TEST REPORT

Report Number. : 13094578-E3V2

Applicant	:	Samsung Electronics Co., Ltd. 129 Samsung-Ro, Yeongtong-Gu, Suwon-Si, Gyeonggi-Do, 16677, Korea
Model	:	SM-N770F and SM-N770F/DS
FCC ID	:	A3LSMN770F
EUT Description	:	GSM/WCDMA/LTE Phablet with BT, DTS/UNII a/b/g/n/ac, NFC, ANT+ and WPT
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C

Date Of Issue:
November 26, 2019

Prepared by:
UL Verification Services Inc.
47173 Benicia Street
Fremont, CA 94538 U.S.A.
TEL: (510) 319-4000
FAX: (510) 661-0888

NVLAP Lab code: 200065-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	11/19/2019	Initial Issue	
V2	11/26/2019	Updated Section 1, 2, 5, and 6	Steven Tran

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47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

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UL VERIFICATION SERVICES INC.
47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

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47173 Benicia Street, Fremont, CA 94538; USA TEL:(510) 319-4000 FAX:(510) 661-0888

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-N770F and SM-N770F/DS
SERIAL NUMBER:	Conducted: R38MA039RER Radiated: R38MA039SFP
DATE TESTED:	OCTOBER 29 – NOVEMBER 7, 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.

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Approved & Released For
UL Verification Services Inc. By:

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

Prepared By:

Glenn Escano
Test Engineer
Consumer Technology Division
UL Verification Services Inc.

Reviewed By:

Steven Tran
Project Engineer
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, ANSI C63.10-2013, KDB 414788 D01 Radiated Test Site v01r01 , and KDB 558074 D01 15.247 Meas Guidance v05r02.

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	☐ Chamber M

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	3.84 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.65 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/WCDMA/LTE Phablet with BT, DTS/UNII a/b/g/n/ac, NFC, ANT+ and WPT. The model SM-N770F was used for final testing and is representative of the test results in this report.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE (1Mbps)	4.38	2.74
2402 - 2480	BLE (2Mbps)	6.47	4.44

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an internal antenna, with a maximum gain of -5.1 dBi.

5.4. SOFTWARE

The test utility software used during testing was N770F.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 Y orientation.

Worst-case data rates as provided by the client were 1Mbps and 2Mbps.

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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-TA800	R37M3531XX1SE3	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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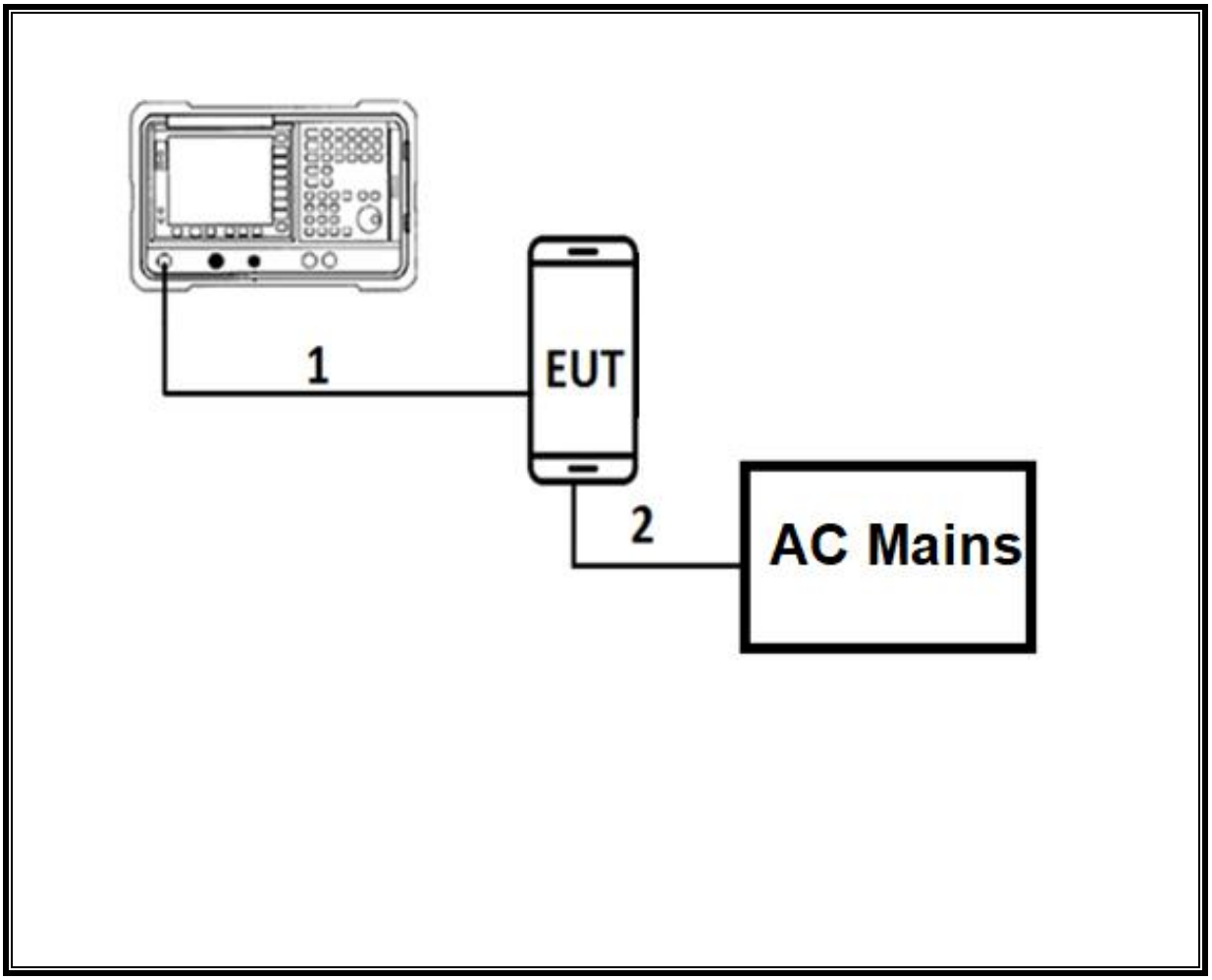
CONDUCTED TEST SETUP DIAGRAM



TEST SETUP

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

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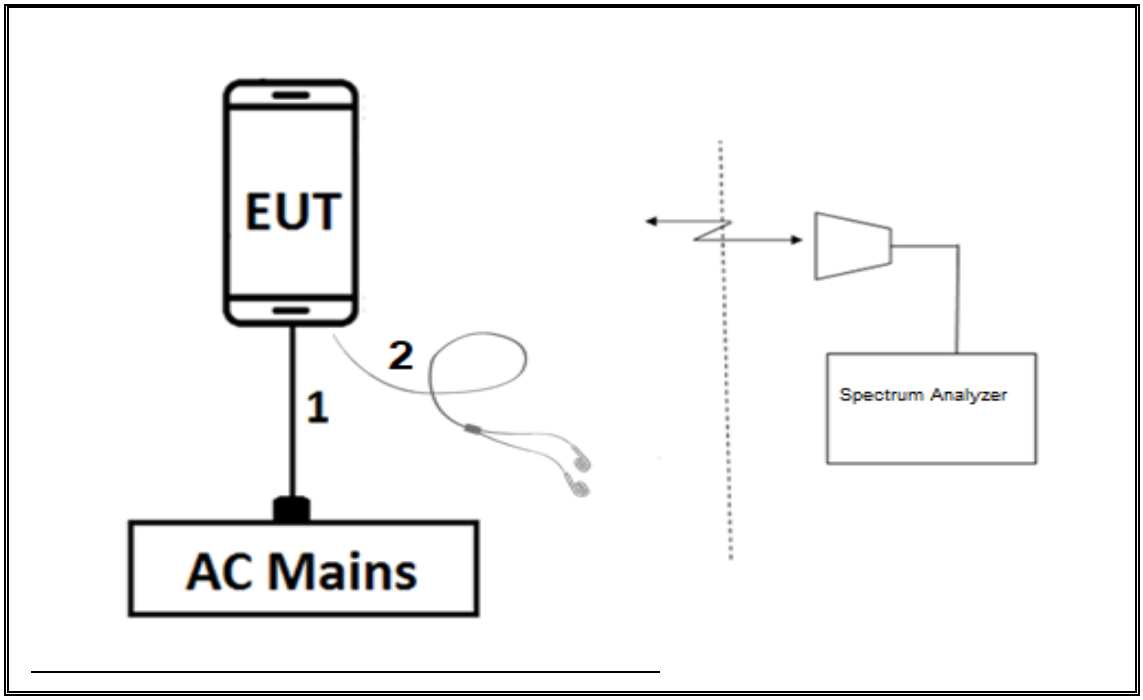
RADIATED AND AC LINE CONDUCTED EMISSIONS SETUP DIAGRAM



TEST SETUP

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

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6. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW ≥ DTS BW

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

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Radiated emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

Band-edge: ANSI C63.10 Subclause - 6.10

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2.

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

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7. 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	EMC4249 / PRE0100034	06/14/2020
Amplifier, 1 to 18GHz	Amplical	AMP1G18-35	T1569	05/04/2020
Antenna, Broadband Hybrid, 30MHz to 3GHz	Sunol Sciences	JB3	PRE0181574	10/14/2020
Amplifier, 9KHz to 1GHz, 32dB	SONOMA INSTRUMENT	310	PRE175953	12/13/2019
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight	E4446A	T146	01/28/2020
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
EMI Test Receiver	Rohde & Schwarz	ESW44	PRE0179372	02/16/2020
Filter, HPF 3.0GHz	MICRO-TRONICS	HPM17543	T897	05/04/2020
Power Meter, P-series single channel	Agilent (Keysight) Technologies	N1911A	T229	01/31/2020
Power Sensor, P-series, 50MHz to 18GHz, Wideband	Agilent (Keysight) Technologies	N1921A	T1226	02/06/2020
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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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

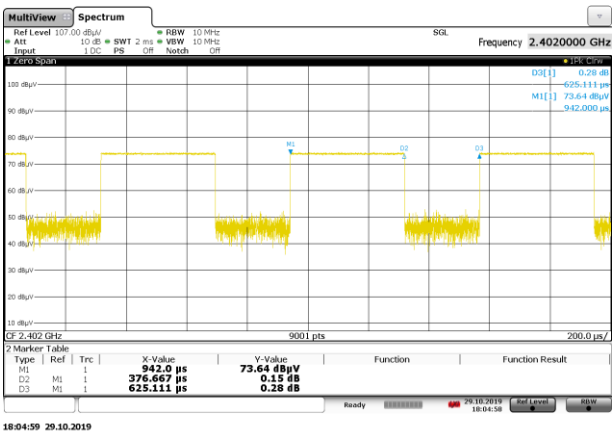
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE (1Mbps)	0.3767	0.6251	0.603	60.26%	2.20	2.655
BLE (2Mbps)	0.1898	0.6256	0.303	30.34%	5.18	5.269

DUTY CYCLE PLOTS



BLE (1Mbps)

BLE (2Mbps)

Tested By:	19480 BS
Date:	10/29/2019

8.2. 6 dB BANDWIDTH

LIMITS

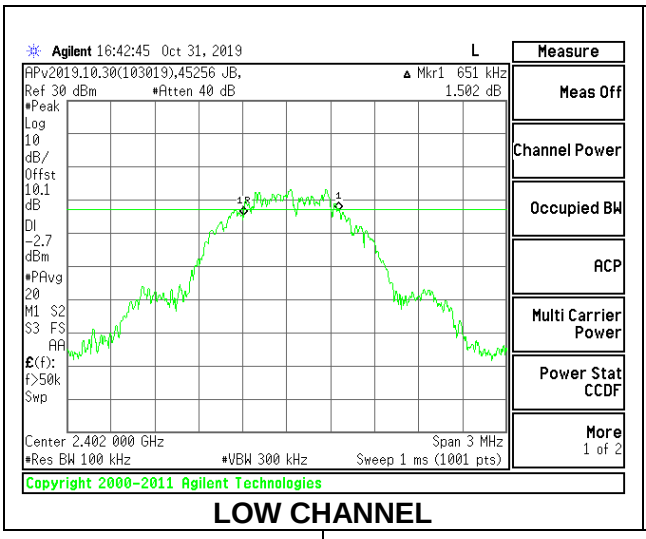
FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

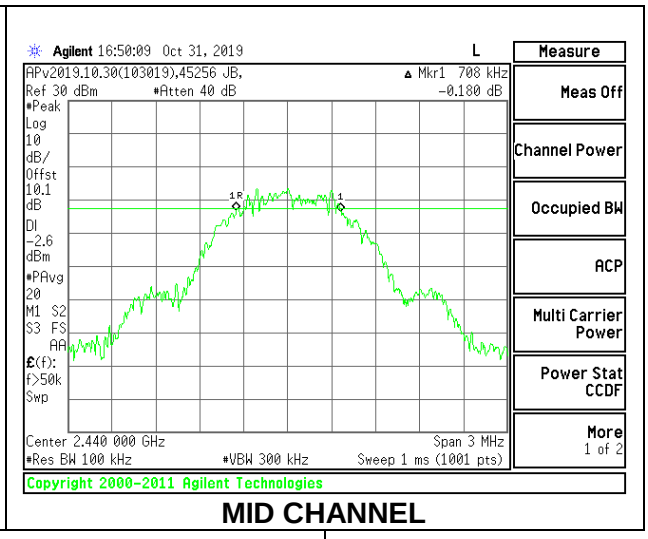
RESULTS

8.2.1. BLE (1Mbps)

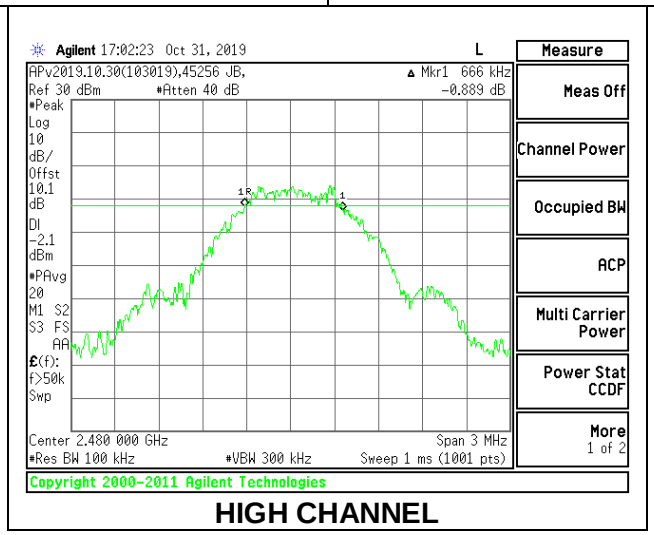
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.651	0.5
Middle	2440	0.708	0.5
High	2480	0.666	0.5



