



CERTIFICATION TEST REPORT

Report Number. : 12563708-E8V3

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

Model : SM-G975F/DS and SM-G975F

FCC ID : A3LSMG975F

EUT Description : GSM/WCDMA/LTE phone with BT, DTS/UNII a/b/g/n/ac/11ax
HE20/40/80, ANT+ and NFC

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

Date Of Issue:
January 28, 2019

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REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	1/7/2019	Initial Issue	
V2	1/24/2019	Update per reviewer's comments sections (1, 2, 5.5, 9, 9.3 and 10)	Glenn Escano
V3	1/28/2019	Update per reviewer's comments sections (5.5)	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
HE20/40/80, ANT+ and NFC

MODEL: SM-G975F/DS and SM-G975F

SERIAL NUMBER: SM-G975F (Glass)Conducted:R38KA093BOT, R38KA0L96BB
SM-G975F (Glass)Radiated:R38KA0L97DV, R38KA0L971T
SM-G975F (Ceramic)Radiated:R38KA092LGJ, R38KA0KV84N

DATE TESTED: November 19, 2018 – January 07, 2019

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

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 the U.S. government.

Approved & Released For
UL Verification Services Inc. By:

Reviewed By:



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Operations Leader
Consumer Technology Division
UL Verification Services Inc.

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2. TEST METHODOLOGY

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

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
<input type="checkbox"/> Chamber A (ISED:2324B-1)	<input type="checkbox"/> Chamber D (ISED:22541-1)	<input type="checkbox"/> Chamber I (ISED:2324A-5)
<input checked="" type="checkbox"/> Chamber B (ISED:2324B-2)	<input type="checkbox"/> Chamber E (ISED:22541-2)	<input type="checkbox"/> Chamber J (ISED:2324A-6)
<input type="checkbox"/> Chamber C (ISED:2324B-3)	<input type="checkbox"/> Chamber F (ISED:22541-3)	<input type="checkbox"/> Chamber K (ISED:2324A-1)
	<input type="checkbox"/> Chamber G (ISED:22541-4)	<input type="checkbox"/> Chamber L (ISED:2324A-3)
	<input type="checkbox"/> 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

RADIATED EMISSIONS

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)

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

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-G975F was used for final testing and is representative of the test results in this report.

5.2. MAXIMUM FUNDAMENTAL FIELD STRENGTH

The transmitter has a maximum peak fundamental field strength as follows:

Frequency Range (MHz)	Mode	Peak E-field Strength (dBuV/m)	Avg E-field Strength (dBuV/m)	Distance (m)
2402 - 2480	ANT +	102.95	76.48	3.00

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -0.4 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was G975F.001.

5.5. WORST-CASE CONFIGURATION AND MODE

WORST-CASE CONFIGURATION AND MODE FOR FINAL TEST

This device may be formed with two different exterior materials: Glass and Ceramic. Glass model was set for full test and additional spot check verification was done with Ceramic model for radiated fundamental frequency, harmonic spurious and radiated band-edge as documented.

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

All radios that can be transmitted simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Samsung	EP-TA300	R3KB5B01S1SE3	N/A
USB Data Cable	Samsung	N/A	N/A	N/A
Earphone	Samsung	N/A	N/A	N/A

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	RF	Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Un-shielded	1	EUT to AC Mains

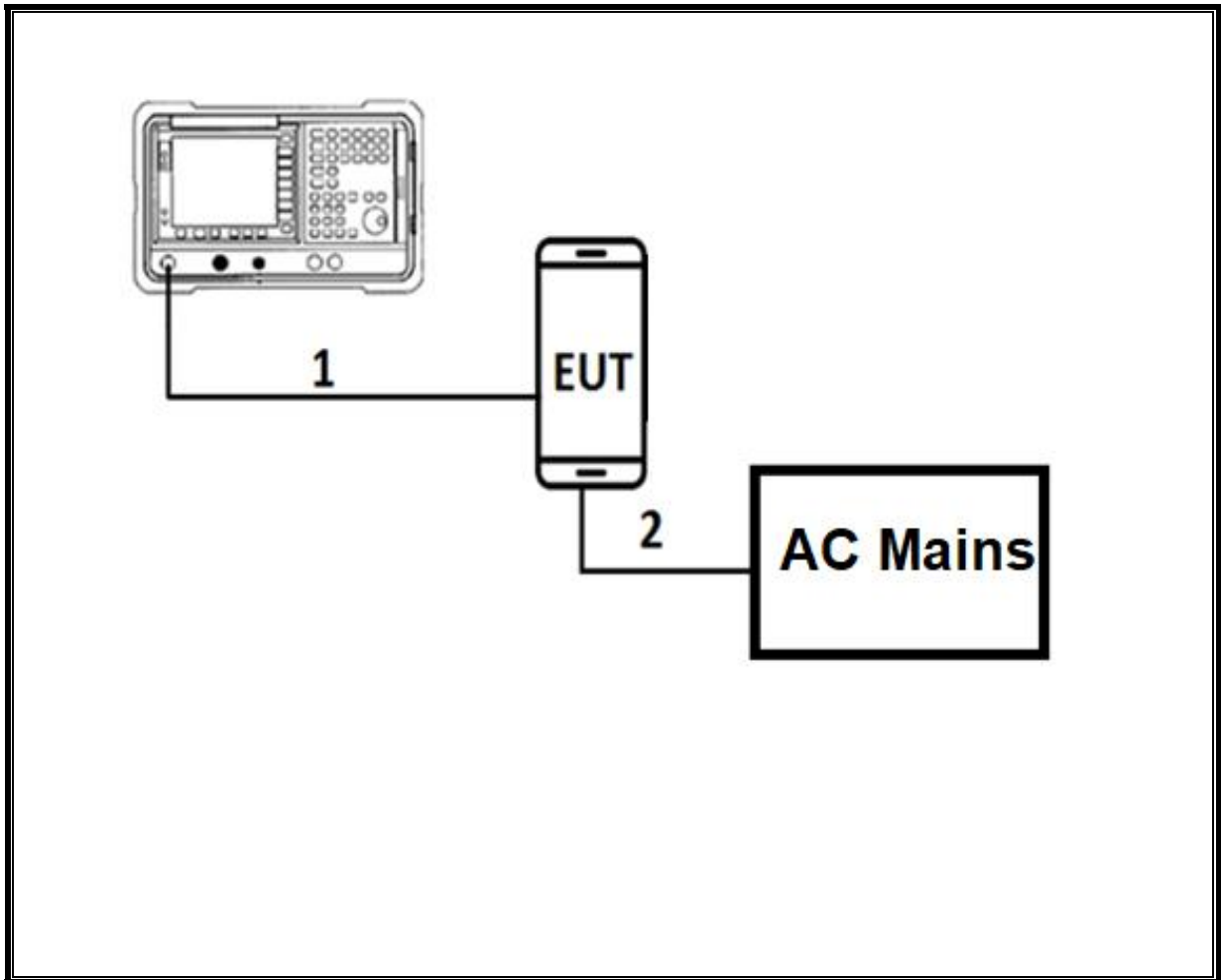
I/O CABLES (RADIATED AND CONDUCTED EMISSIONS)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Shielded	1	N/A
2	earphone	1	3.5mm	Un-shielded	1	N/A

TEST SETUP

The EUT is a stand alone. Test software exercised the radio card.

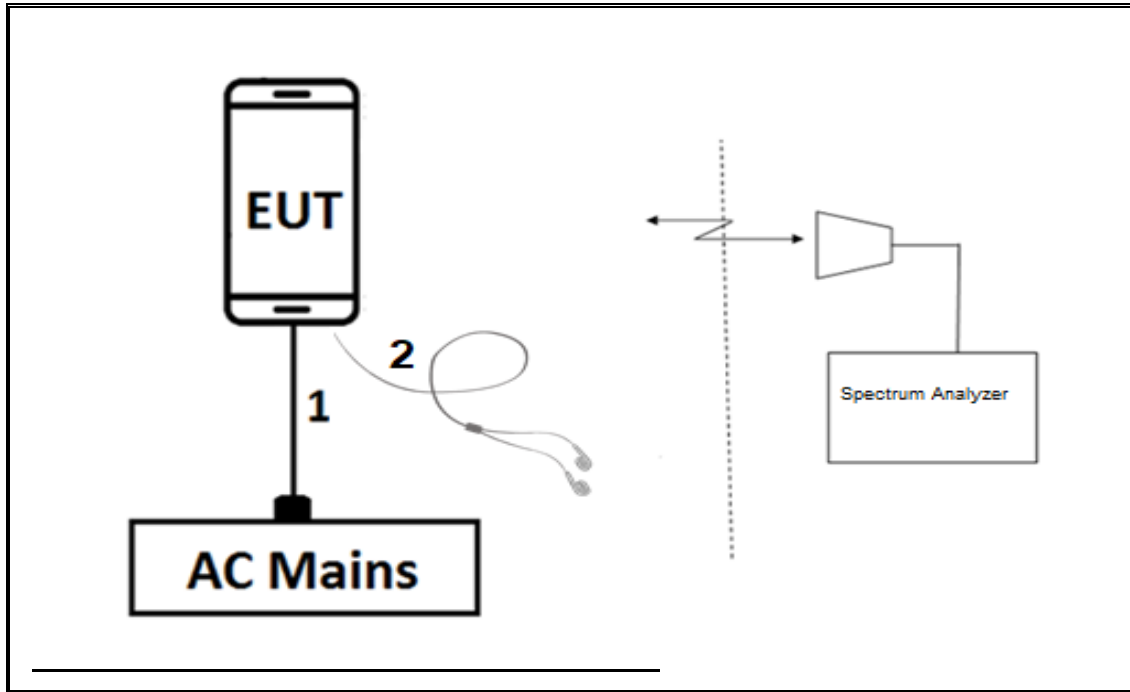
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

For conducted tests: the EUT was Stand alone. The test software exercises the radio.

RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT has support equipment (AC Adapter and Headset). The test software exercises the radio.

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
Amplifier, 9kHz to 1GHz, 32dB	Sonoma Instrument	310	170649	11/01/2019	11/01/2018
Antenna, Horn 1-18GHz	ETS-Lindgren	3117	T863	06/21/2019	06/21/2018
EMI Receiver	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
18 - 26.5 GHz Horn Antenna	Seavey Division	MWH-1826/B	T89	01/18/2019	01/18/2018
Pre-Amp 1-26.5 GHz	Agilent	8449B	T404	03/09/2019	03/09/2018
RF Amplifier	MITEQ	AFS42-00101800-25-S-42	T493	10/13/2019	10/13/2018
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent (Keysight) Technologies	N9030A	T1113	12/21/2018	12/21/2017
Spectrum Analyzer	Agilent (Keysight) Technologies	E4446A	T146	08/13/2019	08/13/2018
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
Antenna Port Software	UL	UL RF	Ver 9.1, Nov 15, 2018

7. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

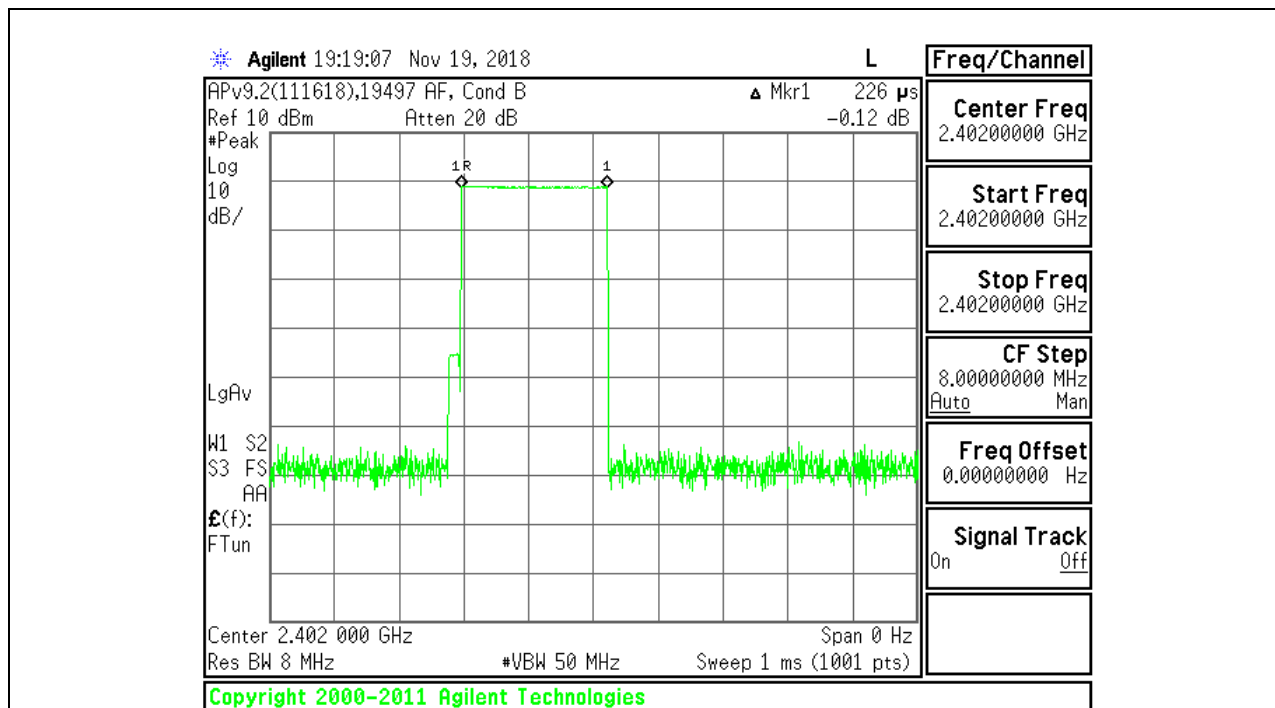
NOTE: For ON TIME measurement:

