



CERTIFICATION TEST REPORT

Report Number. : 12563734-E9V3

Applicant : Samsung Electronics Co., Ltd.
129 Samsung-Ro, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, 16677, Korea

Model : SM-G970F/DS and SM-G970F

FCC ID : A3LSMG970F

EUT Description : GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE 20/40/80,
ANT+ and NFC

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C

Date Of Issue:

January 17, 2019

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	12/21/2018	Initial Issue	
V2	1/14/2019	Updated Sections 5.1, 5.2, 5.4, 5.5, 6 (removed standby and smartwatch test data), and 7 (removed standby and smartwatch test data)	Steven Tran
V3	1/17/2019	Updated Sections 5.2 and 7.1	Steven Tran

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Samsung Electronics Co., Ltd.
129 Samsung-Ro, Yeongtong-Gu,
Suwon-Si, Gyeonggi-Do, 16677, Korea

EUT DESCRIPTION: GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE
20/40/80, ANT+ and NFC

MODEL NAME: SM-G970F/DS and SM-G970F

SERIAL NUMBER: R38KB0FAAGW

DATE TESTED: DECEMBER 13 –DECEMBER 14, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	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, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc By

Prepared By:



Dan Corona
Operations Leader
Consumer Technology Division
UL Verification Services Inc.



Steven Tran
Project Engineer
Consumer Technology Division
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, and FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, 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	47658 Kato Rd
☐ Chamber A (ISED:2324B-1)	☐ Chamber D (ISED:22541-1)	☐ Chamber I (ISED:2324A-5)
☐ Chamber B (ISED:2324B-2)	☐ Chamber E (ISED:22541-2)	☐ Chamber J (ISED:2324A-6)
☒ Chamber C (ISED:2324B-3)	☐ Chamber F (ISED:22541-3)	☐ Chamber K (ISED:2324A-1)
	☐ Chamber G (ISED:22541-4)	☐ Chamber L (ISED:2324A-3)
	☐ Chamber H (ISED:22541-5)	

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers above are covered under Industry Canada company address and respective code

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

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	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax HE 20/40/80, ANT+ and NFC. The model SM-G970F was used for final testing and is representative of the test results in this report.

5.2. MAXIMUM OUTPUT POWER

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

Fundamental Frequency (KHz)	Mode	E field (300m distance) FCC (dBuV/m)
110-148	Charging (Phone)	-14.16

5.3. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was G970F.001.

5.4. WORST-CASE CONFIGURATION AND MODE

The EUT is a single frequency magnetic charger enclosed in a plastic case. For the entire radiated emissions test, the EUT was examined with the following configuration:

Configuration	Mode	Descriptions
1	Operating (With Phone)	EUT and real phone
2	Operating (With Phone with TA)	EUT and real phone powered by AC/DC adapter
3	Operating (With Phone Across on the EUT)	EUT and real phone
4	Operating (With Phone Across on the EUT with TA)	EUT and real phone powered by AC/DC adapter
5	Operating (With Wearable)	EUT and real smart watch
6	Operating (With Wearable and TA)	EUT and real smart watch powered by AC/DC adapter

Note: Preliminary tests were conducted and it was determined that configuration 4 was the worst case configurations for the EUT, therefore configuration 4 were set for final test. Also, the maximum transfer power is 9W, depending on the power requested by the Rx device.

AC power line conducted emissions were also investigated on the following configurations.

Configuration	Mode	Descriptions
1	Operating (With Phone and TA)	EUT and real phone powered by AC/DC adapter
2	Operating (With Phone Across on the EUT with TA)	EUT and real phone powered by AC/DC adapter
3	Operating (With Wearable)	EUT and real smart watch powered by AC/DC adapter

Note: Preliminary tests were conducted and it was determined that configuration 2 was the worst case configurations; therefore configuration 2 was set for final test. Also, the maximum transfer power is 9W, depending on the power requested by the Rx device.

Remark: In order to enable wireless charging, EUT must turn on power sharing mode. Also, the EUT must have battery level over 30% to support power sharing mode. Confirmed that full charging and 30% of the data was the same. Thus, when EUT operates in standalone, EUT was tested in full charging condition. Each charging mode with client device (1-20%, 40-60%, and 90-100%) was tested. The worst condition has been determined to be 1-20%, therefore this battery level is reported.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 300 m open area 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 D01.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT & PERIPHERALS

SUPPORT EQUIPMENT & PERIPHERALS LIST			
Description	Manufacturer	Model	Serial Number
Phone	Samsung	G965F/DS	RF8K11FQ5NP
Smartwatch	Samsung	SM-R805U	R5AK704QDRJ
Travel Adapter	Samsung	EP-TA300	R3KB5B01S1SE3
USB Data Cable	Samsung	N/A	N/A

