CERTIFICATION TEST REPORT

Report Number. : 11981280-E20V2

Applicant	:	FITBIT INC. 199 FREMONT ST, 14TH FLOOR SAN FRANCISCO, CA 94105, U.S.A
Model	:	FB505
FCC ID	:	XRAFB505
IC	:	8542A-FB505
EUT Description	:	SMART WATCH
Test Standard(s)	:	LP0002: 2018

Date Of Issue:
February 13, 2018

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	1/31/2018	Initial Issue	--
V2	2/13/2018	Revised standard version to LP0002: 2018	Tina Chu

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 4

2. TEST METHODOLOGY 6

3. FACILITIES AND ACCREDITATION 6

4. CALIBRATION AND UNCERTAINTY 6

4.1. MEASURING INSTRUMENT CALIBRATION 6

4.2. SAMPLE CALCULATION 6

4.3. MEASUREMENT UNCERTAINTY 7

5. EQUIPMENT UNDER TEST 8

5.1. DESCRIPTION OF EUT 8

5.2. MAXIMUM OUTPUT POWER 8

5.3. DESCRIPTION OF AVAILABLE ANTENNAS 8

5.4. SOFTWARE AND FIRMWARE 8

5.5. WORST-CASE CONFIGURATION AND MODE 8

5.6. DESCRIPTION OF TEST SETUP 9

6. TEST AND MEASUREMENT EQUIPMENT 10

7. ANTENNA PORT TEST RESULTS 11

7.1. OCCUPIED BANDWIDTH 11

8. RADIATED EMISSION TEST RESULTS 12

8.1. LIMITS AND PROCEDURE 12

8.1.1. FUNDAMENTAL EMISSION MASK (11.56 – 15.56MHz) 14
8.1.2. SPURIOUS EMISSIONS (0.09 – 30MHz) 15
8.1.3. TX SPURIOUS EMISSIONS (30 – 1000MHz) 16
8.1.4. RECEIVER WORST-CASE BELOW 1GHz 18

9. FREQUENCY STABILITY 20

10. SETUP PHOTOS 21

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: FITBIT INC.
199 FREMONT ST, 14TH FLOOR
SAN FRANCISCO,
CA 94105, U.S.A

EUT DESCRIPTION: SMART WATCH

MODEL: FB505

SERIAL NUMBER: B2-H1-213
B2-H1-360

DATE TESTED: December 27, 2017 to January 27, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
LP0002: 2018	Complies

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, or any agency of the U.S. Government.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

Approved & Released For
UL Verification Services Inc. By:

FRANCISCO DE ANDA
OPERATIONS LEAD
UL Verification Services Inc.

Prepared By:

ERIC YU
TEST ENGINEER
UL Verification Services Inc.

Reviewed By:

TINA CHU
SENIOR PROJECT ENGINEER
UL Verification Services Inc.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with NCC LP0002: 2018, ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-210 Issue 9.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 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.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A (IC:2324B-1)	☐ Chamber D (IC:22541-1)
☒ Chamber B (IC:2324B-2)	☐ Chamber E (IC:22541-2)
☒ Chamber C (IC:2324B-3)	☐ Chamber F (IC:22541-3)
	☐ Chamber G (IC:22541-4)
	☐ Chamber H (IC:22541-5)

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 9KHz to 0.15 MHz	3.84 dB
Conducted Disturbance, 0.15 to 30 MHz	3.65 dB
Radiated Disturbance, 9KHz to 30 MHz	3.15 dB
Radiated Disturbance, 30 to 1000 MHz	5.36 dB
Radiated Disturbance,1000 to 18000 MHz	4.32 dB
Radiated Disturbance,18000 to 26000 MHz	4.45 dB
Radiated Disturbance,26000 to 40000 MHz	5.24 dB

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

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Smart Watch.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak radiated magnetic field strength as follows:

Frequency Range (MHz)	Type	E Field at 30m distance (dBuV/m)
13.56	B	5.29

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes a coil Antenna.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Tera Term Ver 4.93.
The firmware installed in the EUT during testing was Version 32.3.125.8.

5.5. WORST-CASE CONFIGURATION AND MODE

EUT has 1 type of plastic wristband and 3 types of metallic bands: Mesh, Link and Tri-Link. The worst-case configuration was investigated with wristbands and it was determined that EUT with plastic wristband the worst-case. Also, normal operating of NFC was standalone mode (without the charger); therefore, all final radiated testing was performed with this configuration and AC mains line conducted emissions is not applicable.

The fundamental of the EUT was investigated under three orthogonal orientations X (Flatbed), Y (Landscape), and Z (Portrait); It was determined that The Y (Landscape) was worst-case orientation.

