



FCC 47 CFR PART 15 SUBPART B

CERTIFICATION TEST REPORT

FOR

Multi Path Blue Force Tracker

MODEL NUMBER : mBFT17

FCC ID: 2AL3AHDJC-1701

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Prepared for

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Prepared by

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Revision History

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V1	06/02/17	Initial issue	Steven Kim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: HYUNDAI J-COMM. CO., LTD.
EUT DESCRIPTION: Multi Path Blue Force Tracker
MODEL NUMBER: mBFT17
SERIAL NUMBER: 0002
DATE TESTED: APR 28, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:



SungGil Park
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Tested By:



Steven Kim
Suwon Lab Engineer
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2014, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro	
<input checked="" type="checkbox"/>	Chamber 1
<input type="checkbox"/>	Chamber 2

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <http://www.iasonline.org/PDF/TL/TL-637.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	2.32 dB
Radiated Disturbance, Below 1GHz	4.14 dB
Radiated Disturbance, Above 1 GHz	5.97 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Multi Path Blue Force Tracker.
This test report addresses the PC Data Communication operational mode.

GENERAL INFORMATION

Type of device	Class B personal computers and peripherals
AC adapter power requirements	100-240 VAC / 50-60 Hz, 0.3 A
List of frequencies generated or used by the EUT	12.4 GHz (5 th harmonic of the frequency of 2.4 GHz BLE)

5.2. PRELIMINARY TEST CONFIGURATIONS

The system was configured for testing in a typical fashion that a customer would normally use.

5.3. MODE(S) OF OPERATION INVESTIGATED

Mode	Description
PC Data Communication Mode	Connect from to PC External/Internal Memory Read and Write and BLE On

5.4. MODIFICATIONS

No modifications were made during testing.

5.5. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT & PERIPHERALS

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID/DoC
Data cable 1	Hyundai	-	-	N/A
Data cable 2	Hyundai	-	-	N/A
Micro SD card	Samsung	16G	-	N/A
AC Adapter	LIANYUNDA	LYD0505000	-	N/A
Desktop Computer	HP	C8N27AV	CZC4125J25	DoC
LCD monitor	HP	C9V75AA	3CQ4250CNN	DoC
Mouse	Logitech	U0026	1451HS05S6G8	DoC
Keyboard	Logitech	Y-U0009	1410MG00RVY8	DoC

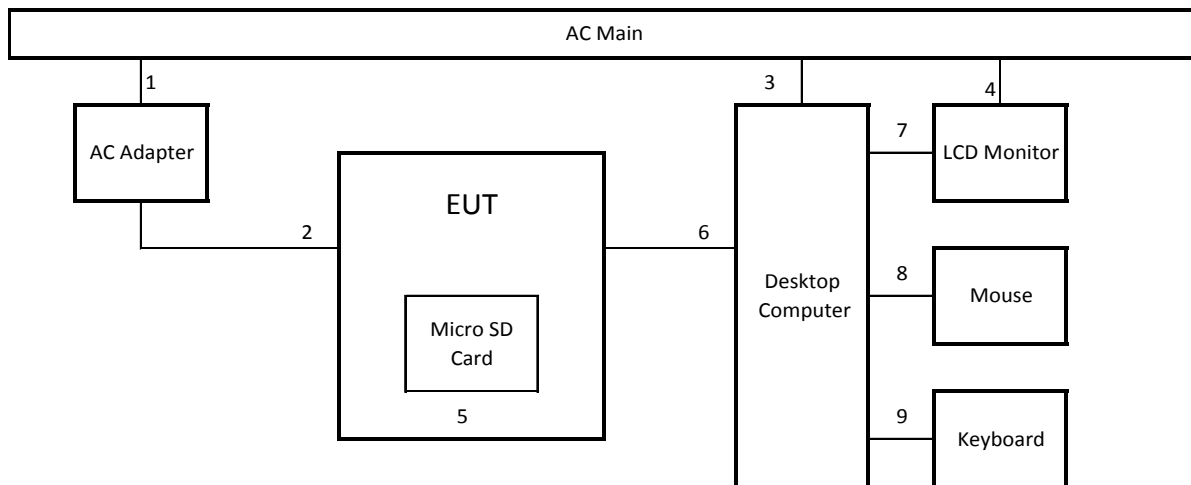
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC Power	1	AC	Unshielded	1.5m	From AC Adapter to AC Main
2	J4	1	DC	Shielded	1.2m	From EUT to AC Adapter
3	AC Power	1	AC	Shielded	1.5m	From Computer to AC Main
4	AC Power	1	AC	Unshielded	1.5m	From LCD Monitor to AC Main
5	CARD	1	-	-	Direct	From EUT to Micro SD card
6	J1	1	USB	Shielded	0.5m	From EUT to Computer
7	D-SUB	1	D-SUB	Shielded	1.8m	From Computer to LCD Monitor
8	USB	1	USB	Shielded	1.5m	From Computer to Keyboard
9	USB	1	USB	Shielded	1.5m	From Computer to Mouse