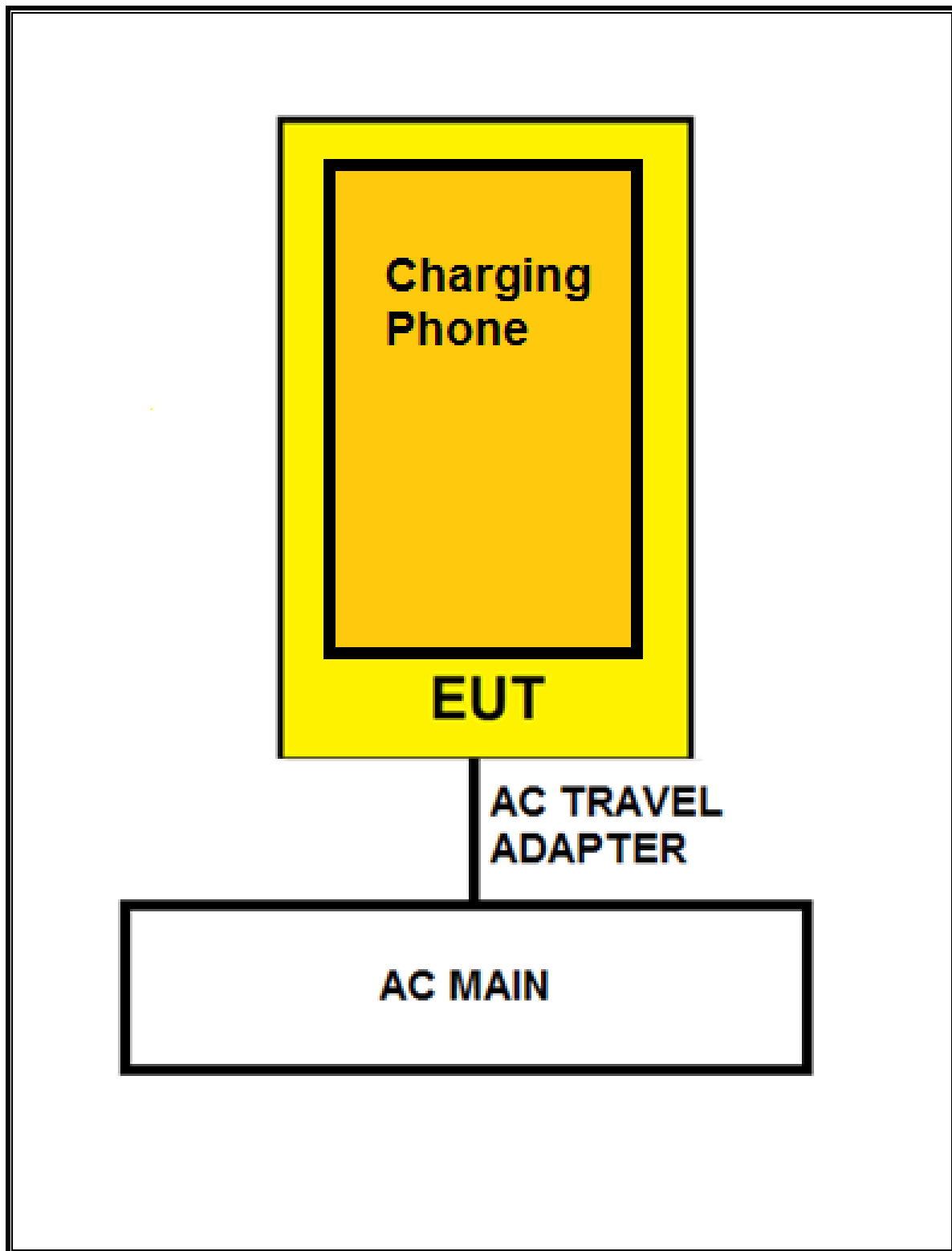
I/O CABLES

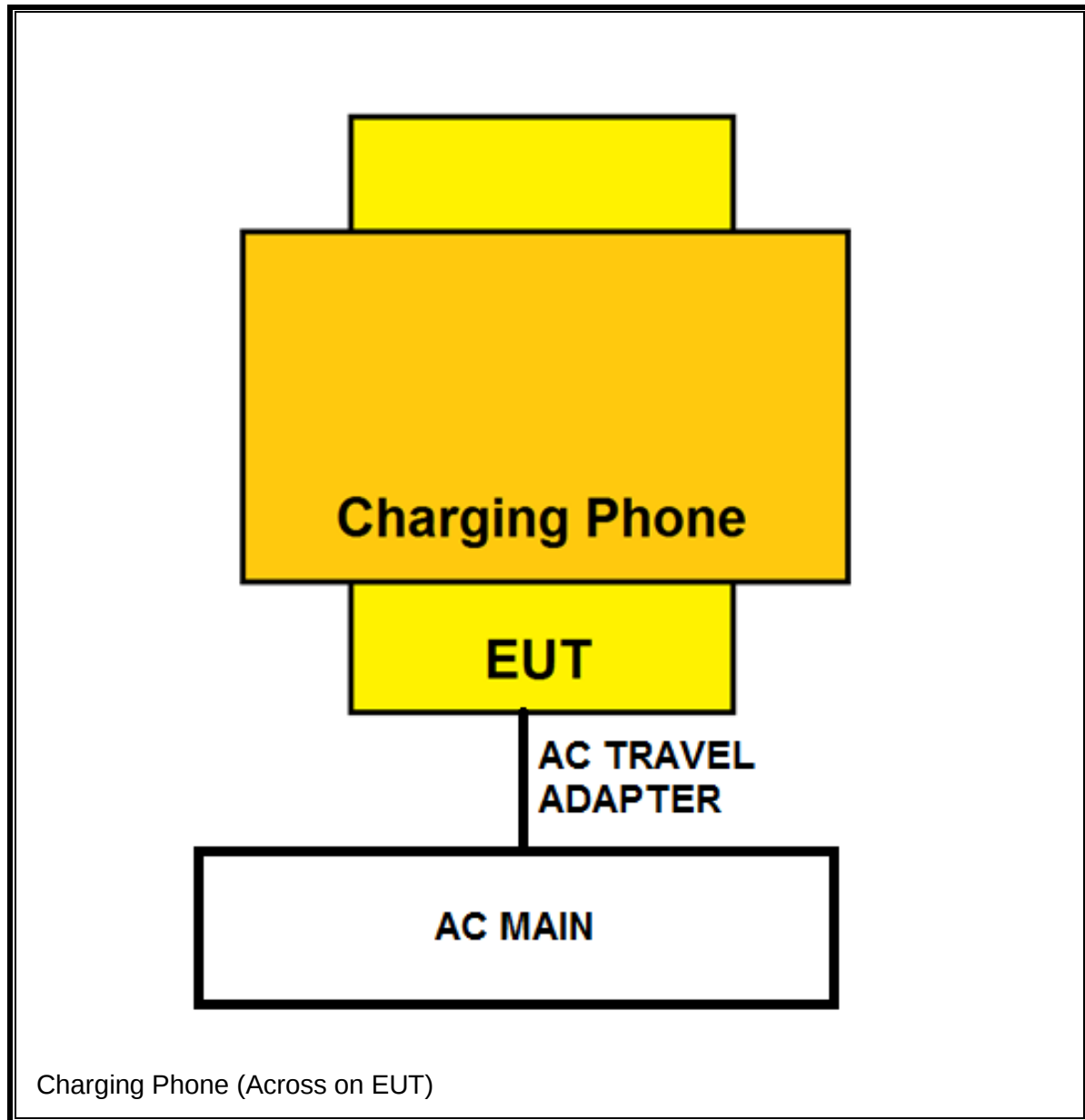
N/A

TEST SETUP

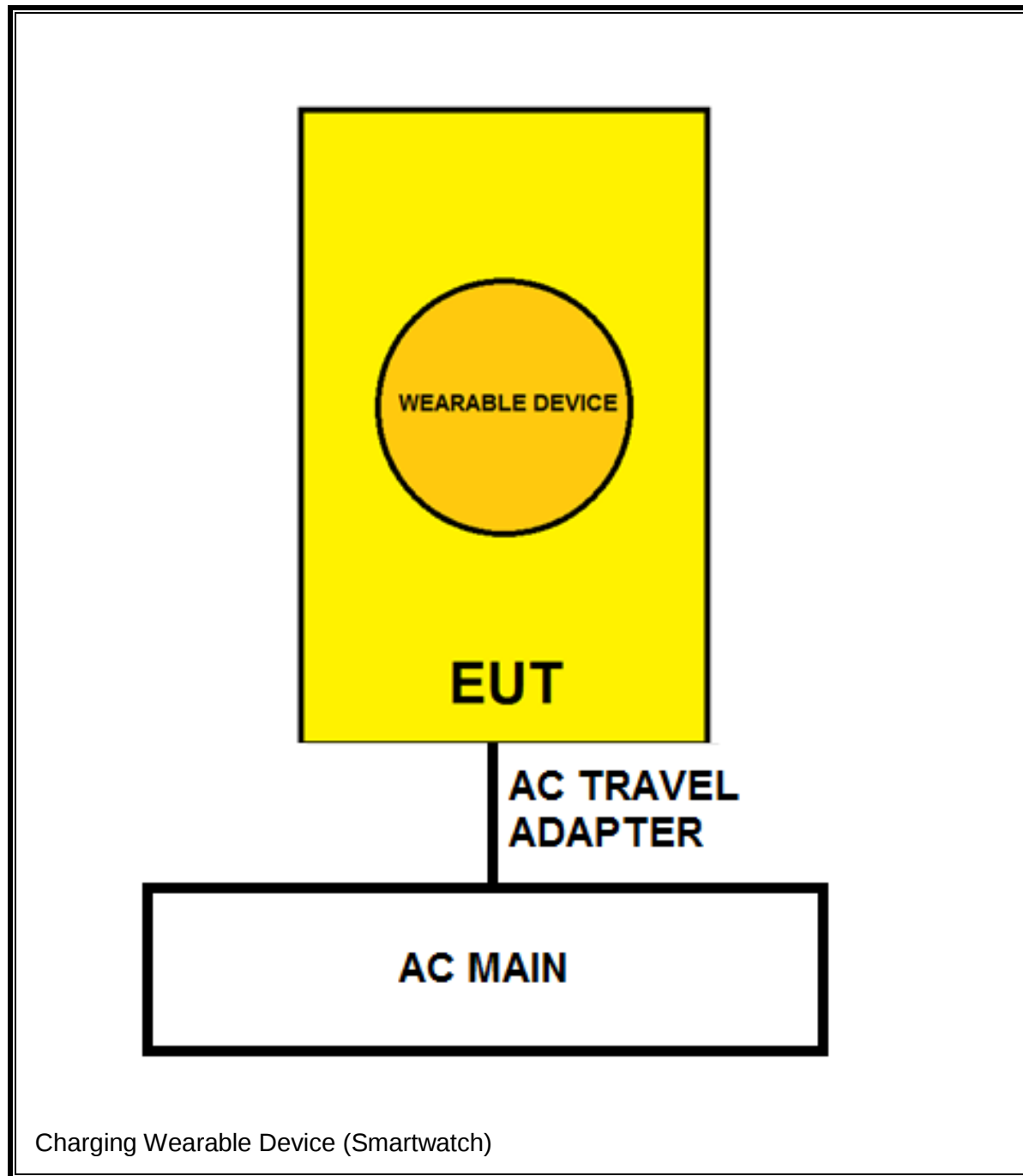
Please see the following configurations for the test setups. Both configurations indicate that the EUT is directly connected to an AC/DC adapter.

CONFIGURATION 1: OPERATING MODE WITH PHONE



CONFIGURATION 2: OPERATING MODE WITH PHONE ACROSS

CONFIGURATION 2: OPERATING MODE WITH WEARABLE



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	ID Num	Cal Due	Last Cal