The data rates as provided by the client were: Type A 106, 212, 424 and 848kbps; Type B 106, 212, 424 and 848kbps, and type F 212 and 424kbps. Based on the baseline scan, the worst-case data rate was Type B 106kbps; therefore, all final testing was performed with the Type B 106kbps.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

N/A

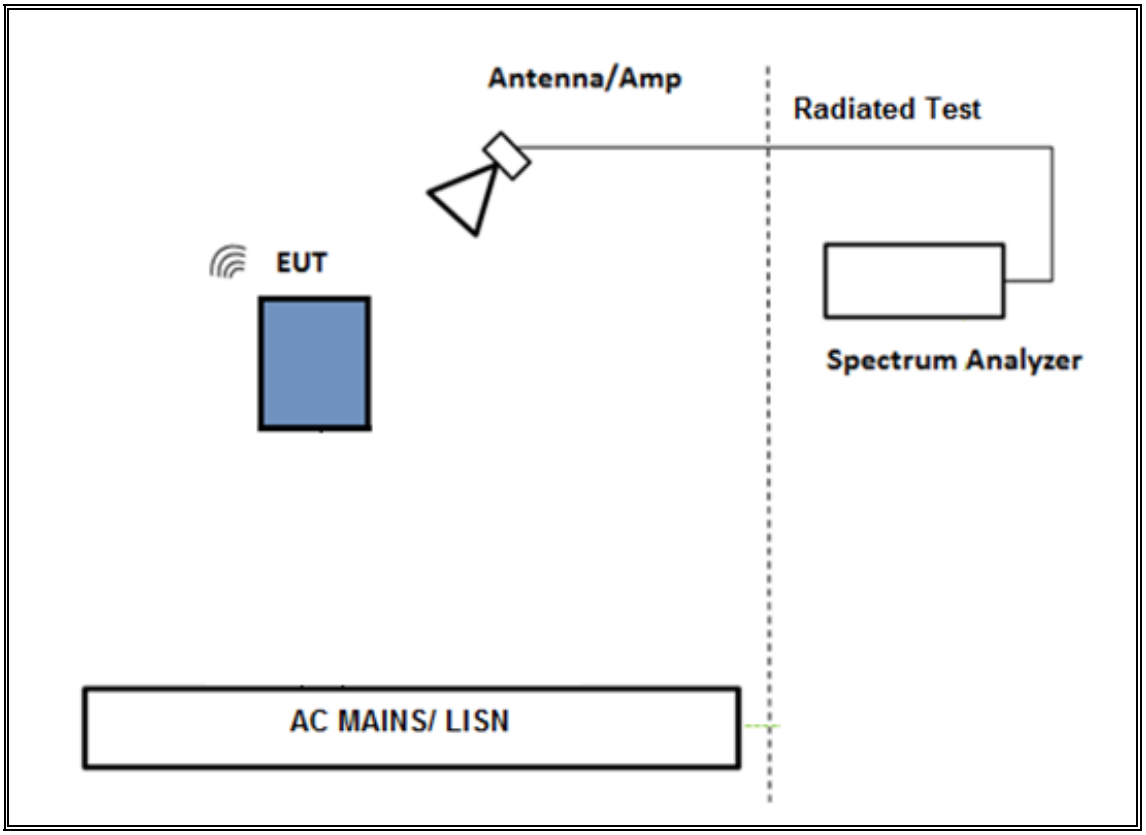
I/O CABLES (ANTENNA PORT AND RADIATED TEST)

N/A

TEST SETUP- ANTENNA PORT AND RADIATED TEST

The EUT was standalone. Test software exercised the EUT.

SETUP DIAGRAM



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

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**	**Asset**	**Cal Due**
Amplifier, 10KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310N	T300	12/11/2018
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	T1866	10/10/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	T899	06/15/2018
Amplifier, 30kHz-1000MHz	Keysight	8447D	T10	02/15/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A	T905	1/11/2018
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight	E4446A	T146	07/18/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Keysight	N9030A-544	T1113	12/21/2018
Temperature/Humidity Chamber	Thermotron	SE-600-10-10	T80	04/11/2018
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016	
Conducted Software	UL	UL EMC	Ver 7.7, Dec 14, 2017	

NOTES:

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

7. ANTENNA PORT TEST RESULTS

7.1. OCCUPIED BANDWIDTH

LIMITS

For reporting purposes only

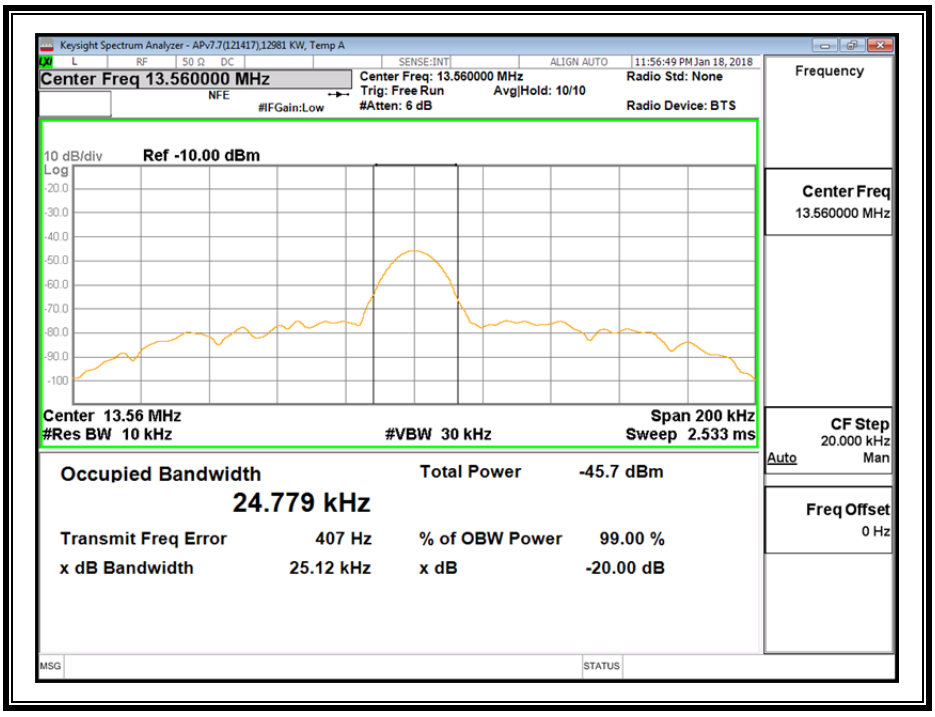
TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 10 kHz. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

Note: Because the measured signal is CW/CW-like adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (KHz)	20dB Bandwidth (KHz)
Low	13.56	24.78	25.120



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8. RADIATED EMISSION TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

NCC LP0002 §3.2.1.1 and §3.2.1.2

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Limits for radiated disturbance of an intentional radiator		
Frequency range (MHz)	Limits (µV/m)	Measurement Distance (m)
0.009 – 0.490	2400 / F (kHz)	300
0.490 – 1.705	24000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100**	3
88 - 216	150**	3
216 – 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

TEST PROCEDURE

NCC LP0002
ANSI C63.10, 2013

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the 10th harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

KDB 414788 OATS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

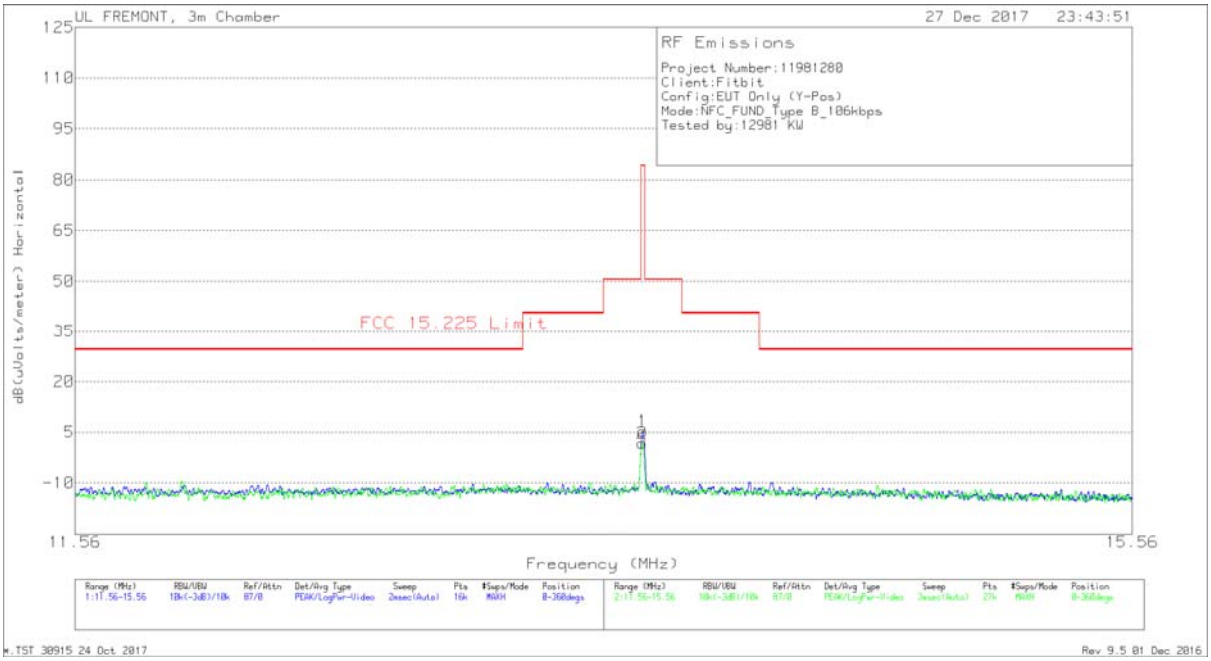
OATs and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

RESULTS

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.1.1. FUNDAMENTAL EMISSION MASK (11.56 – 15.56MHz)