TEST SETUP

The EUT is installed in a typical configuration.
Test software exercised the Desktop Computer OS.

TEST SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	S/N	Cal Due
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	10-14-18
Antenna, Horn, 18 GHz	ETS	3115	00161451	03-10-19
Antenna, Horn, 18 GHz	ETS	3117	00168724	06-17-17
Antenna, Horn, 18 GHz	ETS	3117	00168717	06-17-17
Antenna, Horn, 40 GHz	ETS	3116C	00166155	11-30-17
Antenna, Horn, 40 GHz	ETS	3116C-PA	00168841	12-15-17
Preamplifier, 1000 MHz	Sonoma	310N	341282	08-17-17
Preamplifier, 1000 MHz	Sonoma	310N	351741	08-16-17
Preamplifier	ETS	3115-PA	00167475	08-17-17
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	08-16-17
EMI Test Receive, 40 GHz	R&S	ESU40	100439	08-17-17
EMI Test Receive, 40 GHz	R&S	ESU40	100457	08-16-17
EMI Test Receive, 3 GHz	R&S	ESR3	101832	08-16-17
Attenuator / Switch driver	HP	11713A	3748A04272	N/A
LISN	R&S	ENV-216	101584	06-30-17
LISN	R&S	ENV-216	101837	08-16-17
UL Software				
Description	Manufacturer	Model	Version	
Radiated software	UL	UL EMC	Ver 9.5	
AC Line Conducted software	UL	UL EMC	Ver 9.5	

Note: The testing was performed in accordance with ANSI C63.4-2014.
C63.4:2014 requires measurement antennas to be calibrated in accordance with C63.5: 2006.
The antenna calibration was done in accordance with C63.5: 2006.

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4: 2014

The highest clock frequency generated or used in the EUT is 5.8GHz therefore the frequency range was investigated from 30 MHz to 30 GHz.

