TEST REPORT

Report Number. : 13171837-E8V1

Applicant	:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677 Korea
Model	:	SM-A515U, SM-A515U1, SM-A515W and SM-S515DL
FCC ID	:	A3LSMA515U
ISED	:	649E-SMA515W
EUT Description	:	GSM/CDMA/WCDMA/LTE Phablet with BT/BLE, DTS/UNII a/b/g/n/ac, NFC and ANT+
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-210 ISSUE 9 ISED RSS-GEN Issue 5

Date Of Issue:
January 15, 2020

Prepared by:
UL Verification Services Inc.
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NVLAP TESTING

NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	1/15/2020	Initial Issue	

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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 Phablet with BT, DTS/UNII a/b/g/n/ac, NFC, ANT+ and WPT

MODEL: SM-A515U, SM-A515U1, SM-A515W and SM-S515DL

SERIAL NUMBER: Conducted: R38MB0B5QVN
Radiated: 353327110219805

DATE TESTED: January 02 to 07, 2020

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-210 Issue 9	Complies
ISED RSS-GEN Issue 5	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.

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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, ANSI C63.10-2013, , KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, ISED RSS-GEN Issue 5 and ISED 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, 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	☐ Chamber D	☐ Chamber I
☐ Chamber B	☐ Chamber E	☒ Chamber J
☐ Chamber C	☐ Chamber F	☐ Chamber K
	☐ Chamber G	☐ Chamber L
	☐ Chamber H	

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: 2324A.

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

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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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 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	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

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5. EQUIPMENT UNDER TEST

5.1. EUT DESCRIPTION

The EUT is a GSM/CDMA/WCDMA/LTE Phablet with BT/BLE, DTS/UNII a/b/g/n/ac, NFC and ANT+.
The model SM-A515U 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 +	90.12	56.57	3.00

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -1.1 dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was A515U.001.

5.5. WORST-CASE CONFIGURATION AND MODE

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 Y 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.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Samsung	EP-TA200	R37KBKL03C1DK3	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

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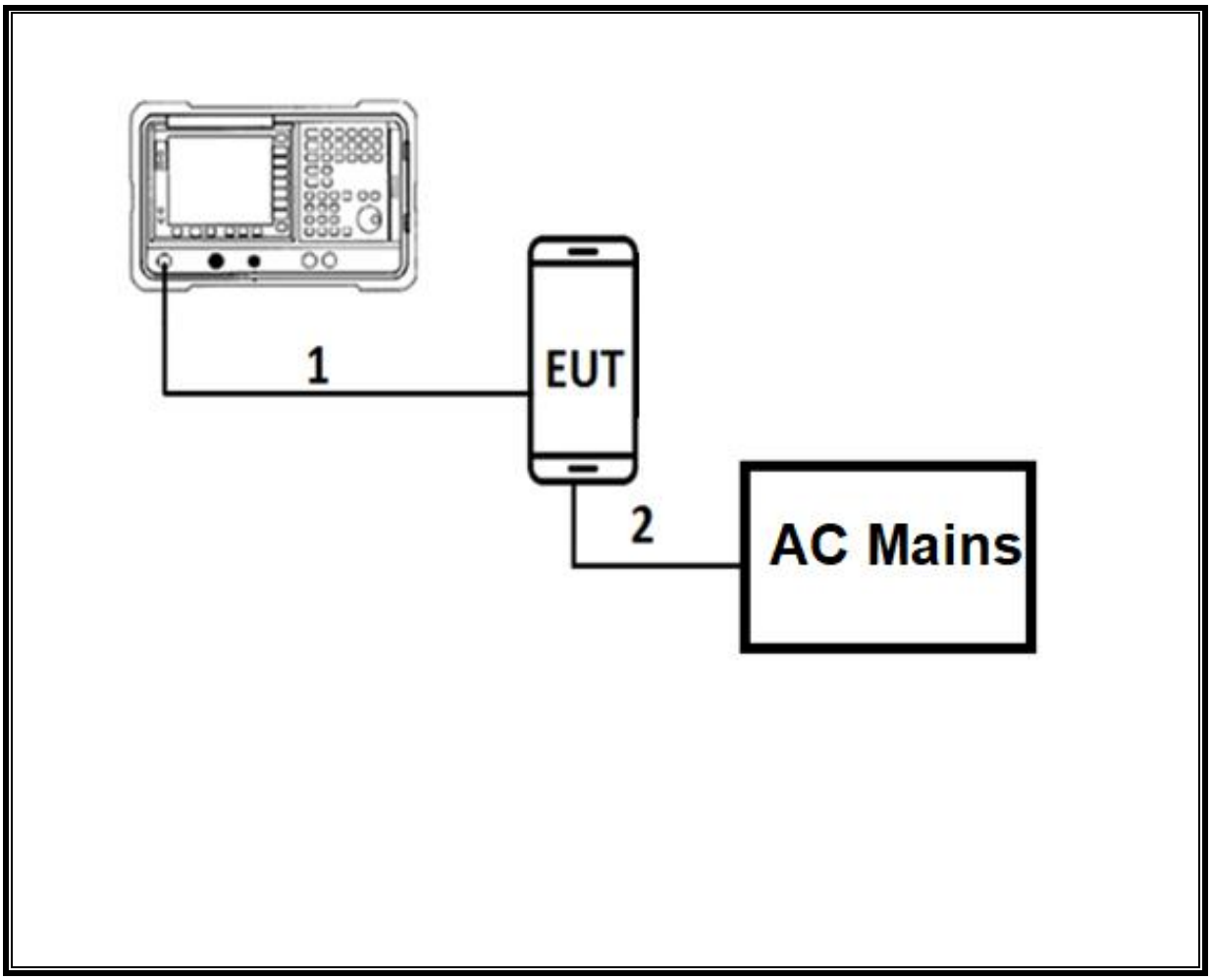
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

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

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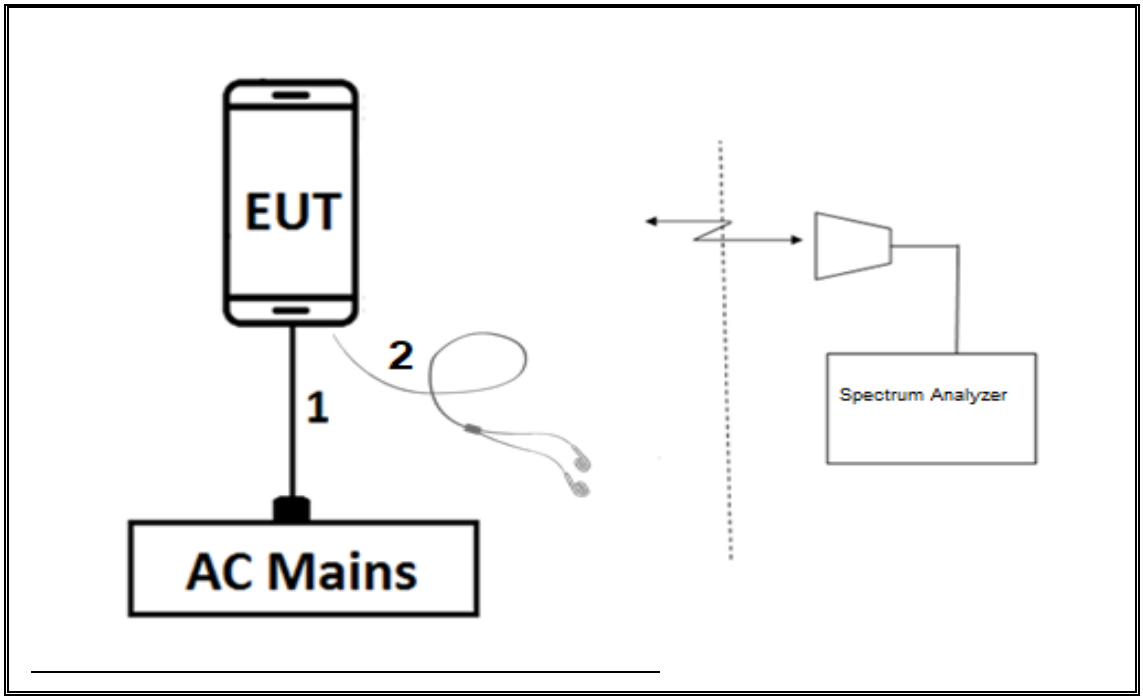
RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

For radiated tests: EUT is connected to earphone. The test software exercises the radio.

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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**
Antenna, Passive Loop 30Hz to 1MHz	ELETRO METRICS	EM-6871	PRE0179466	05/31/2020
Antenna, Passive Loop 100KHz to 30MHz	ELETRO METRICS	EM-6872	PRE0179468	05/31/2020
Antenna, Horn 1-18GHz	ETS Lindgren	3117	T344	05/07/2020
Amplifier, 1 to 18GHz, 35dB	AMPLICAL	AMP1G18-35	T1571	05/28/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE0180174	06/01/2020
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences Corp.	JB3	T899	08/23/2020
EMI TEST RECEIVER	Rohde & Schwarz	ESW44	PRE0179367	05/16/2020
Antenna Horn, 18 to 26.5GHz	ARA	MWH-1826/B	T447	08/13/2020
Pre-Amp 1-26.5 GHz	AMPLICAL	AMP18G26.5-60	PRE0181238	05/01/2020
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies (Formerly Agilent)	E4446A	T146	01/28/2020
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	171901	05/28/2020
AC Line Conducted				
EMI Receiver	Rohde & Schwarz	ESR	T1436	02/14/2020
LISN for Conducted Emissions CISPR-16	FCC INC.	FCC LISN 50/250	T1310	01/24/2020
UL AUTOMATION SOFTWARE				
Radiated Software	UL	UL EMC	Ver 9.5, June 15, 2019	
Antenna Port Software	UL	UL RF	Ver 10.4, Oct 10, 2019	
AC Line Conducted Software	UL	UL EMC	Ver 9.5, May 26, 2015	

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.

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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

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 Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

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

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

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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

Tested By:	19497 AF
Date:	12/31/2019

Note:

ON Time (over 100ms period) = ON Time over 1msec period x No. of pulses over 100msec period.