LOW CHANNEL



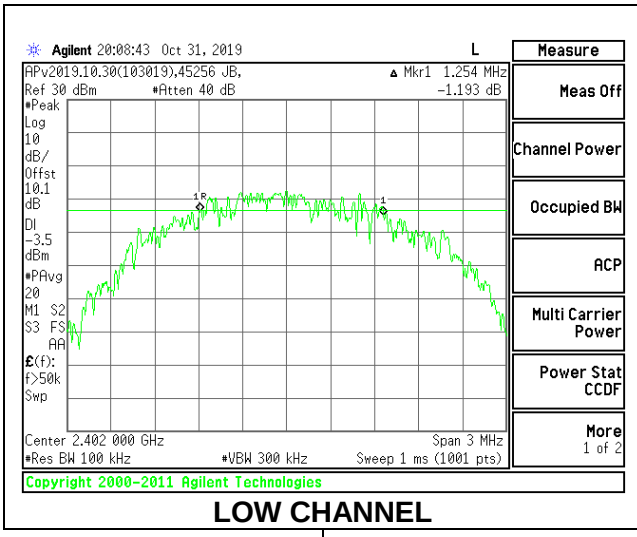
MID CHANNEL



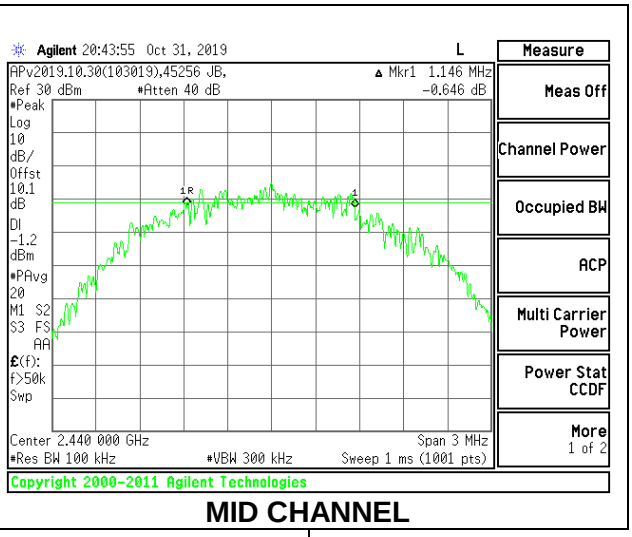
HIGH CHANNEL

8.2.2. BLE (2Mbps)

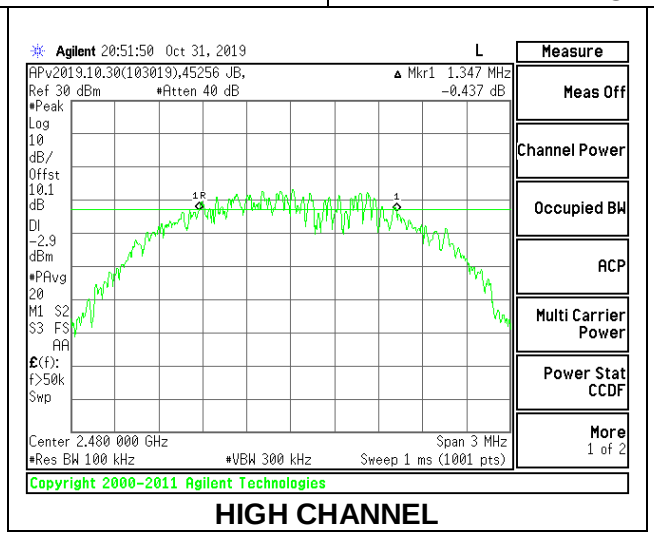
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.254	0.5
Middle	2440	1.146	0.5
High	2480	1.347	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

8.3. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter. The cable assembly insertion loss was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

8.3.1. BLE (1Mbps)

Tested By:	19480 BS
Date:	10/30/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	3.81	30	-26.19
Middle	2440	3.97	30	-26.03
High	2480	4.38	30	-25.62

8.3.2. BLE (2Mbps)

Tested By:	19480 BS
Date:	10/30/2019

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.82	30	-24.18
Middle	2440	6.09	30	-23.91
High	2480	6.47	30	-23.53

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8.4. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter. The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

8.4.1. BLE (1Mbps)

Tested By:	19480 BS
Date:	10/30/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	3.5
Middle	2440	3.65
High	2480	4.09

8.4.2. BLE (2Mbps)

Tested By:	19480 BS
Date:	10/30/2019

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	5.21
Middle	2440	5.5
High	2480	5.86

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8.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

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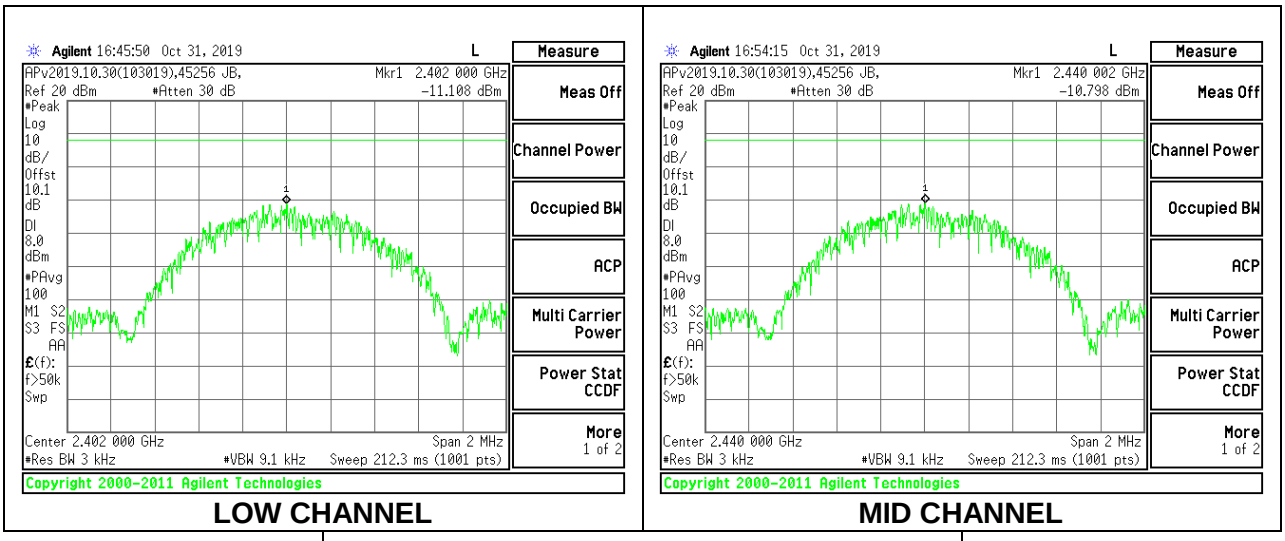
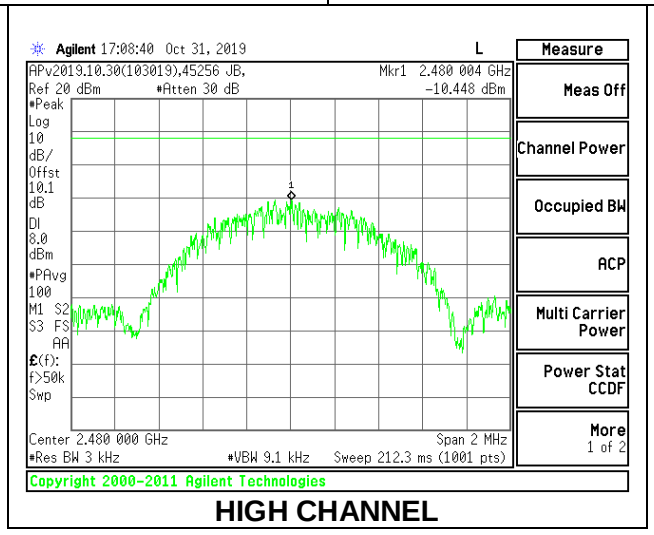
8.5.1. BLE (1Mbps)

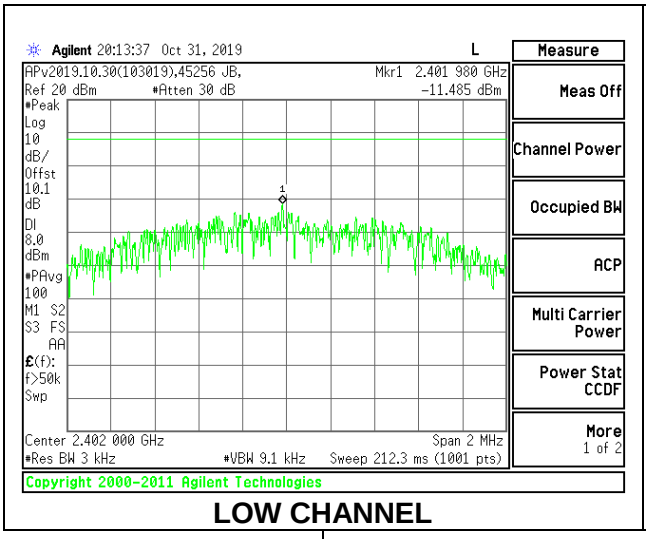
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-11.108	8	-19.11
Middle	2440	-10.798	8	-18.80
High	2480	-10.448	8	-18.45



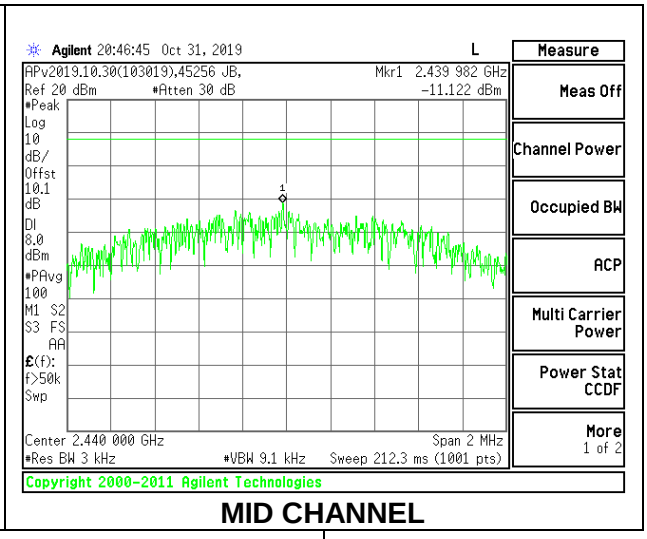


8.5.2. BLE (2Mbps)

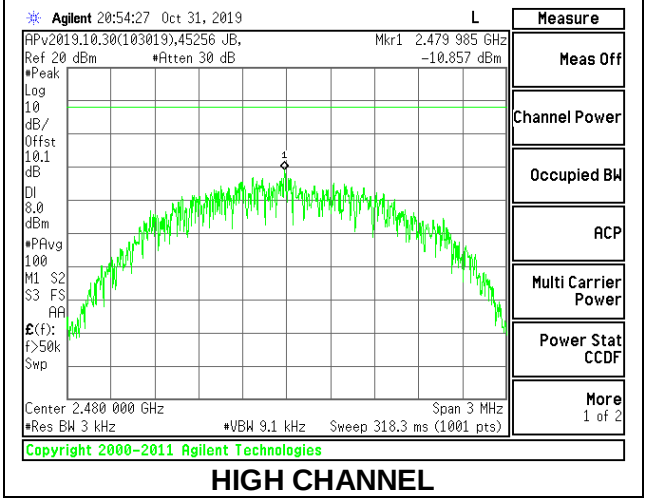
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-11.485	8	-19.49
Middle	2440	-11.122	8	-19.12
High	2480	-10.857	8	-18.86



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

8.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

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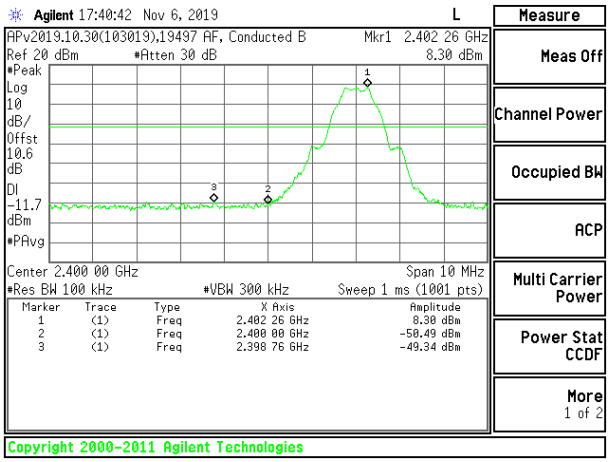
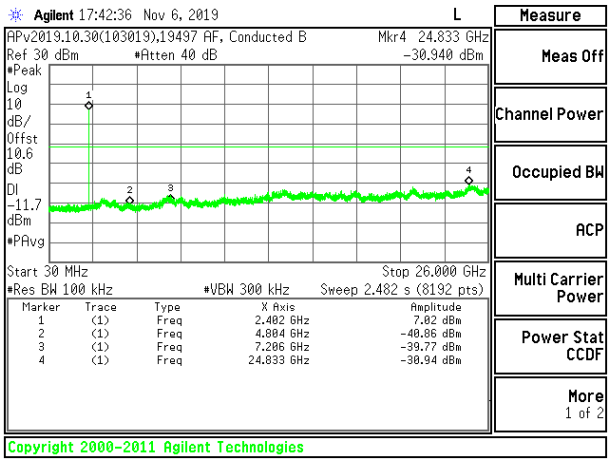
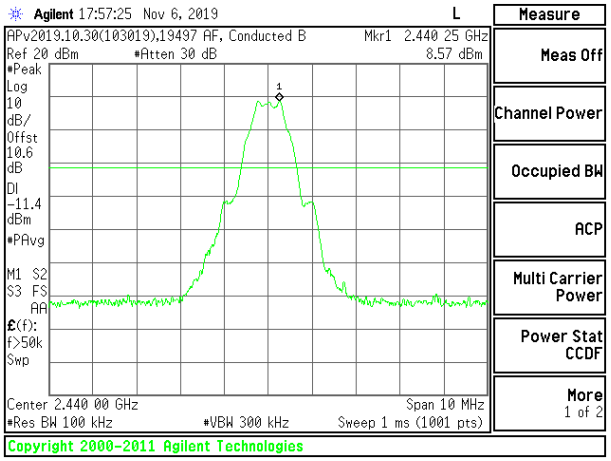
8.6.1. BLE (1Mbps)