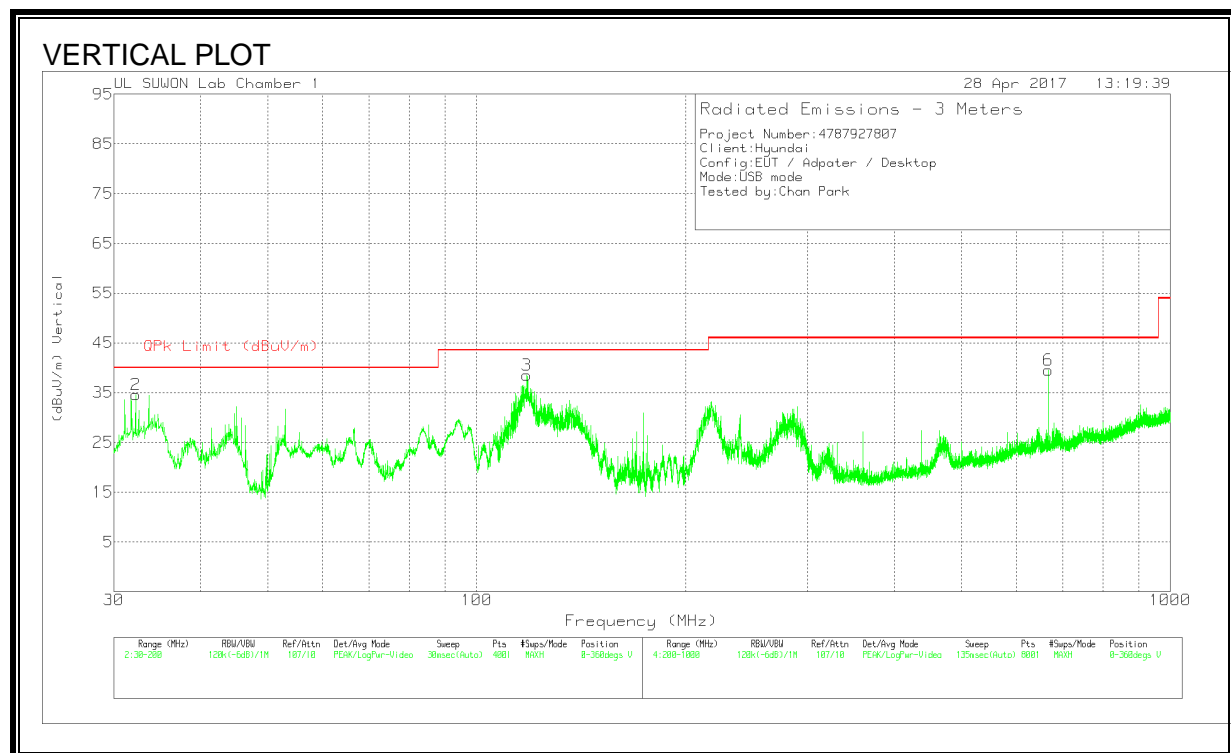
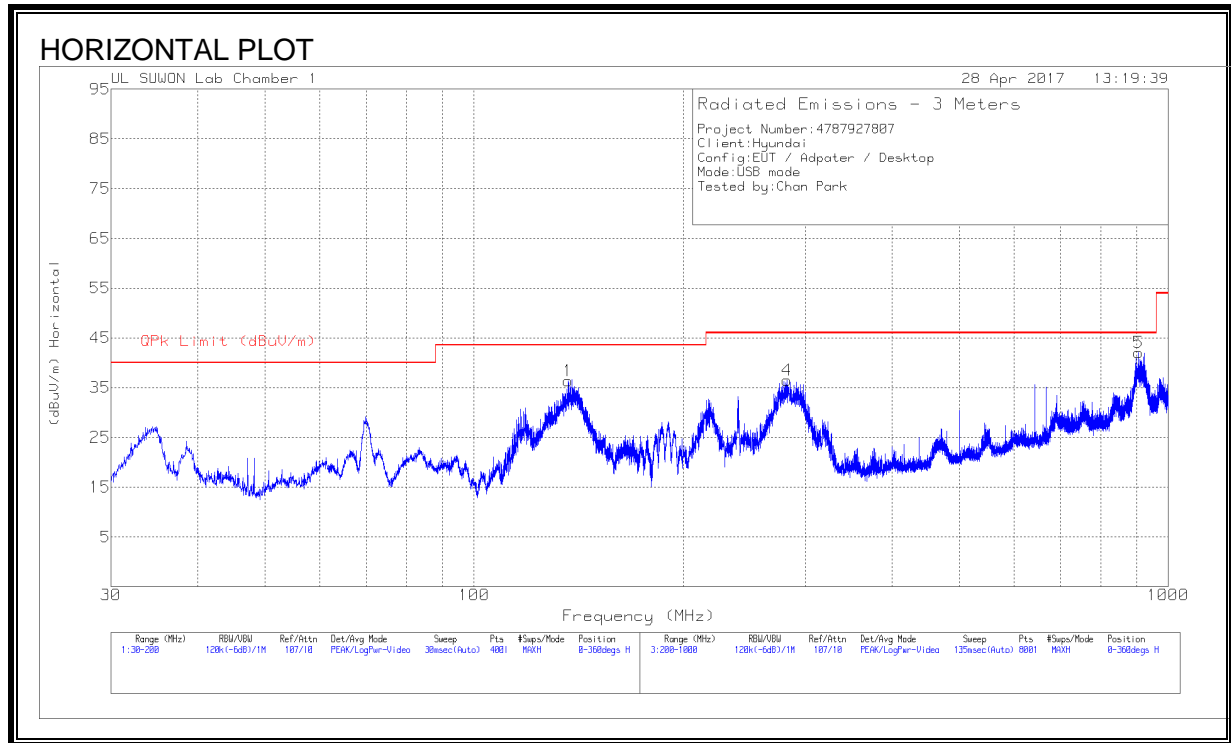
LIMIT