FACE ON/FACE OFF PLOT



DATA

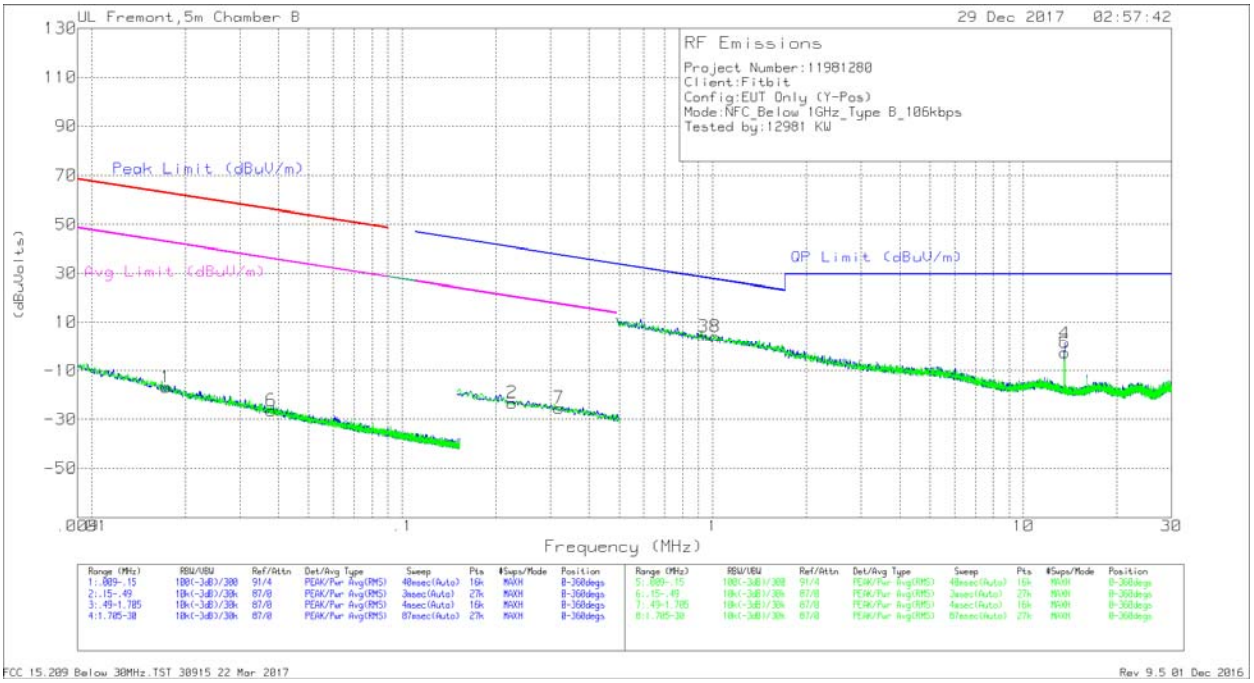
arker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit	PK Margin (dB)	Azimuth (Degs)
2	13.55807	25.73	Pk	14.5	1.6	-40	1.83	84	-82.17	0-360
1	13.56	29.19	Pk	14.5	1.6	-40	5.29	84	-78.71	0-360

Pk - Peak detector

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.1.2. SPURIOUS EMISSIONS (0.09 – 30MHz)

FACE ON/FACE OFF PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 300m	Corrected Reading (dBuVolts)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01738	46.41	Pk	15.4	1.4	-80	-16.79	62.78	-79.57	42.78	-59.57	0-360
6	.03786	39.18	Pk	12.9	1.4	-80	-26.52	56.02	-82.54	36.02	-62.54	0-360
2	.22598	44.29	Pk	11	1.5	-80	-23.21	40.53	-63.74	20.53	-43.74	0-360
7	.31919	42.17	Pk	10.9	1.5	-80	-25.43	37.53	-62.96	17.53	-42.96	0-360