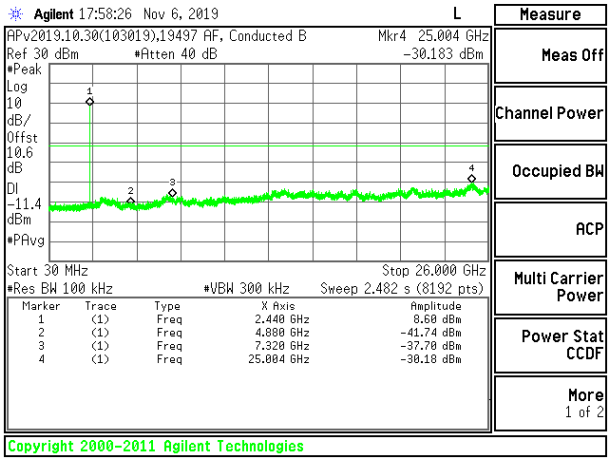
LOW CHANNEL BANDEDGE



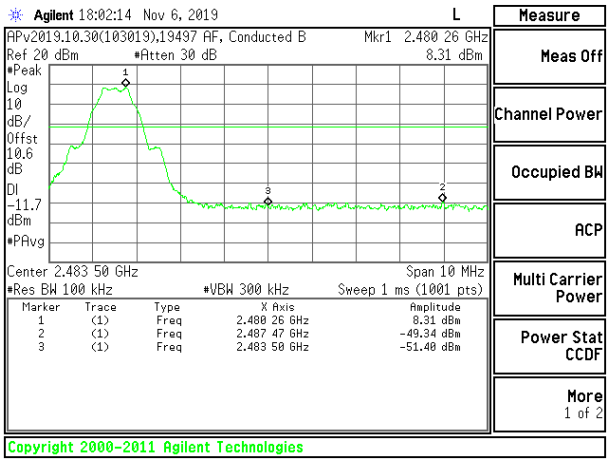
OUT-OF-BAND LOW CHANNEL



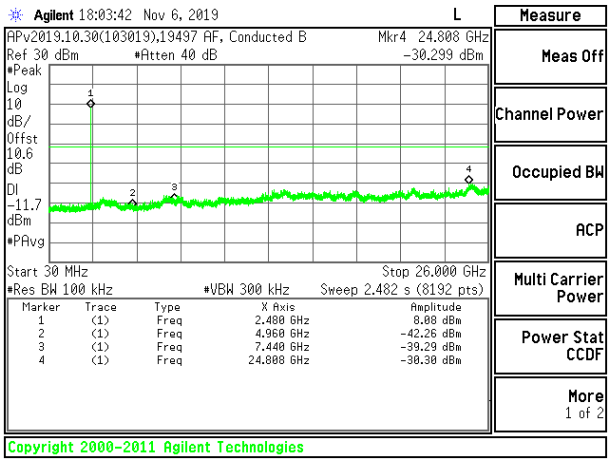
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL

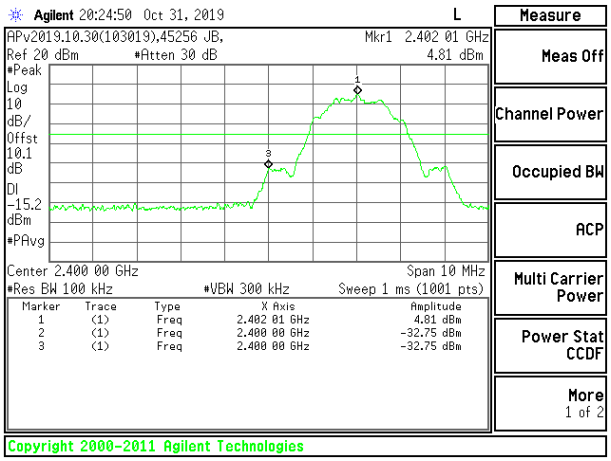


HIGH CHANNEL BANDEDGE

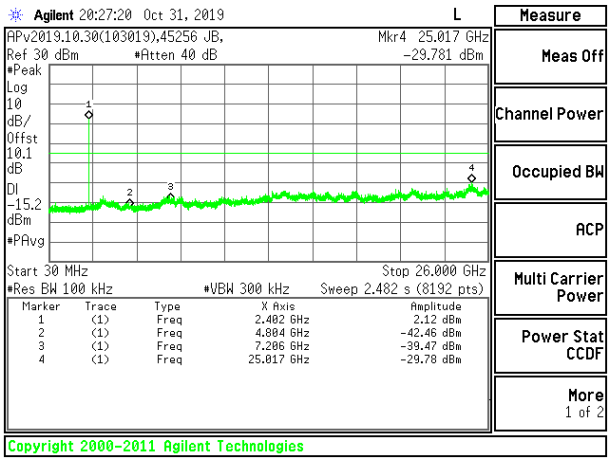


OUT-OF-BAND HIGH CHANNEL

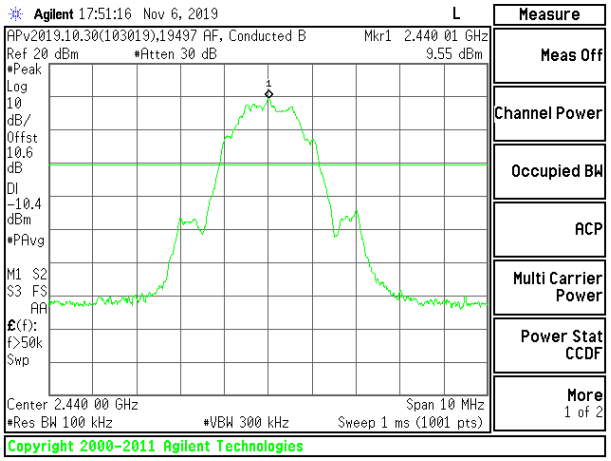
8.6.2. BLE (2Mbps)



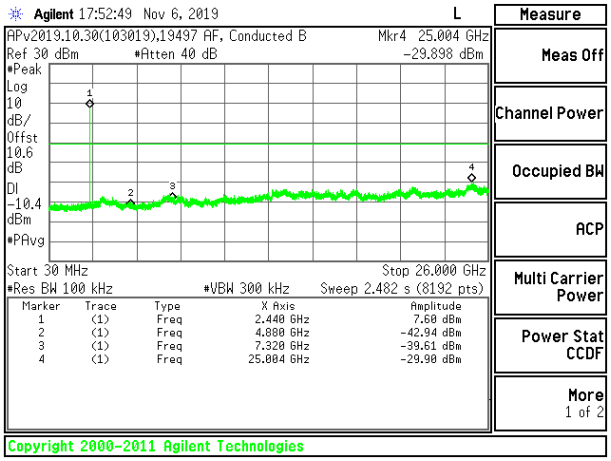
LOW CHANNEL BANDEDGE



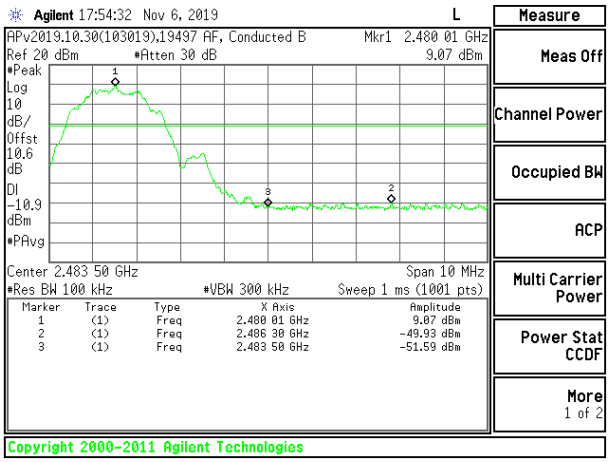
OUT-OF-BAND LOW CHANNEL



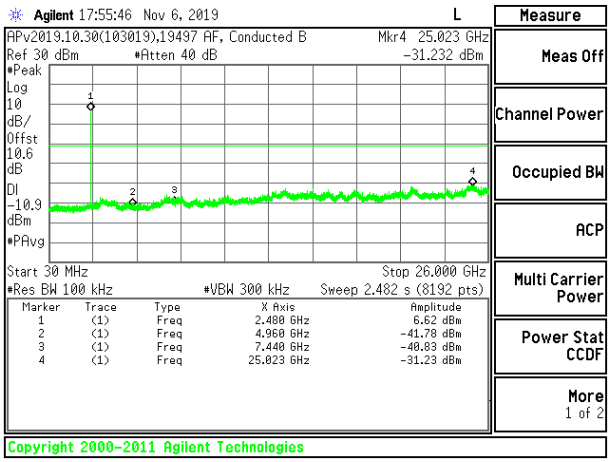
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

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 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 as applicable 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.

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KDB 414788 Open Field Site(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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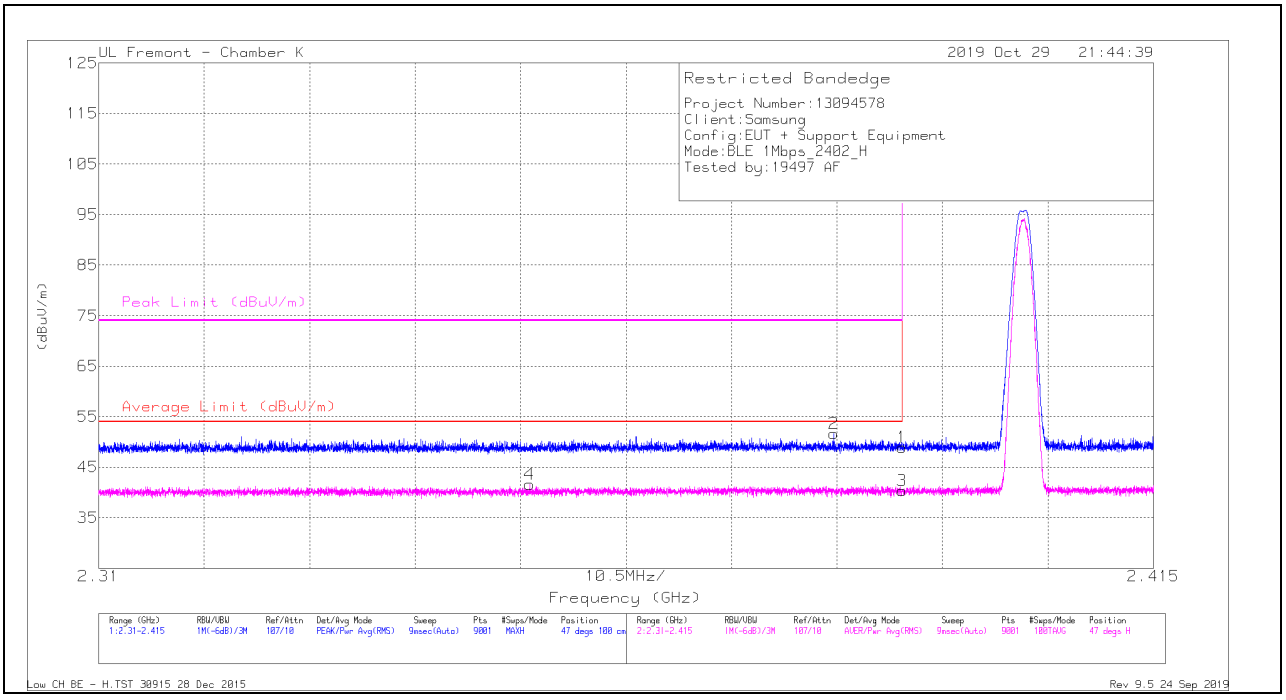
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

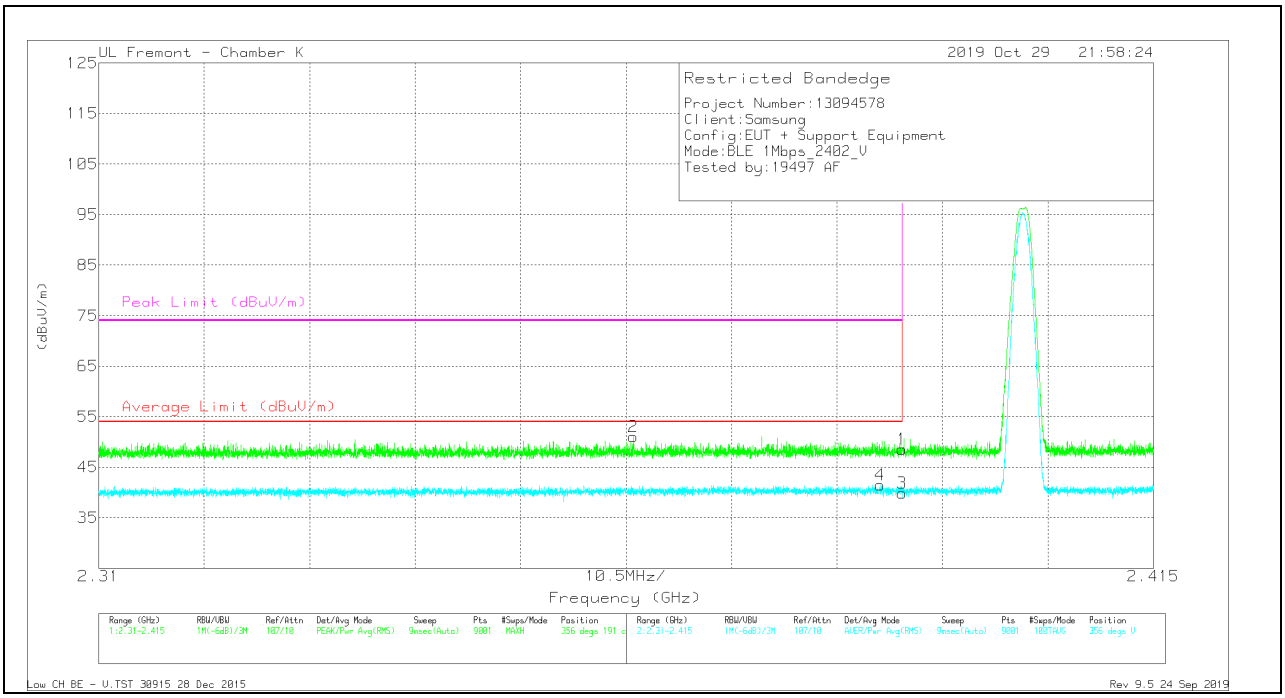


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	41.73	Pk	31.9	-24.7	0	48.93	-	-	74	-25.07	47	100	H
2	* 2.38315	44.51	Pk	31.9	-24.7	0	51.71	-	-	74	-22.29	47	100	H
3	* 2.38999	30.91	RMS	31.9	-24.7	2.2	40.31	54	-13.69	-	-	47	100	H
4	* 2.35289	32.4	RMS	31.7	-24.7	2.2	41.6	54	-12.4	-	-	47	100	H