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T407	05/10/2019	05/10/2018
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T900	06/18/2019	06/18/2018
Amplifier, 9kHz to 1GHz, 32dB	Sonoma Instrument	310	170649	11/01/2019	11/01/2018
EMI Reciever	Rohde & Schwarz	ESR	T1436	02/21/2019	02/21/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T1310	06/15/2019	06/15/2018
L.I.S.N.	FCC INC.	FCC LISN 50/250	T24	03/06/2019	03/06/2018
Antenna, Active Loop 9kHz-30MHz	Com-Power Corp.	AL-130R	PRE0165308	12/13/2018	12/13/2017
Antenna, Active Loop 9kHz-30MHz	ETS-Lindgren	6502	T1683	02/21/2019	02/21/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1450	02/05/2019	02/05/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1454	01/08/2019	01/08/2018

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Ver 9.5, Dec 01, 2016

7. RADIATED EMISSION TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.209 (a)

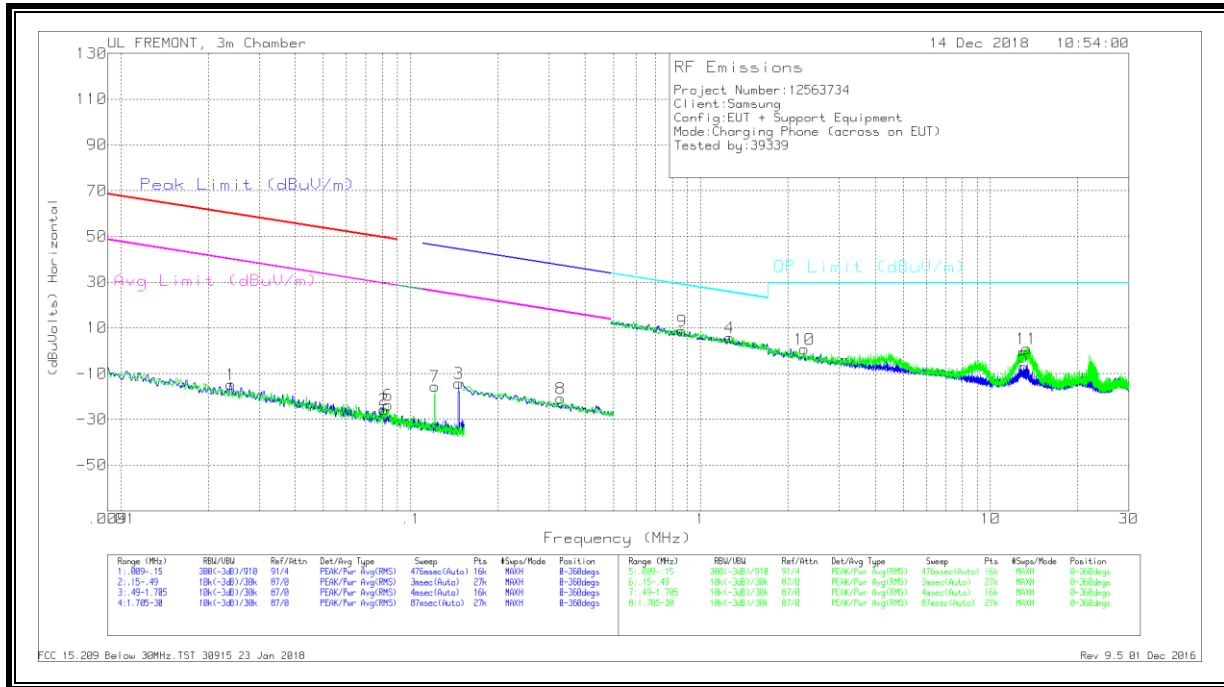
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Note: The lower limit shall apply at the transition frequency.		