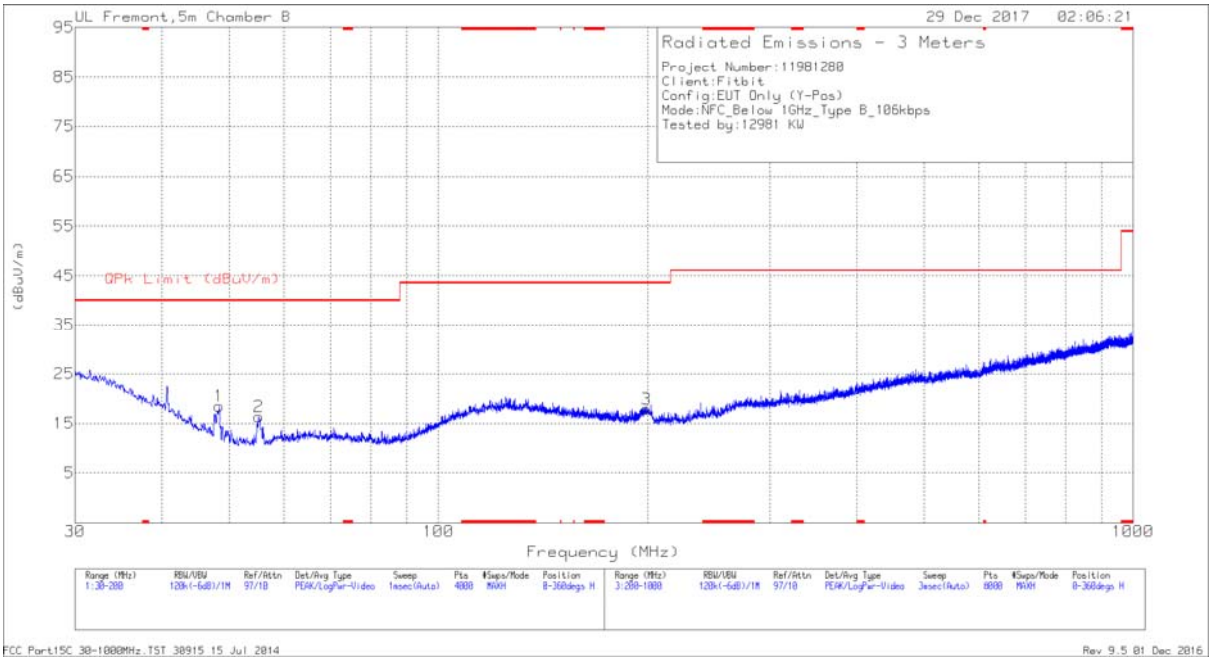
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.93376	31.28	Pk	11.2	1.5	-40	3.98	28.22	-24.24	0-360
8	1.01759	31.31	Pk	11.3	1.5	-40	4.11	27.47	-23.36	0-360
5	13.55893	24.68	Pk	11	1.6	-40	-2.72	29.5	-32.22	0-360
4	13.55945	28.96	Pk	11	1.6	-40	1.56	29.5	-27.94	0-360

Pk - Peak detector

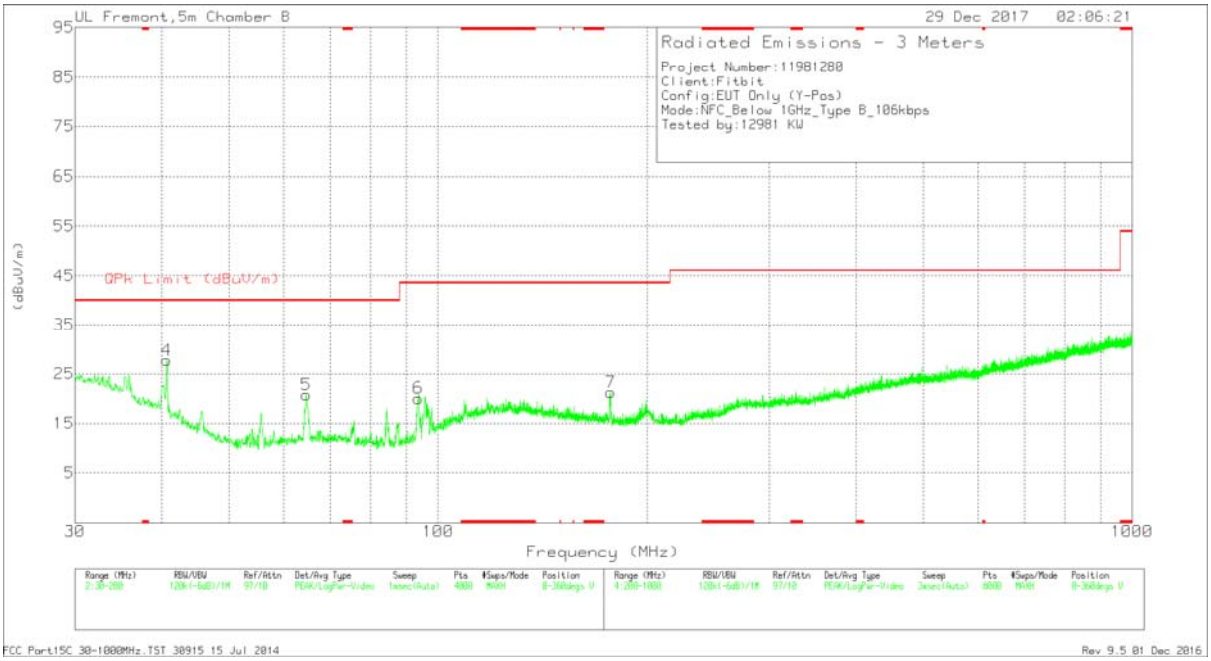
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