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

VERTICAL RESULT



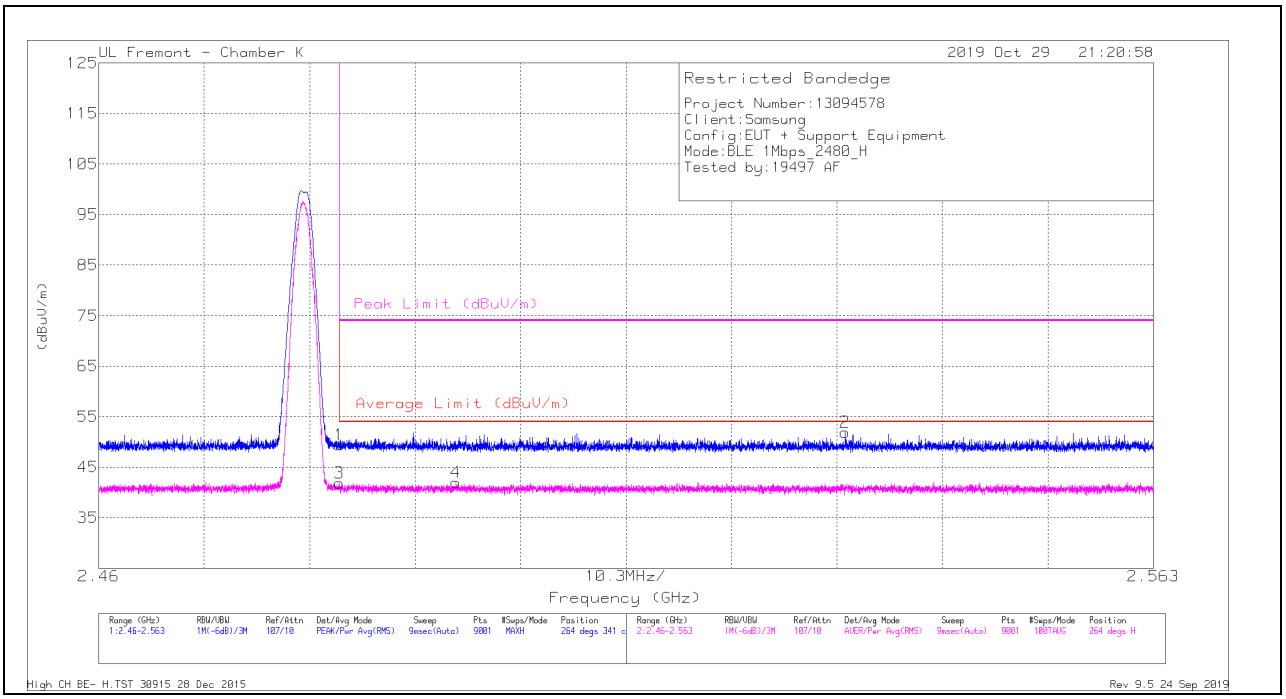
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	41.39	Pk	31.9	-24.7	0	48.59	-	-	74	-25.41	356	191	V
2	* 2.36322	43.87	Pk	31.8	-24.6	0	51.07	-	-	74	-22.93	356	191	V
3	* 2.38999	30.41	RMS	31.9	-24.7	2.2	39.81	54	-14.19	-	-	356	191	V
4	* 2.38778	31.95	RMS	31.9	-24.6	2.2	41.45	54	-12.55	-	-	356	191	V

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

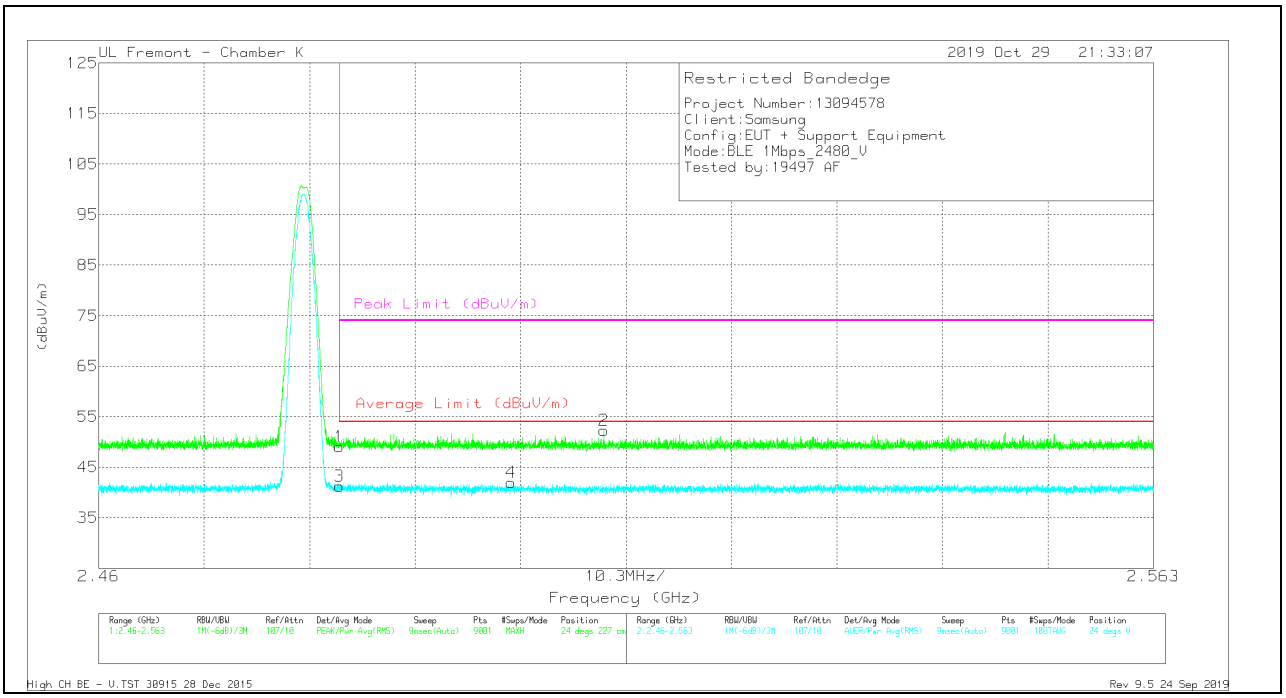


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	41.76	Pk	32.5	-24.8	0	49.46	-	-	74	-24.54	264	341	H
2	2.5329	44.22	Pk	32.4	-24.7	0	51.92	-	-	74	-22.08	264	341	H
3	* 2.48351	31.96	RMS	32.5	-24.8	2.2	41.86	54	-12.14	-	-	264	341	H
4	* 2.4949	32.2	RMS	32.4	-24.8	2.2	42	54	-12	-	-	264	341	H

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

VERTICAL RESULT



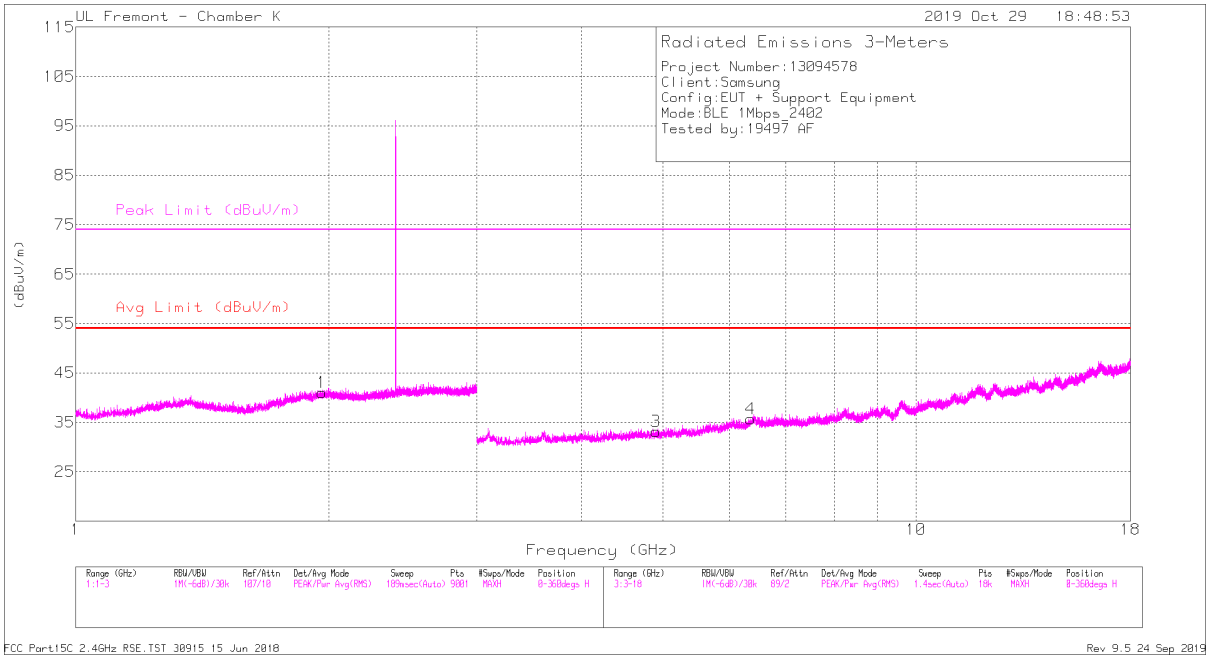
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	41.4	Pk	32.5	-24.8	0	49.1	-	-	74	-24.9	24	227	V
2	2.50931	44.73	Pk	32.3	-24.8	0	52.23	-	-	74	-21.77	24	227	V
3	* 2.48351	31.3	RMS	32.5	-24.8	2.2	41.2	54	-12.8	-	-	24	227	V
4	2.50028	32.12	RMS	32.4	-24.7	2.2	42.02	54	-11.98	-	-	24	227	V