§15.109 (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dB μ V/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54
Note: The lower limit shall apply at the transition frequency.	

RESULTS

RADIATED EMISSIONS 30 TO 1000 MHz



HORIZONTAL AND VERTICAL DATA

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750(dB)	30-1000MHz(dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	136.7175	55.11	Pk	8	-26.8	36.31	43.52	-7.21	0-360	200	H
2	32.2525	52.49	Pk	10.5	-28.4	34.59	40	-5.41	0-360	100	V
3	118.0175	55.23	Pk	10.2	-26.9	38.53	43.52	-4.99	0-360	100	V
4	282.2	49.72	Pk	12.9	-26.1	36.52	46.02	-9.5	0-360	100	H
5	906.6	41.58	Pk	22	-21.5	42.08	46.02	-3.94	0-360	100	H
6	666.8	44.18	Pk	19.1	-23.7	39.58	46.02	-6.44	0-360	200	V

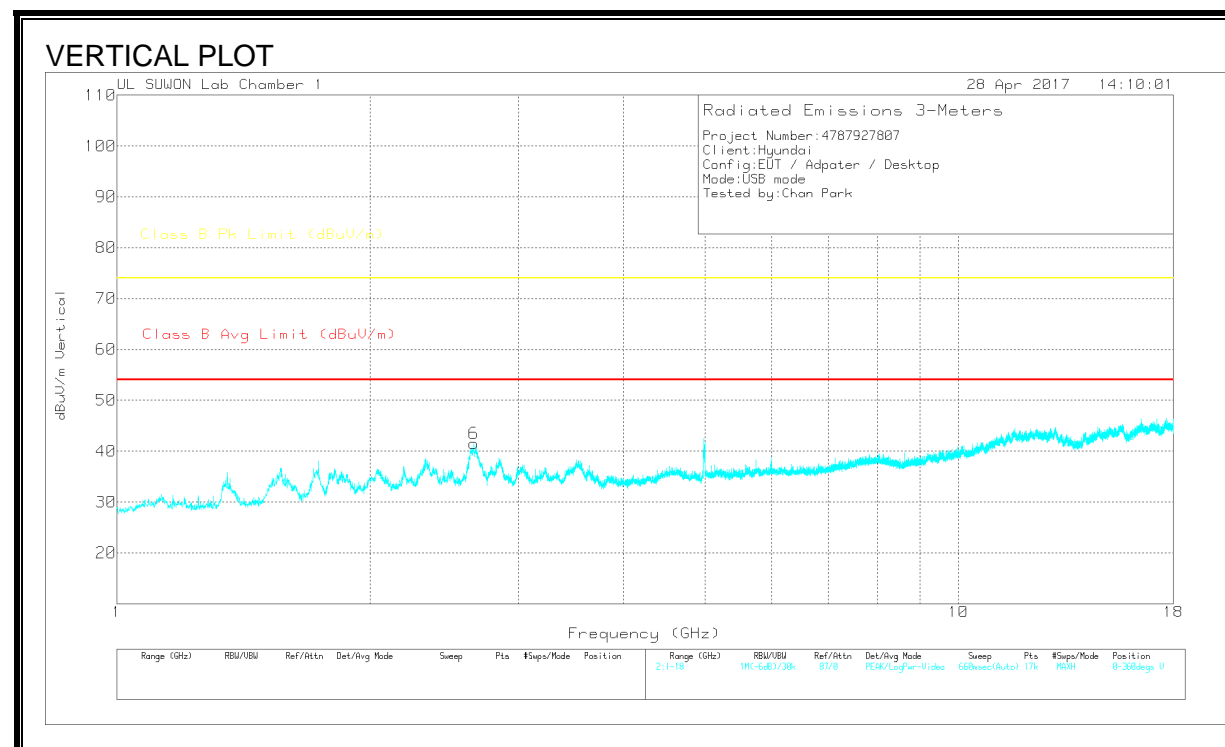
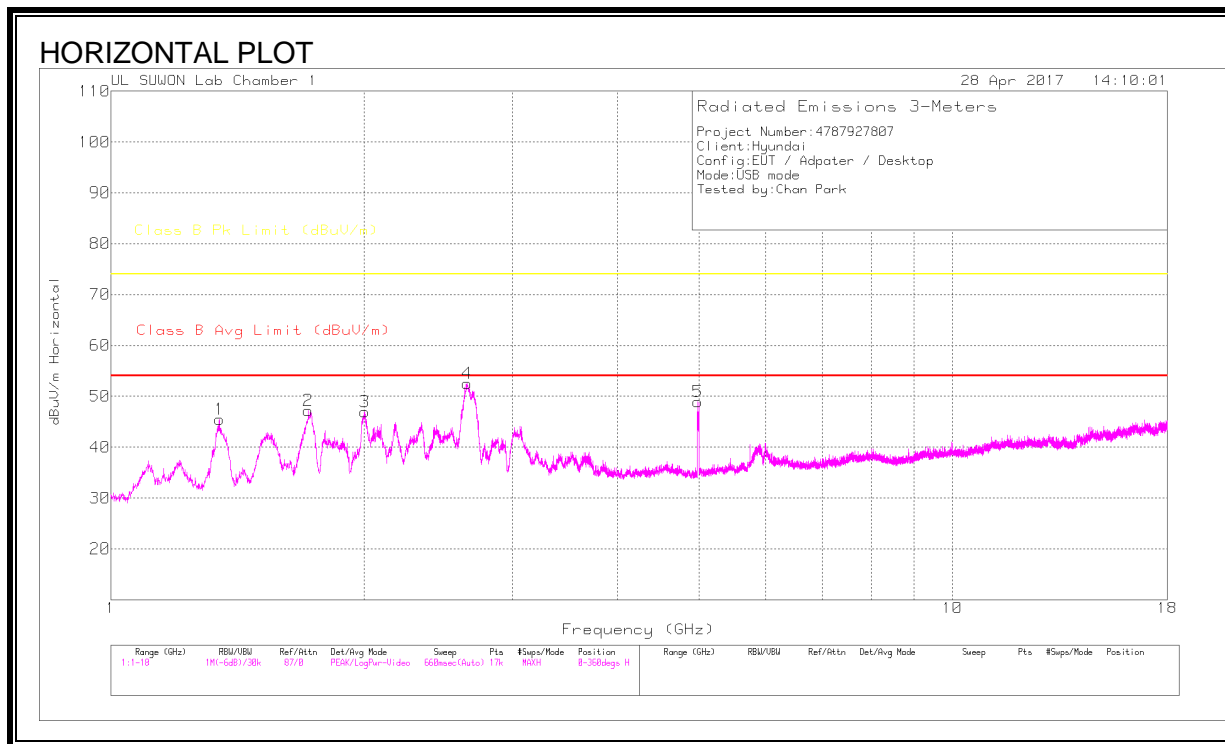
Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163_750(dB)	30-1000MHz(dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
136.8989	50.5	Qp	8	-26.8	31.7	43.52	-11.82	268	233	H
32.34082	42.45	Qp	10.5	-28.4	24.55	40	-15.45	137	100	V
118.0780	42.53	Qp	10.2	-26.9	25.83	43.52	-17.69	165	116	V
281.9948	45.27	Qp	12.9	-26.1	32.07	46.02	-13.95	308	114	H
906.5944	37.18	Qp	22	-21.5	37.68	46.02	-8.34	187	106	H
666.7532	31.81	Qp	19.1	-23.7	27.21	46.02	-18.81	303	330	V