8.1.3. TX SPURIOUS EMISSIONS (30 – 1000MHz)

HORIZONTAL PLOT



VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	40.6703	38.77	Pk	17.7	-28.7	27.77	40	-12.23	0-360	100	V
1	48.3648	35	Pk	12.1	-28.6	18.5	40	-21.5	0-360	300	H
2	55.1453	33.69	Pk	11	-28.4	16.29	40	-23.71	0-360	300	H
5	64.5614	37.04	Pk	12.1	-28.4	20.74	40	-19.26	0-360	100	V
6	93.6815	35.58	Pk	12.5	-28	20.08	43.52	-23.44	0-360	100	V
7	177.2581	33.13	Pk	15.3	-27.1	21.33	43.52	-22.19	0-360	100	V
3	199.1513	28.18	Pk	16.6	-26.9	17.88	43.52	-25.64	0-360	100	H

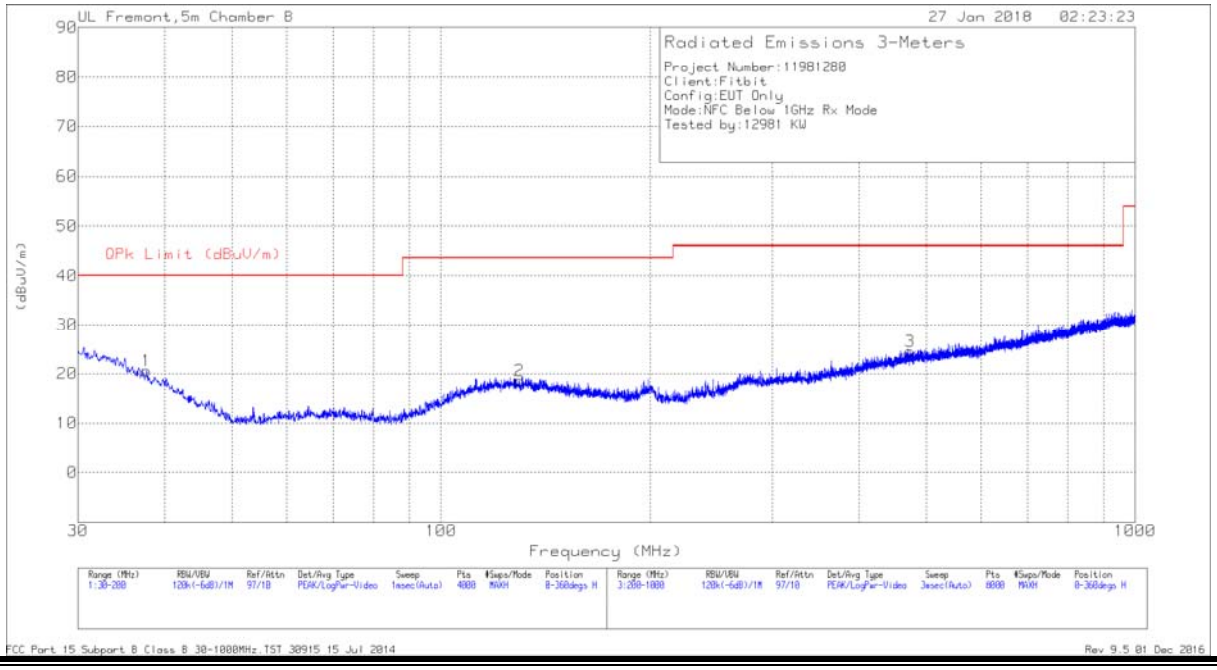
Pk - Peak detector

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

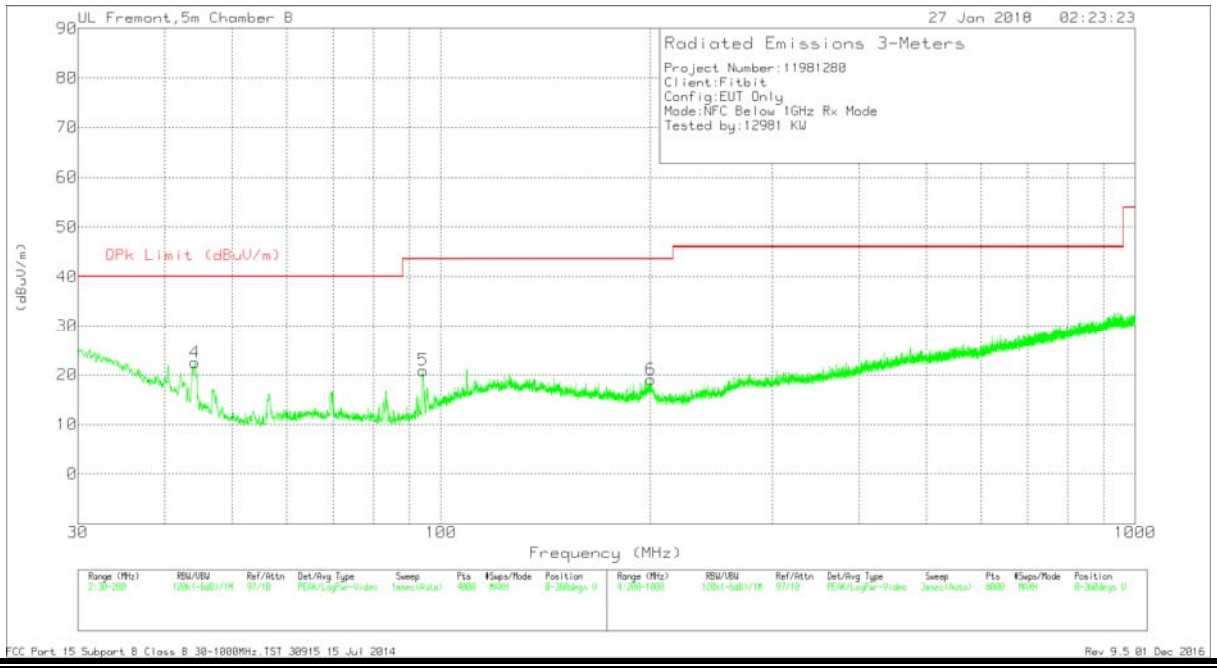
8.1.4. RECEIVER WORST-CASE BELOW 1GHz

3 m RADIATED EMISSIONS 30 – 1000MHz

HORIZONTAL PLOT



VERTICAL PLOT



This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T899 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	37.652	29.25	Pk	20	-28.7	20.55	40	-19.45	0-360	100	H
