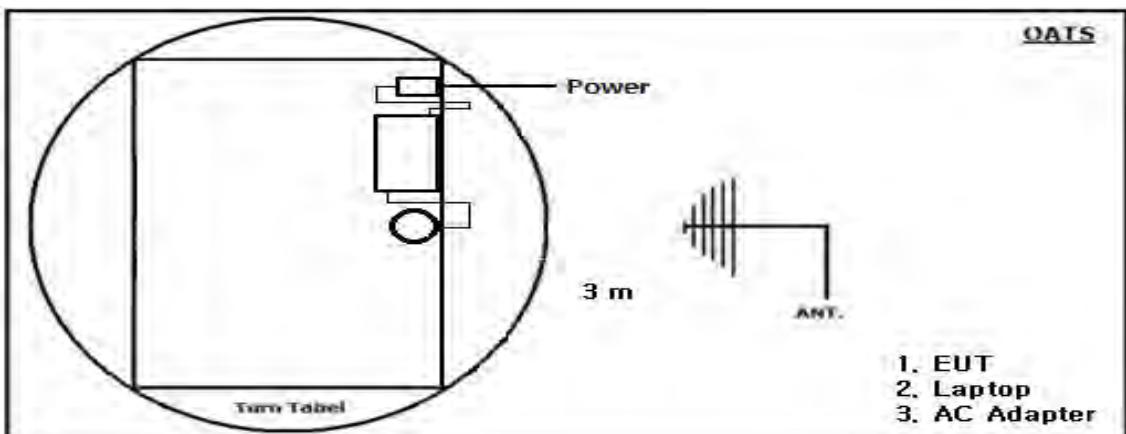
Note :



Test Set-Up



Conducted Emissions



Radiated Emissions



SUMMARY

Emissions

■ Conducted Emission

The requirements are

- MET
- Not MET

Minimum limit margin

17.20 dB at 0.150 MHz

Maximum limit exceeding

Remarks : Limits are kept with more than 3 dB margin.

■ Radiated Emission(Limits Below 1 GHz)

The requirements are

- MET
- Not MET

Minimum limit margin

3.61 dB at 237.415 MHz

Maximum limit exceeding

Remarks : Limits are kept with more than 3 dB margin.

■ Radiated Emission(Limits Above 1 GHz)

The requirements are

- MET
- Not MET

Minimum limit margin

20.41 dB at 4.874 GHz

Maximum limit exceeding

Remarks : Limits are kept with more than 3 dB margin.



Sample Calculation

Conducted Emission

Sample Signal Strength Calculation

$S(\text{Result}) = \text{Measurement} + \text{IL} + \text{CL}$

Margin = Limit - $S(\text{Result})$

$S(\text{Result})$ = Signal Strength

Measurement = Voltage at the Receiver

IL = LISN Insertion Loss

CL = Cable Loss

For example at 15.402 MHz if the measured voltage is 45.35 dBuV, the Cable loss is 0.15 dB, the insertion loss is 0.74 dB, the signal strength would be calculated:

$S(\text{Result}) = 45.35 + 0.15 + 0.74 = 46.24 \text{ dBuV}$

Margin = 60 dBuV - 46.24 dBuV = 13.76 dB

Radiated Emission

Sample Field Strength Calculation

$FS(\text{Result}) = \text{Reading} + \text{AF} + \text{CL}$

Margin = Limit - $FS(\text{Result})$

$FS(\text{Result})$ = Field Strength

Reading = Measured Voltage at the Receiver

AF = Antenna Factor

CL = Cable Loss

For example at 240.000 MHz if the measured voltage is 21.70 dBuV with an antenna Distance of 3 meters, the field intensity would be calculated:

$\text{Limit}[\text{dBuV/m}] = 200[\text{uV/m}] = 20 \log(200) = 46.00 \text{ dBuV/m}$

$FS(\text{Result}) = 21.70 + 10.71 + 2.28 = 34.69 \text{ dBuV/m}$

Margin = 46.00 dBuV/m - 34.69 dBuV/m = 11.31 dB



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TEST CONDITIONS AND DATA

Conducted Emissions

[Applicable]

◆ Test Equipment Used

Model	Name	Description	Manufacturer	Due for Cal	Serial No.
ESCI		Test Receiver	Rohde & Schwarz	Jul. 21, 2015	100373
ENV216		LISN	Rohde & Schwarz	Dec. 09, 2014	101718

◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Environmental Conditions

Temperature (22.9 ± 0.2) °C

Humidity (50.7 ± 0.2) % R.H.