Qp - Quasi-Peak detector

RADIATED EMISSIONS 1GHz to 18GHz



HORIZONTAL AND VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	1-18G(dB)	Corrected Reading dBuV/m	Class B Avg Limit (dBuV/m)	Margin (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.346	56.87	PK	28.4	-39.8	45.47	-	-	74	-28.53	0-360	100	H
2	1.716	56.81	PK	29.7	-39.3	47.21	-	-	74	-26.79	0-360	100	H
3	2.001	54.86	PK	31.1	-39	46.96	-	-	74	-27.04	0-360	100	H
4	2.651	58.81	PK	32.1	-38.4	52.51	-	-	74	-21.49	0-360	100	H
5	4.978	49.38	PK	34.1	-34.5	48.98	-	-	74	-25.02	0-360	200	H
6	2.654	48.02	PK	32.1	-38.6	41.52	-	-	74	-32.48	0-360	200	V

PK – Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(0016 8717)_150 619	1-18G(dB)	Corrected Reading dBuV/m	Class B Avg Limit (dBuV/m)	Margin (dB)	Class B Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1.347	65.1	Pk	28.4	-39.8	53.7	-	-	74	-20.3	352	100	H
1.347	51.89	Ca	28.4	-39.8	40.49	54	-13.51	-	-	352	100	H
1.716	66.85	Pk	29.7	-39.3	57.25	-	-	74	-16.75	331	132	H
1.716	53.76	Ca	29.7	-39.3	44.16	54	-9.84	-	-	331	132	H
2.001	63.38	Pk	31.1	-39	55.48	-	-	74	-18.52	326	106	H
2.001	51.51	Ca	31.1	-39	43.61	54	-10.39	-	-	326	106	H
2.653	68.46	Pk	32.1	-38.5	62.06	-	-	74	-11.94	50	108	H
2.653	55.84	Ca	32.1	-38.5	49.44	54	-4.56	-	-	50	108	H
4.979	60.22	Pk	34.1	-34.5	59.82	-	-	74	-14.18	346	229	H
4.979	40.72	Ca	34.1	-34.5	40.32	54	-13.68	-	-	346	229	H
2.654	56.72	Pk	32.1	-38.6	50.22	-	-	74	-23.78	356	324	V
2.654	42.85	Ca	32.1	-38.6	36.35	54	-17.65	-	-	356	324	V