ON Time over 1msec period x No. of pulses over 100msec period = ON TIME

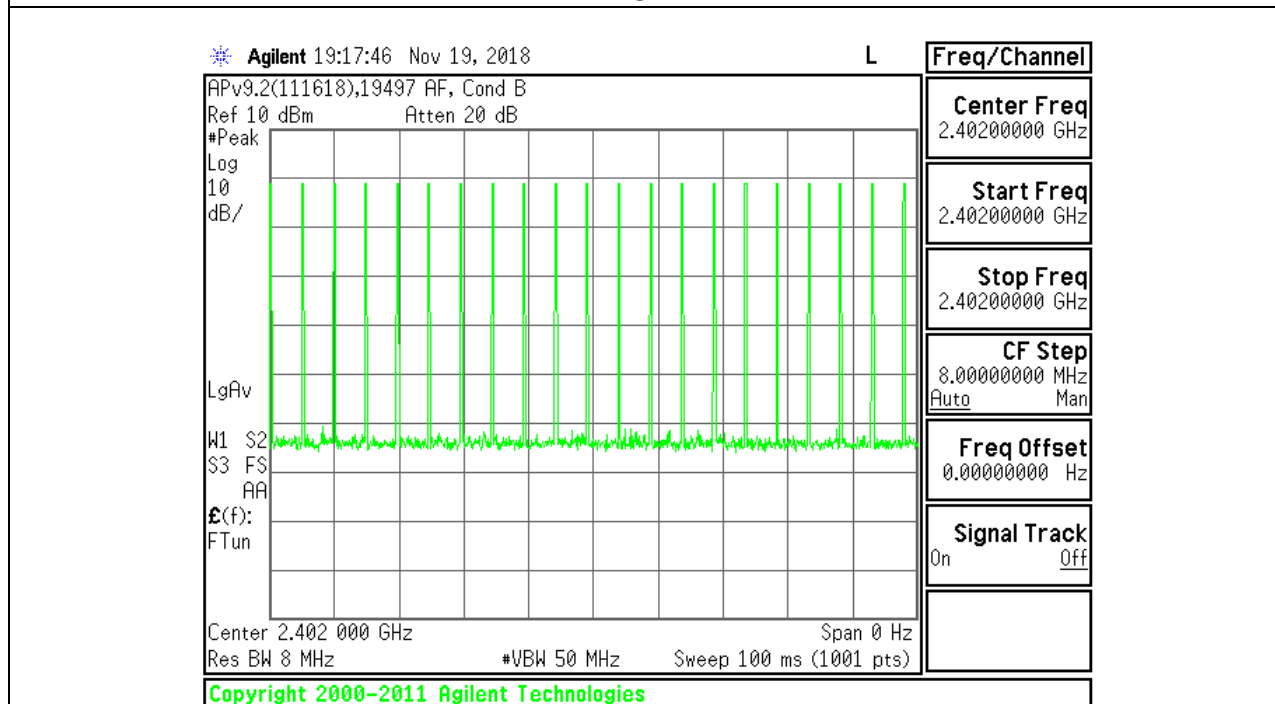
226us x 21 pulses = 4.746msec

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor for Average Measurements (dB)
2.4GHz Band					
ANT+	4.746	100.00	0.047	4.75%	-26.47

DUTY CYCLE PLOTS



ANT+ ON TIME



ANT+ 100ms PERIOD

8.2. 99% BANDWIDTH

LIMITS

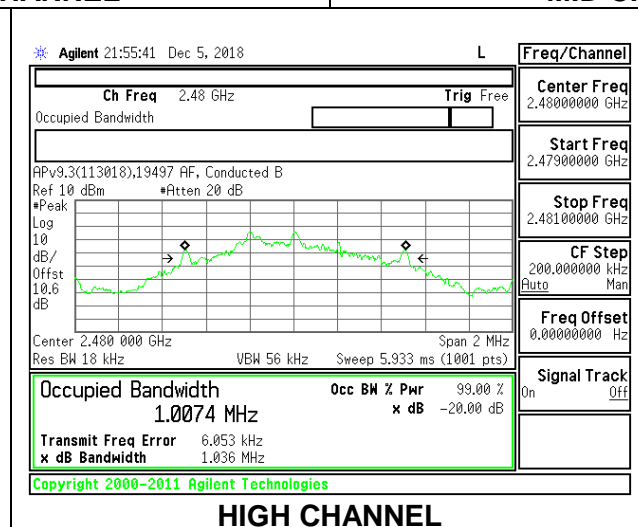
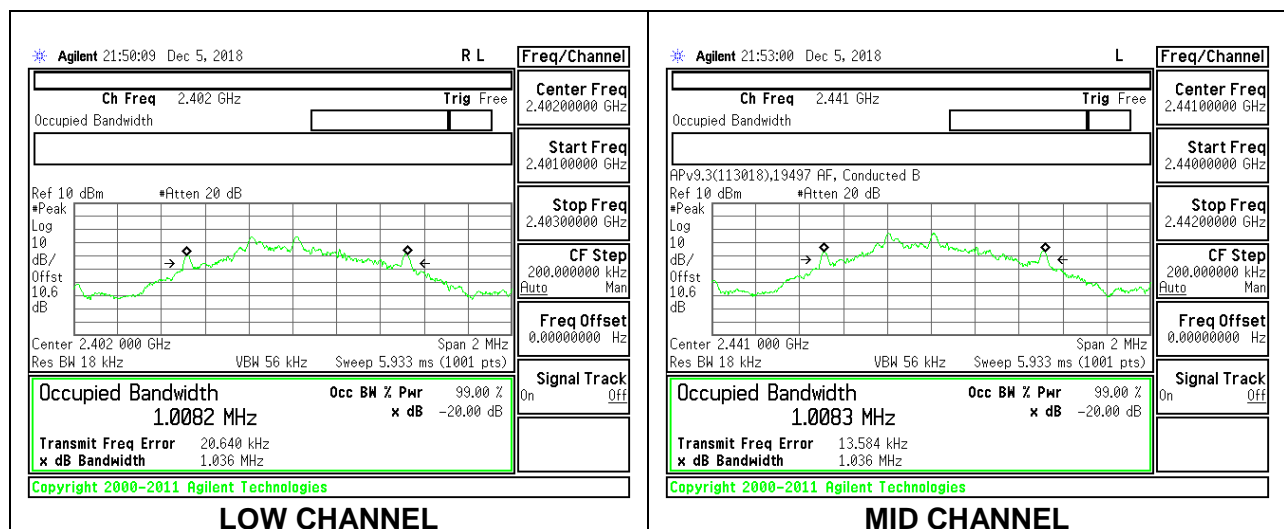
None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (KHz)
Low	2402	1.0082
Mid	2441	1.0083
High	2480	1.0074



8.3. 20dB BANDWIDTH

LIMITS

None; for reporting purposes only.

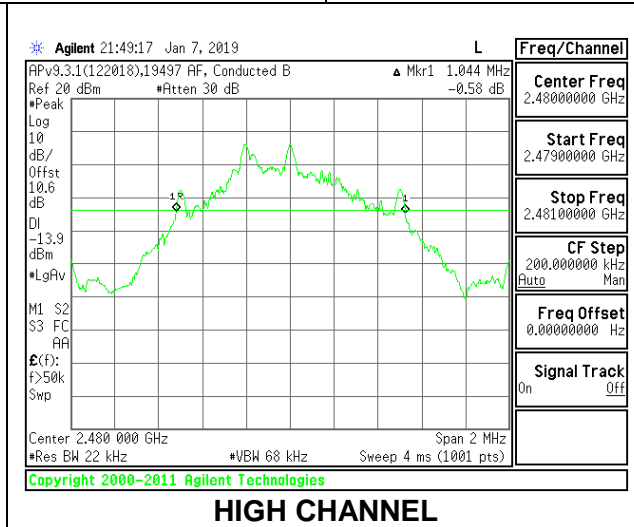
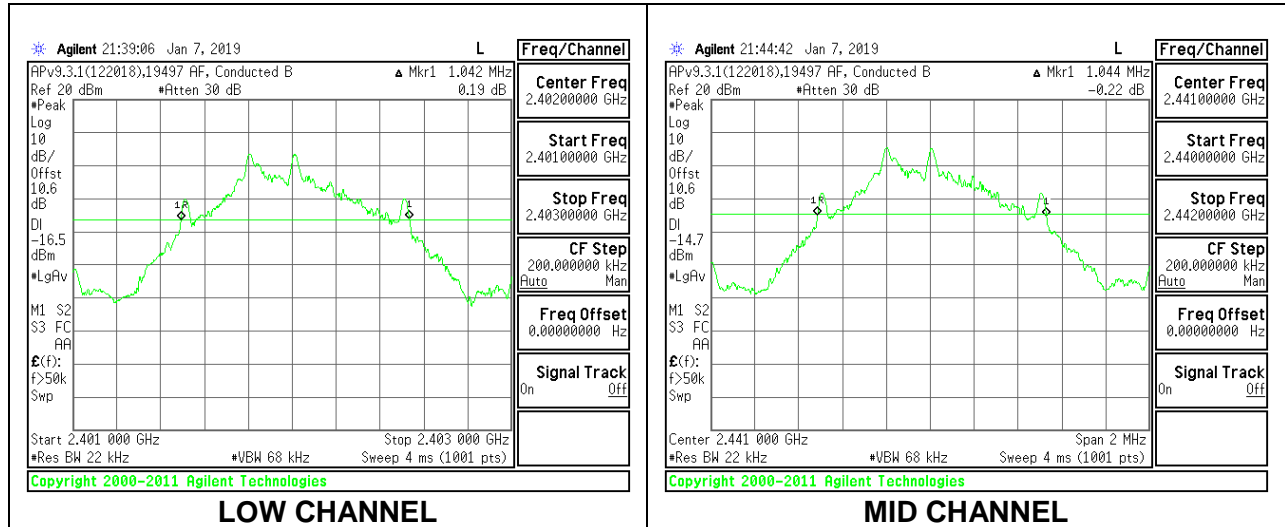
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled

RESULTS

Test table results for FCC Rule Part15.215(c): Compliant.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Frequency Edge (MHz)	Limit (MHz)	Margin (MHz)
Low	2402	1.042	2401.4790	2400	-1.48
Mid	2441	1.044	N/A	N/A	N/A
High	2480	1.044	2480.5220	2483.5	-2.98



9. RADIATED TEST RESULTS

LIMITS

FCC §15.249
 FCC §15.205 and §15.209

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

(e) As shown in Sec. 15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T (4.7kHz) video bandwidth with peak detector for average measurements.