RESULTS

7.2.FCC TX FUNDAMENTAL AND SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz

7.2.1. OPERATING CONFIGURATION

OPERATING WITH PHONE



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)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Polarization
1	.02399	48.93	Pk	14.8	1.4	-80	-14.87	59.99	-74.86	39.99	-54.86	-	-	-	-	0-360	Face On
2	.08084	38.84	Pk	14.1	1.4	-80	-25.66	49.43	-75.09	29.43	-55.09	-	-	-	-	0-360	Face On
6	.08364	40.77	Pk	14.1	1.4	-80	-23.73	49.14	-72.87	29.14	-52.87	-	-	-	-	0-360	Face Off
7	.12111	49.2	Pk	13.8	1.4	-80	-15.6	-	-	-	-	45.96	-61.56	25.96	-41.56	0-360	Face Off
3	.14615	50.64	Pk	13.8	1.4	-80	-14.16	-	-	-	-	44.33	-58.49	24.33	-38.49	0-360	Face On
8	.32967	43.93	Pk	13.7	1.5	-80	-20.87	-	-	-	-	37.25	-58.12	17.25	-38.12	0-360	Face Off

Pk - Peak detector

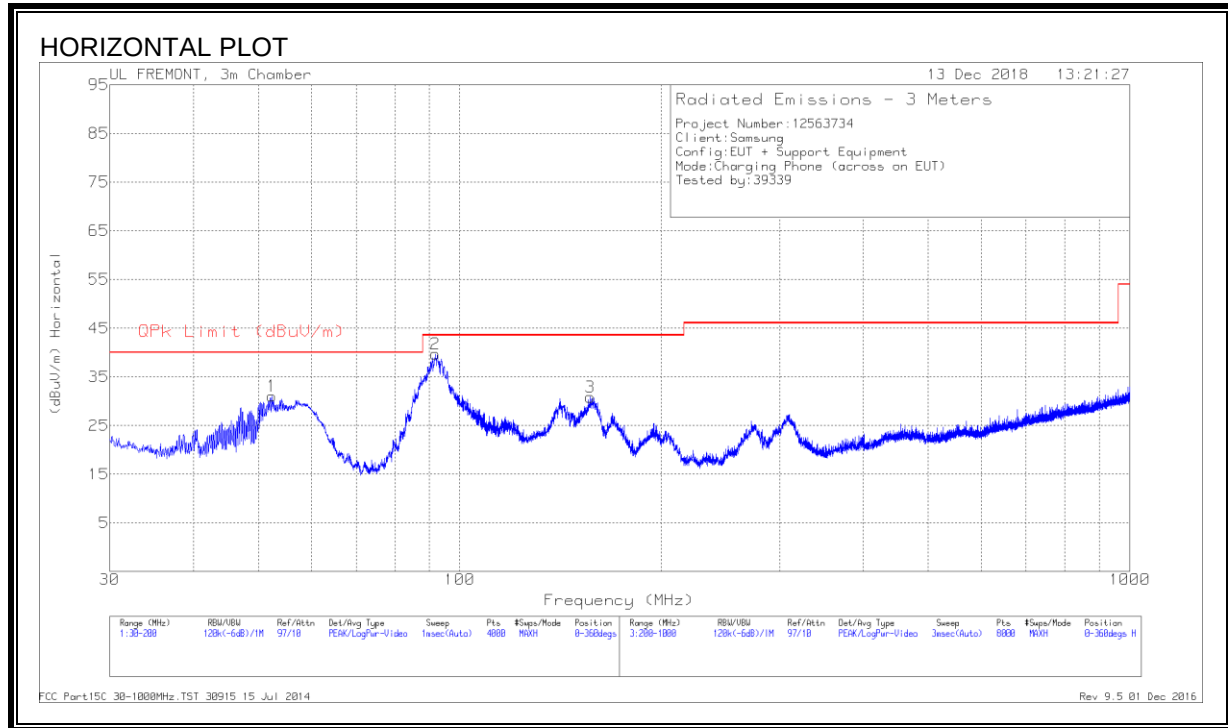
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cbl (dB)	Dist Corr 30m	Corrected Reading (dBuVolts)	OP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Polarization
9	.86362	33.12	Pk	14	1.5	-40	8.62	28.89	-20.27	0-360	Face Off
4	1.25593	30.04	Pk	14.2	1.5	-40	5.74	25.65	-19.91	0-360	Face On
10	2.27826	24.9	Pk	14.2	1.5	-40	.6	29.5	-28.9	0-360	Face Off
5	13.00454	16.71	Pk	14.5	1.6	-40	-7.19	29.5	-36.69	0-360	Face On
11	13.35614	24.99	Pk	14.4	1.6	-40	.99	29.5	-28.51	0-360	Face Off