Atmosphere pressure 1000 mbar

◆ Test Program See the operation mode on page 8

◆ Test Area Conducted Room #2

◆ Test Date Oct. 02, 2014

Note :



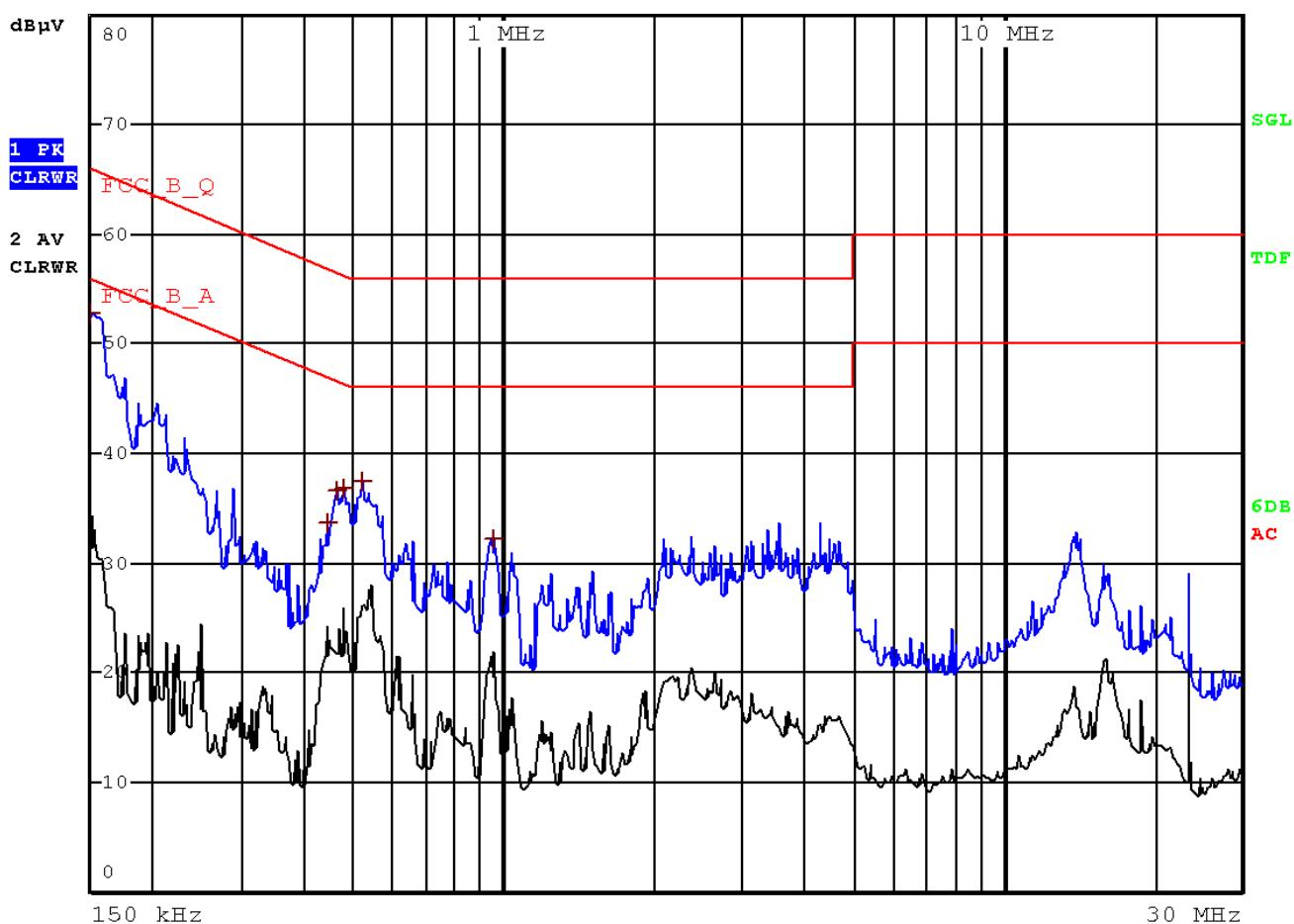
Conducted Emissions

Live



Att 10 dB

RBW 9 kHz
MT 160 ms
PREAMP OFF



Model Name: 360FLYBLK 120 Vac 60 Hz Phase : Live

Freq. [MHz]	Measurement [dB μ V]		Limit [dB μ V]		Insertion Loss	Cable Loss	Result [dB μ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.150	38.97	24.56	66.00	56.00	9.54	0.10	48.61	34.20	17.39	21.80
0.446	22.23	14.91	56.95	46.95	9.55	0.12	31.90	24.58	25.05	22.37
0.462	22.87	15.64	56.66	46.66	9.55	0.11	32.53	25.30	24.12	21.35
0.487	24.59	15.88	56.22	46.22	9.55	0.11	34.25	25.54	21.97	20.68
0.523	25.01	17.75	56.00	46.00	9.55	0.10	34.66	27.40	21.34	18.60
0.958	18.64	10.64	56.00	46.00	9.56	0.09	28.29	20.29	27.71	25.71

Note : Charging + File Up & Down mode.