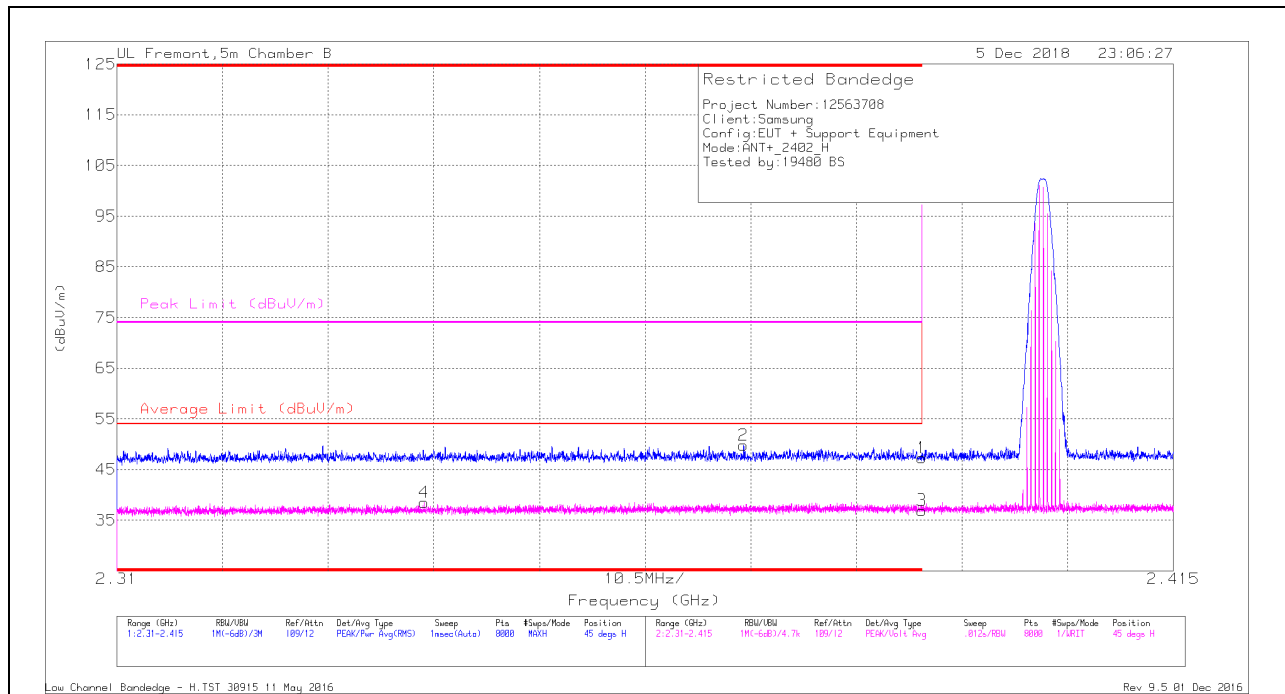
The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

9.1. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Trace Markers

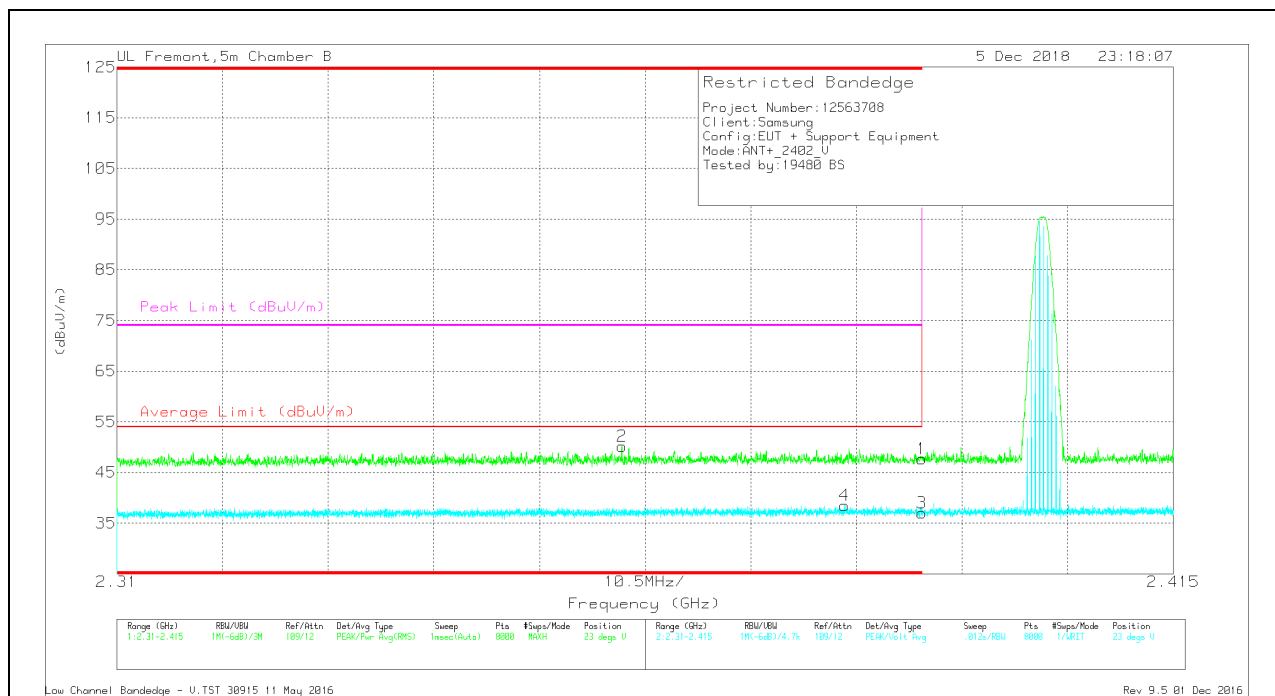
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	35.74	Pk	32.3	-20.7	47.34	-	-	74	-26.66	45	124	H
2	* 2.372	38.23	Pk	32.3	-20.7	49.83	-	-	74	-24.17	45	124	H
3	* 2.39	25.34	VA1T	32.3	-20.7	36.94	54	-17.06	-	-	45	124	H
4	* 2.341	27.15	VA1T	32.1	-20.7	38.55	54	-15.45	-	-	45	124	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average $V_B=1/T_{on}$ where: T_{on} is transmit duration

VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	36.11	Pk	32.3	-20.7	47.71	-	-	74	-26.29	23	366	V
2	* 2.36	38.75	Pk	32.2	-20.8	50.15	-	-	74	-23.85	23	366	V
3	* 2.39	25.44	VA1T	32.3	-20.7	37.04	54	-16.96	-	-	23	366	V
4	* 2.382	26.92	VA1T	32.3	-20.7	38.52	54	-15.48	-	-	23	366	V

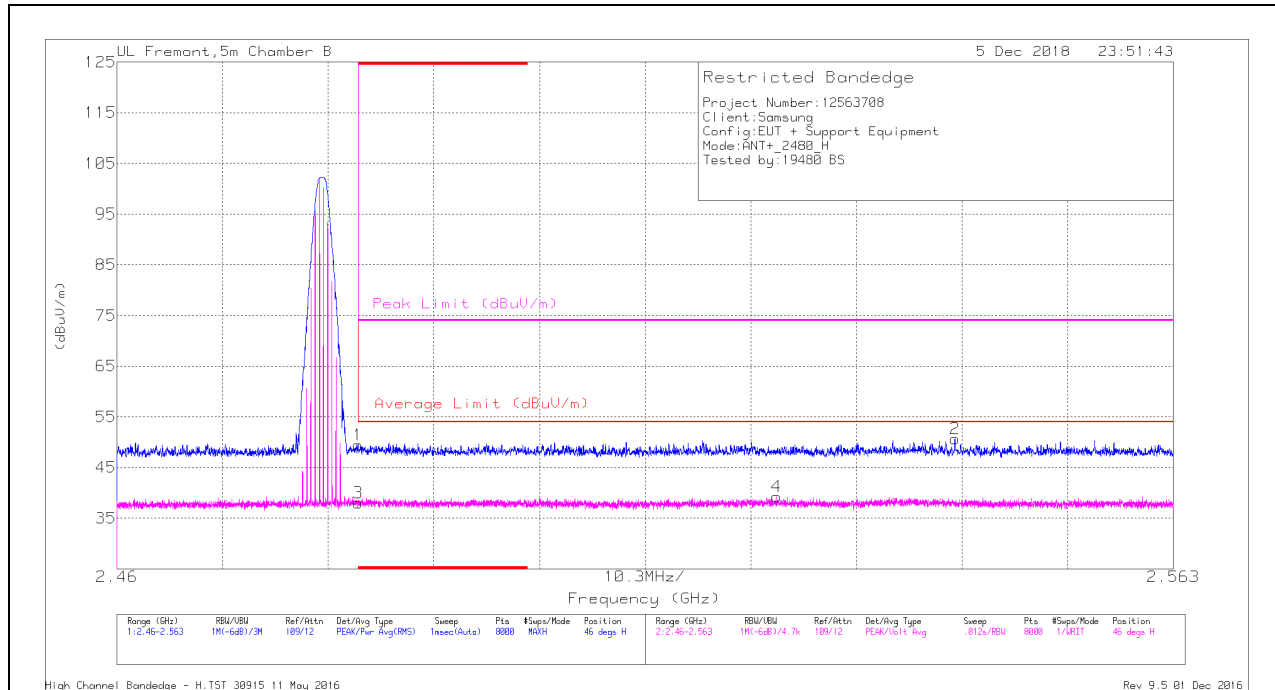
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

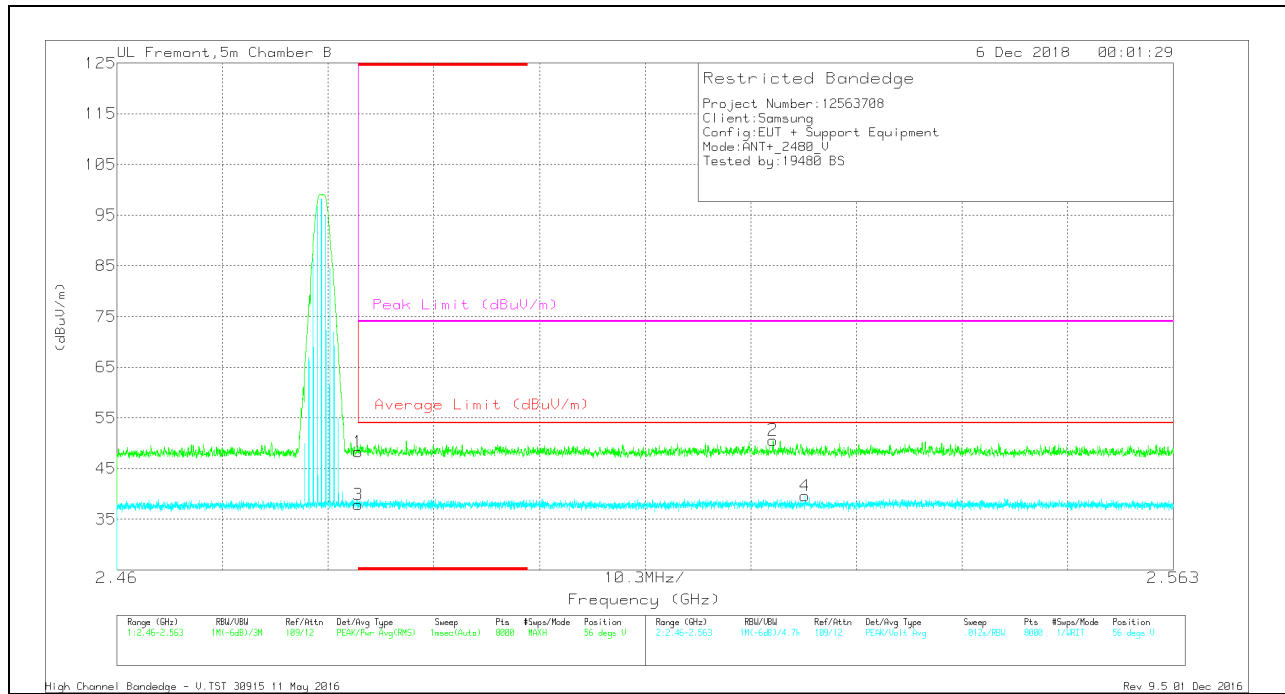
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	37.12	Pk	32.6	-20.3	49.42	-	-	74	-24.58	46	125	H
3	* 2.484	25.67	VA1T	32.6	-20.3	37.97	54	-16.03	-	-	46	125	H
4	2.524	26.99	VA1T	32.7	-20.4	39.29	54	-14.71	-	-	46	125	H
2	2.542	38.42	Pk	32.7	-20.5	50.62	-	-	74	-23.38	46	125	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	36.04	Pk	32.6	-20.3	48.34	-	-	74	-25.66	56	381	V
3	* 2.484	25.6	VA1T	32.6	-20.3	37.9	54	-16.1	-	-	56	381	V
2	2.524	38.3	Pk	32.7	-20.4	50.6	-	-	74	-23.4	56	381	V
4	2.527	27.5	VA1T	32.7	-20.6	39.6	54	-14.4	-	-	56	381	V