Pk - Peak detector

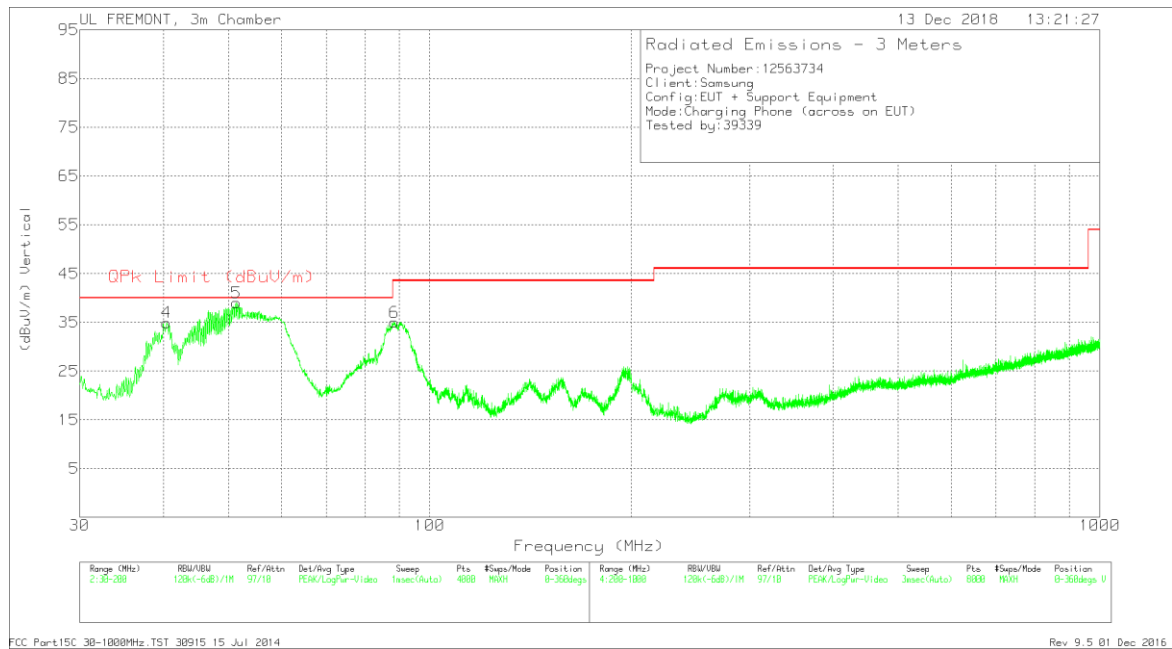
7.3. FCC TX SPURIOUS EMISSION 30 TO 1000 MHz

7.3.1. OPERATING CONFIGURATION

OPERATING WITH PHONE



VERTICAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	40.4577	47.86	Pk	18	-30.9	34.96	40	-5.04	0-360	100	V
5	51.4681	58.72	Pk	11.1	-30.8	39.02	40	-9.98	0-360	100	V
1	52.4033	50.85	Pk	11	-30.8	31.05	40	-8.95	0-360	400	H
6	88.4526	54.11	Pk	11.3	-30.4	35.01	43.52	-8.51	0-360	100	V
2	91.896	58.21	Pk	11.9	-30.4	39.71	43.52	-3.81	0-360	200	H
3	156.4702	44.45	Pk	16.2	-29.8	30.85	43.52	-12.67	0-360	300	H