Mode	ON Time over 1msec	Number of Pulses over 100msec	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor for Average Measurements (dB)	1/B Minimum VBW (kHz)
ANT+	0.1617	13	2.1021	100.00	0.021	2.102	-33.55	0.476

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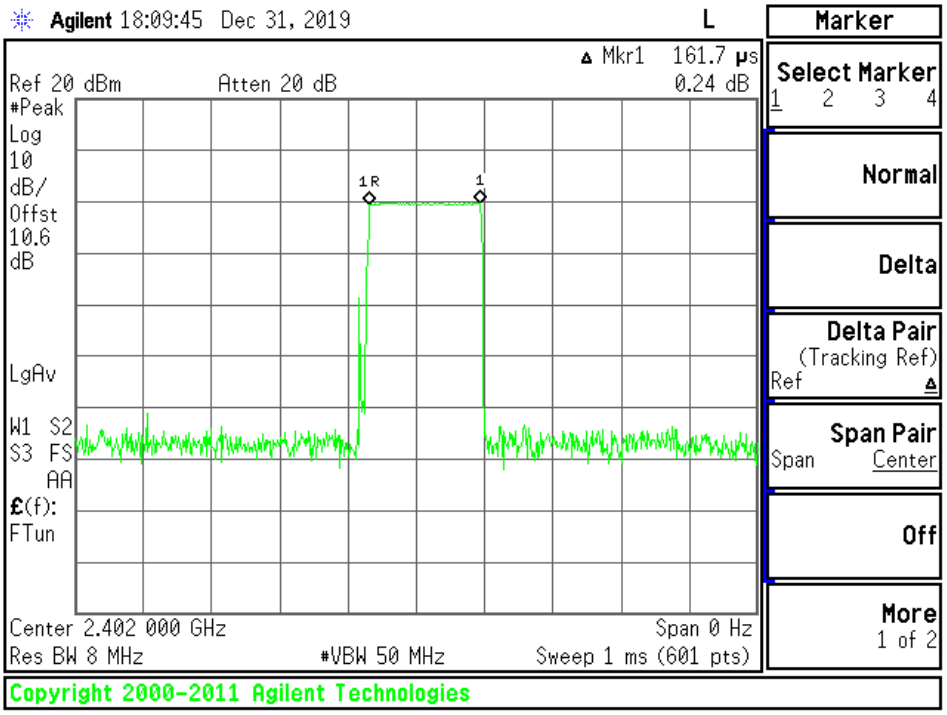
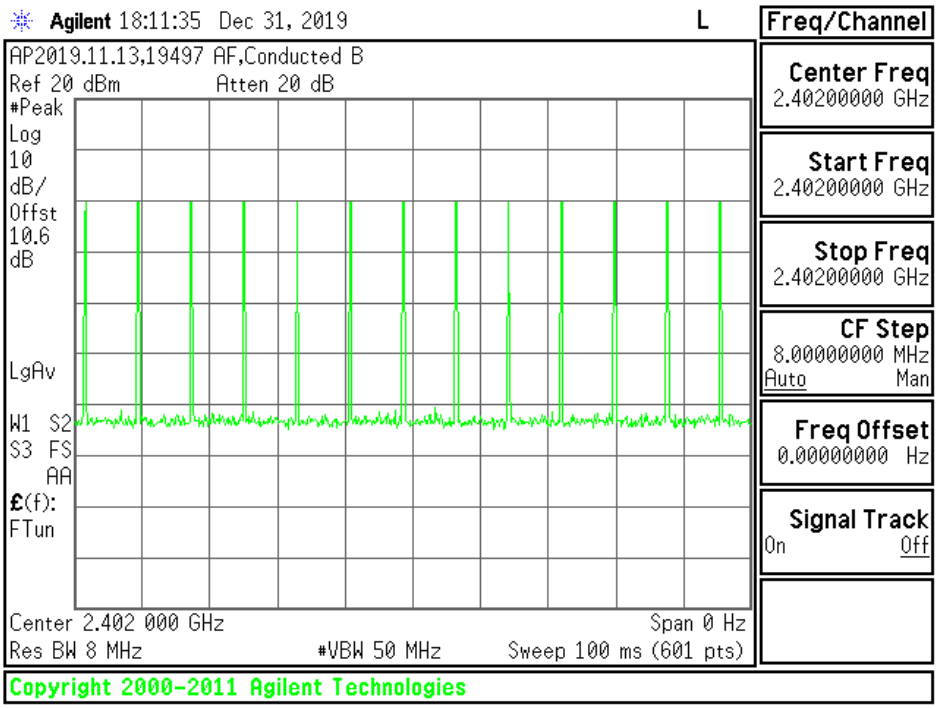
DUTY CYCLE PLOTS



ON TIME over 1ms



Number of pulses over 100ms period

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8.2. 99% BANDWIDTH

LIMITS

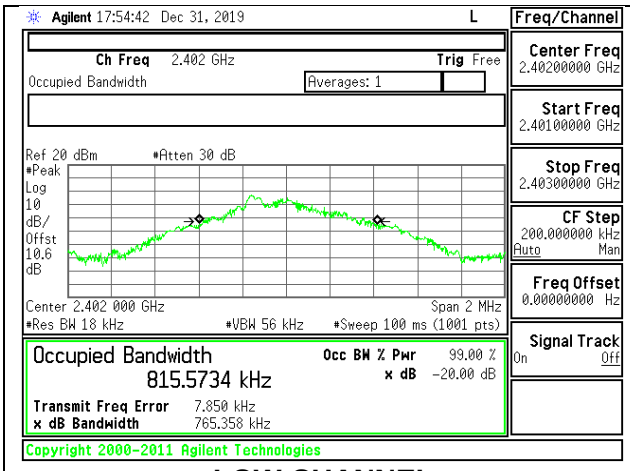
None; for reporting purposes only.

TEST PROCEDURE

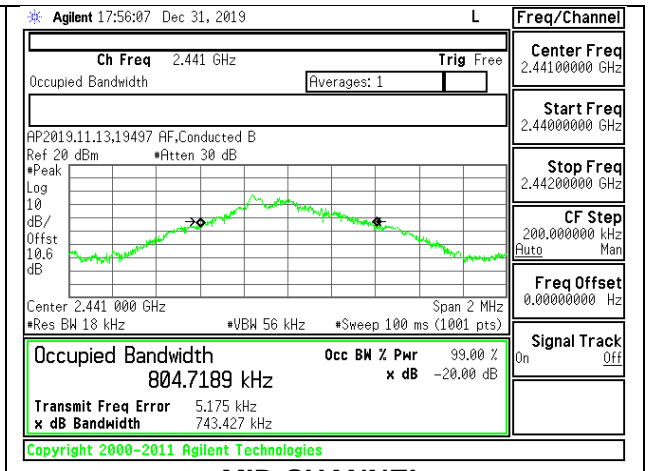
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

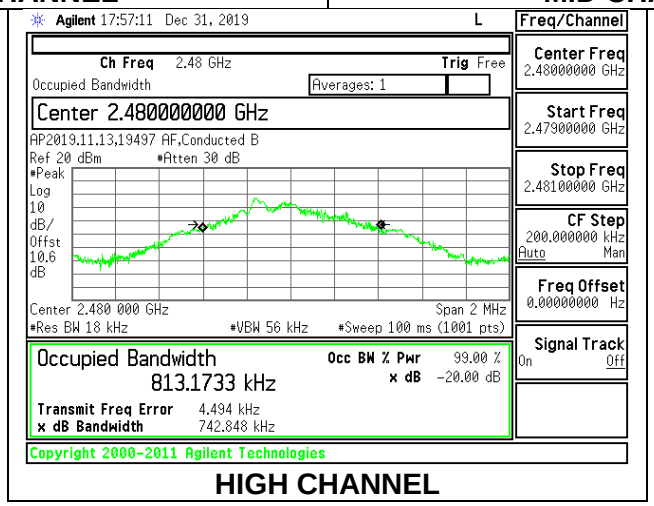
Channel	Frequency (MHz)	99% Bandwidth (KHz)
Low	2402	815.5734
Mid	2441	804.7189
High	2480	813.1733



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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8.3. 20dB BANDWIDTH

LIMITS

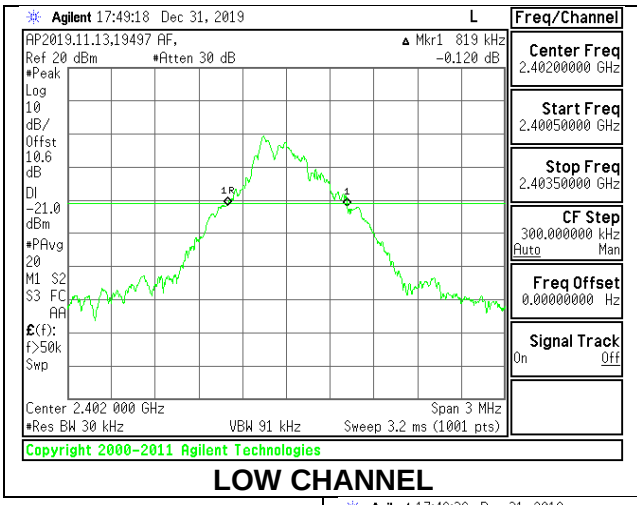
None; for reporting purposes only.