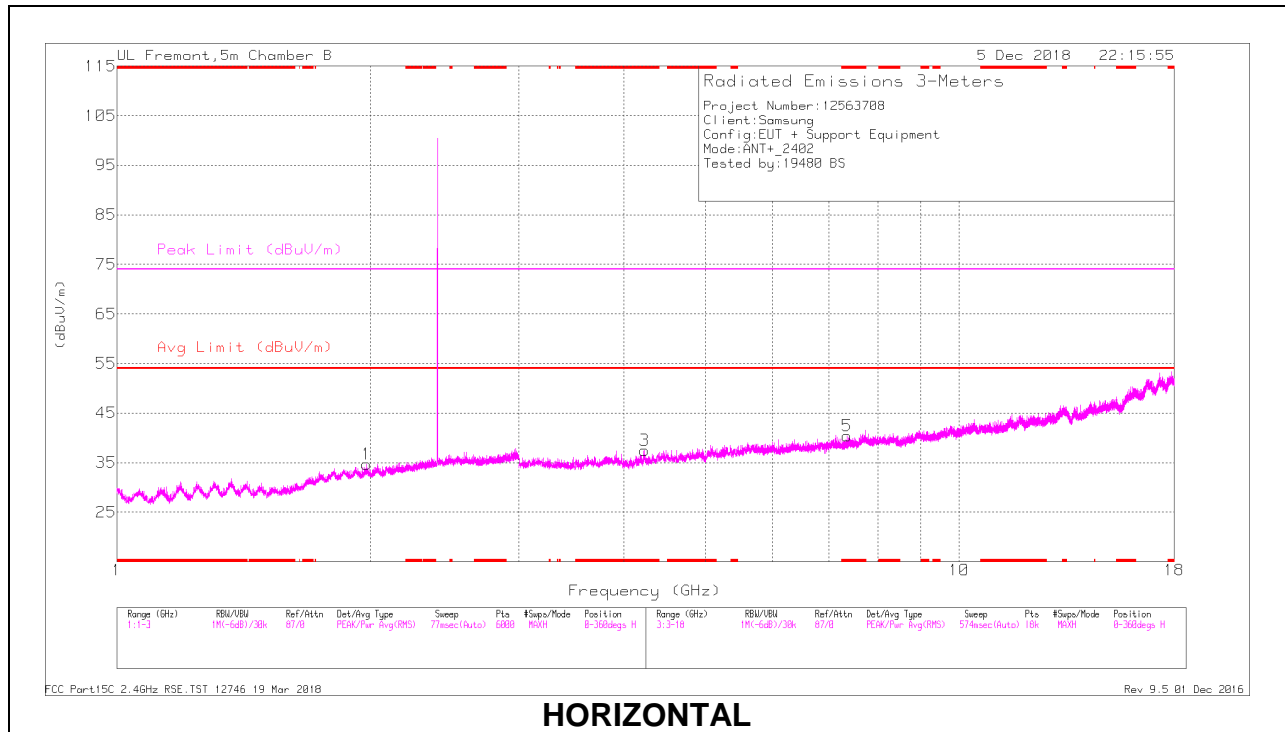
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

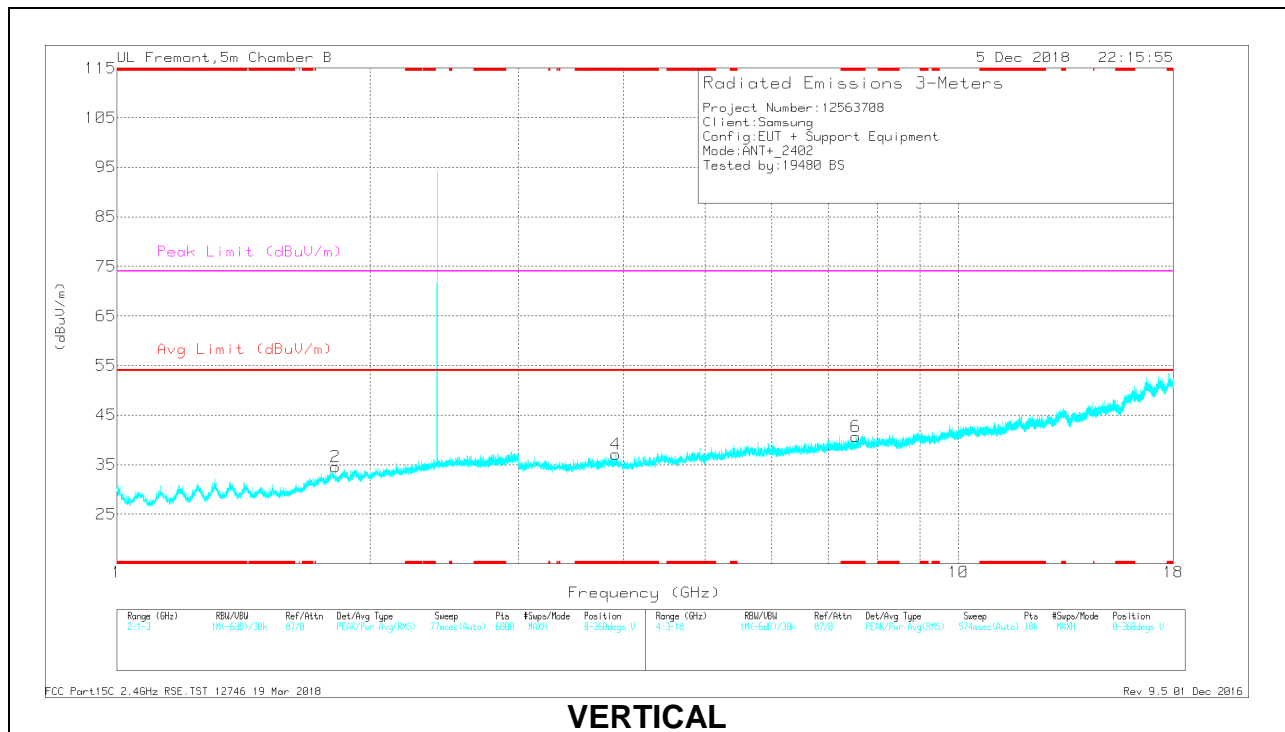
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

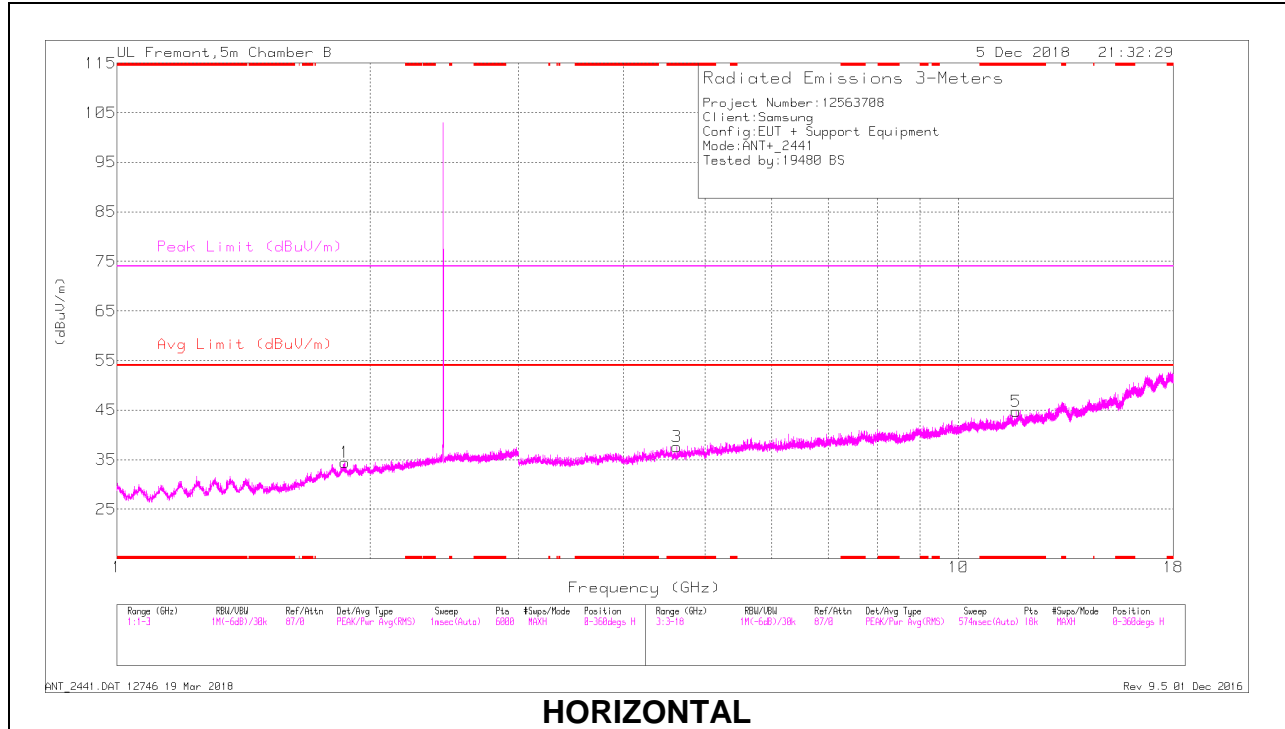
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 4.23	37.73	PKFH	33.6	-29.3	42.03	-	-	74	-31.97	91	325	H
	* 4.228	27.88	VA1T	33.6	-29.3	32.18	54	-21.82	-	-	91	325	H
5	* 7.354	34.96	PKFH	36	-27	43.96	-	-	74	-30.04	246	292	H
	* 7.354	25.48	VA1T	36	-27	34.48	54	-19.52	-	-	246	292	H
4	* 3.913	38.33	PKFH	33.4	-29.7	42.03	-	-	74	-31.97	4	387	V
	* 3.913	28.43	VA1T	33.4	-29.7	32.13	54	-21.87	-	-	4	387	V
6	* 7.551	35.76	PKFH	36.3	-27.1	44.96	-	-	74	-29.04	225	164	V
	* 7.55	25.53	VA1T	36.3	-27.1	34.73	54	-19.27	-	-	225	164	V
2	1.82	27.43	PKFH	30.8	-20.6	37.63	-	-	74	-36.37	85	294	V
	1.818	17.78	VA1T	30.8	-20.6	27.98	54	-26.02	-	-	85	294	V
1	1.979	28.21	PKFH	30.9	-20.5	38.61	-	-	74	-35.39	279	340	H
	1.98	18.67	VA1T	30.9	-20.6	28.97	54	-25.03	-	-	279	340	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

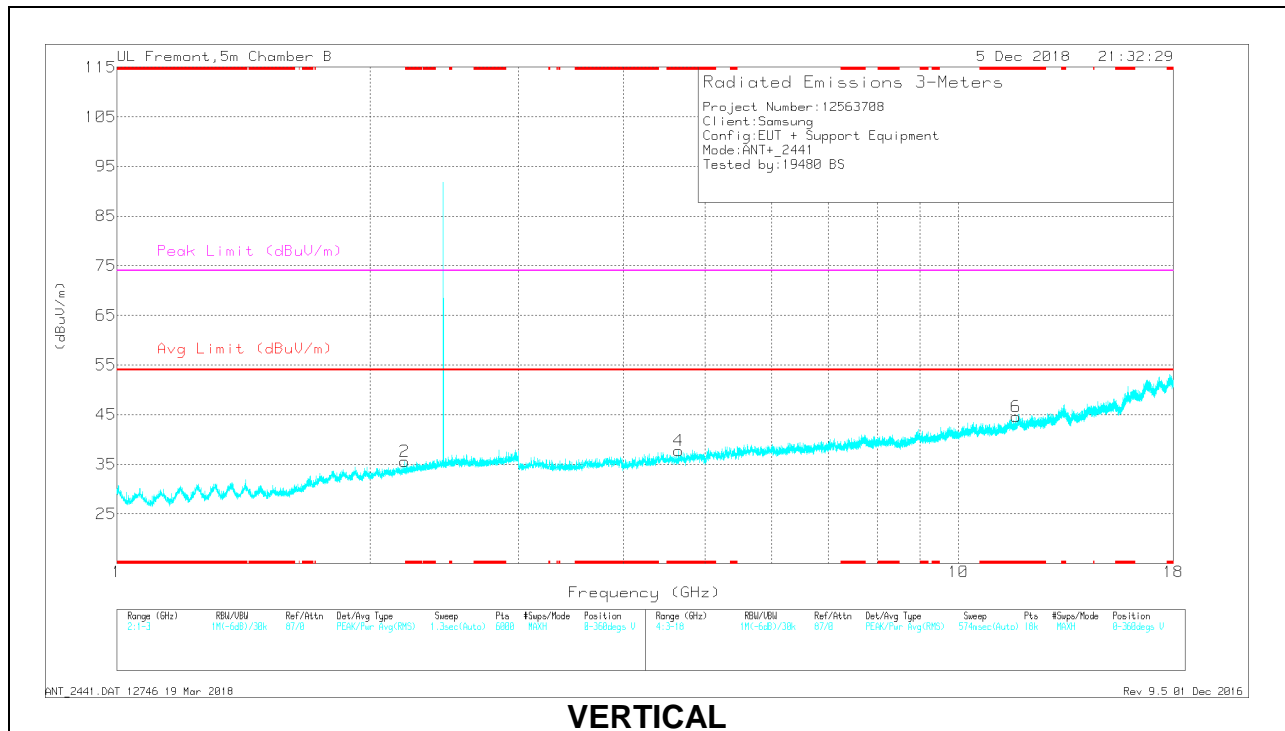
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