Pk - Peak detector

Radiated Emissions

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
40.4236	42.05	Qp	18	-30.9	29.15	40	-10.85	93	110	V
51.5396	55.41	Qp	11.1	-30.8	35.71	40	-4.29	56	102	V
88.4963	49.93	Qp	11.3	-30.4	30.83	43.52	-12.69	306	100	V
91.7021	49.69	Qp	11.8	-30.4	31.09	43.52	-12.43	214	180	H

Qp - Quasi-Peak detector

8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

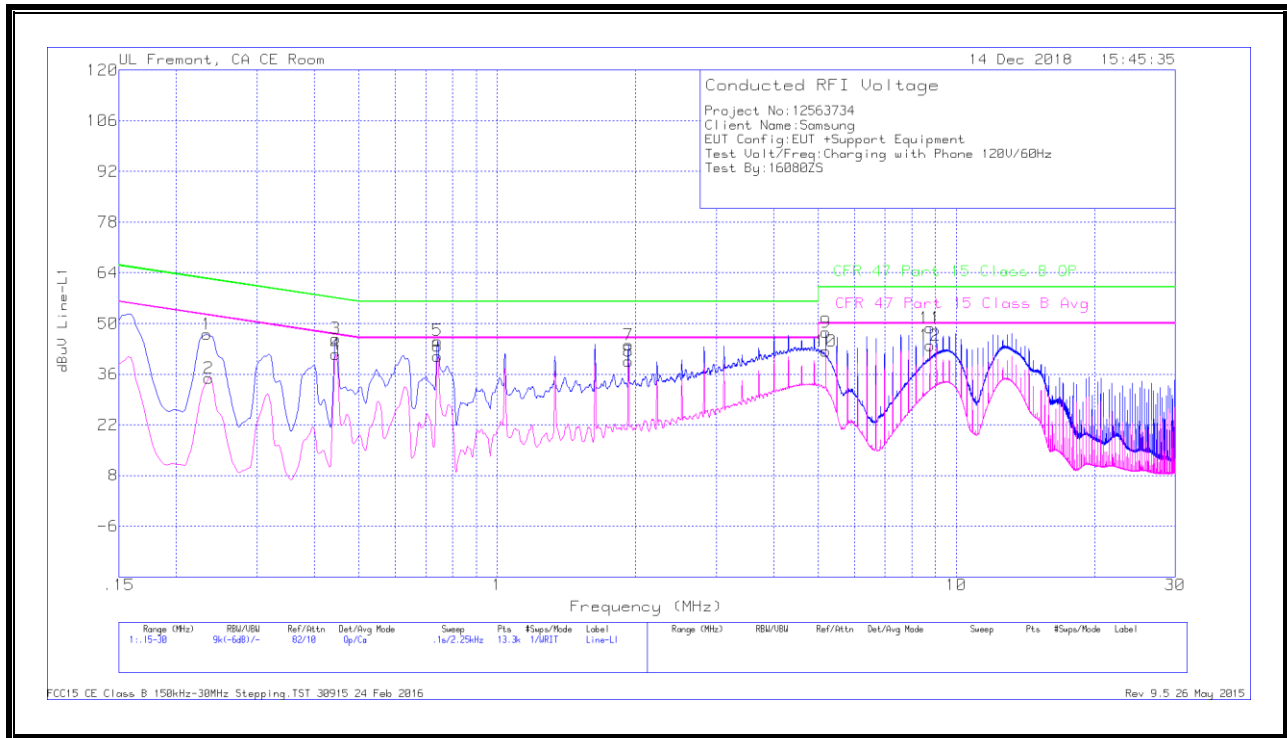
TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