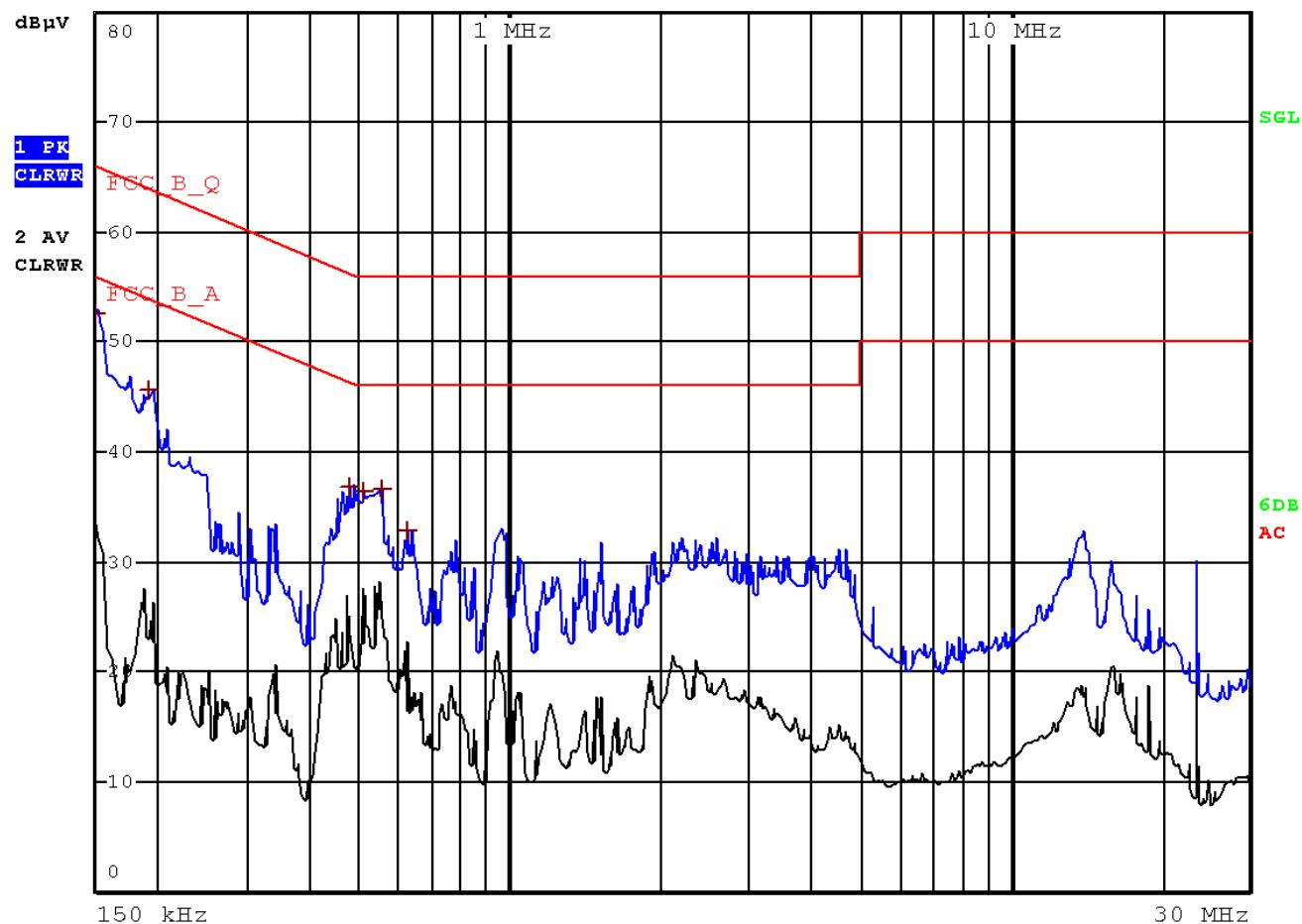
Conducted Emissions

Neutral



Att 10 dB

RBW 9 kHz
MT 160 ms
PREAMP OFF



Model Name: 360FLYBLK 120 Vac 60 Hz Phase : Neutral

Freq. [MHz]	Measurement [dB μ V]		Limit [dB μ V]		Insertion Loss [dB]	Cable Loss [dB]	Result [dB μ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.150	39.15	23.82	66.00	56.00	9.55	0.10	48.80	33.47	17.20	22.53
0.183	32.48	16.09	64.35	54.35	9.55	0.07	42.10	25.71	22.24	28.63
0.489	24.77	16.23	56.18	46.18	9.55	0.11	34.43	25.89	21.76	20.30
0.524	24.56	17.72	56.00	46.00	9.55	0.10	34.21	27.37	21.79	18.63
0.537	24.75	18.78	56.00	46.00	9.55	0.09	34.39	28.42	21.61	17.58
0.646	19.05	10.21	56.00	46.00	9.56	0.08	28.69	19.85	27.31	26.15

Note : Charging + File Up & Down mode.



TEST CONDITIONS AND DATA

Radiated Emission

[Applicable]

◆ Test Equipment Used

Model Name	Description	Manufacture	Due for Cal	Serial No.
ESCS30	Test Receiver	Rohde & Schwarz	May 08, 2015	100171
VULB 9160	Antenna	Schwarzbeck	Jun. 03, 2015	3071
ESCI7	Test Receiver	Rohde & Schwarz	Jul. 21, 2015	100872
SPECTRUM ANALYZER	R3273	ADVANTEST	May. 08, 2015	110600587