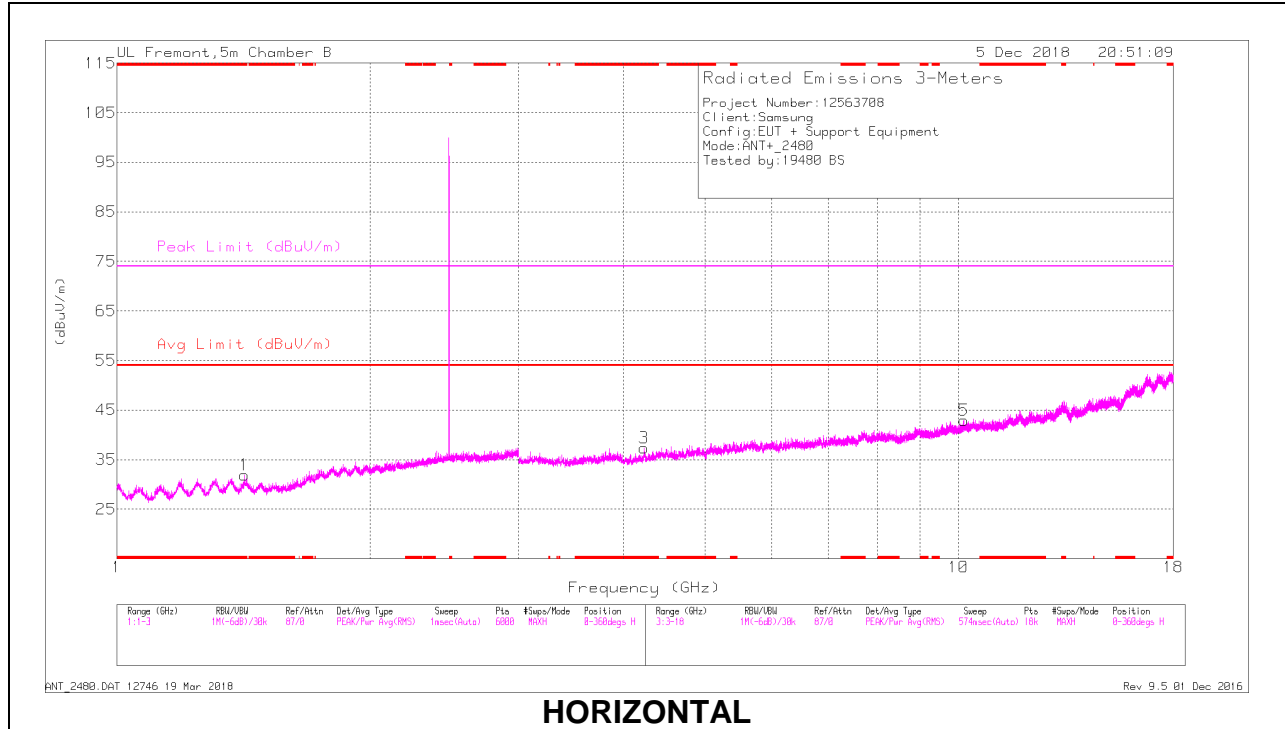
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 4.623	38.46	PKFH	34.1	-30.6	41.96	-	-	74	-32.04	27	302	H
	4.623	28.66	VA1T	34.1	-30.6	32.16	54	-21.84	-	-	27	302	H
5	* 11.711	31.79	PKFH	39	-22.3	48.49	-	-	74	-25.51	182	112	H
	11.711	21.99	VA1T	39	-22.3	38.69	54	-15.31	-	-	182	112	H
4	* 4.653	38.26	PKFH	34.1	-30.1	42.26	-	-	74	-31.74	0	279	V
	4.652	28.42	VA1T	34.1	-30.1	32.42	54	-21.58	-	-	0	279	V
6	* 11.706	32.36	PKFH	39	-22.3	49.06	-	-	74	-24.94	309	293	V
	11.702	22.08	VA1T	39	-22.4	38.68	54	-15.32	-	-	309	293	V
1	1.866	29.02	PKFH	30.9	-20.7	39.22	-	-	74	-34.78	28	219	H
	1.867	18.5	VA1T	30.9	-20.7	28.7	54	-25.3	-	-	28	219	H
2	2.199	28.29	PKFH	31.5	-20.8	38.99	-	-	74	-35.01	34	388	V
	2.197	18.52	VA1T	31.5	-20.7	29.32	54	-24.68	-	-	34	388	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

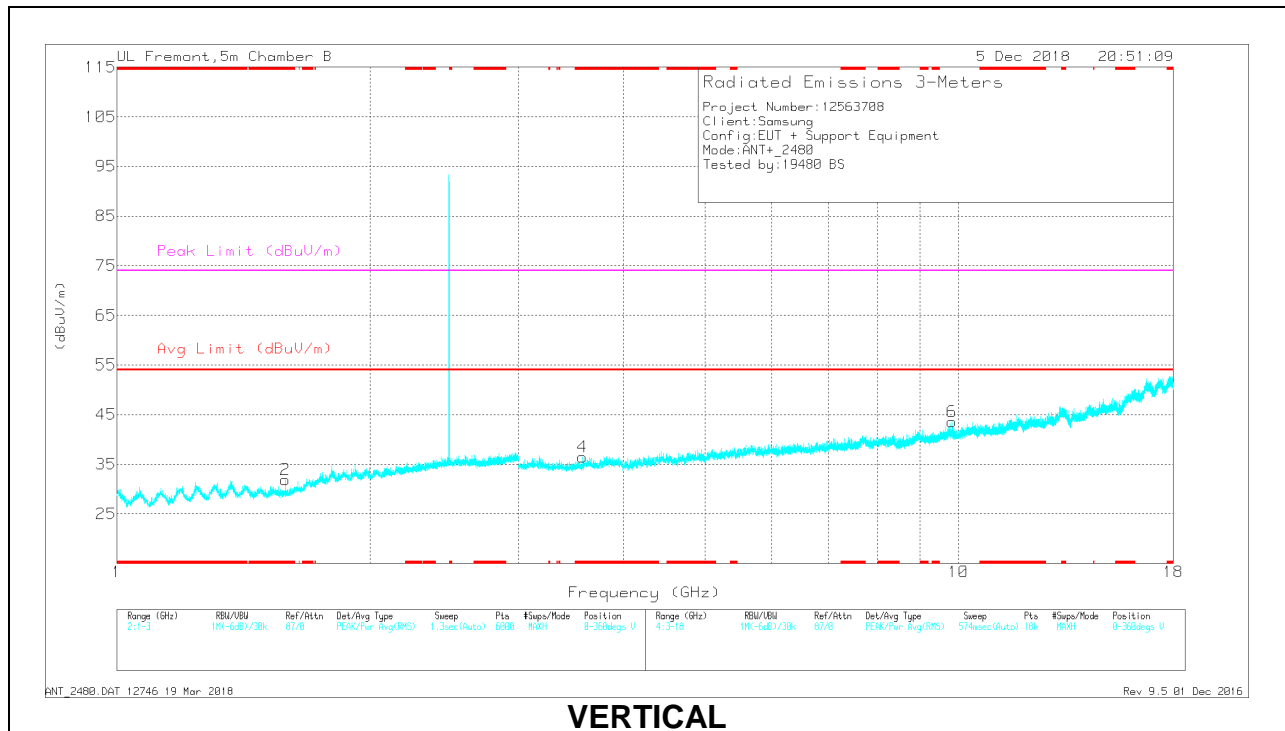
PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.419	28.47	PKFH	28.4	-21.1	35.77	-	-	74	-38.23	291	220	H
	* 1.418	18.56	VA1T	28.4	-21.1	25.86	54	-28.14	-	-	291	220	H
2	* 1.584	28.28	PKFH	27.7	-20.8	35.18	-	-	74	-38.82	3	204	V
	* 1.585	17.92	VA1T	27.7	-20.9	24.72	54	-29.28	-	-	3	204	V
3	* 4.229	38.22	PKFH	33.6	-29.3	42.52	-	-	74	-31.48	196	338	H
	* 4.229	27.95	VA1T	33.6	-29.3	32.25	54	-21.75	-	-	196	338	H
4	* 3.574	38.39	PKFH	33.2	-30.6	40.99	-	-	74	-33.01	140	250	V
	* 3.575	28.36	VA1T	33.2	-30.7	30.86	54	-23.14	-	-	140	250	V
6	9.819	33.57	PKFH	37.3	-23.1	47.77	-	-	74	-26.23	98	256	V
	9.822	23.29	VA1T	37.3	-23.1	37.49	54	-16.51	-	-	98	256	V
5	10.147	34.07	PKFH	37.8	-23.5	48.37	-	-	74	-25.63	198	378	H
	10.148	23.5	VA1T	37.8	-23.5	37.8	54	-16.2	-	-	198	378	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

9.2. FUNDAMENTAL FREQUENCY RADIATED EMISSION

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.402	90.21	PKFH	32.4	-20.8	0	101.81	-	-	114	-12.19	49	174	H
	90.21	AVG	32.4	-20.8	-26.47	75.34	94	-18.66	-	-	49	174	H
	85.46	PKFH	32.4	-20.8	0	97.06	-	-	114	-16.94	107	363	V
	85.46	AVG	32.4	-20.8	-26.47	70.59	94	-23.41	-	-	107	363	V
2.441	90.95	PKFH	32.5	-20.5	0	102.95	-	-	114	-11.05	44	127	H
	90.95	AVG	32.5	-20.5	-26.47	76.48	94	-17.52	-	-	44	127	H
	87.69	PKFH	32.5	-20.5	0	99.69	-	-	114	-14.31	95	395	V
	87.69	AVG	32.5	-20.5	-26.47	73.22	94	-20.78	-	-	95	395	V
2.480	88.95	PKFH	32.6	-20.5	0	101.05	-	-	114	-12.95	52	126	H
	88.95	AVG	32.6	-20.5	-26.47	74.58	94	-19.42	-	-	52	126	H
	86.49	PKFH	32.6	-20.5	0	98.59	-	-	114	-15.41	56	384	V
	86.49	AVG	32.6	-20.5	-26.47	72.12	94	-21.88	-	-	56	384	V

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak
 AVG = Peak Reading + Duty Cycle Correction Factor
 Duty Cycle Correction Factor = -26.47 dB

9.3. SPOT CHECK DATA (CERAMIC)

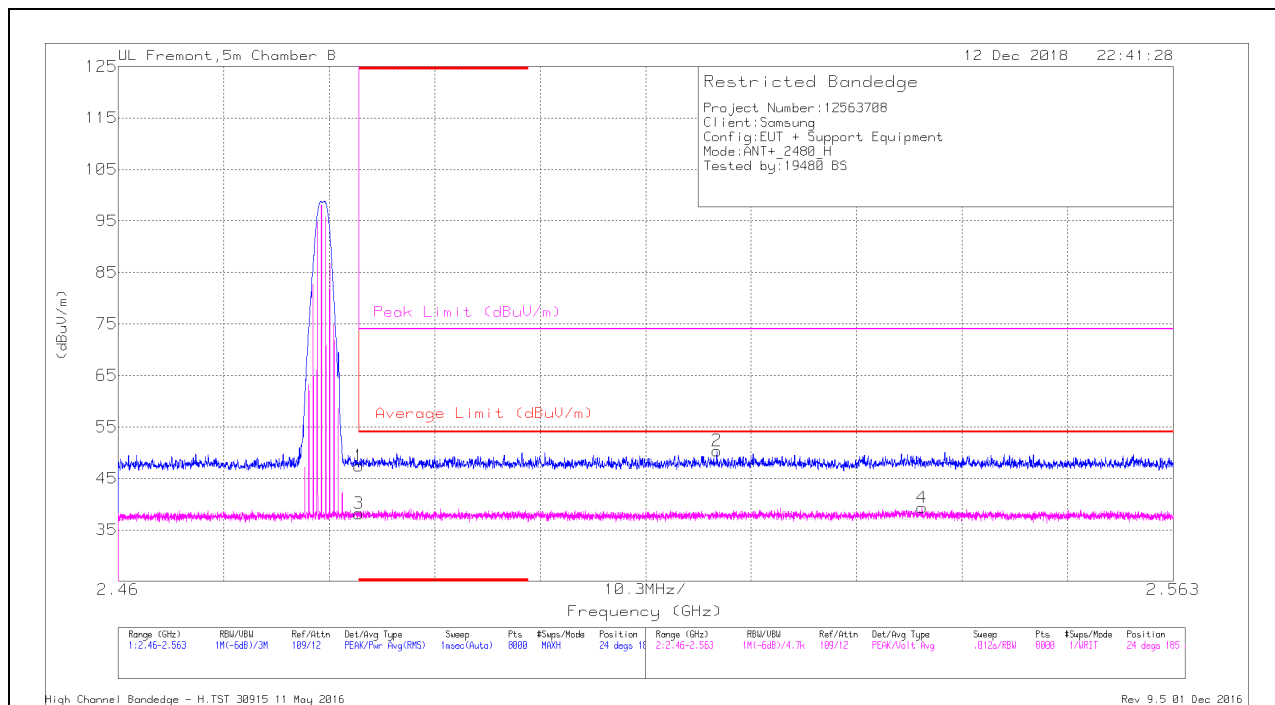
FUNDAMENTAL FREQUENCY RADIATED EMISSION

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.441	88.73	PKFH	32.5	-20.5	0	100.73	-	-	114	-13.27	43	387	H
	88.73	AVG	32.5	-20.5	-26.47	74.26	94	-19.74	-	-	43	387	H