TEST PROCEDURE

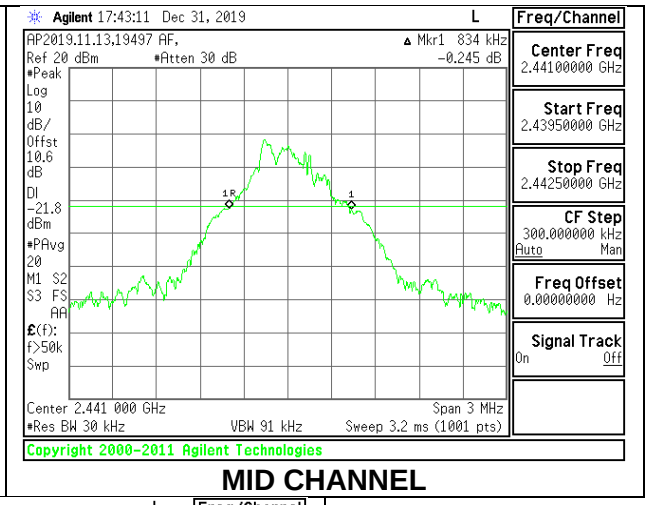
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 5% of the 20 dB bandwidth. The VBW is set to approximately three times RBW. The sweep time is coupled

RESULTS

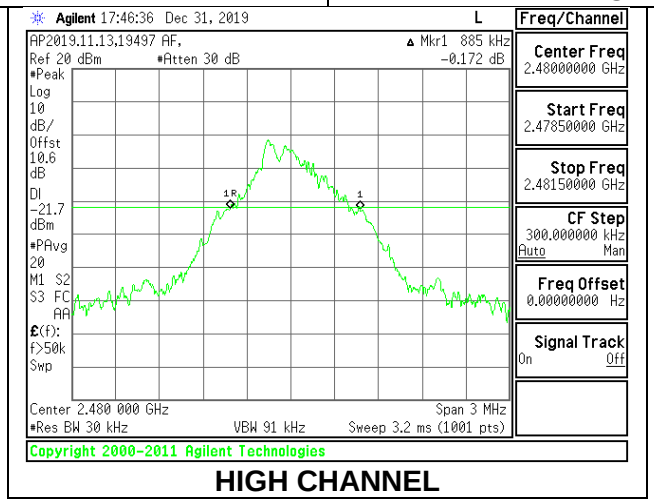
Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Frequency Edge (MHz)	Limit (MHz)	Margin (MHz)
Low	2402	0.819	2401.5905	2400	-1.59
Mid	2441	0.834	N/A	N/A	N/A
High	2480	0.885	2480.4425	2483.5	-3.06



LOW CHANNEL



MID CHANNEL



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9. RADIATED TEST RESULTS

LIMITS

FCC §15.249

FCC §15.205 and §15.209

ISED RSS-GEN, Section 8.9 and 8.10

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

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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 final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T (500 Hz) 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.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

KDB 414788 OFS 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.

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

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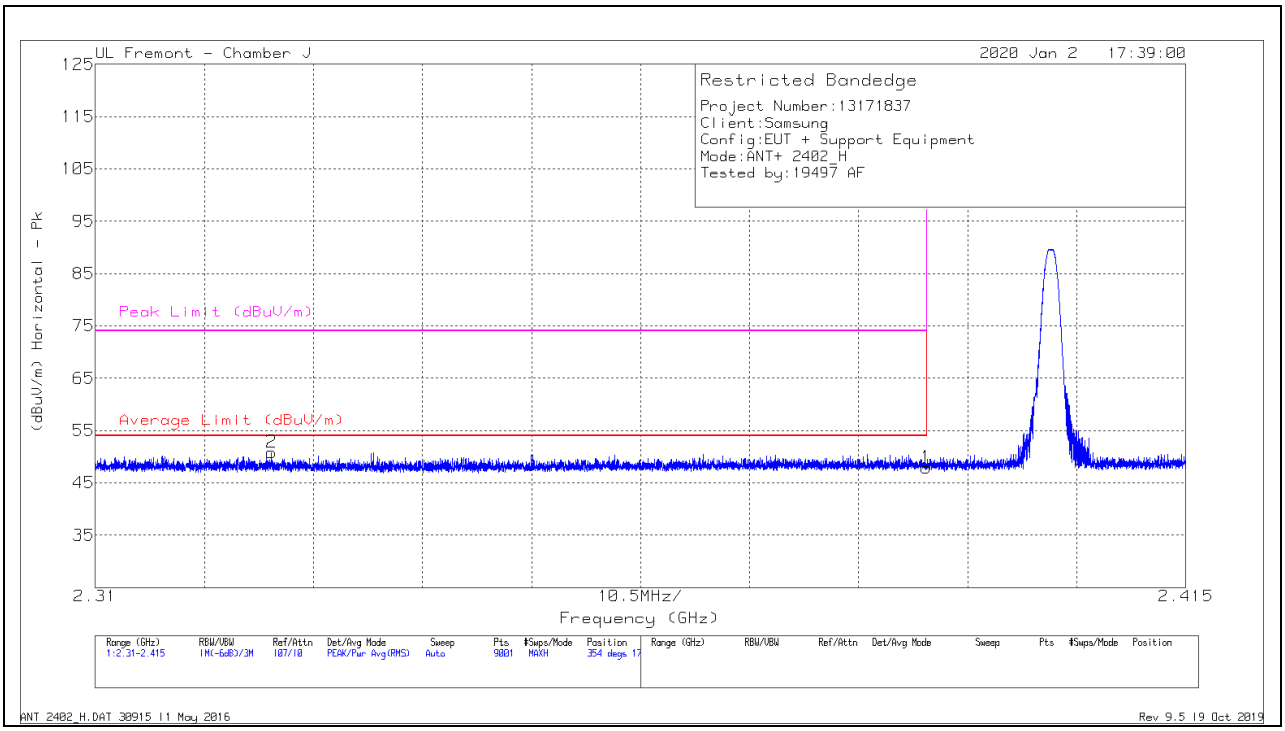
9.1. TRANSMITTER ABOVE 1 GHz

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	41.52	Pk	31.9	-25.5	0	47.92	-	-	74	-26.08	354	176	H
	* 2.38999	41.52	AVG	31.9	-25.5	-33.55	14.37	54	-39.63	-	-	354	176	H
2	* 2.32695	44.83	Pk	31.6	-25.6	0	50.83	-	-	74	-23.17	354	176	H
	* 2.32695	44.83	AVG	31.6	-25.6	-33.55	17.28	54	-36.72	-	-	354	176	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
AVG = Peak Reading + Duty Cycle Correction Factor
Duty Cycle Correction Factor = -33.55 dB

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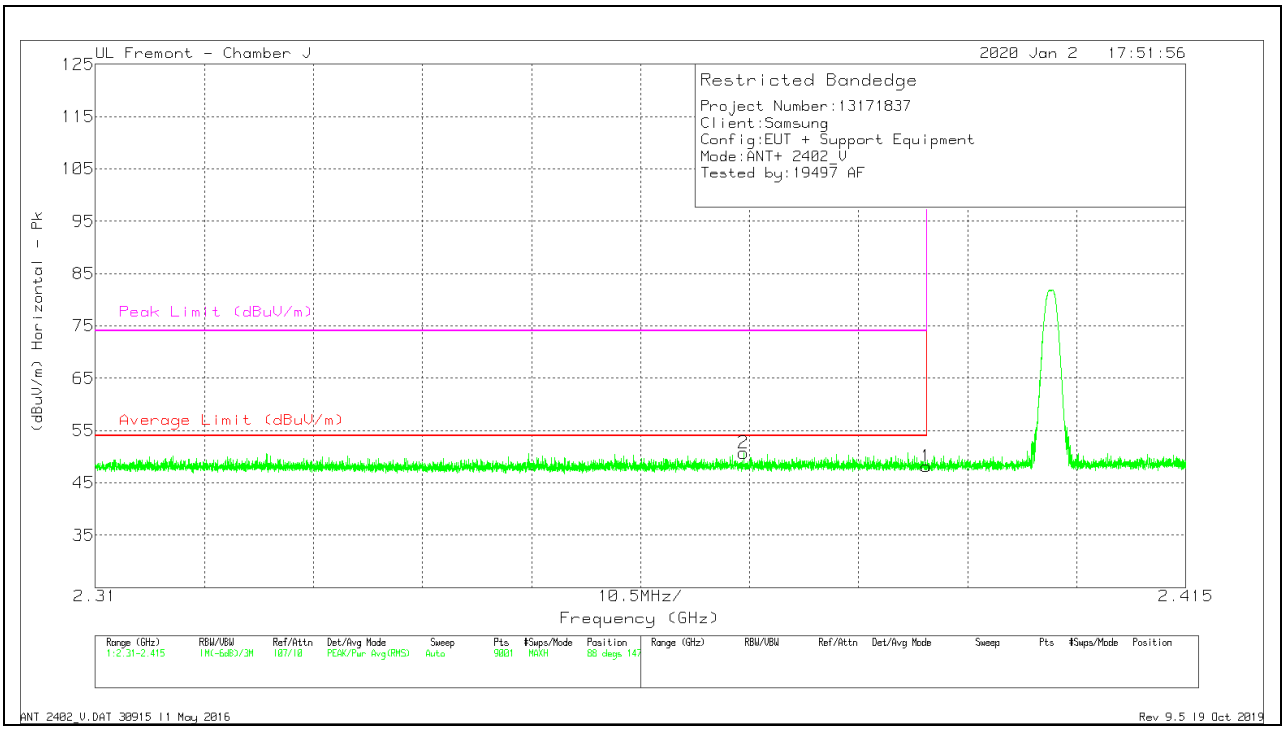
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.38999	41.76	Pk	31.9	-25.5	0	48.16	-	-	74	-25.84	88	147	V
	* 2.38999	41.76	AVG	31.9	-25.5	-33.55	14.61	54	-39.39	-	-	88	147	V
2	* 2.37242	44.45	Pk	31.8	-25.5	0	50.75	-	-	74	-23.25	88	147	V
	* 2.37242	44.45	AVG	31.8	-25.5	-33.55	17.2	54	-36.8	-	-	88	147	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
AVG = Peak Reading + Duty Cycle Correction Factor
Duty Cycle Correction Factor = -33.55 dB