8449B OPT H02	Pre Amplifier	HP	Oct. 06, 2015	3008A0530
3115	Horn Ant.	EMCO	Dec. 04, 2015	9012-3602
HF906	Horn Ant.	Rohde & Schwarz	Oct. 25, 2015	100530

◆ Test Accessories Used

Type	Manufacturer
Aneroid Barometer	Sato
Hygrometer	Sato

◆ Environmental Conditions

	Below 1 GHz	Above 1 GHz
Temperature	(28.1 ± 1.0) °C	(24.4 ± 0.2) °C
Humidity	(50.7 ± 0.2) % R.H.	(53.4 ± 0.2) % R.H.
Atmosphere pressure	1009 mbar	1009 mbar

◆ Test Program

See the operational condition page 8.

◆ Test Area

Open Site #2, Full-Anechoic Room (3 m)

◆ Test Date

Oct 01 2014

Note :



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Radiated Emissions

Below 1GHz

[Applicable]

1. Charging + File Up & Down mode

Freq. [MHz]	Reading [dBuV]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Limit [dBuV/m]	Result [dBuV/ m]	Margin [dB]
36.012	20.10	11.24	0.98	H	40.00	32.32	7.68
119.097	24.80	10.60	1.77	H	43.50	37.17	6.33
227.672	25.70	10.26	2.59	H	46.00	38.55	7.45
237.415	29.10	10.66	2.63	H	46.00	42.39	3.61
240.618	28.90	10.79	2.65	H	46.00	42.34	3.66
478.013	16.20	17.49	3.65	V	46.00	37.34	8.66

Note : Limits Below 1 GHz (3 m method)