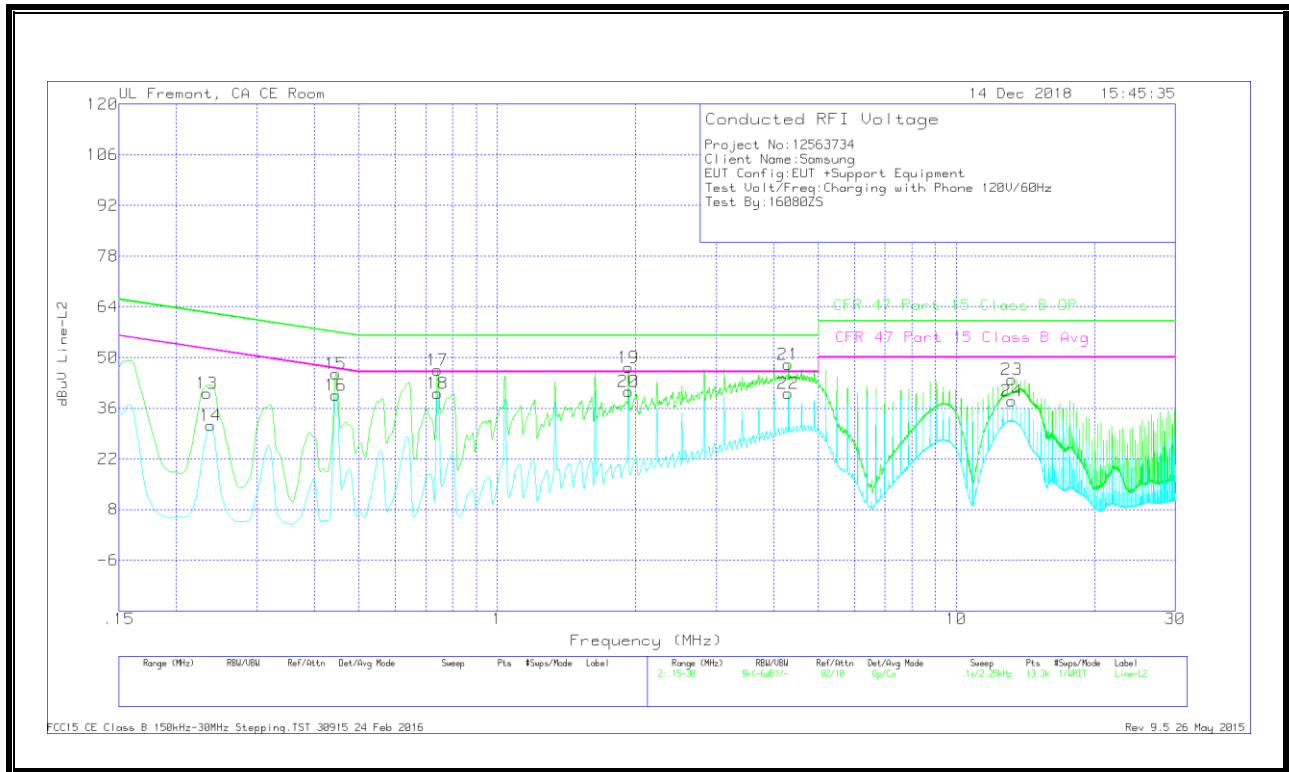
RESULTS

8.1. OPERATING WITH PHONE**LINE 1 RESULTS****WORST EMISSIONS**

Range 1: Line-L1 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L1	LC Cables C1&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
1	.23325	36.9	Qp	0	0	10.1	47	62.33	-15.33	-	-
2	.2355	24.75	Ca	0	0	10.1	34.85	-	-	52.25	-17.4
3	.44475	35.71	Qp	0	0	10.1	45.81	56.97	-11.16	-	-
4	.44475	31.41	Ca	0	0	10.1	41.51	-	-	46.97	-5.46
5	.74175	35.12	Qp	0	0	10.1	45.22	56	-10.78	-	-
6	.74175	30.85	Ca	0	0	10.1	40.95	-	-	46	-5.05
7	1.93088	33.91	Qp	0	.1	10.1	44.11	56	-11.89	-	-
8	1.932	29.44	Ca	0	.1	10.1	39.64	-	-	46	-6.36
9	5.199	37.33	Qp	0	.1	10.1	47.53	60	-12.47	-	-
10	5.199	32.22	Ca	0	.1	10.1	42.42	-	-	50	-7.58
11	8.763	38.43	Qp	0	.2	10.2	48.83	60	-11.17	-	-
12	8.763	33.5	Ca	0	.2	10.2	43.9	-	-	50	-6.1

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS**WORST EMISSIONS**

Range 2: Line-L2 .15 - 30MHz											
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN L2	LC Cables C2&C3	Limiter (dB)	Corrected Reading dBuV	CFR 47 Part 15 Class B QP	QP Margin (dB)	CFR 47 Part 15 Class B Avg	Av(CISPR) Margin (dB)
13	.23325	42.42	Qp	0	0	10.1	52.52	62.33	-9.81	-	-
14	.23775	21.13	Ca	0	0	10.1	31.23	-	-	52.17	-20.94
15	.44475	35.35	Qp	0	0	10.1	45.45	56.97	-11.52	-	-
16	.44475	29.43	Ca	0	0	10.1	39.53	-	-	46.97	-7.44
17	.74175	36.37	Qp	0	0	10.1	46.47	56	-9.53	-	-
18	.74175	29.95	Ca	0	0	10.1	40.05	-	-	46	-5.95
19	1.932	36.98	Qp	0	.1	10.1	47.18	56	-8.82	-	-
20	1.932	30.43	Ca	0	.1	10.1	40.63	-	-	46	-5.37
21	4.308	37.92	Qp	0	.1	10.1	48.12	56	-7.88	-	-
22	4.308	29.96	Ca	0	.1	10.1	40.16	-	-	46	-5.84
23	13.2225	33.49	Qp	.1	.2	10.2	43.99	60	-16.01	-	-
24	13.2225	27.49	Ca	.1	.2	10.2	37.99	-	-	50	-12.01

Qp - Quasi-Peak detector

Ca - CISPR average detection