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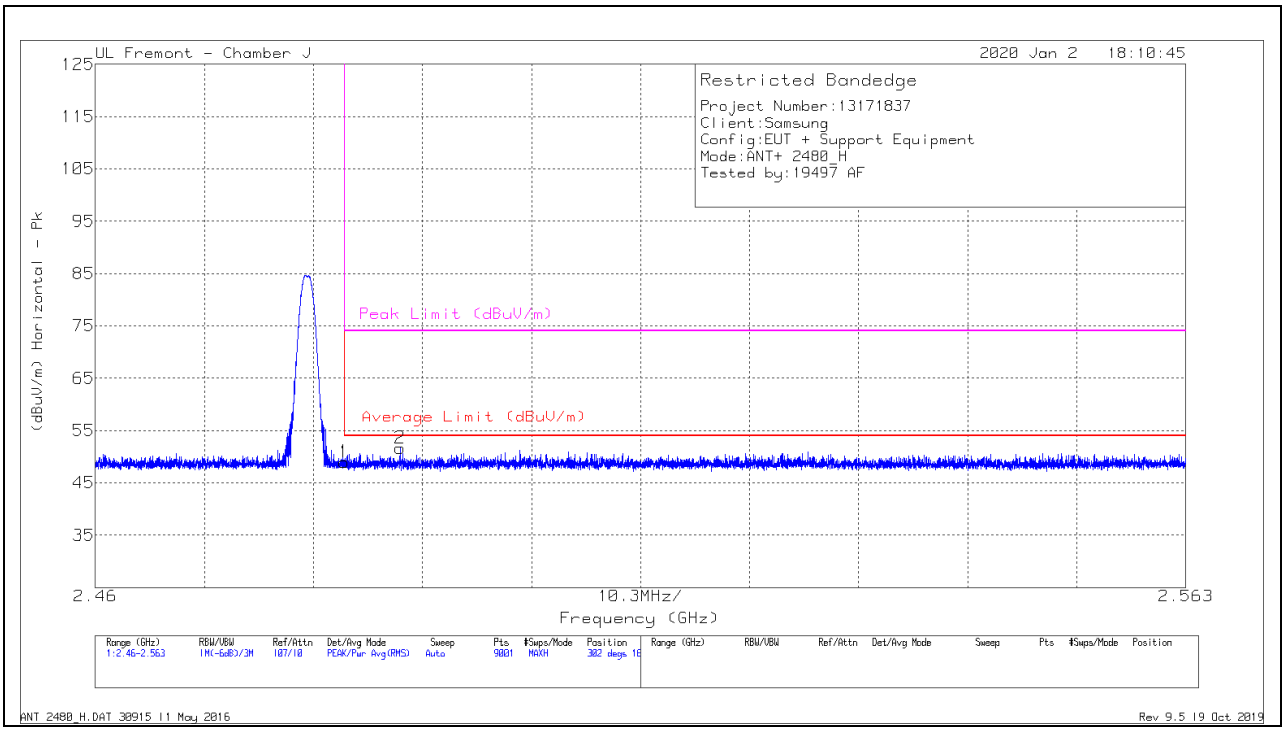
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	42.16	Pk	32.3	-25.5	0	48.96	-	-	74	-25.04	302	167	H
	* 2.48351	42.16	AVG	32.3	-25.5	-33.55	15.41	54	-38.59	-	-	302	167	H
2	* 2.48878	44.87	Pk	32.3	-25.5	0	51.67	-	-	74	-22.33	302	167	H
	* 2.48878	44.87	AVG	32.3	-25.5	-33.55	18.12	54	-35.88	-	-	302	167	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
AVG = Peak Reading + Duty Cycle Correction Factor
Duty Cycle Correction Factor = -33.55 dB

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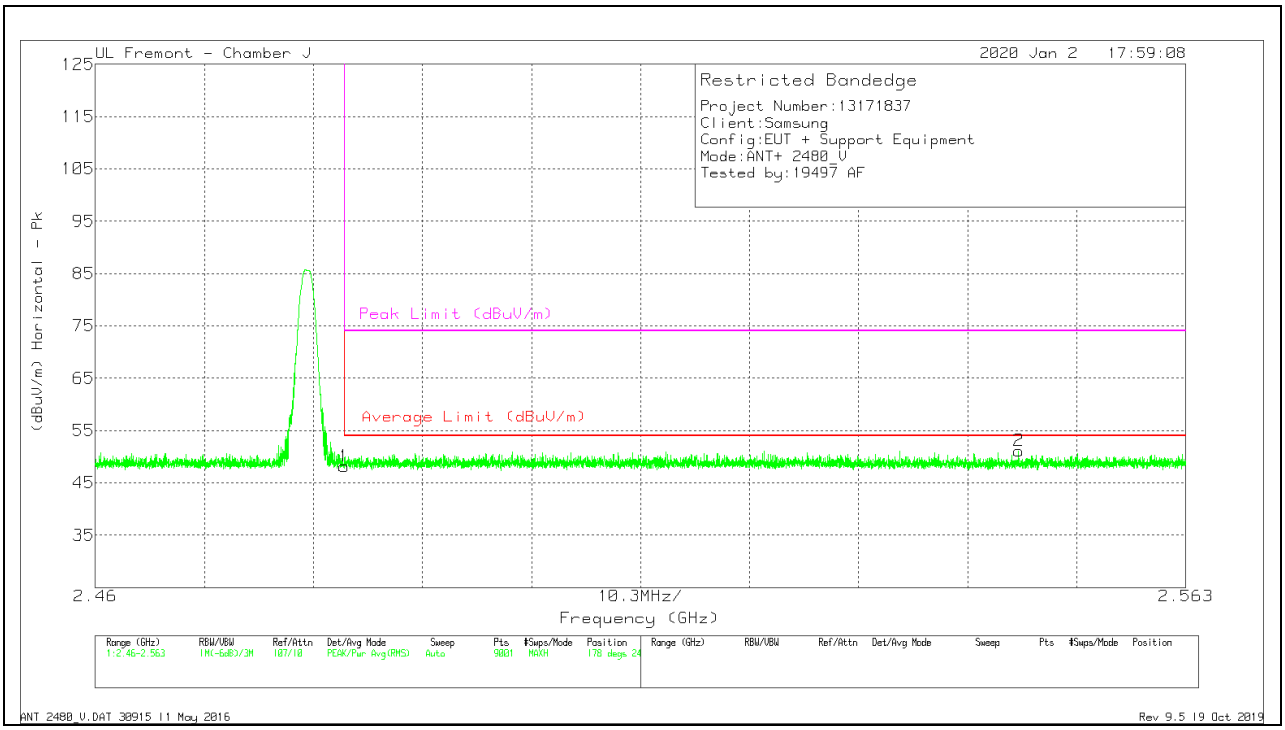
VERTICAL RESULT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.48351	41.36	Pk	32.3	-25.5	0	48.16	-	-	74	-25.84	178	244	V
	* 2.48351	41.36	AVG	32.3	-25.5	-33.55	14.61	54	-39.39	-	-	178	244	V
2	2.5472	44.19	Pk	32.3	-25.4	0	51.09	-	-	74	-22.91	178	244	V
	2.5472	44.19	AVG	32.3	-25.4	-33.55	17.54	54	-36.46	-	-	178	244	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
AVG = Peak Reading + Duty Cycle Correction Factor
Duty Cycle Correction Factor = -33.55 dB