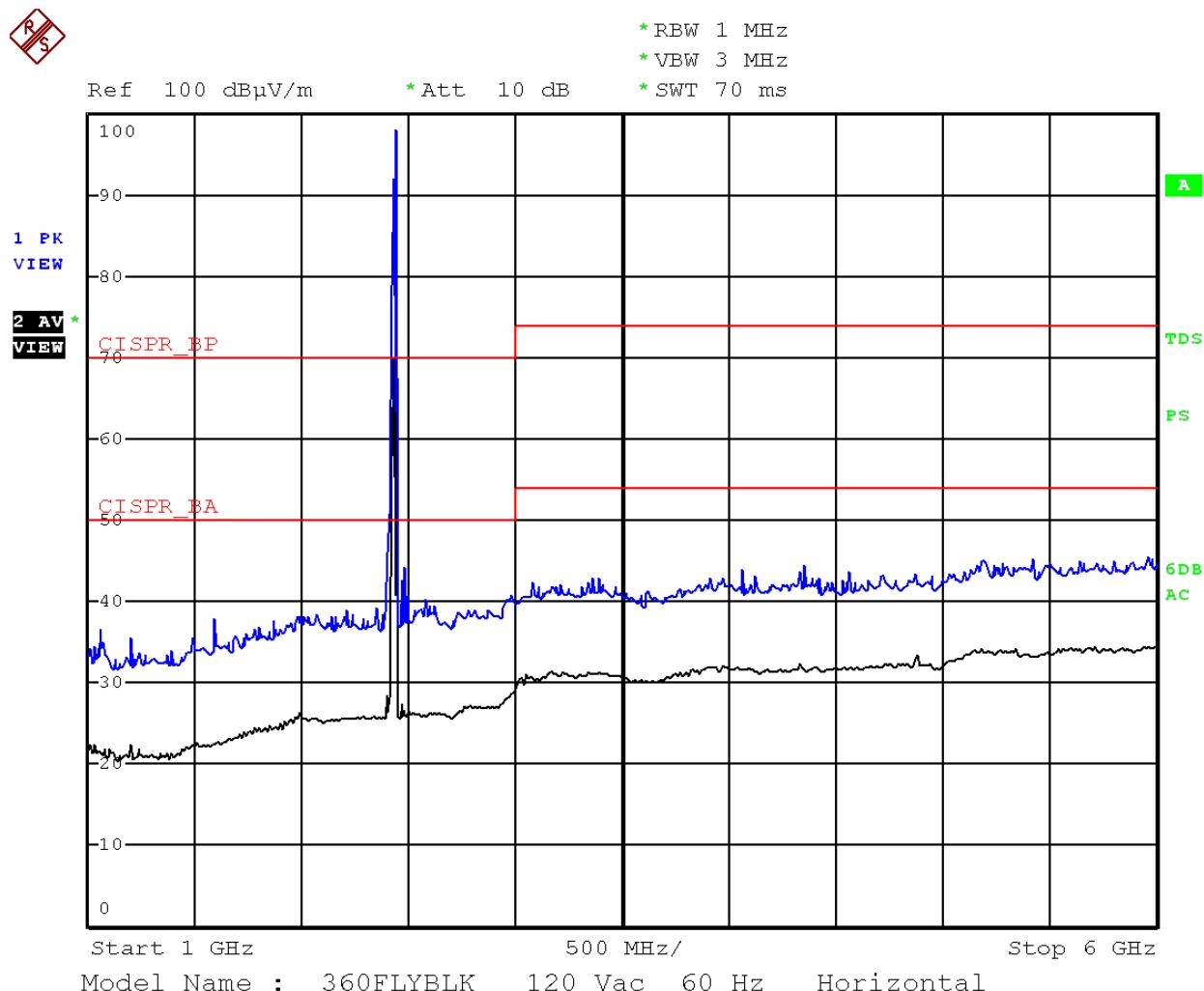


Radiated Emissions

Above 1GHz

Charging + File Up & Down mode

Horizontal



Freq. [GHz]	Reading[dBuV]		Ant. Height [cm]	Limit[dBuV/m]		Margin [dB]	
	Peak	Average		Peak	Average	Peak	Average
1.063	36.60	21.80	100	74.00	54.00	37.40	32.20
1.200	35.62	22.56	100	74.00	54.00	38.38	31.44
1.245	33.85	21.81	100	74.00	54.00	40.15	32.19
1.490	35.66	22.37	100	74.00	54.00	38.34	31.63
4.361	44.40	32.32	100	74.00	54.00	29.60	21.68
4.874	43.49	33.59	100	74.00	54.00	30.51	20.41

Note : Reading measurement is included Loss factors.