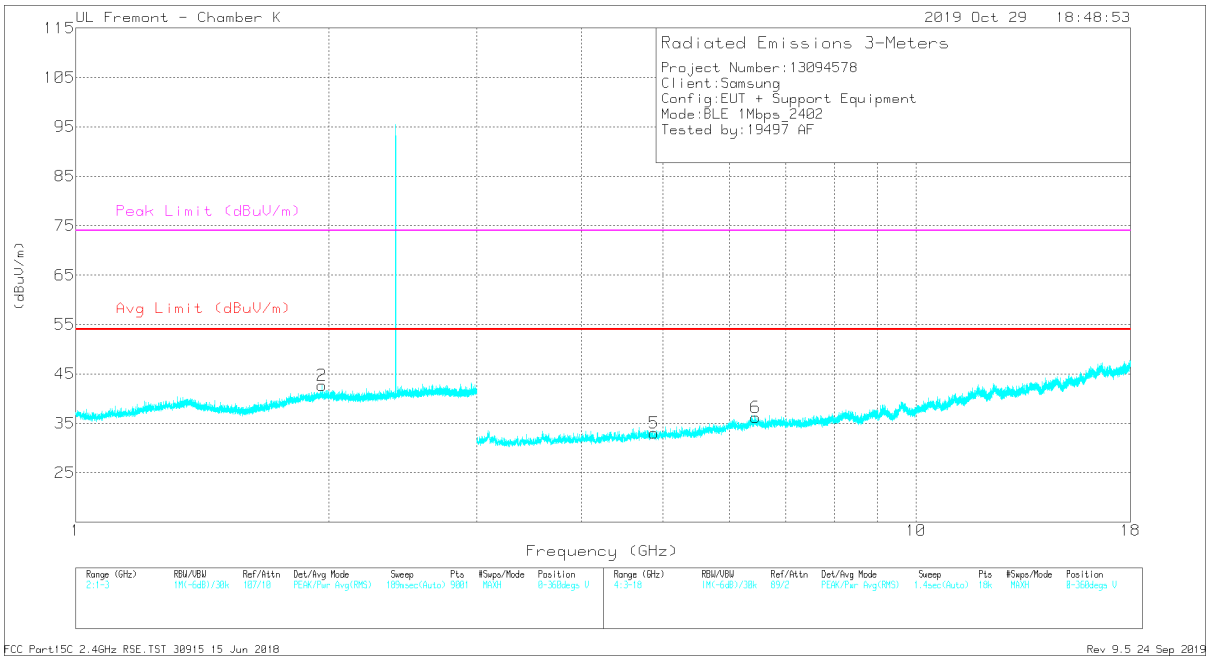
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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
1	1.96533	41.69	PK2	31.5	-24.4	0	48.79	-	-	-	-	180	367	H
2	1.96502	41.93	PK2	31.6	-24.4	0	49.13	-	-	-	-	309	298	V
3	* 4.90075	37.16	PK2	34.1	-30.5	0	40.76	-	-	74	-33.24	213	205	H
	* 4.90038	27.39	MAv1	34.1	-30.5	2.2	33.19	54	-20.81	-	-	213	205	H
4	6.35667	34.8	PK2	35.8	-27.1	0	43.5	-	-	-	-	145	318	H
5	* 4.88105	37.18	PK2	34.1	-30.5	0	40.78	-	-	74	-33.22	46	223	V
	* 4.8821	26.56	MAv1	34.1	-30.5	2.2	32.36	54	-21.64	-	-	46	223	V
6	6.44577	34.61	PK2	35.8	-26.3	0	44.11	-	-	-	-	332	382	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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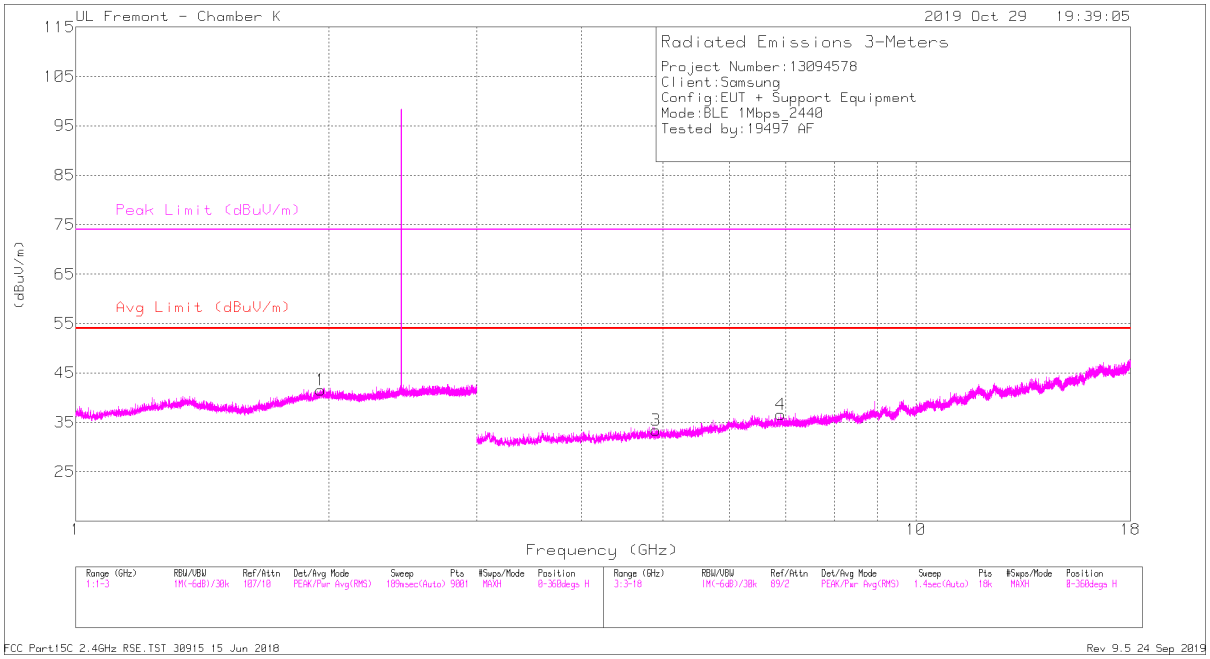
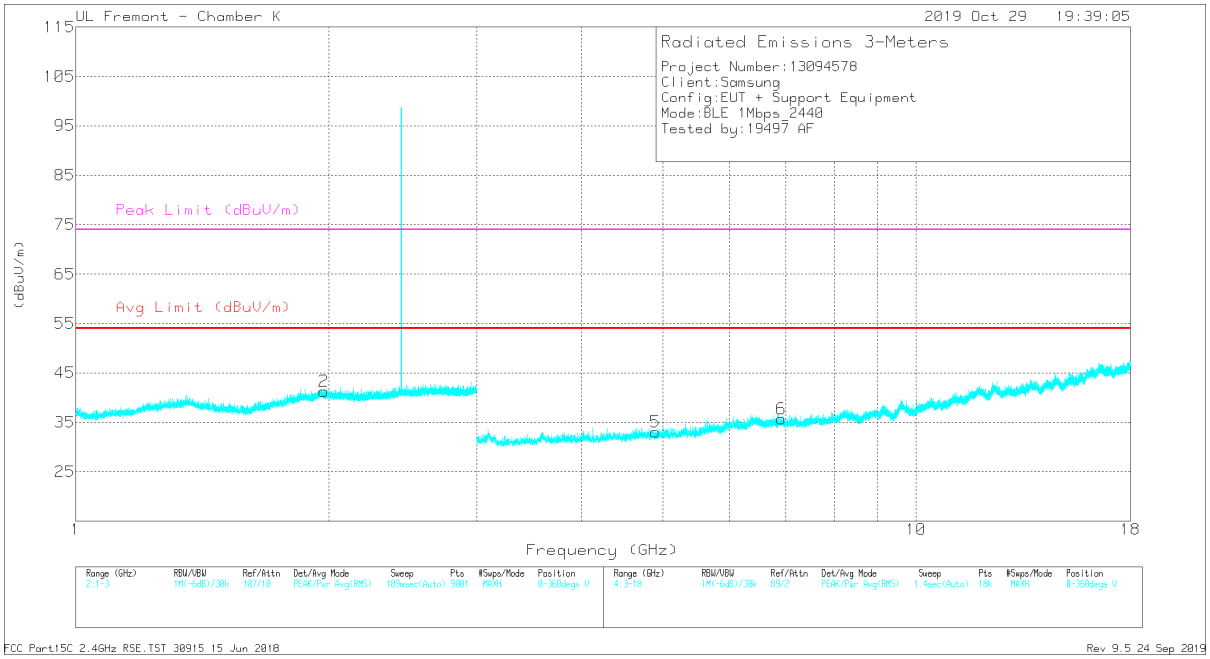
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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
1	1.95731	41.82	PK2	31.5	-24.2	0	49.12	-	-	-	-	191	267	H
2	1.97466	41.42	PK2	31.6	-24.4	0	48.62	-	-	-	-	266	222	V
3	* 4.90103	38.12	PK2	34.1	-30.5	0	41.72	-	-	74	-32.28	238	148	H
	* 4.89978	27.46	MAv1	34.1	-30.5	2.2	33.26	54	-20.74	-	-	238	148	H
4	6.89934	34.6	PK2	35.8	-26.4	0	44	-	-	-	-	246	187	H
5	* 4.89467	37.15	PK2	34.1	-30.5	0	40.75	-	-	74	-33.25	121	180	V
	* 4.8948	27.48	MAv1	34.1	-30.5	2.2	33.28	54	-20.72	-	-	121	180	V
6	6.91853	34.48	PK2	35.7	-26.5	0	43.68	-	-	-	-	186	277	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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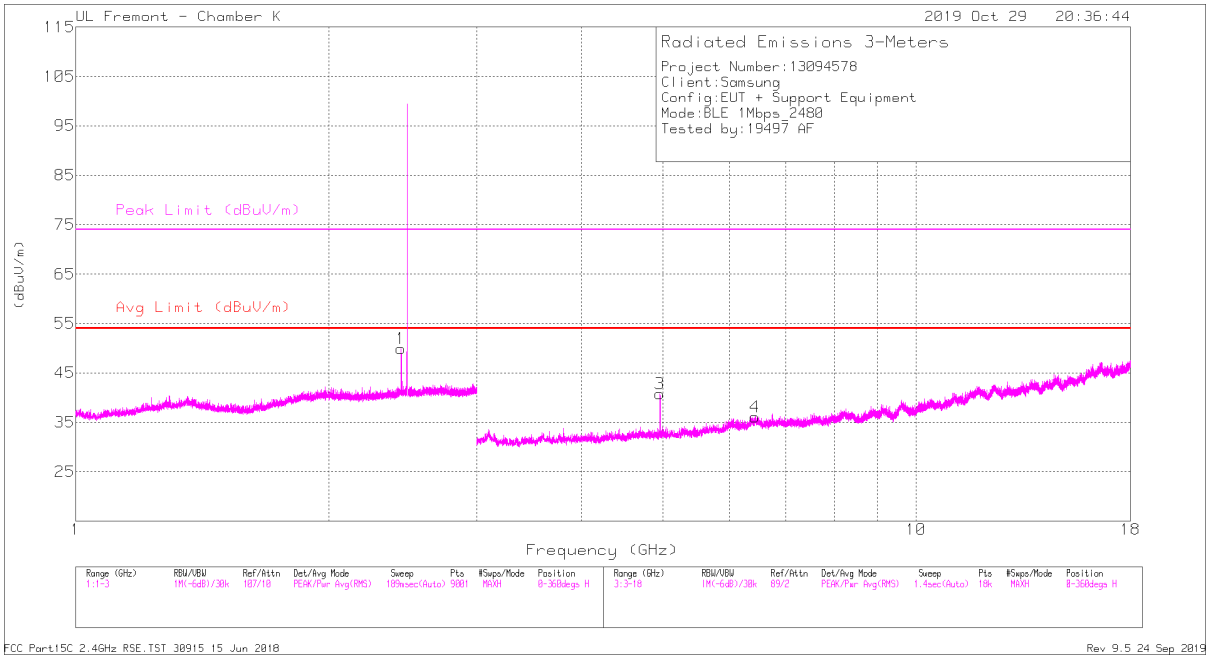
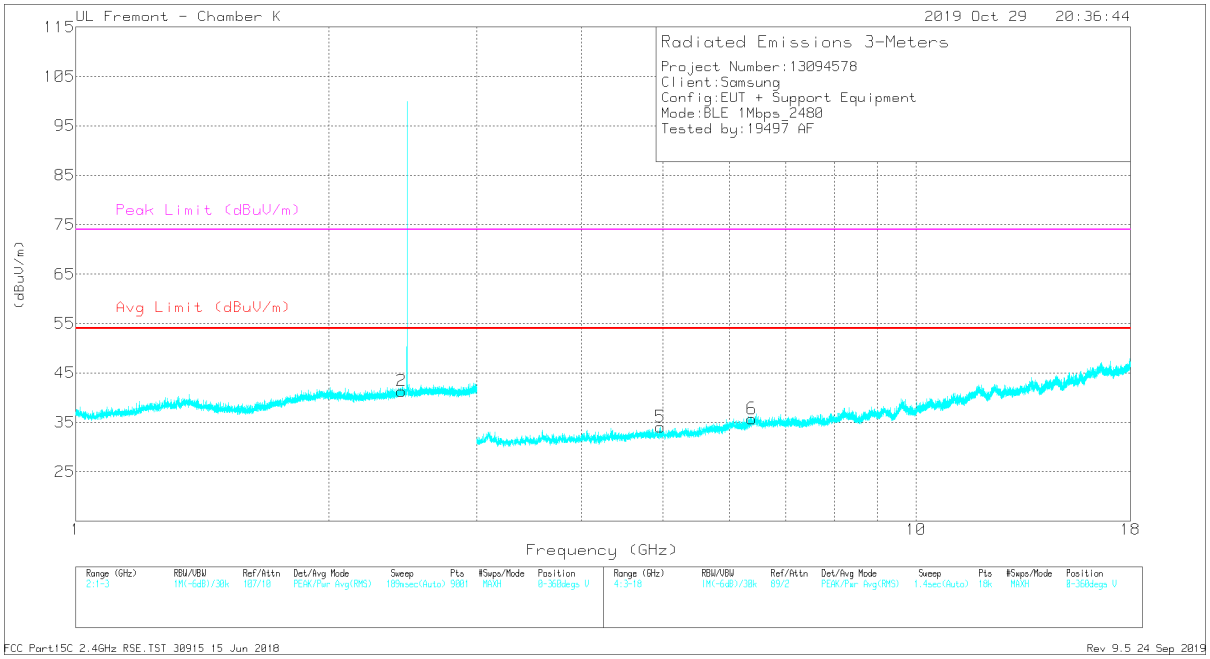
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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
1	2.44085	42.09	PK2	32.3	-24.7	0	49.69	-	-	-	-	89	102	H
2	2.43978	86.98	PK2	32.3	-24.7	0	94.58	-	-	-	-	0	296	V
3	* 4.95959	40.63	PK2	34.1	-30.6	0	44.13	-	-	74	-29.87	312	191	H
	* 4.95959	28.54	MAv1	34.1	-30.6	2.2	34.24	54	-19.76	-	-	312	191	H
4	6.43249	34.48	PK2	35.8	-26.3	0	43.98	-	-	-	-	79	291	H
5	* 4.96062	40.01	PK2	34.1	-30.6	0	43.51	-	-	74	-30.49	259	127	V
	* 4.95848	27.73	MAv1	34.1	-30.6	2.2	33.43	54	-20.57	-	-	259	127	V
6	6.37674	34.43	PK2	35.8	-26.8	0	43.43	-	-	-	-	35	322	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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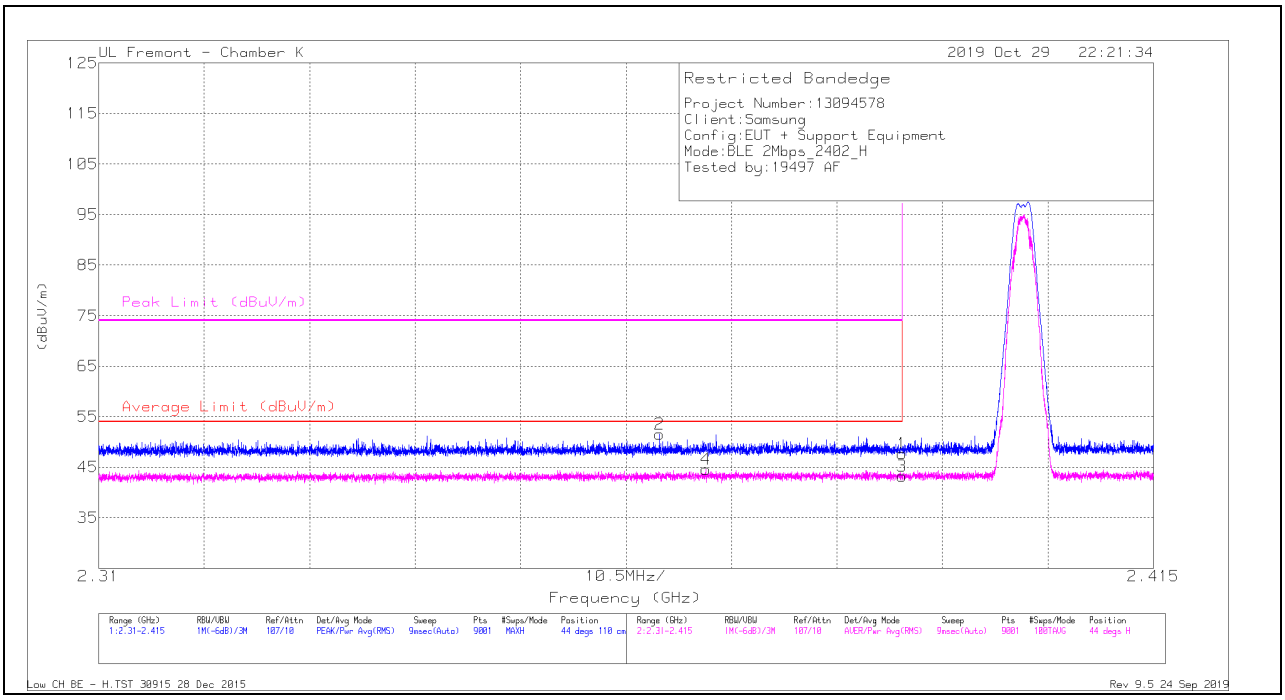
9.2.2. BLE (2Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT

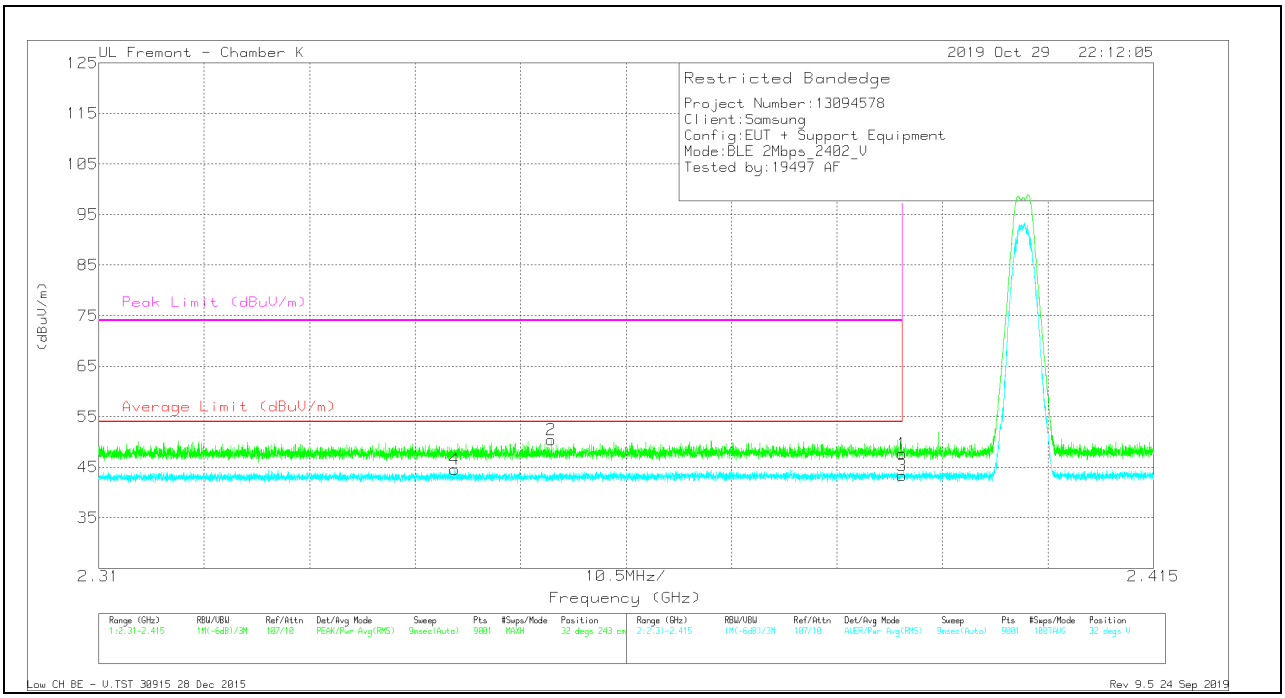


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	40.52	Pk	31.9	-24.7	0	47.72	-	-	74	-26.28	44	110	H
2	* 2.36585	44.29	Pk	31.8	-24.6	0	51.49	-	-	74	-22.51	44	110	H
3	* 2.38999	30.86	RMS	31.9	-24.7	5.18	43.24	54	-10.76	-	-	44	110	H
4	* 2.37042	32.13	RMS	31.9	-24.6	5.18	44.61	54	-9.39	-	-	44	110	H

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

VERTICAL RESULT



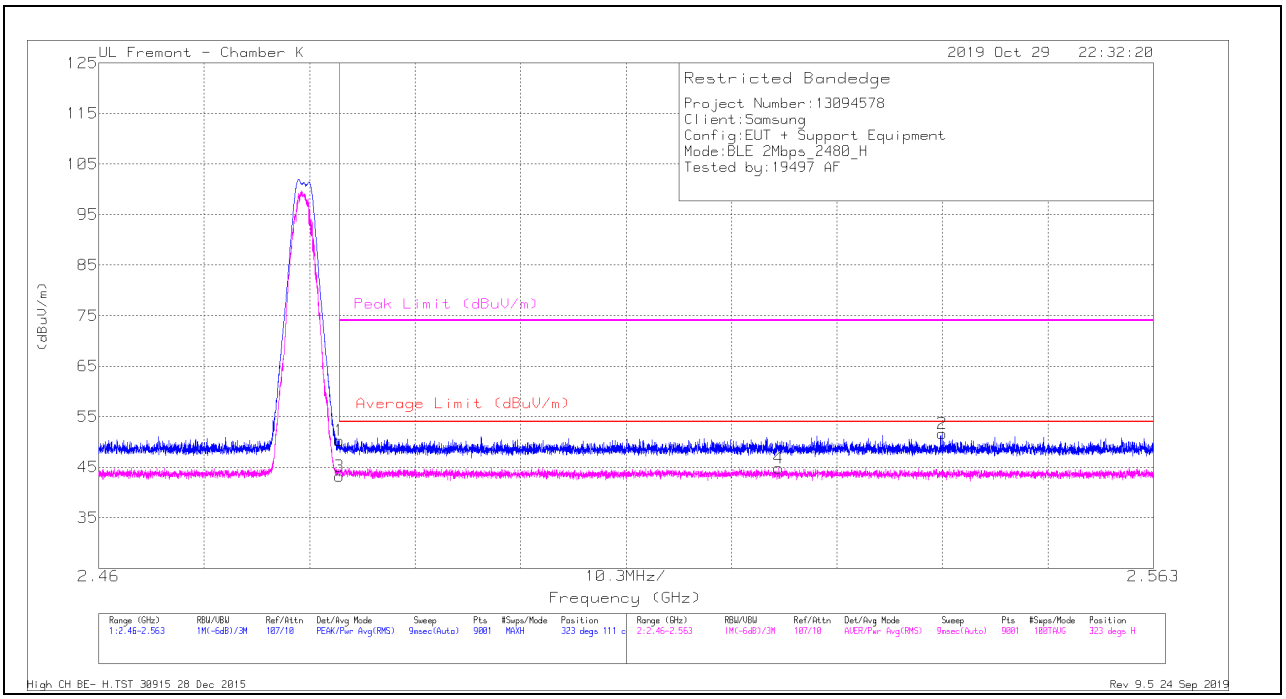
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	40.53	Pk	31.9	-24.7	0	47.73	-	-	74	-26.27	32	243	V
2	* 2.35503	43.3	Pk	31.7	-24.6	0	50.4	-	-	74	-23.6	32	243	V
3	* 2.38999	30.98	RMS	31.9	-24.7	5.18	43.36	54	-10.64	-	-	32	243	V
4	* 2.34546	32.28	RMS	31.7	-24.6	5.18	44.56	54	-9.44	-	-	32	243	V

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

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT

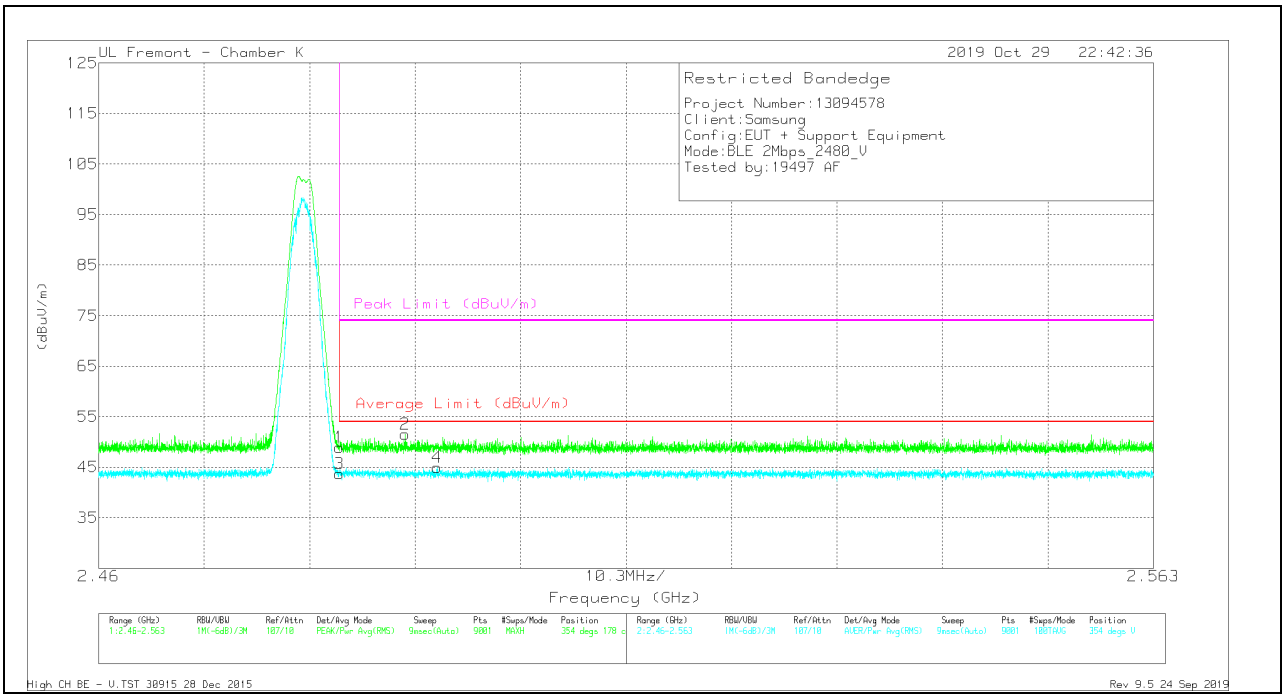


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	42.54	Pk	32.5	-24.8	0	50.24	-	-	74	-23.76	323	111	H
2	2.54237	44.07	Pk	32.4	-24.8	0	51.67	-	-	74	-22.33	323	111	H
3	* 2.48351	30.38	RMS	32.5	-24.8	5.18	43.26	54	-10.74	-	-	323	111	H
4	2.5264	32	RMS	32.5	-24.8	5.18	44.88	54	-9.12	-	-	323	111	H

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

VERTICAL RESULT



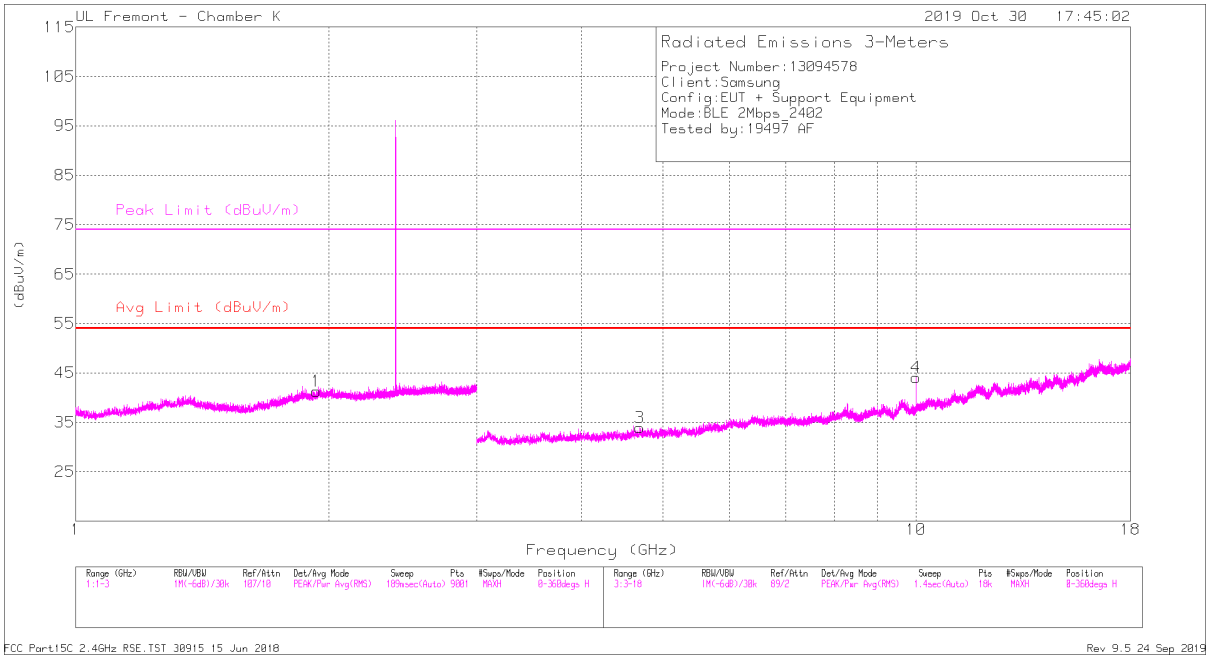
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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	41.28	Pk	32.5	-24.8	0	48.98	-	-	74	-25.02	354	178	V
2	* 2.48991	43.78	Pk	32.5	-24.8	0	51.48	-	-	74	-22.52	354	178	V
3	* 2.48351	30.8	RMS	32.5	-24.8	5.18	43.68	54	-10.32	-	-	354	178	V
4	* 2.49302	32.1	RMS	32.5	-24.8	5.18	44.98	54	-9.02	-	-	354	178	V