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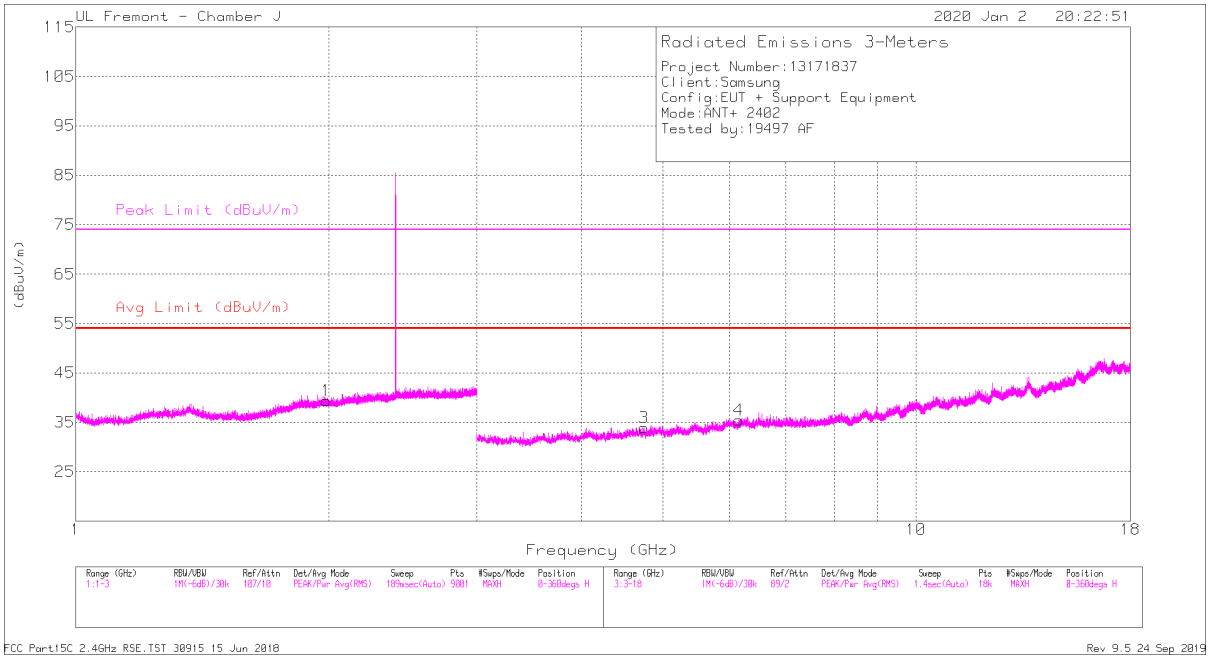
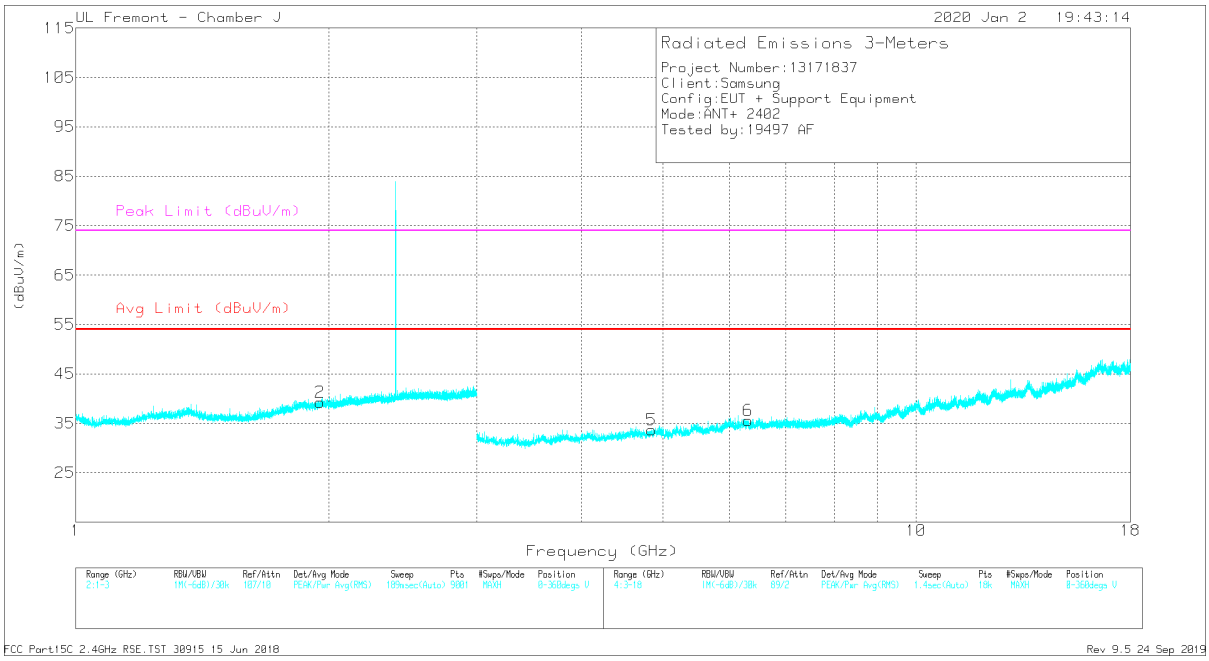
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	1.98753	42.46	PKFH	31	-25.7	47.76	-	-	-	-	102	265	H
2	1.95387	42.47	PKFH	31	-25.7	47.77	-	-	-	-	278	144	V
3	* 4.74516	38.71	PKFH	34.1	-30.5	42.31	-	-	74	-31.69	117	252	H
	* 4.74414	25.25	VA1T	34.1	-30.5	28.85	54	-25.15	-	-	117	252	H
4	6.15256	36.86	PKFH	35.7	-29	43.56	-	-	-	-	13	349	H
5	* 4.84544	39.03	PKFH	34.2	-31.1	42.13	-	-	74	-31.87	199	222	V
	* 4.84489	25.99	VA1T	34.2	-31.1	29.09	54	-24.91	-	-	199	222	V
6	6.31219	35.68	PKFH	35.6	-27.8	43.48	-	-	-	-	3	367	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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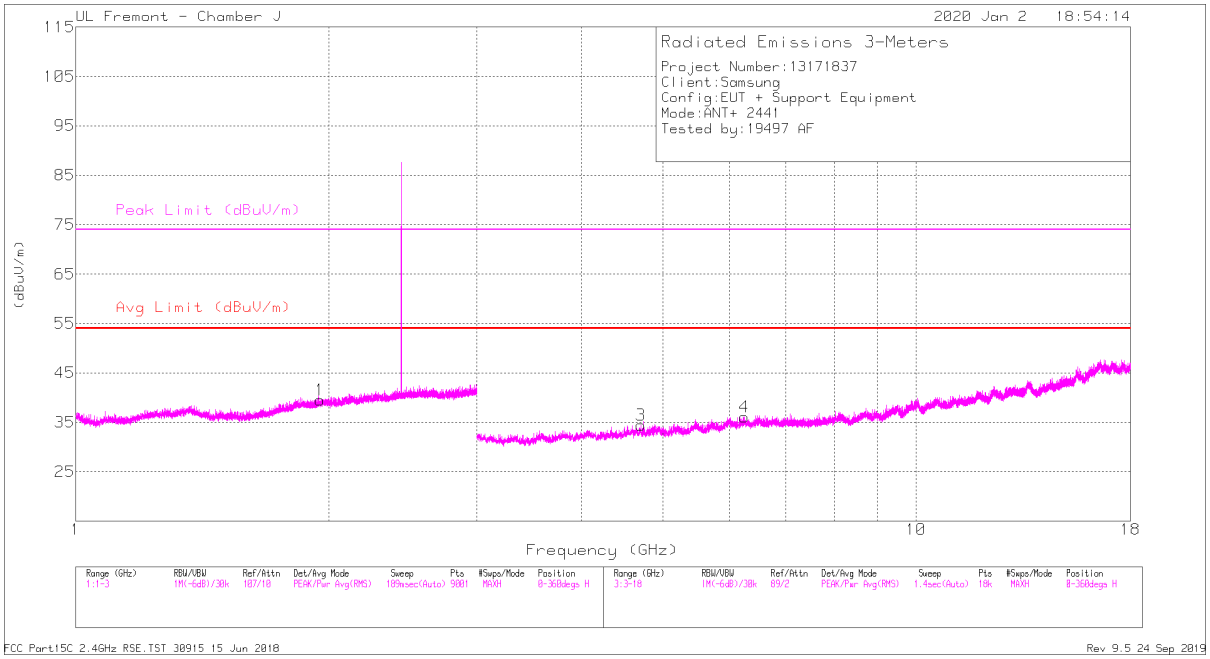
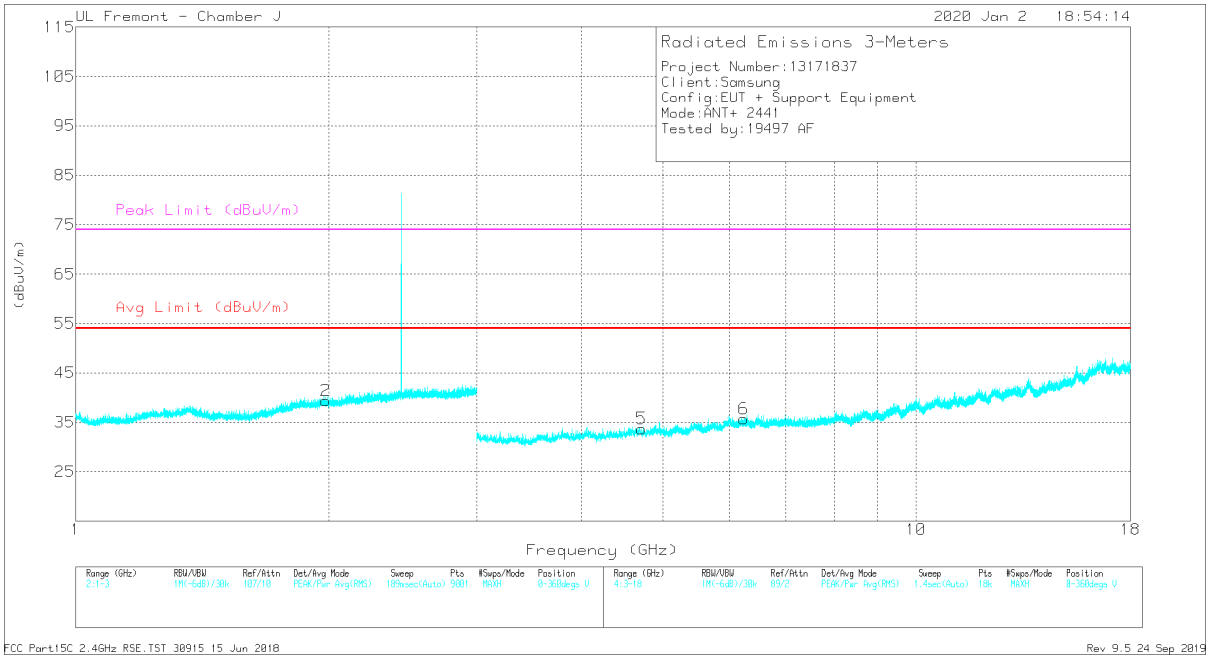
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	1.95405	43.1	PKFH	31	-25.7	48.4	-	-	-	-	207	178	H
2	1.98418	41.82	PKFH	31	-25.7	47.12	-	-	-	-	206	347	V
3	* 4.70846	38.33	PKFH	34.1	-30.8	41.63	-	-	74	-32.37	231	142	H
	* 4.70946	25.41	VA1T	34.1	-30.8	28.71	54	-25.29	-	-	231	142	H
4	6.24683	36.78	PKFH	35.6	-27.8	44.58	-	-	-	-	184	381	H
5	* 4.71735	38.64	PKFH	34.1	-30.8	41.94	-	-	74	-32.06	79	134	V
	* 4.71492	25.4	VA1T	34.1	-30.8	28.7	54	-25.3	-	-	79	134	V
6	6.23679	36.06	PKFH	35.6	-28.1	43.56	-	-	-	-	309	104	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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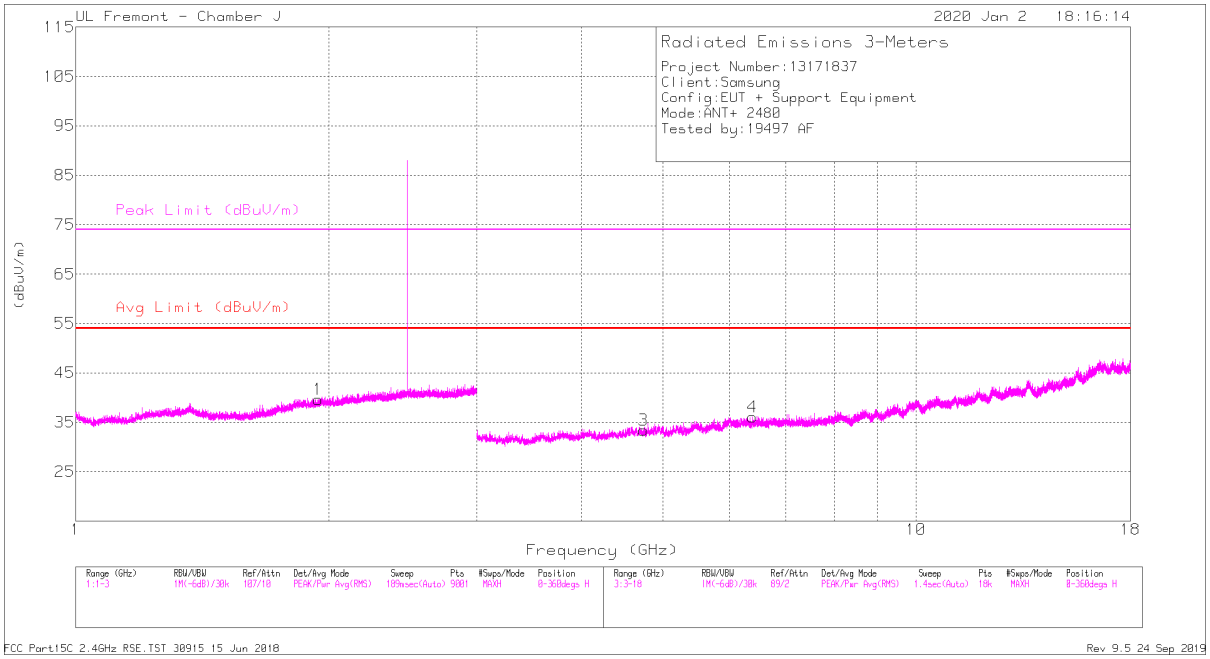
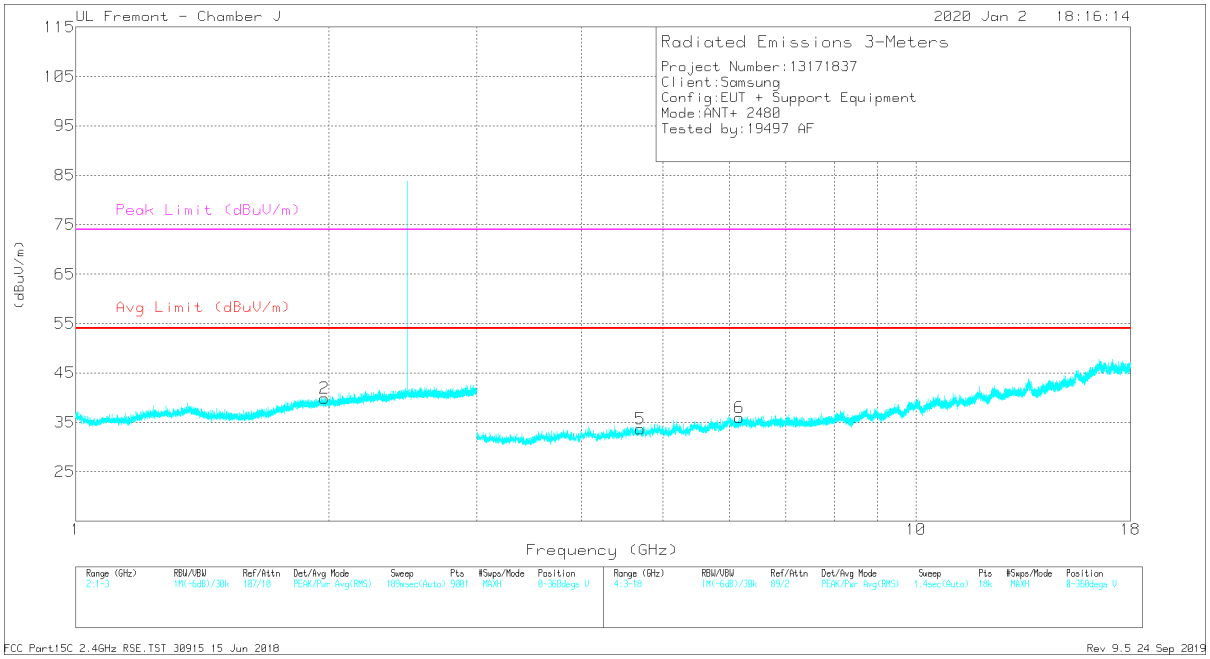
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	1.94432	42.09	PKFH	30.8	-25.7	47.19	-	-	-	-	152	301	H
2	1.97798	41.97	PKFH	31	-25.7	47.27	-	-	-	-	292	111	V
3	* 4.74153	38.25	PKFH	34.1	-30.6	41.75	-	-	74	-32.25	9	360	H
	* 4.74044	25.57	VA1T	34.1	-30.6	29.07	54	-24.93	-	-	9	360	H
4	6.3905	36.43	PKFH	35.5	-28.5	43.43	-	-	-	-	221	190	H
5	* 4.70041	38.73	PKFH	34.1	-30.7	42.13	-	-	74	-31.87	38	378	V
	* 4.69839	25.43	VA1T	34.1	-30.7	28.83	54	-25.17	-	-	38	378	V
6	6.16057	36.56	PKFH	35.7	-29	43.26	-	-	-	-	313	159	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PKFH FHSS/BT RB=100k for Frequencies<1GHz / RB=1MHz for Frequencies>1GHz, VB=3 x RB, Peak
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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9.2. FUNDAMENTAL FREQUENCY RADIATED EMISSION