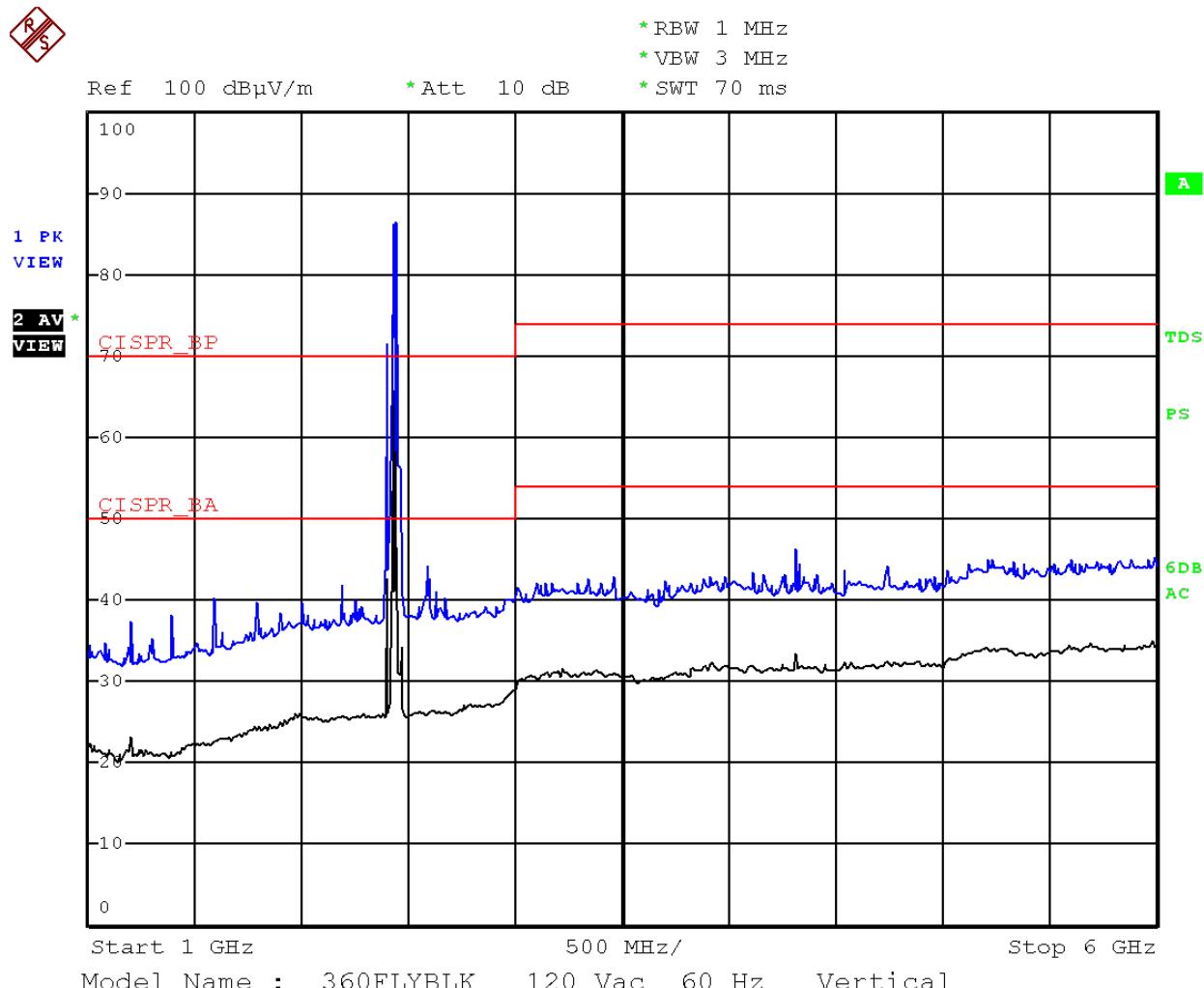


Radiated Emissions

Above 1GHz

1. Charging + File Up & Down mode

Vertical



Freq. [GHz]	Reading[dBuV]		Ant. Height [cm]	Limit[dBuV/m]		Margin [dB]	
	Peak	Average		Peak	Average	Peak	Average
1.200	37.36	23.19	100	74.00	54.00	36.64	30.81
1.397	38.21	21.49	100	74.00	54.00	35.79	32.51
1.595	40.29	22.66	100	74.00	54.00	33.71	31.34
2.196	41.94	25.79	100	74.00	54.00	32.06	28.21
2.597	44.35	26.46	100	74.00	54.00	29.65	27.54
4.307	46.45	33.57	100	74.00	54.00	27.55	20.43

Note : Reading measurement is included Loss factors.