4	44.2412	36.25	Pk	14.9	-28.6	22.55	40	-17.45	0-360	100	V
5	94.2341	36.32	Pk	12.6	-28	20.92	43.52	-22.6	0-360	100	V
2	129.7733	28.61	Pk	17.6	-27.6	18.61	43.52	-24.91	0-360	100	H
6	200.6001	29.68	Pk	16.3	-26.9	19.08	43.52	-24.44	0-360	100	V
3	473.4355	29.06	Pk	21.4	-25.9	24.56	46.02	-21.46	0-360	100	H

Pk - Peak detector

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

9. FREQUENCY STABILITY

LIMIT

NCC LP0002 §3.2.1.3

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -10 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

RSS-210 Annex B.6: Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

TEST PROCEDURE

ANSI C63.10, 2013 Clause 6.8.1 and 6.8.2

RESULTS

No non-compliance noted.

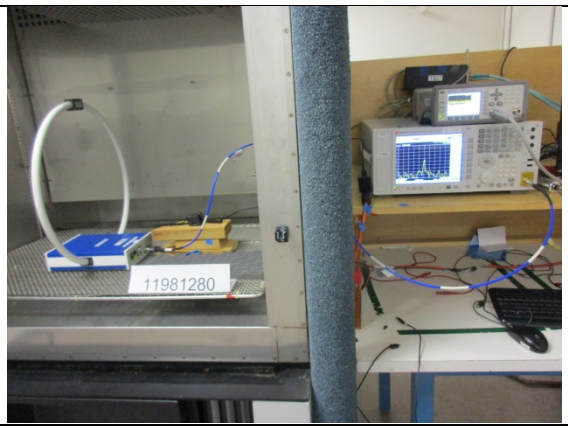
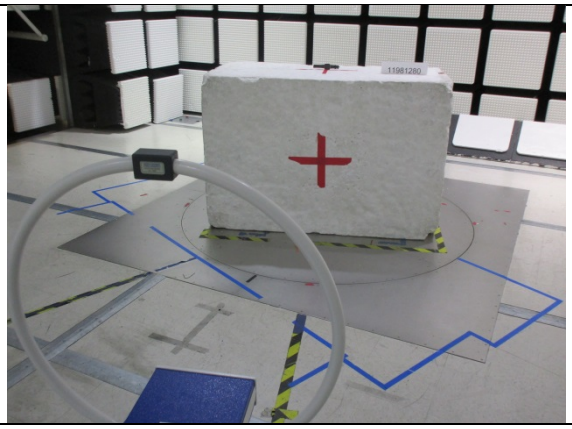
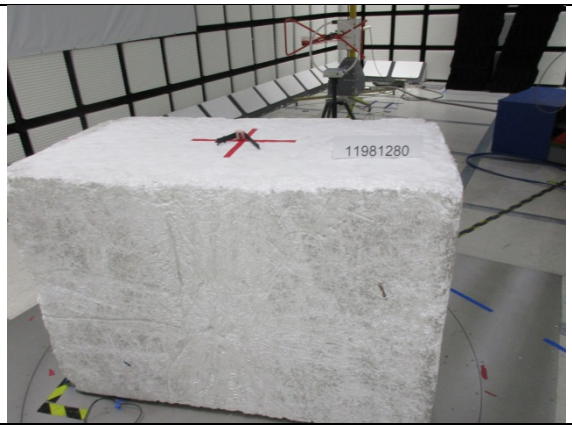
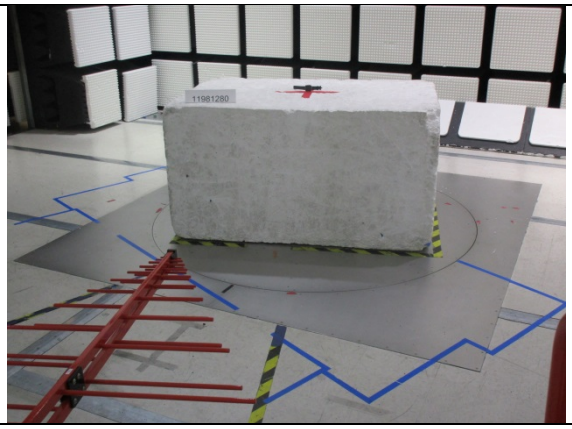
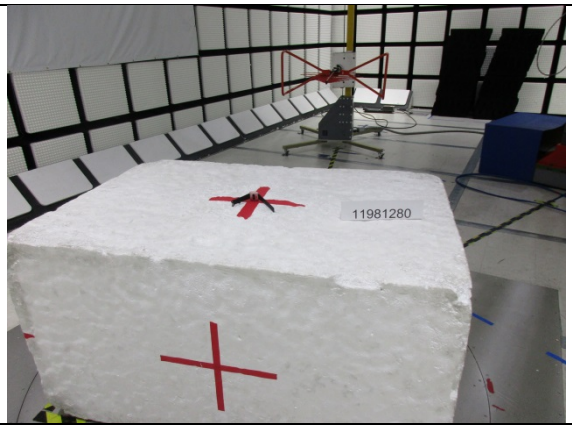
ID:	12981 KW	Date:	01/11/18