Tested By:	19497 AF
Date:	01/02/2020

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (dB/m)	Amp/Cbl/Fltr/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	83.72	PKFH	31.9	-25.5	0	90.12	-	-	114	-23.88	81	400	H
	83.72	AVG	31.9	-25.5	-33.55	56.57	94	-37.43	-	-	81	400	H
	79.23	PKFH	31.9	-25.5	0	85.63	-	-	114	-28.37	66	102	V
	79.23	AVG	31.9	-25.5	-33.55	52.08	94	-41.92	-	-	66	102	V
2.441	83.51	PKFH	32.1	-25.5	0	90.11	-	-	114	-23.89	338	222	H
	83.51	AVG	32.1	-25.5	-33.55	56.56	94	-37.44	-	-	338	222	H
	80.87	PKFH	32.1	-25.5	0	87.47	-	-	114	-26.53	315	397	V
	80.87	AVG	32.1	-25.5	-33.55	53.92	94	-40.08	-	-	315	397	V
2.480	83.1	PKFH	32.4	-25.5	0	90.00	-	-	114	-24	103	294	H
	83.1	AVG	32.4	-25.5	-33.55	56.45	94	-37.55	-	-	103	294	H
	80.36	PKFH	32.4	-25.5	0	87.26	-	-	114	-26.74	60	376	V
	80.36	AVG	32.4	-25.5	-33.55	53.71	94	-40.29	-	-	60	376	V

PKFH - FHSS: RB=1MHz VB=3 x RB, Peak
AVG = Peak Reading + Duty Cycle Correction Factor
Duty Cycle Correction Factor = -33.55 dB

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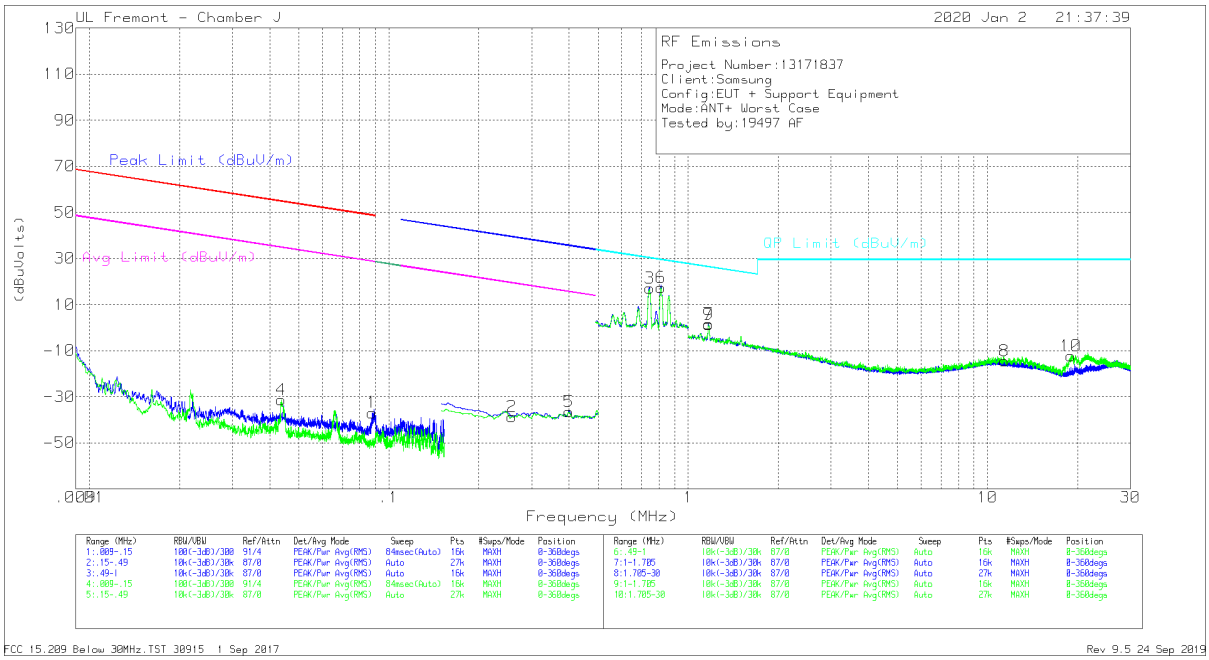
9.3. WORST CASE BELOW 30 MHz

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



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30 MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	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	.08802	16.12	Pk	55.6	-28.6	-80	-36.88	48.69	-85.57	28.69	-65.57	-	-	-	-	0-360
2	.25795	13.91	Pk	56.1	-28.6	-80	-38.59	-	-	-	-	39.38	-77.97	19.38	-57.97	0-360
4	.04367	20.22	Pk	57	-28.5	-80	-31.28	54.78	-86.06	34.78	-66.06	-	-	-	-	0-360
5	.39942	15.92	Pk	56	-28.5	-80	-36.58	-	-	-	-	35.58	-72.16	15.58	-52.16	0-360
1	.08802	16.12	Pk	55.6	-28.6	-80	-36.88	48.69	-85.57	28.69	-65.57	-	-	-	-	0-360