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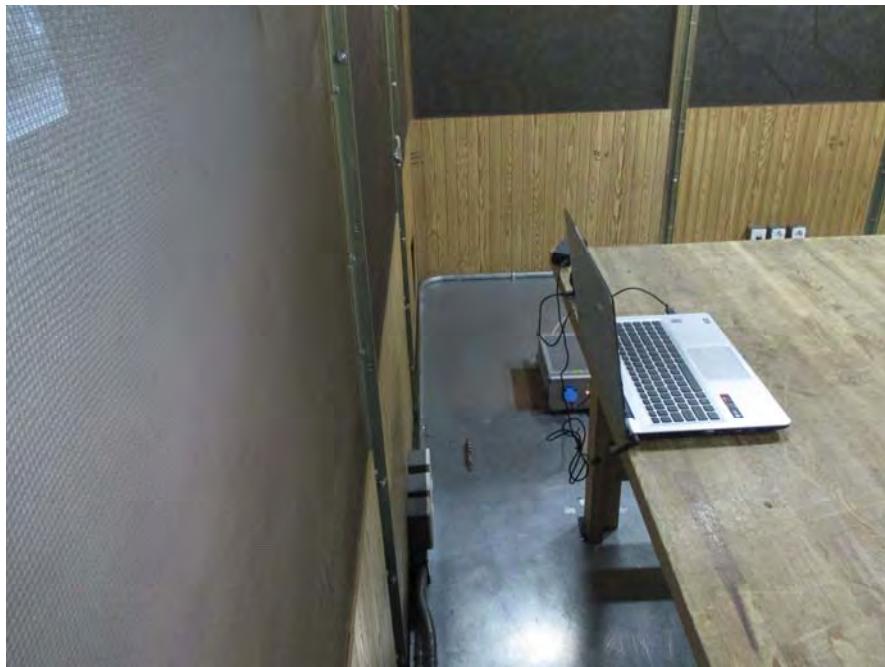
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Appendix A. Test Setup Photos

Conducted Emissions - Front View



Conducted Emissions - Rear View



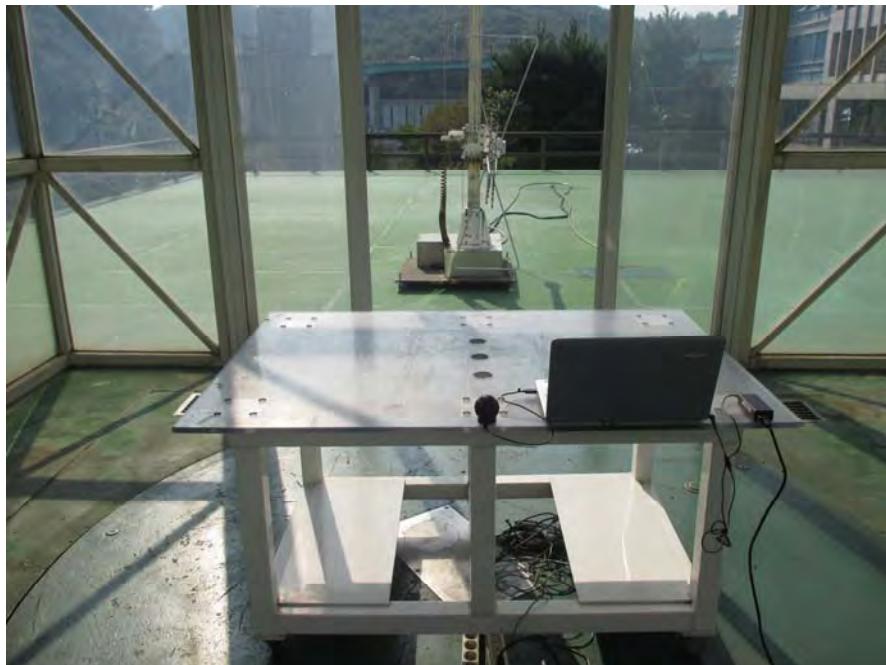


Appendix A. Test Setup Photos

Radiated Emissions below 1 GHz - Front View



Radiated Emissions below 1 GHz - Rear View





Appendix A. Test Setup Photos

Radiated Emissions Above 1 GHz - Front View



Radiated Emissions Above 1 GHz - Rear View