Pk - Peak detector

Ca - CISPR average detection

8. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4: 2014

LIMIT

§15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

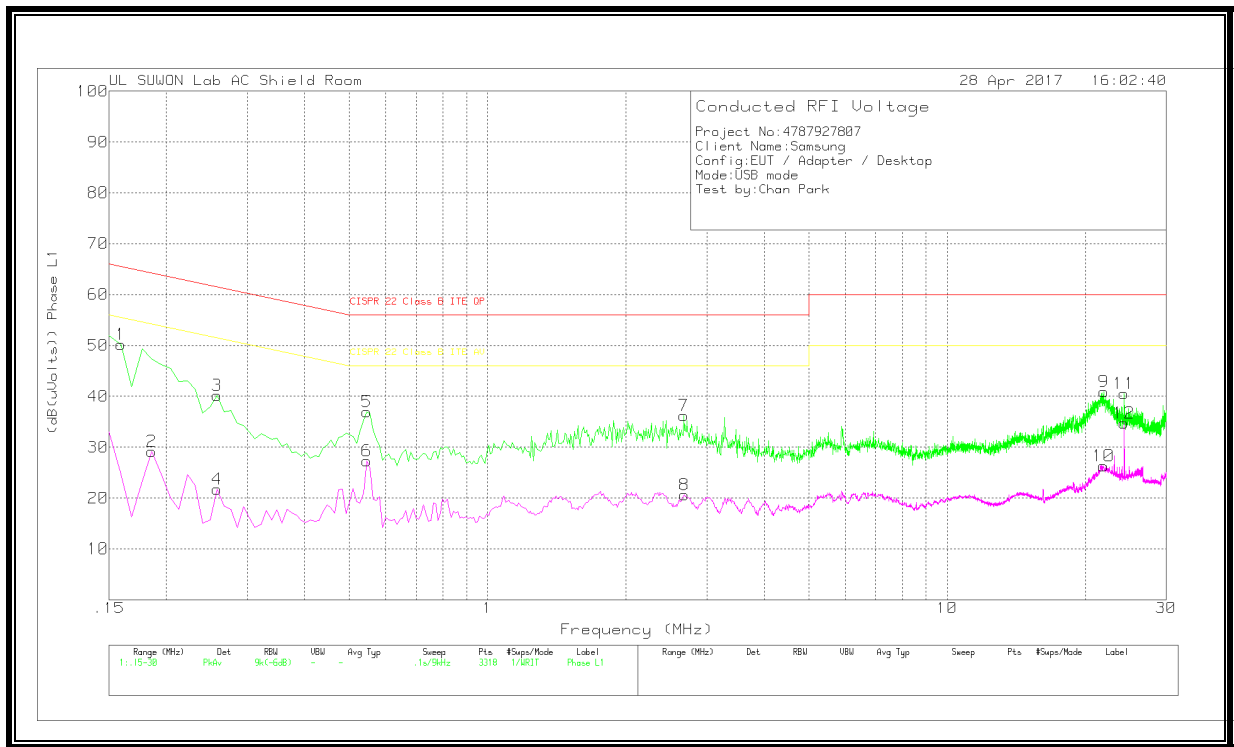
Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Notes:
1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