Pk - Peak detector

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Loop Antenna (ACF)	Cables w/ PRE0186650	Dist Corr 30m (dB) 40Log	Corrected Reading (dBuVolts)	QP Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
3	.74341	29.42	Pk	56.1	-28.5	-40	17.02	30.19	-13.17	0-360
6	.81107	29.71	Pk	56.1	-28.5	-40	17.31	29.44	-12.13	0-360
7	1.17068	24.14	Pk	45.9	-28.4	-40	1.64	26.26	-24.62	0-360
8	11.37909	19.28	Pk	34.4	-28	-40	-14.32	29.5	-43.82	0-360
9	1.17057	23.75	Pk	45.9	-28.4	-40	1.25	26.26	-25.01	0-360
10	18.96346	21.61	Pk	34	-27.8	-40	-12.19	29.5	-41.69	0-360
3	.74341	29.42	Pk	56.1	-28.5	-40	17.02	30.19	-13.17	0-360

Pk - Peak detector

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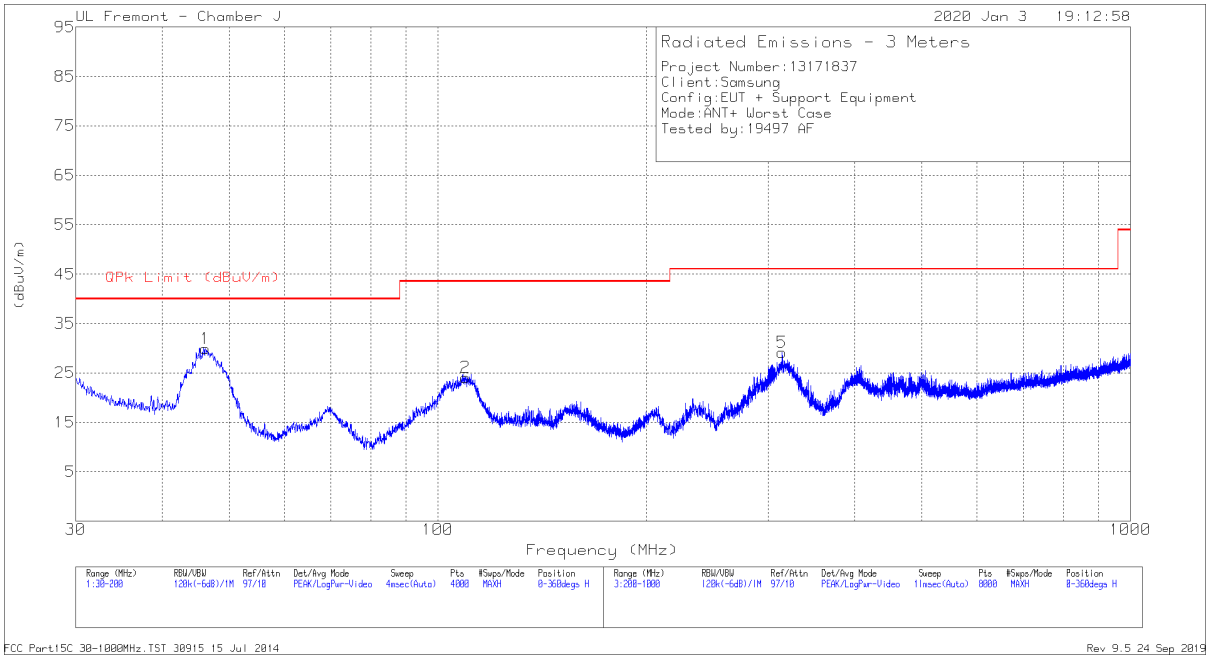
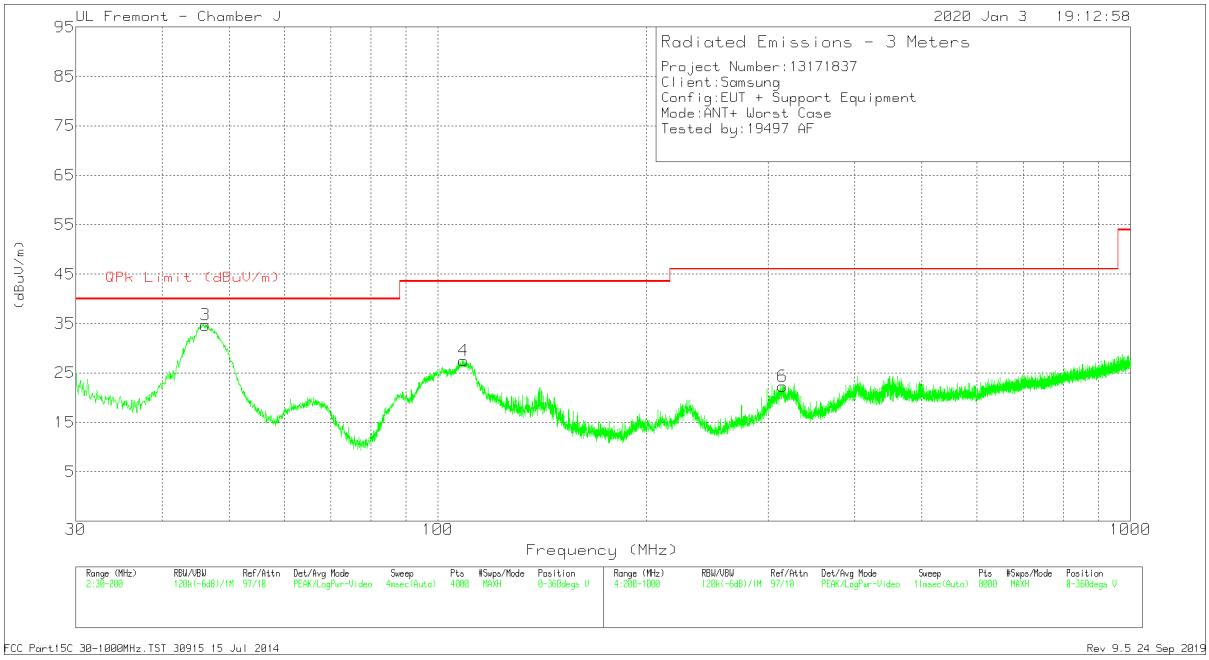
9.4. WORST CASE BELOW 1 GHz

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



HORIZONTAL



VERTICAL

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Below 1GHz 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	46.1967	45.76	Pk	15.6	-31.4	29.96	40	-10.04	0-360	399	H
2	* 109.5806	36.65	Pk	18.4	-31	24.05	43.52	-19.47	0-360	298	H
3	46.1622	44.52	Pk	15.6	-31.4	28.72	40	-11.28	328	391	V
	46.1622	41.46	Qp	15.6	-31.4	25.66	40	-14.34	328	391	V
4	* 108.8579	40.15	Pk	18.3	-31	27.45	43.52	-16.07	0-360	101	V
5	314.2148	39.42	Pk	19.7	-30	29.12	46.02	-16.9	0-360	101	H
6	314.7149	32.59	Pk	19.7	-30	22.29	46.02	-23.73	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector

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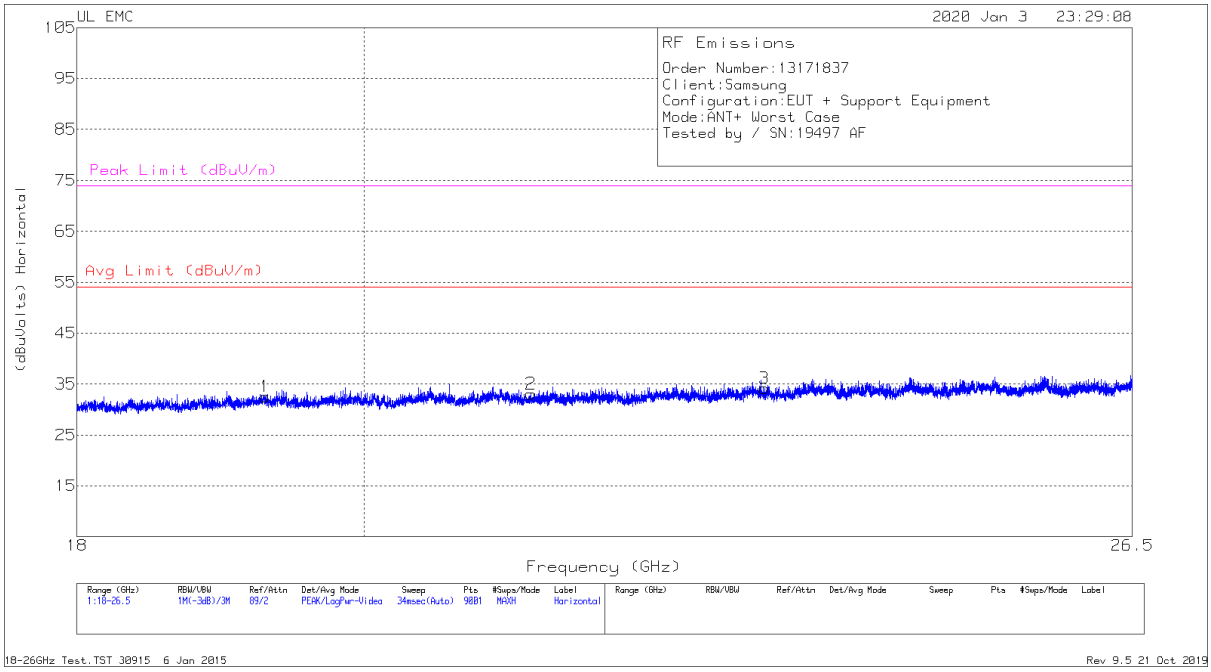
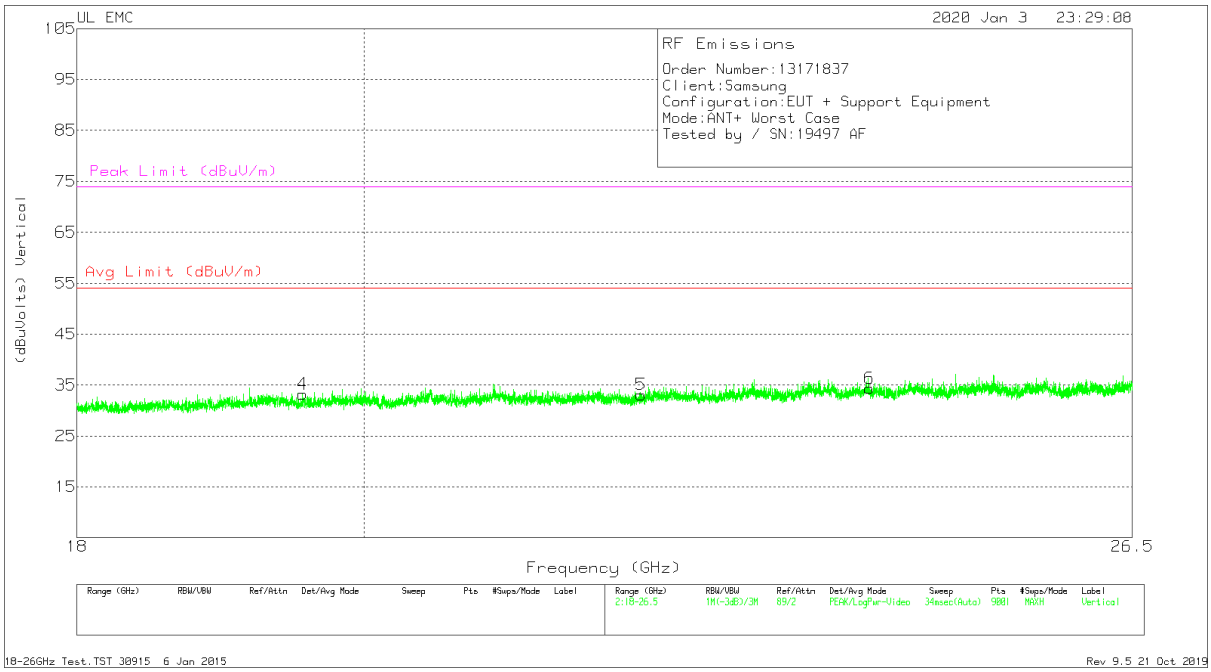
9.5. WORST CASE 18-26 GHz