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak
 AVG = Peak Reading + Duty Cycle Correction Factor
 Duty Cycle Correction Factor = -26.47 dB

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

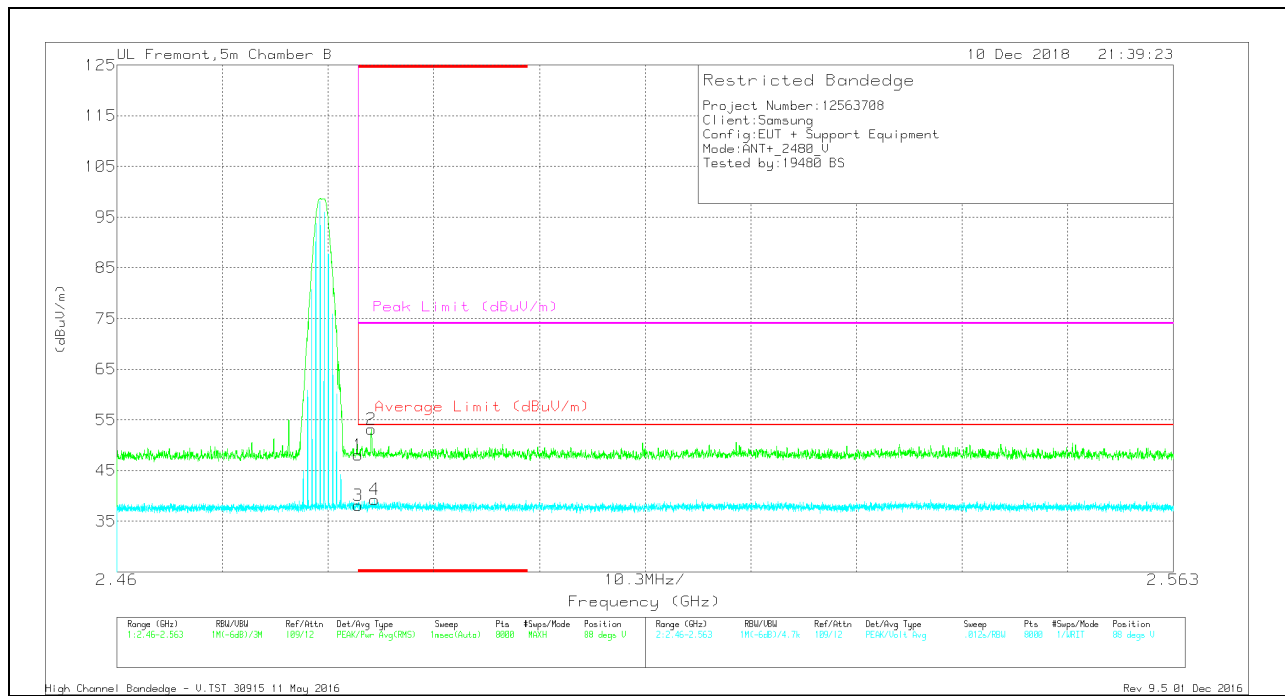
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Ftr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	35.11	Pk	32.6	-20.3	47.41	-	-	74	-26.59	24	186	H
3	* 2.484	25.89	VA1T	32.6	-20.3	38.19	54	-15.81	-	-	24	185	H
2	2.518	38.16	Pk	32.7	-20.5	50.36	-	-	74	-23.64	24	186	H
4	2.538	26.92	VA1T	32.7	-20.3	39.32	54	-14.68	-	-	24	185	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cb/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	35.79	Pk	32.6	-20.3	48.09	-	-	74	-25.91	88	379	V
2	* 2.485	40.83	Pk	32.6	-20.3	53.13	-	-	74	-20.87	88	379	V
3	* 2.484	25.86	VA1T	32.6	-20.3	38.16	54	-15.84	-	-	88	379	V
4	* 2.485	27	VA1T	32.6	-20.3	39.3	54	-14.7	-	-	88	379	V

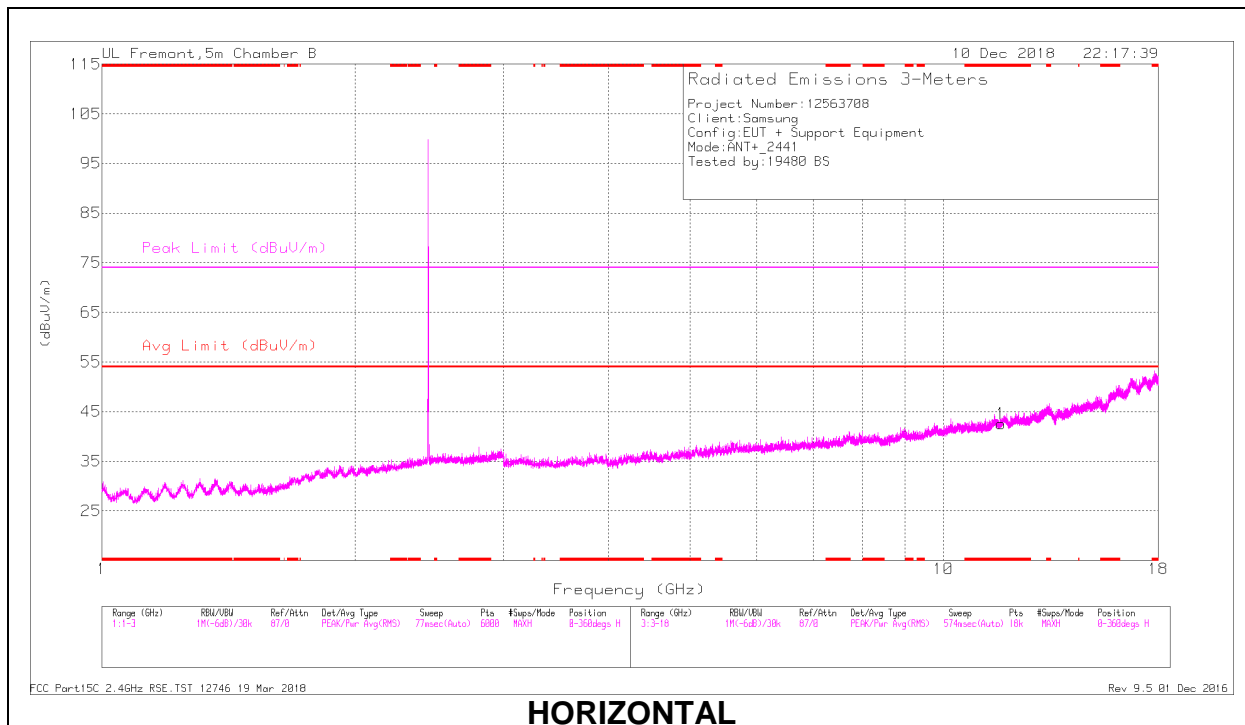
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

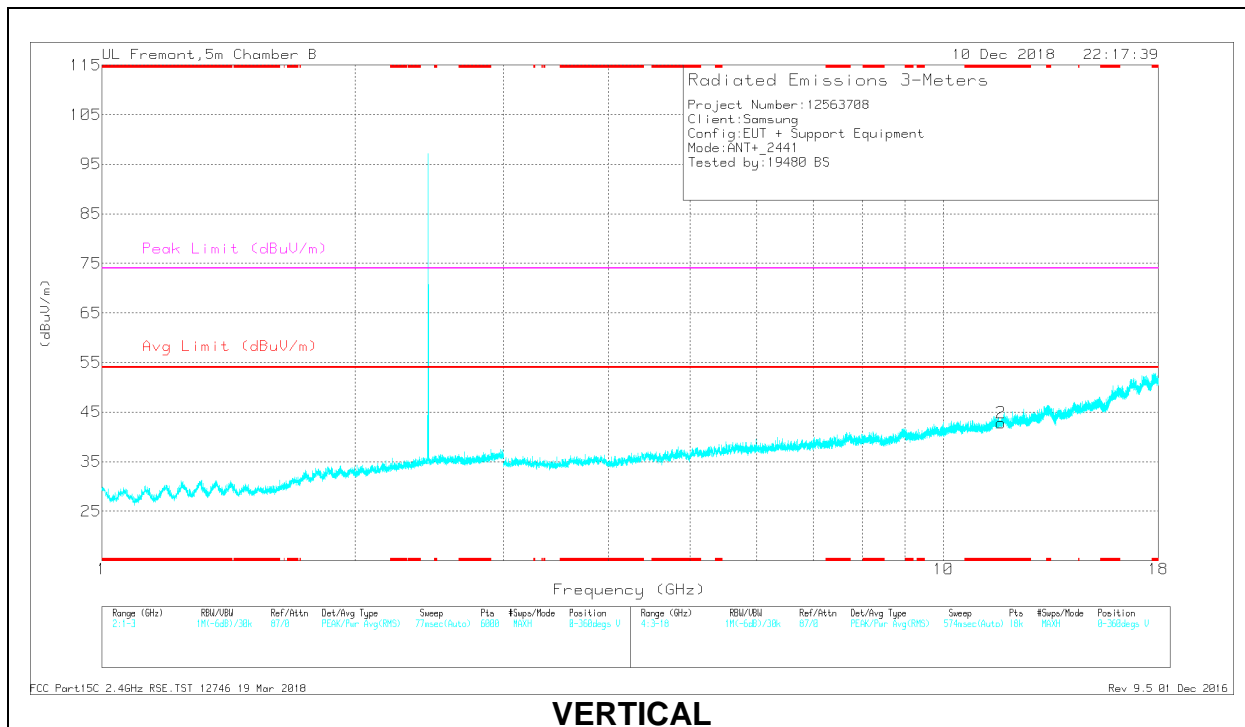
VA1T - FHSS: Linear Voltage Average $V_B=1/T_{on}$ where: T_{on} is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL, RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T863 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 11.706	25.8	Pk	39	-22.3	42.5	-	-	74	-31.5	0-360	199	H
2	* 11.706	31.76	PKFH	39	-22.3	48.46	-	-	74	-25.54	225	336	V
	* 11.706	22.44	VA1T	39	-22.3	39.14	54	-14.86	-	-	225	336	V