RESULTS

6 WORST EMISSIONS(Charging Mode)

Line-L1 .15 - 30MHz



LINE 1 RESULTS

Trace Markers

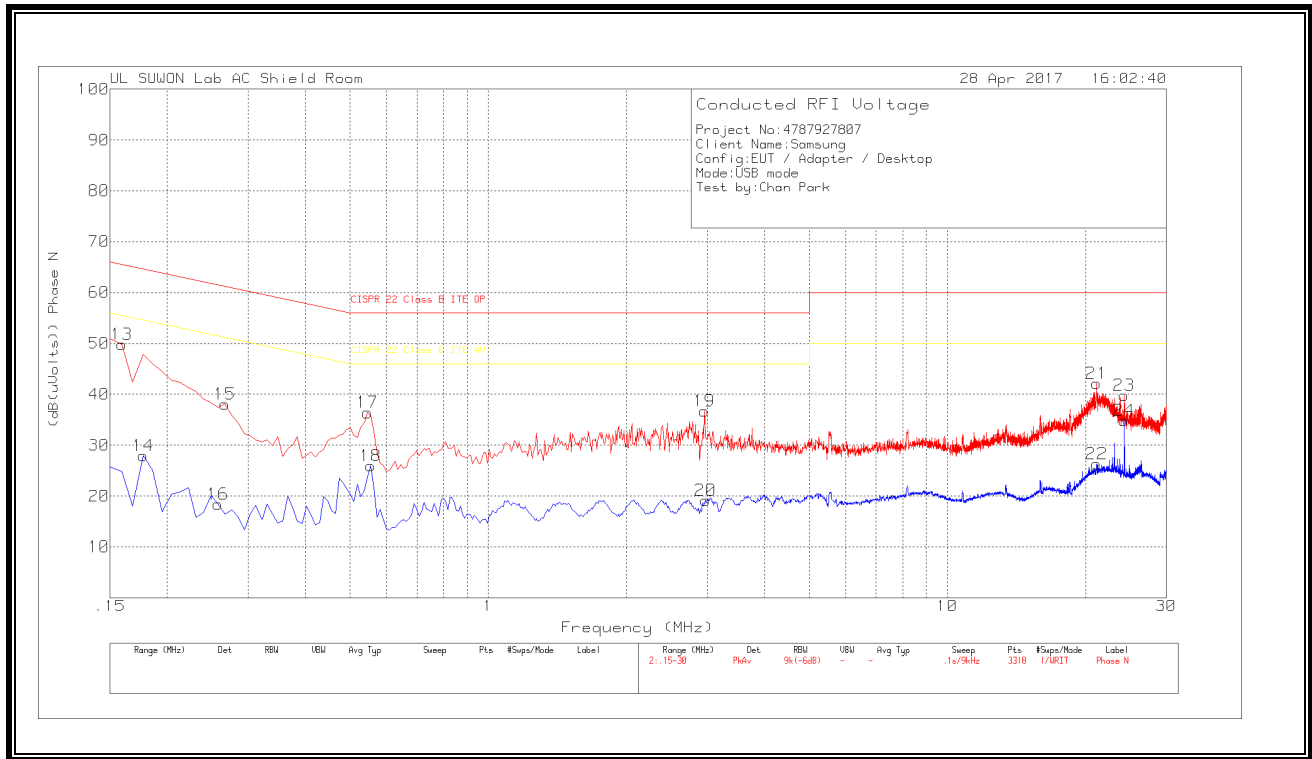
Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_L 1	CABLELOS S(dB)	Corrected Reading (dB(uVolts)	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.159	40.22	Pk	9.9	.1	50.22	65.52	-15.3	-	-
2	.186	19.09	Av	9.9	.2	29.19	-	-	54.21	-25.02
3	.258	30.28	Pk	9.7	.2	40.18	61.5	-21.32	-	-
4	.258	11.85	Av	9.7	.2	21.75	-	-	51.5	-29.75
5	.546	26.87	Pk	9.9	.2	36.97	56	-19.03	-	-
6	.546	17.19	Av	9.9	.2	27.29	-	-	46	-18.71
7	2.67	26.21	Pk	9.7	.3	36.21	56	-19.79	-	-
8	2.679	10.62	Av	9.7	.3	20.62	-	-	46	-25.38
9	21.93	29.96	Pk	10.5	.4	40.86	60	-19.14	-	-
10	21.912	15.46	Av	10.5	.4	26.36	-	-	50	-23.64
11	24.306	29.46	Pk	10.7	.4	40.56	60	-19.44	-	-
12	24.306	23.67	Av	10.7	.4	34.77	-	-	50	-15.23

Pk - Peak detector

Av - Average detection

Line-L2 .15 - 30MHz



LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101836_N	CABLELOS S(dB)	Corrected Reading (dB(uVolts)	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.159	39.94	Pk	9.8	.1	49.84	65.52	-15.68	-	-
14	.177	17.75	Av	10	.2	27.95	-	-	54.63	-26.68
15	.267	28.17	Pk	9.7	.2	38.07	61.21	-23.14	-	-
16	.258	8.49	Av	9.7	.2	18.39	-	-	51.5	-33.11
17	.546	26.3	Pk	9.9	.2	36.4	56	-19.6	-	-
18	.555	15.87	Av	9.9	.2	25.97	-	-	46	-20.03
19	2.958	26.65	Pk	9.7	.3	36.65	56	-19.35	-	-
20	2.976	9.18	Av	9.7	.3	19.18	-	-	46	-26.82
21	21.165	31.31	Pk	10.4	.4	42.11	60	-17.89	-	-
22	21.165	15.54	Av	10.4	.4	26.34	-	-	50	-23.66
23	24.306	28.92	Pk	10.5	.4	39.82	60	-20.18	-	-
24	24.306	23.94	Av	10.5	.4	34.84	-	-	50	-15.16

Pk - Peak detector

Av - Average detection