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



HORIZONTAL



VERTICAL

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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T447 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	19.28539	66.53	Pk	32.7	-57.2	-9.5	32.53	54	-21.47	74	-41.47
2	21.25833	66.56	Pk	33.1	-57.1	-9.5	33.06	54	-20.94	74	-40.94
3	23.15666	67.46	Pk	33.8	-57.6	-9.5	34.16	54	-19.84	74	-39.84
4	19.55078	67	Pk	32.8	-57.1	-9.5	33.2	54	-20.8	74	-40.8
5	22.13383	66.68	Pk	33.5	-57.6	-9.5	33.08	54	-20.92	74	-40.92
6	24.06616	66.46	Pk	34.3	-56.9	-9.5	34.36	54	-19.64	74	-39.64

Pk - Peak detector

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10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)
ISED RSS-GEN, Section 8.8

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

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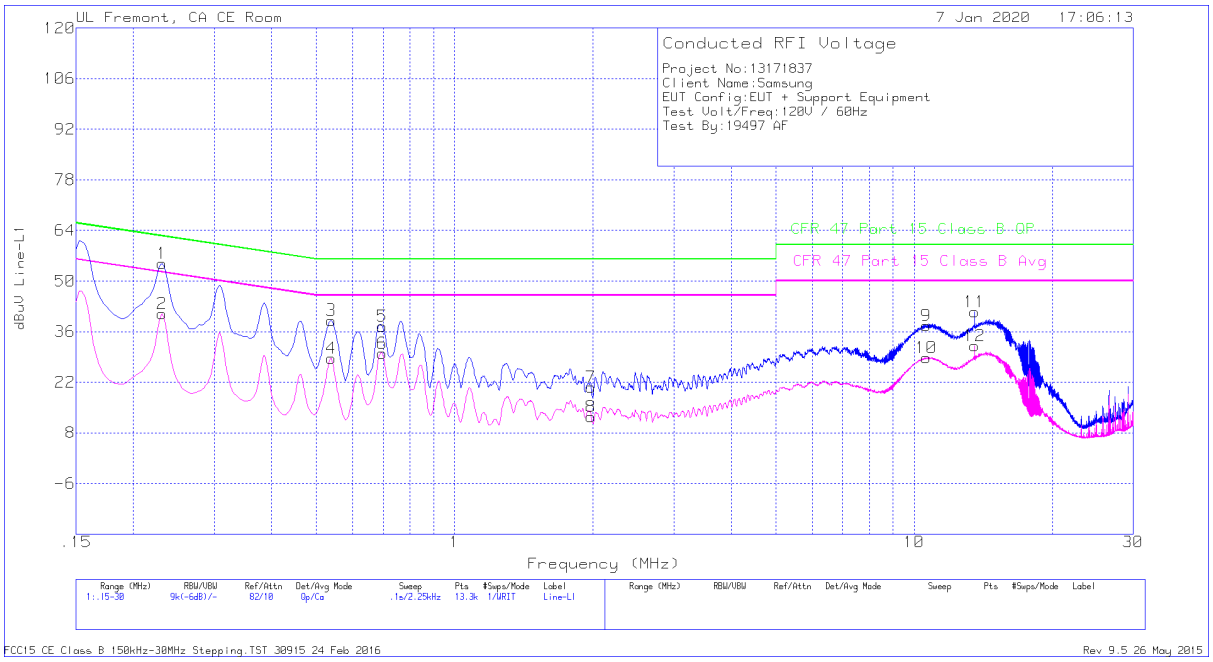
AC Power Line Norm

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	.231	44.7	Qp	0	0	10.1	54.8	62.41	-7.61	-	-
2	.231	30.82	Ca	0	0	10.1	40.92	-	-	52.41	-11.49
3	.53925	29.03	Qp	0	0	10.1	39.13	56	-16.87	-	-
4	.53925	18.58	Ca	0	0	10.1	28.68	-	-	46	-17.32
5	.69675	27.37	Qp	0	0	10.1	37.47	56	-18.53	-	-
6	.69675	19.9	Ca	0	0	10.1	30	-	-	46	-16
7	1.98375	10.43	Qp	0	.1	10.1	20.63	56	-35.37	-	-
8	1.98375	2.32	Ca	0	.1	10.1	12.52	-	-	46	-33.48
9	10.64175	27.22	Qp	0	.2	10.2	37.62	60	-22.38	-	-
10	10.62375	18.38	Ca	0	.2	10.2	28.78	-	-	50	-21.22
11	13.56	30.91	Qp	.1	.2	10.2	41.41	60	-18.59	-	-
12	13.56	21.53	Ca	.1	.2	10.2	32.03	-	-	50	-17.97

Qp - Quasi-Peak detector
Ca - CISPR average detection

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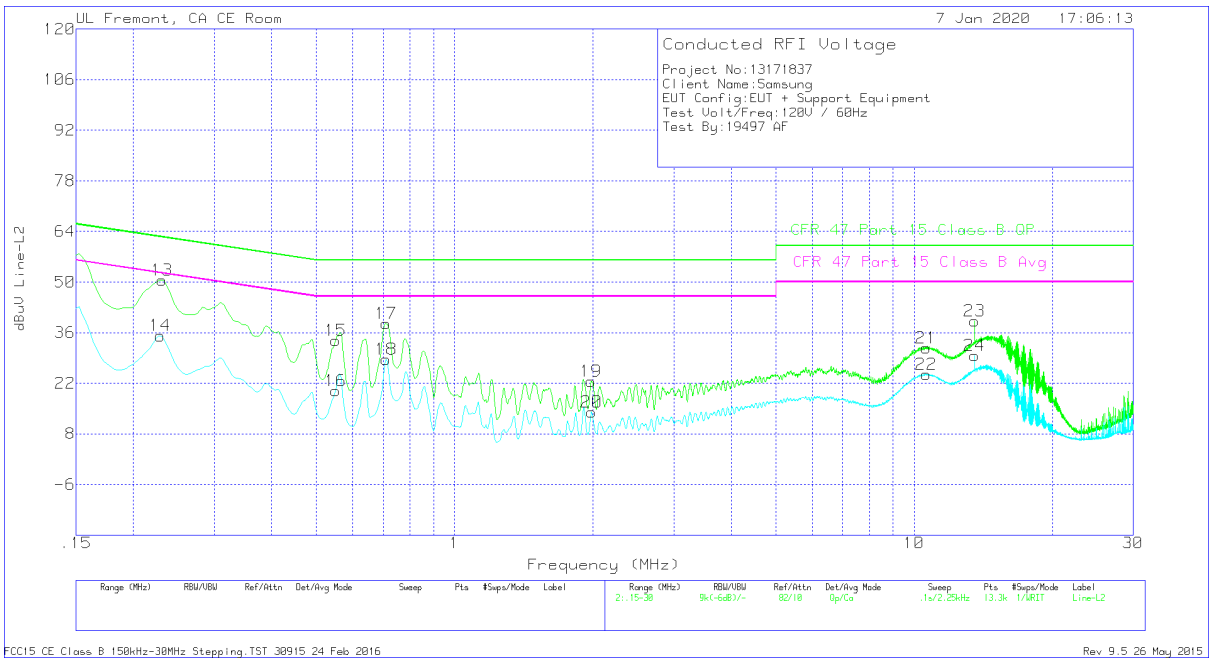
LINE 2 RESULTS



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	.231	40.45	Qp	0	0	10.1	50.55	62.41	-11.86	-	-
14	.22875	25.04	Ca	0	0	10.1	35.14	-	-	52.49	-17.35
15	.5505	23.72	Qp	0	0	10.1	33.82	56	-22.18	-	-
16	.5505	9.86	Ca	0	0	10.1	19.96	-	-	46	-26.04
17	.71025	28.44	Qp	0	0	10.1	38.54	56	-17.46	-	-
18	.71025	18.48	Ca	0	0	10.1	28.58	-	-	46	-17.42
19	1.9815	12.39	Qp	0	.1	10.1	22.59	56	-33.41	-	-
20	1.986	3.89	Ca	0	.1	10.1	14.09	-	-	46	-31.91
21	10.64175	21.38	Qp	0	.2	10.2	31.78	60	-28.22	-	-
22	10.64175	13.98	Ca	0	.2	10.2	24.38	-	-	50	-25.62
23	13.56	28.8	Qp	.1	.2	10.2	39.3	60	-20.7	-	-
24	13.56	19.16	Ca	.1	.2	10.2	29.66	-	-	50	-20.34

Qp - Quasi-Peak detector
Ca - CISPR average detection

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