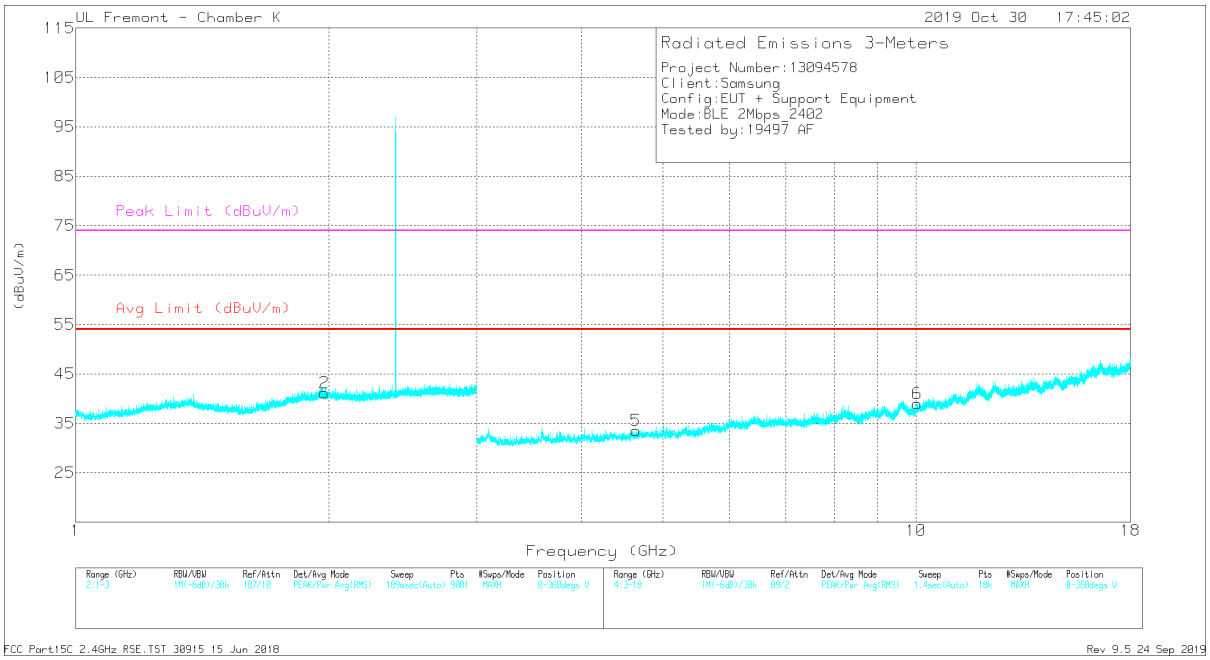
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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
1	1.9341	42.51	PK2	31.1	-24.1	0	49.51	-	-	-	-	110	243	H
2	1.97869	41.52	PK2	31.5	-24.4	0	48.62	-	-	-	-	156	277	V
3	* 4.69116	37.82	PK2	34	-30.5	0	41.32	-	-	74	-32.68	207	358	H
	* 4.69181	27.86	MAv1	34	-30.5	5.18	36.54	54	-17.46	-	-	207	358	H
4	10.00204	31.77	PK2	37	-23.1	0	45.67	-	-	-	-	39	338	H
5	* 4.64226	37.77	PK2	33.9	-30.9	0	40.77	-	-	74	-33.23	341	180	V
	* 4.64458	28.25	MAv1	33.9	-30.9	5.18	36.43	54	-17.57	-	-	341	180	V
6	10.045	32.48	PK2	37.1	-23.1	0	46.48	-	-	-	-	337	383	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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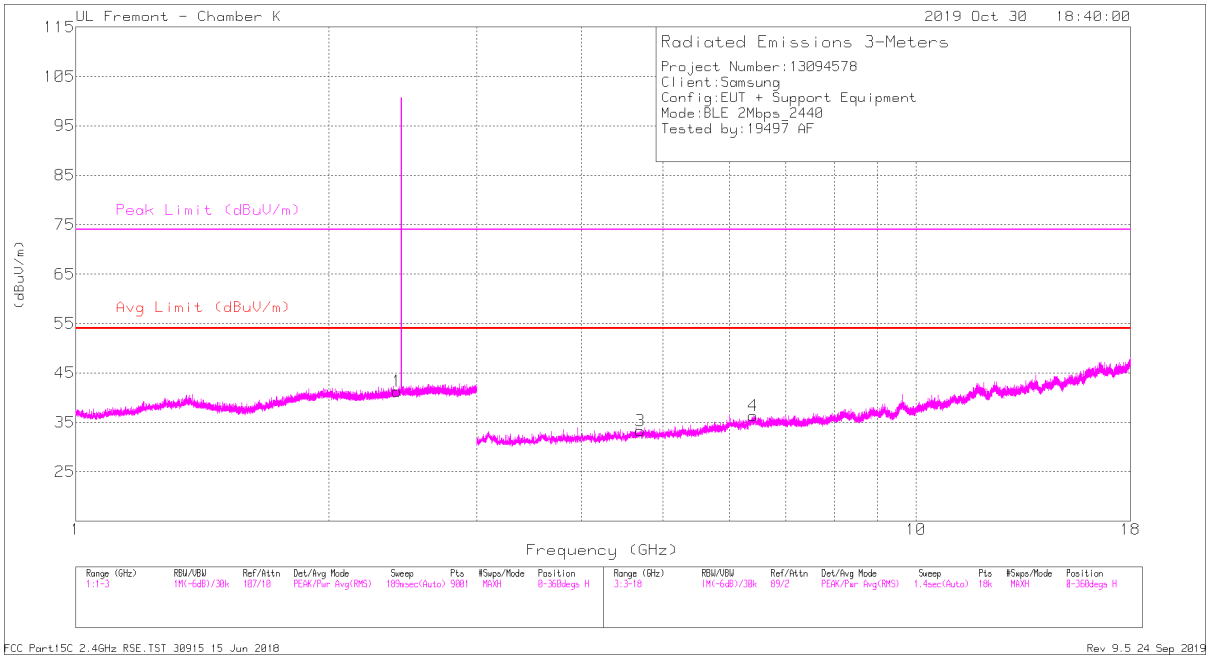
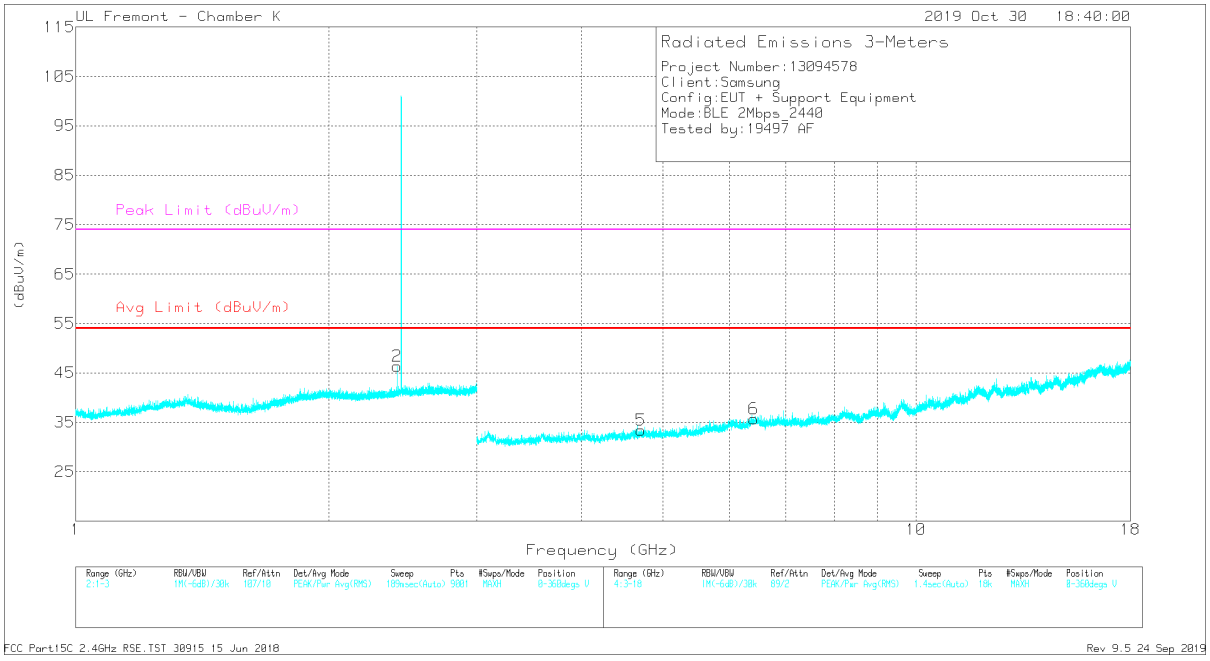
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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
1	2.41268	42.33	PK2	32	-24.7	0	49.63	-	-	-	-	11	342	H
2	2.41023	42.16	PK2	32	-24.7	0	49.46	-	-	-	-	330	148	V
3	* 4.69523	38.23	PK2	34	-30.5	0	41.73	-	-	74	-32.27	108	175	H
	* 4.69569	27.98	MAv1	34	-30.5	5.18	36.66	54	-17.34	-	-	108	175	H
4	6.39595	35.55	PK2	35.8	-26.6	0	44.75	-	-	-	-	223	385	H
5	* 4.70727	38.71	PK2	34	-30.4	0	42.31	-	-	74	-31.69	356	364	V
	* 4.71002	27.09	MAv1	34	-30.5	5.18	35.77	54	-18.23	-	-	356	364	V
6	6.41269	34.28	PK2	35.8	-26.6	0	43.48	-	-	-	-	112	393	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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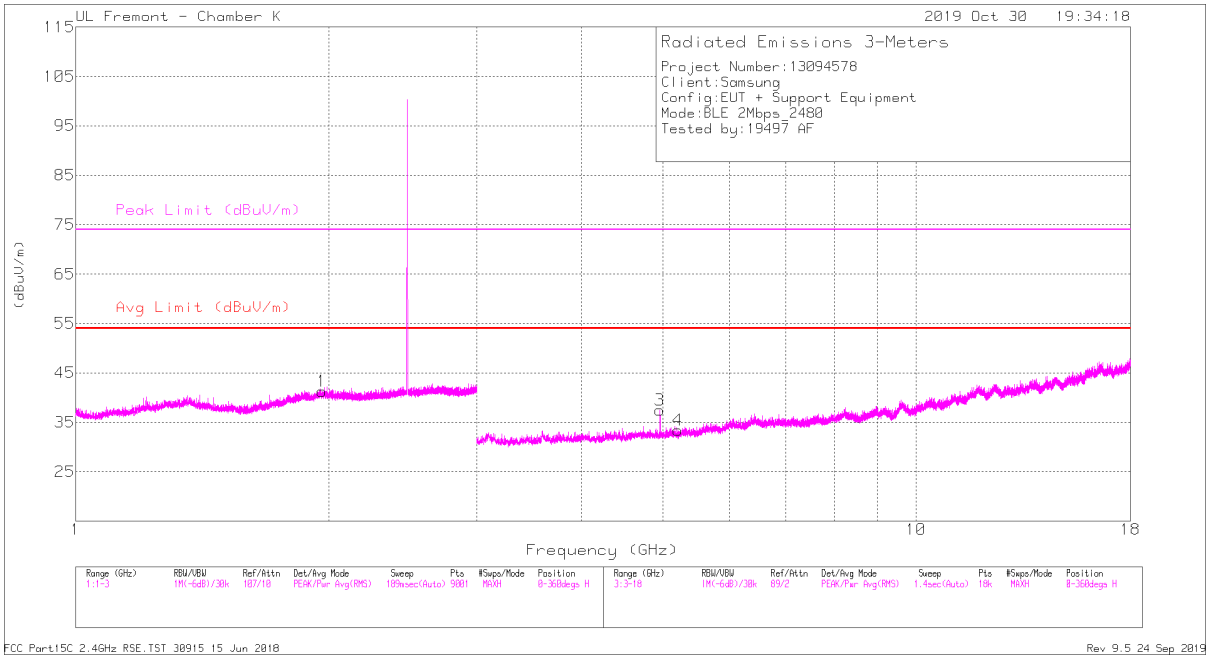
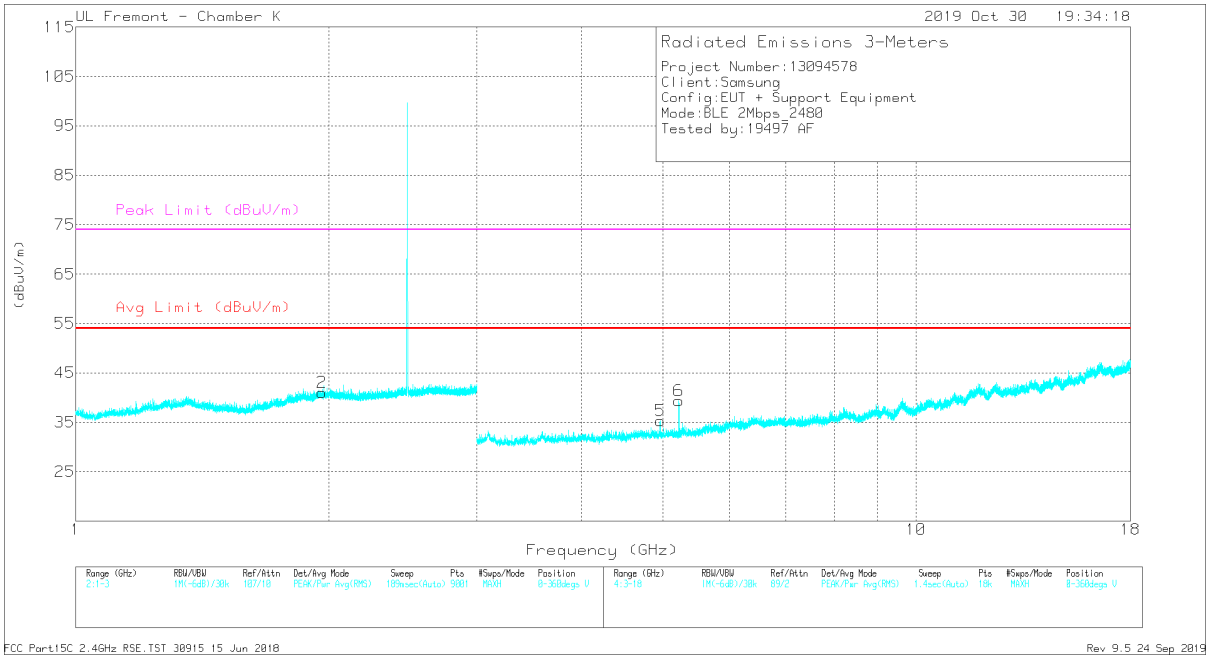
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF EMC4294 (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
1	1.96478	42.11	PK2	31.6	-24.3	0	49.41	-	-	-	-	145	163	H
2	1.9609	42	PK2	31.6	-24.3	0	49.3	-	-	-	-	130	394	V
3	* 4.95895	41.17	PK2	34.1	-30.6	0	44.67	-	-	74	-29.33	135	99	H
	* 4.95932	29.02	MAv1	34.1	-30.6	5.18	37.7	54	-16.3	-	-	135	99	H
4	5.21158	36.6	PK2	34.3	-30	0	40.9	-	-	-	-	42	148	H
5	* 4.96109	40.53	PK2	34.1	-30.6	0	44.03	-	-	74	-29.97	345	95	V
	* 4.95927	27.86	MAv1	34.1	-30.6	5.18	36.54	54	-17.46	-	-	345	95	V
6	5.22148	36.81	PK2	34.2	-30	0	41.01	-	-	-	-	51	182	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
PK2 - KDB558074 Method: Maximum Peak
MAv1 - KDB558074 Option 1 Maximum RMS Average

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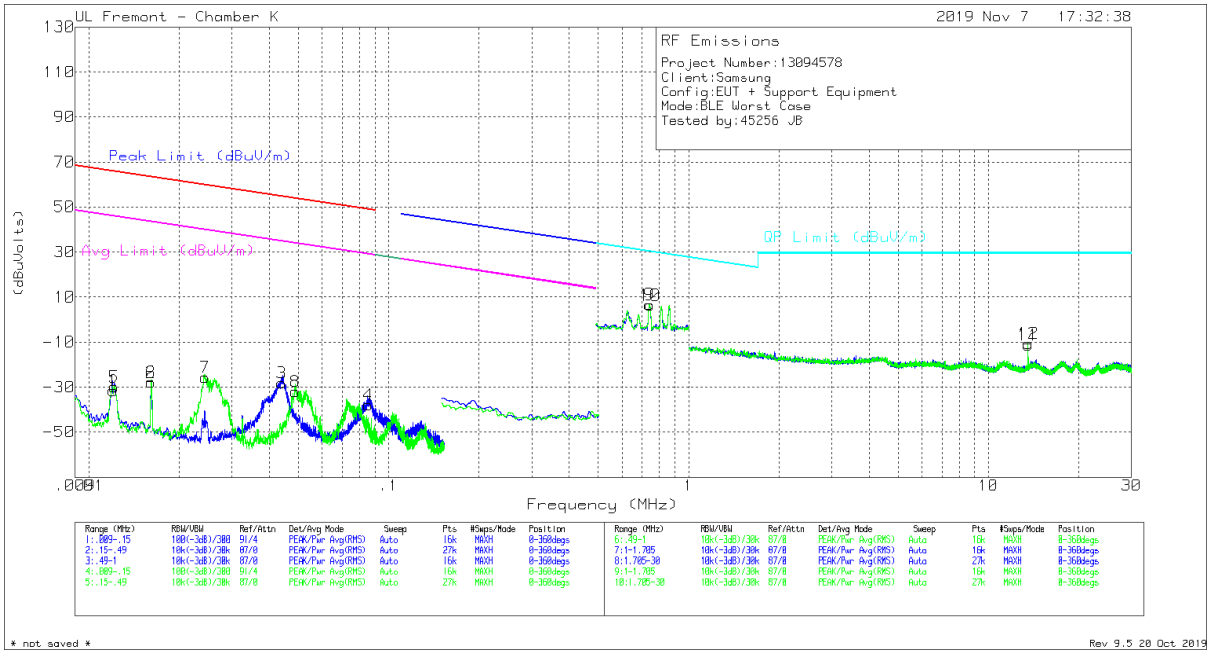
9.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- TWO ORIENTATIONS FACE ON/FACE OFF