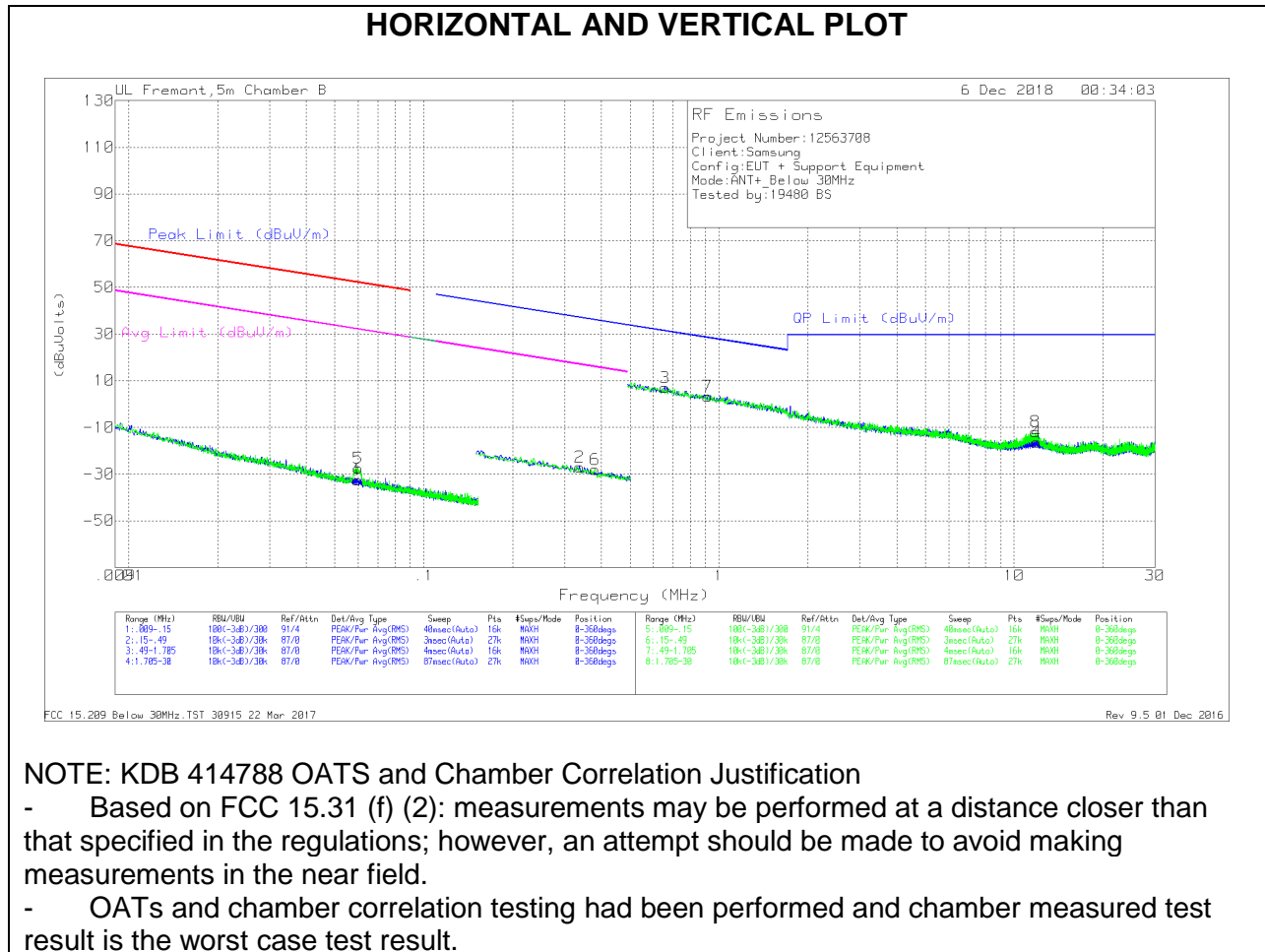
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PKFH - FHSS: RB=100k/1MHz VB=3 x RB, Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

9.4. Worst Case Below 30 MHz

SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)



Below 30 MHz Data

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (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)
1	.0596	35.57	Pk	11.8	0	-80	-32.63	52.08	-84.71	32.08	-64.71	-	-	-	-	0-360
5	.0599	40.59	Pk	11.8	0	-80	-27.61	52.04	-79.65	32.04	-59.65	-	-	-	-	0-360
2	.33712	42.11	Pk	10.9	.1	-80	-26.89	-	-	-	-	37.05	-63.94	17.05	-43.94	0-360
6	.38039	41.04	Pk	10.9	.1	-80	-27.96	-	-	-	-	36	-63.96	16	-43.96	0-360

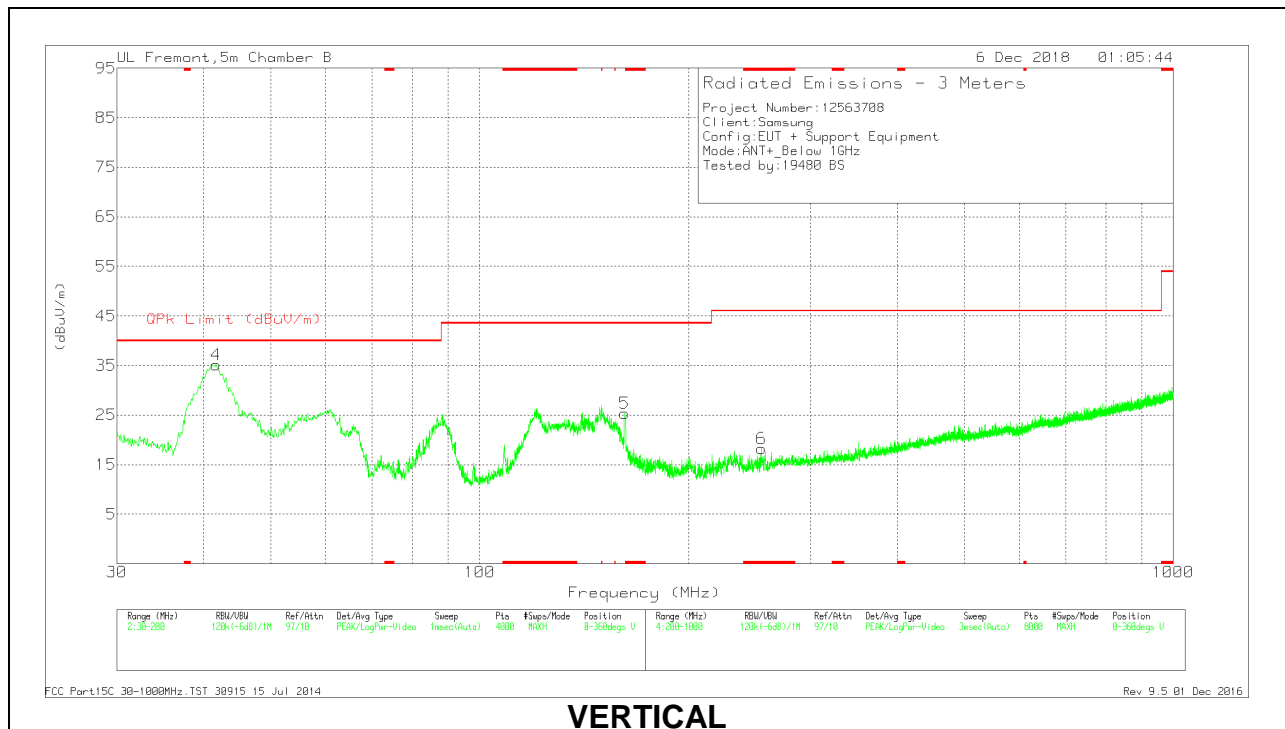
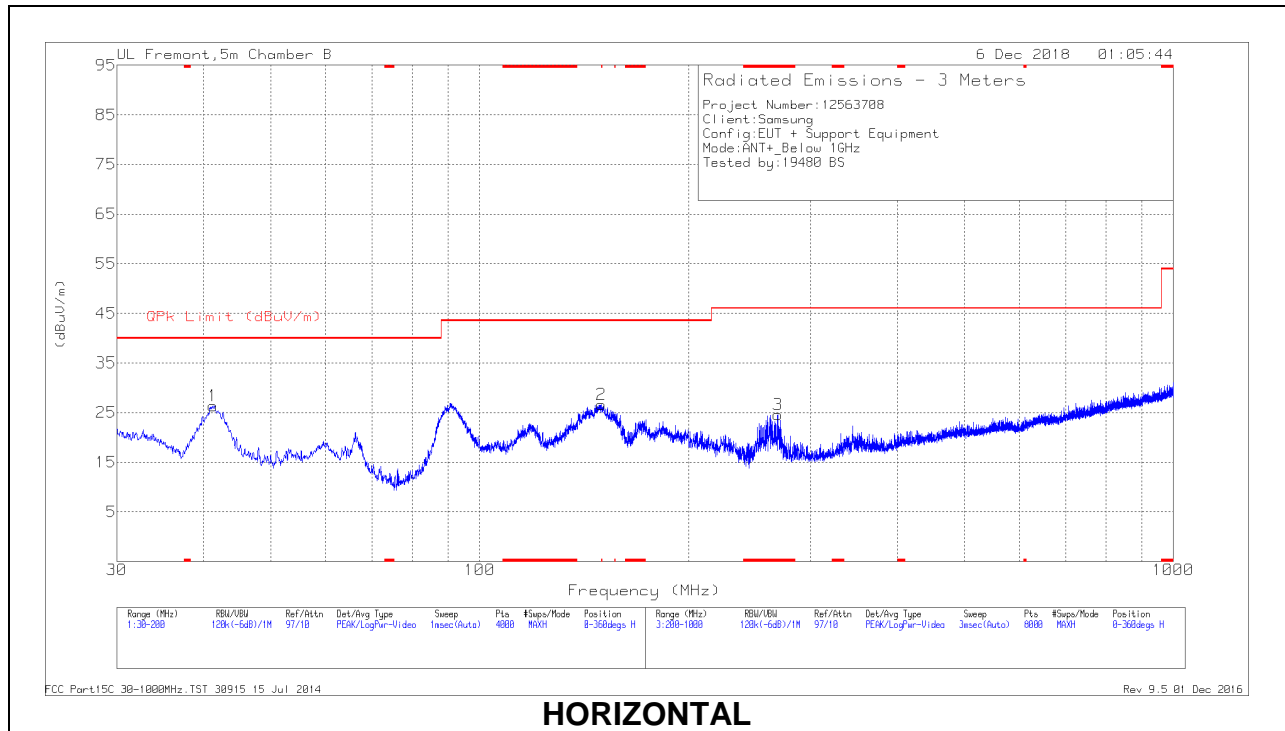
Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (dB/m)	Cables (dB)	Dist Corr (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.65538	35.96	Pk	11	.1	-40	7.06	31.28	-24.22	-	-	-	-	0-360
7	.91514	32.08	Pk	11.1	.1	-40	3.28	28.39	-25.11	-	-	-	-	0-360
8	11.82344	16.63	Pk	11	.5	-40	-11.87	29.5	-41.37	-	-	-	-	0-360
4	11.92981	12.16	Pk	11	.5	-40	-16.34	29.5	-45.84	-	-	-	-	0-360

Pk - Peak detector

9.5. Worst Case Below 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)



Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T407 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 268.909	37.13	Pk	17.2	-29.7	24.63	46.02	-21.39	0-360	100	H
6	* 255.0572	32.44	Pk	15.6	-29.8	18.24	46.02	-27.78	0-360	100	V
1	41.2654	40.63	Pk	17	-31.3	26.33	40	-13.67	0-360	400	H
4	41.6905	49.7	Pk	16.7	-31.3	35.1	40	-4.9	0-360	100	V
	41.5833	42.78	Qp	16.8	-31.3	28.28	40	-11.72	0	100	V
2	149.6685	40.43	Pk	16.5	-30.3	26.63	43.52	-16.89	0-360	200	H
5	161.7416	39.46	Pk	16.2	-30.3	25.36	43.52	-18.16	0-360	100	V