TYPE B 106Kbps

Reference Frequency: EUT Channel 13.56 MHz @ 20ºC Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measureed with Time Elapse								
(Vdc)	(ºC)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
4.40	50	13.5599749	-0.026	13.5599792	-0.346	13.5599862	-0.859	13.5599891	-1.074	± 100
4.40	40	13.5599603	1.050	13.5599614	0.967	13.5599624	0.897	13.5599634	0.826	± 100
4.40	30	13.5599636	0.808	13.5599621	0.916	13.5599609	1.005	13.5599605	1.039	± 100
4.40	***20***	***13.5599746***	***0.000***	***13.5599737***	***0.063***	***13.5599730***	***0.111***	***13.5599728***	***0.126***	***± 100***
4.40	10	13.5599861	-0.849	13.5599880	-0.993	13.5599914	-1.239	13.5599944	-1.461	± 100
4.40	0	13.5600365	-4.571	13.5600369	-4.594	13.5600370	-4.608	13.5600370	-4.607	± 100
4.40	-10	13.5600461	-5.273	13.5600507	-5.616	13.5600537	-5.834	13.5600542	-5.872	± 100
3.74	20	13.5599765	-0.140	13.5599758	-0.088	13.5599760	-0.103	13.5599762	-0.118	± 100
5.06	20	13.5599710	0.261	13.5599706	0.290	13.5599702	0.323	13.5599698	0.347	± 100

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

10. SETUP PHOTOS

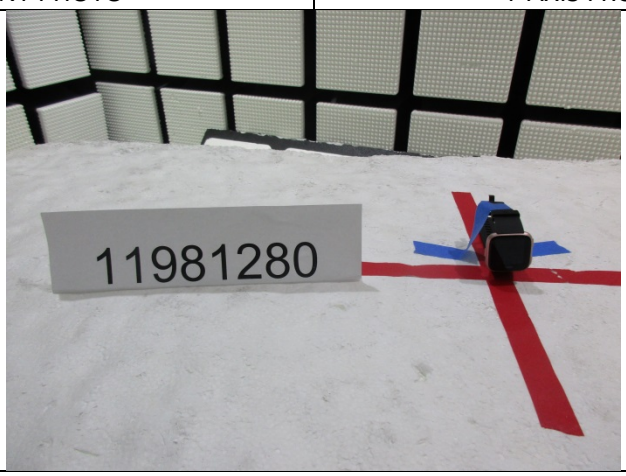
ENVIRONMENTAL CHAMBER PHOTO	
	
FRONT PHOTO	
3 METER RADIATED SPURIOUS EMISSIONS BELOW 30MHZ	
	
FRONT PHOTO	BACK PHOTO
3 METER RADIATED SPURIOUS EMISSIONS 30MHZ TO 1GHZ	
	
FRONT PHOTO	BACK PHOTO

This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.

RADIATED RF MEASUREMENT FOR PORTABLE CONFIGURATION

X-AXIS FRONT PHOTO

Y-AXIS FRONT PHOTO



Z-AXIS FRONT PHOTO

END OF REPORT

UL VERIFICATION SERVICES INC. FORM NO: CCSUP4701I
47173 BENICIA STREET, FREMONT, CA 94538, USA TEL: (510) 771-1000 FAX: (510) 661-0888
This report shall not be reproduced except in full, without the written approval of UL Verification Services Inc.