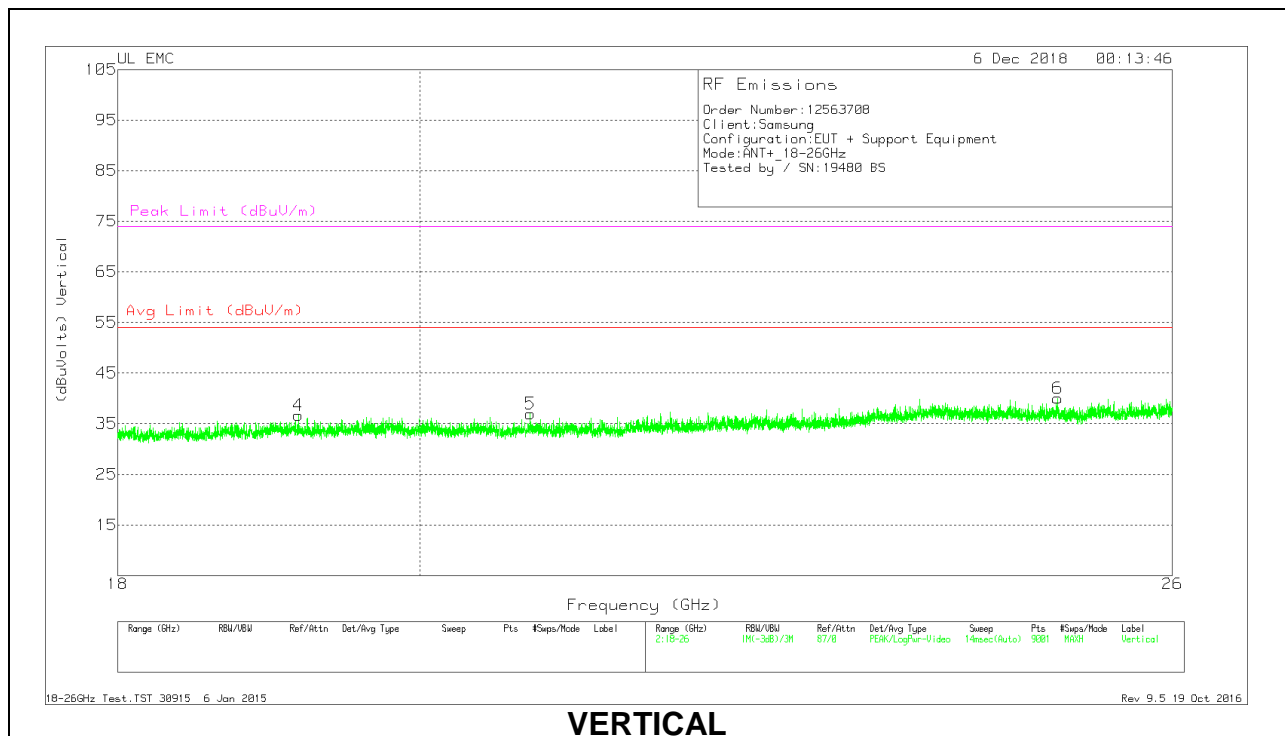
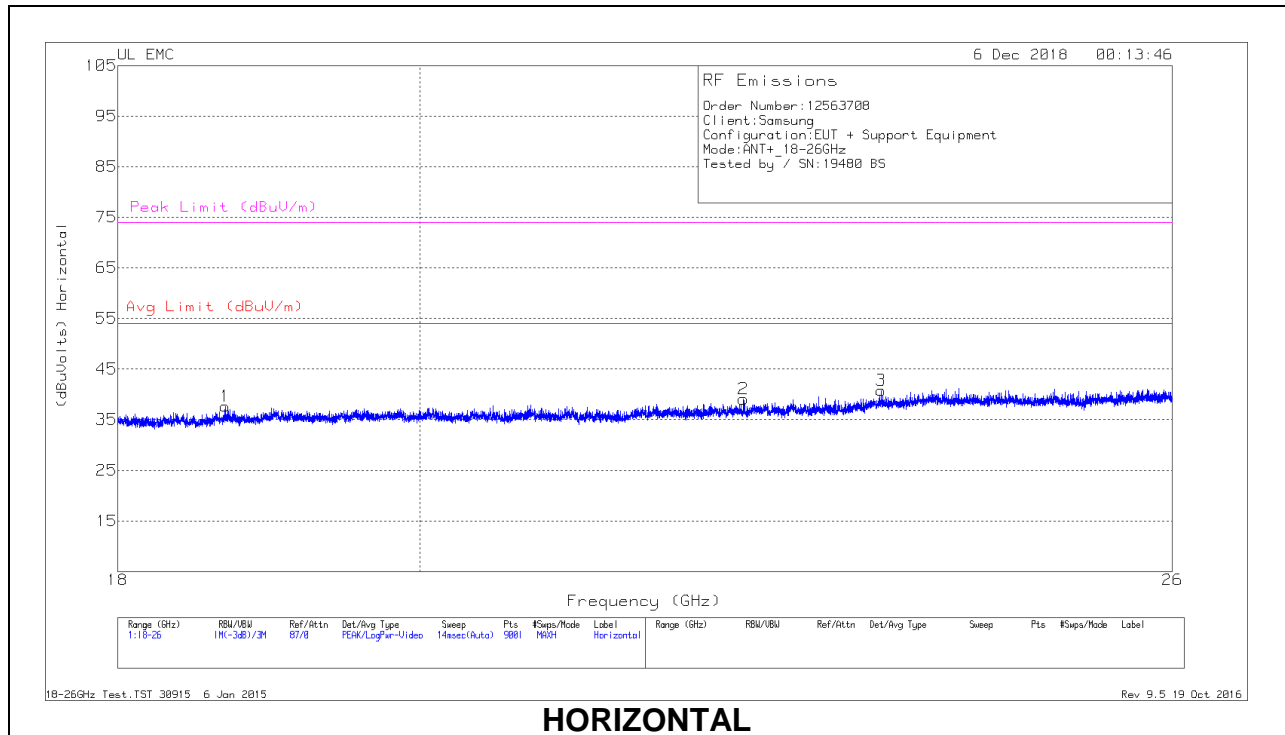
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

Qp - Quasi-Peak detector

9.6. Worst Case 18-26 GHz

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	18.687	39.15	Pk	32.4	-24.4	-9.5	37.65	54	-16.35	74	-36.35
2	22.388	39.9	Pk	33.5	-24.8	-9.5	39.1	54	-14.9	74	-34.9
3	23.49	40.58	Pk	34.1	-24.4	-9.5	40.78	54	-13.22	74	-33.22
4	19.17	38.25	Pk	32.6	-24.7	-9.5	36.65	54	-17.35	74	-37.35
5	20.785	38.26	Pk	33	-24.8	-9.5	36.96	54	-17.04	74	-37.04
6	24.981	39.44	Pk	34.4	-24.3	-9.5	40.04	54	-13.96	74	-33.96

Pk - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	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.

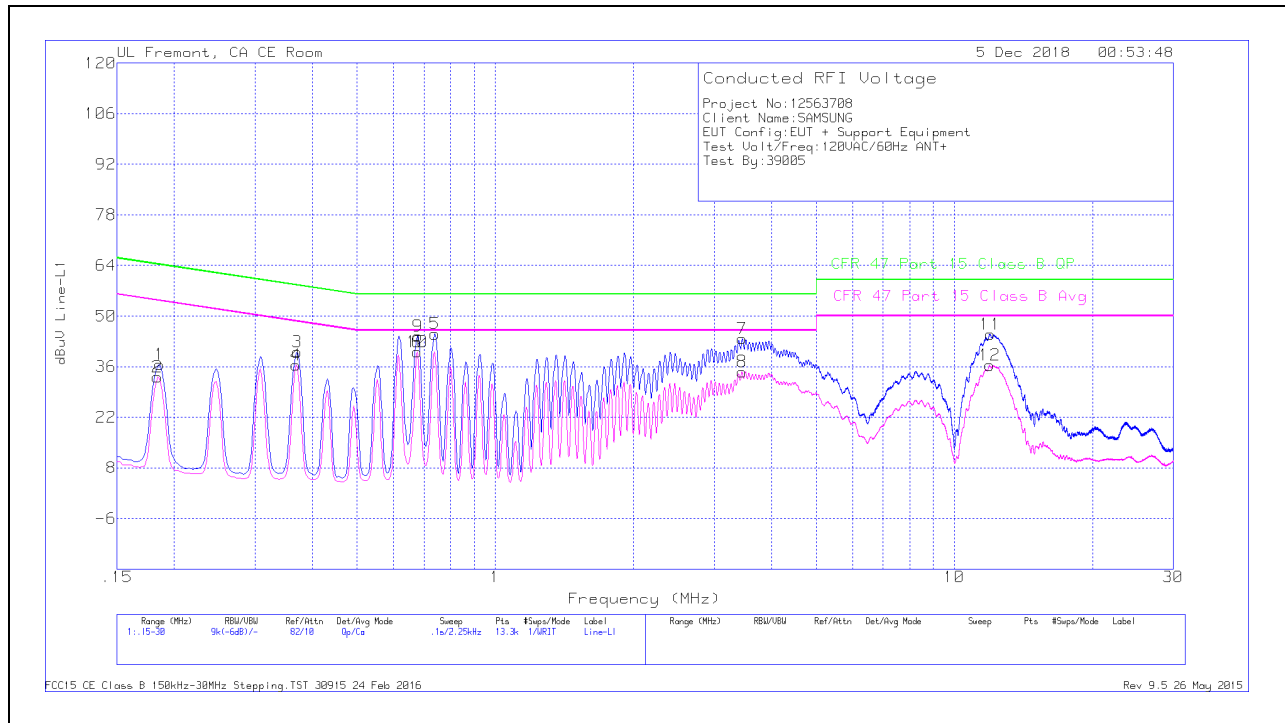
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

10.1.1. AC Power Line Norm

LINE 1 RESULTS

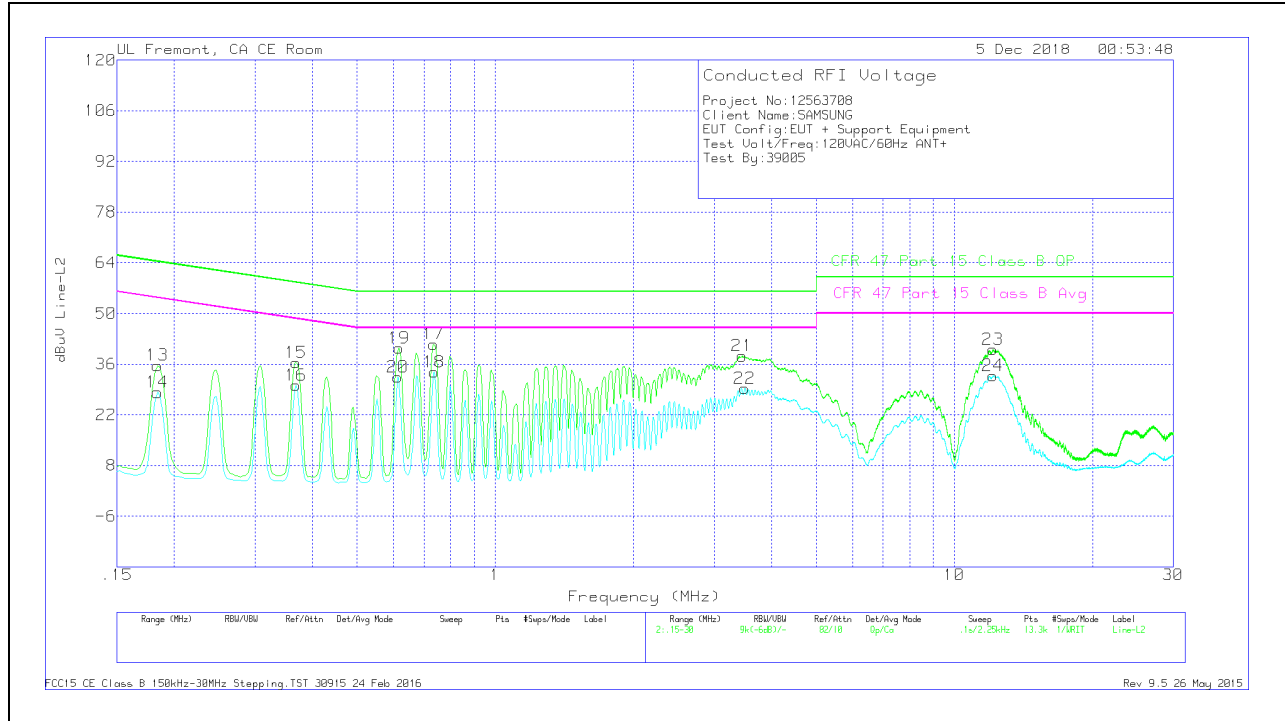


Trace Markers

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	.186	26.47	Qp	0	0	10.1	36.57	64.21	-27.64	-	-
2	.18375	23.02	Ca	0	0	10.1	33.12	-	-	54.31	-21.19
3	.3705	29.91	Qp	0	0	10.1	40.01	58.49	-18.48	-	-
4	.36825	26.35	Ca	0	0	10.1	36.45	-	-	48.54	-12.09
5	.7395	34.95	Qp	0	0	10.1	45.05	56	-10.95	-	-
6	.6765	30.06	Ca	0	0	10.1	40.16	-	-	46	-5.84
7	3.4485	33.48	Qp	0	.1	10.1	43.68	56	-12.32	-	-
8	3.4485	24.41	Ca	0	.1	10.1	34.61	-	-	46	-11.39
9	.67875	34.35	Qp	0	0	10.1	44.45	56	-11.55	-	-
10	.6765	30.06	Ca	0	0	10.1	40.16	-	-	46	-5.84
11	11.976	34.5	Qp	.1	.2	10.2	45	60	-15	-	-
12	11.9535	25.86	Ca	.1	.2	10.2	36.36	-	-	50	-13.64

Qp - Quasi-Peak detector
 Ca - CISPR average detection

LINE 2 RESULTS



Trace Markers

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	.18375	25.56	Qp	0	0	10.1	35.66	64.31	-28.65	-	-
14	.18375	18.09	Ca	0	0	10.1	28.19	-	-	54.31	-26.12
15	.36825	26.39	Qp	0	0	10.1	36.49	58.54	-22.05	-	-
16	.36825	20.16	Ca	0	0	10.1	30.26	-	-	48.54	-18.28
17	.735	31.47	Qp	0	0	10.1	41.57	56	-14.43	-	-
18	.73725	23.69	Ca	0	0	10.1	33.79	-	-	46	-12.21
19	.618	30.32	Qp	0	0	10.1	40.42	56	-15.58	-	-
20	.6135	22.3	Ca	0	0	10.1	32.4	-	-	46	-13.6
21	3.4485	28.07	Qp	0	.1	10.1	38.27	56	-17.73	-	-
22	3.498	19.1	Ca	0	.1	10.1	29.3	-	-	46	-16.7
23	12.14925	29.54	Qp	.1	.2	10.2	40.04	60	-19.96	-	-
24	12.147	22.37	Ca	.1	.2	10.2	32.87	-	-	50	-17.13

Qp - Quasi-Peak detector
 Ca - CISPR average detection