Below 30MHz 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)	Azimuth (Degs)
1	.01202	20.39	Pk	59.9	-31.8	-80	-31.51	65.99	-97.5	45.99	-77.5	0-360
2	.01612	24.77	Pk	59.3	-31.9	-80	-27.83	63.44	-91.27	43.44	-71.27	0-360
3	.04393	27.03	Pk	57	-32.2	-80	-28.17	54.73	-82.9	34.73	-62.9	0-360
4	.08544	18.62	Pk	55.6	-32.2	-80	-37.98	48.95	-86.93	28.95	-66.93	0-360
5	.01213	21.95	Pk	59.9	-31.8	-80	-29.95	65.91	-95.86	45.91	-75.86	0-360
6	.01612	24.69	Pk	59.3	-31.9	-80	-27.91	63.44	-91.35	43.44	-71.35	0-360
7	.0244	28.18	Pk	58.3	-32.1	-80	-25.62	59.84	-85.46	39.84	-65.46	0-360
8	.04884	23.32	Pk	56.9	-32.2	-80	-31.98	53.81	-85.79	33.81	-65.79	0-360

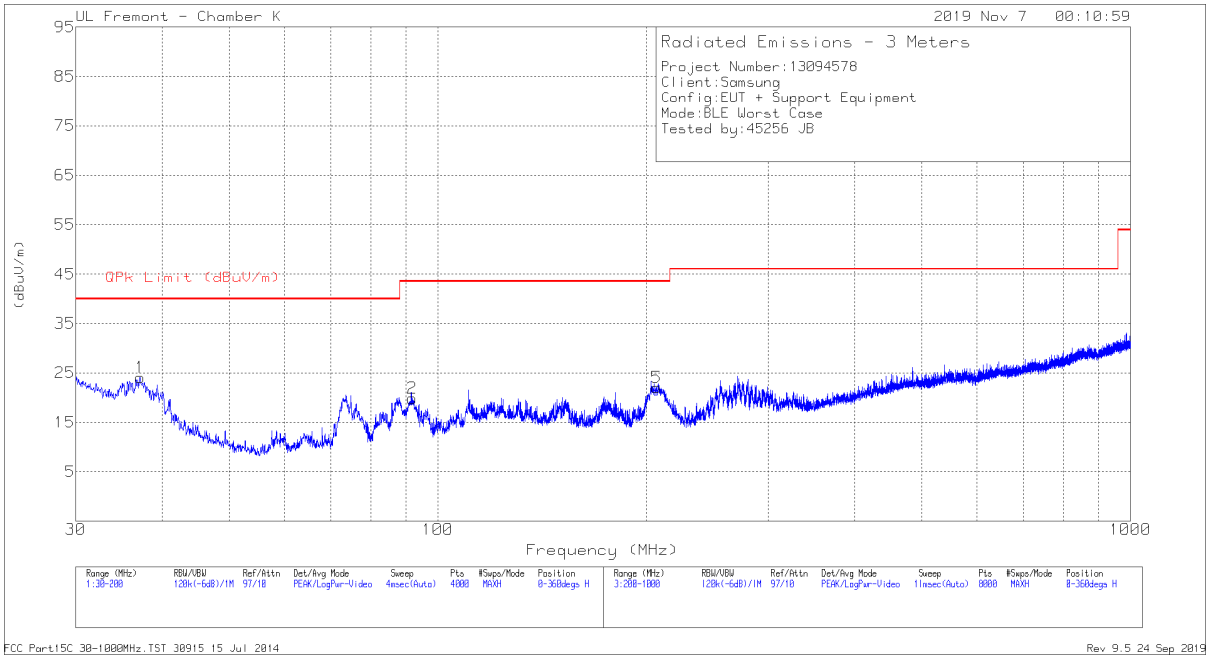
Pk - Peak detector

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)
9	.74067	22.64	Pk	56.1	-32.1	-40	6.64	30.22	-23.58	0-360
10	.74341	22.31	Pk	56.1	-32.1	-40	6.31	30.19	-23.88	0-360
11	13.55998	26.47	Pk	34.1	-31.8	-40	-11.23	29.5	-40.73	0-360
12	13.55998	27.18	Pk	34.1	-31.8	-40	-10.52	29.5	-40.02	0-360

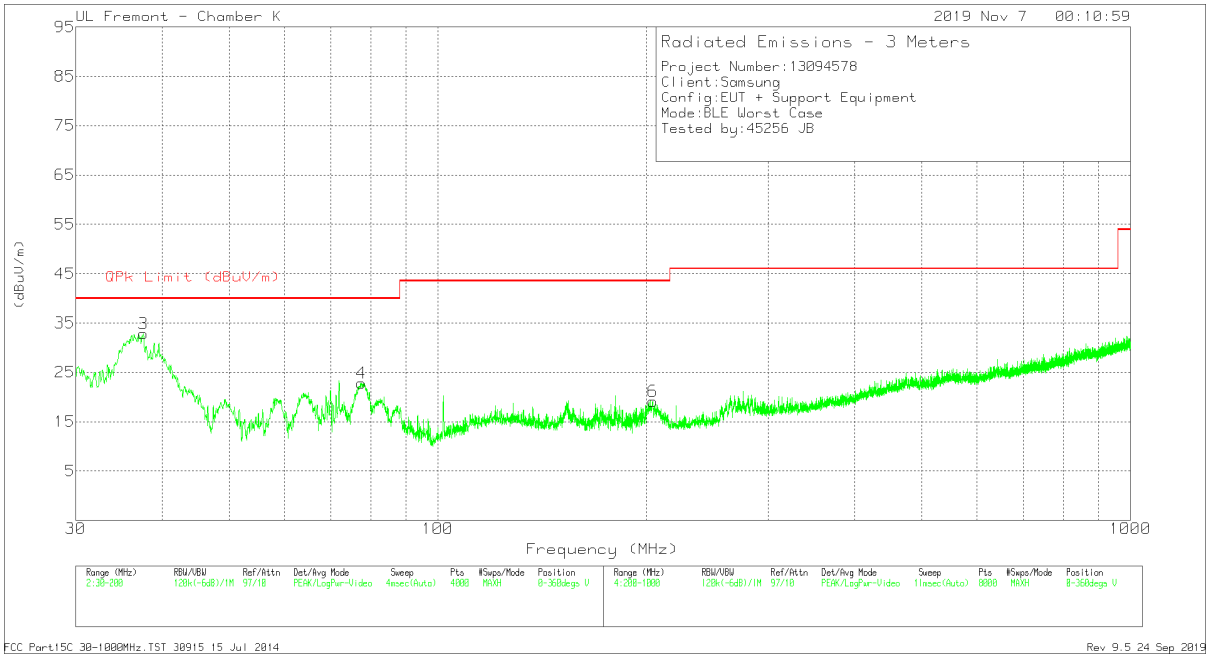
Pk - Peak detector

9.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF PRE0181574 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	37.1418	33.69	Pk	21.9	-31.5	24.09	40	-15.91	0-360	299	H
2	91.896	36.83	Pk	14	-31	19.83	43.52	-23.69	0-360	299	H
3	* 37.97	38.7	Pk	21.2	-31.5	28.4	40	-11.6	43	115	V
	* 37.97	36.17	Qp	21.2	-31.5	25.87	40	-14.13	43	115	V
4	77.4848	40.13	Pk	13.8	-31.1	22.83	40	-17.17	0-360	95	V
5	206.8009	35.9	Pk	16.4	-30.3	22	43.52	-21.52	0-360	99	H
6	204.3006	32.38	Pk	17	-30.3	19.08	43.52	-24.44	0-360	100	V

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

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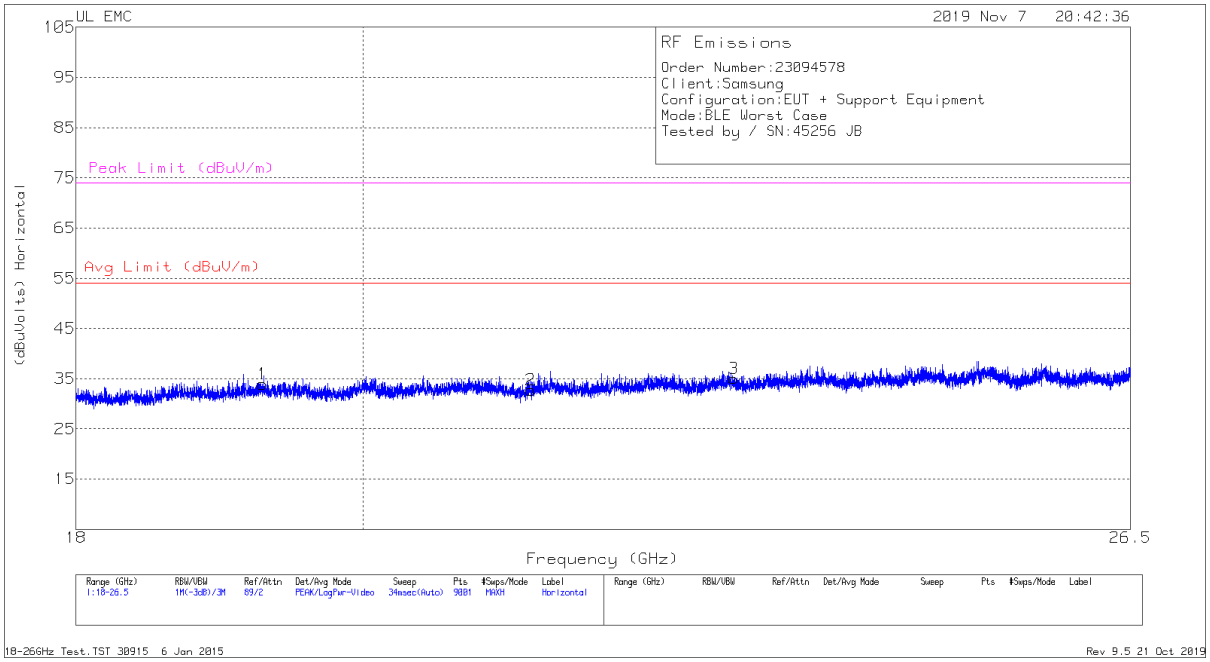
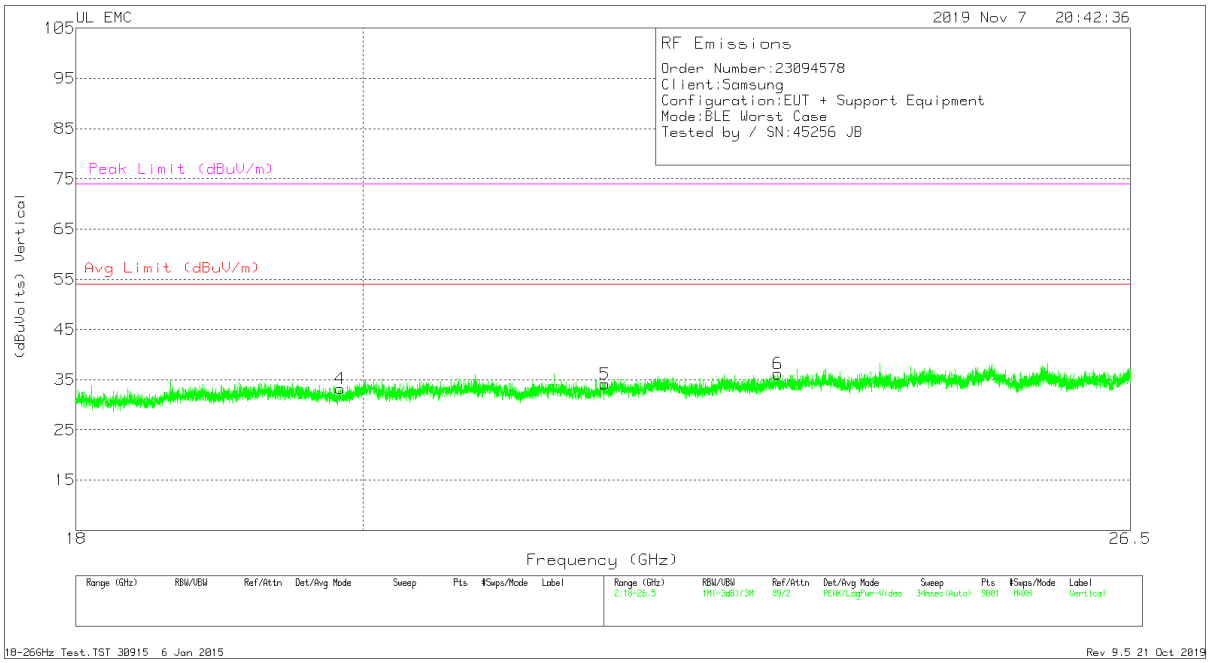
9.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

18 – 26 GHz 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	19.275	68.01	Pk	32.7	-57.3	-9.5	33.91	54	-20.09	74	-40.09
2	21.26683	66.33	Pk	33.1	-57.2	-9.5	32.73	54	-21.27	74	-41.27
3	22.91016	68.43	Pk	33.7	-57.6	-9.5	35.03	54	-18.97	74	-38.97
4	19.83128	67.03	Pk	32.8	-57.1	-9.5	33.23	54	-20.77	74	-40.77
5	21.85239	67.97	Pk	33.3	-57.6	-9.5	34.17	54	-19.83	74	-39.83
6	23.28416	68.86	Pk	33.9	-57.1	-9.5	36.16	54	-17.84	74	-37.84

Pk - Peak detector

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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.

RESULTS

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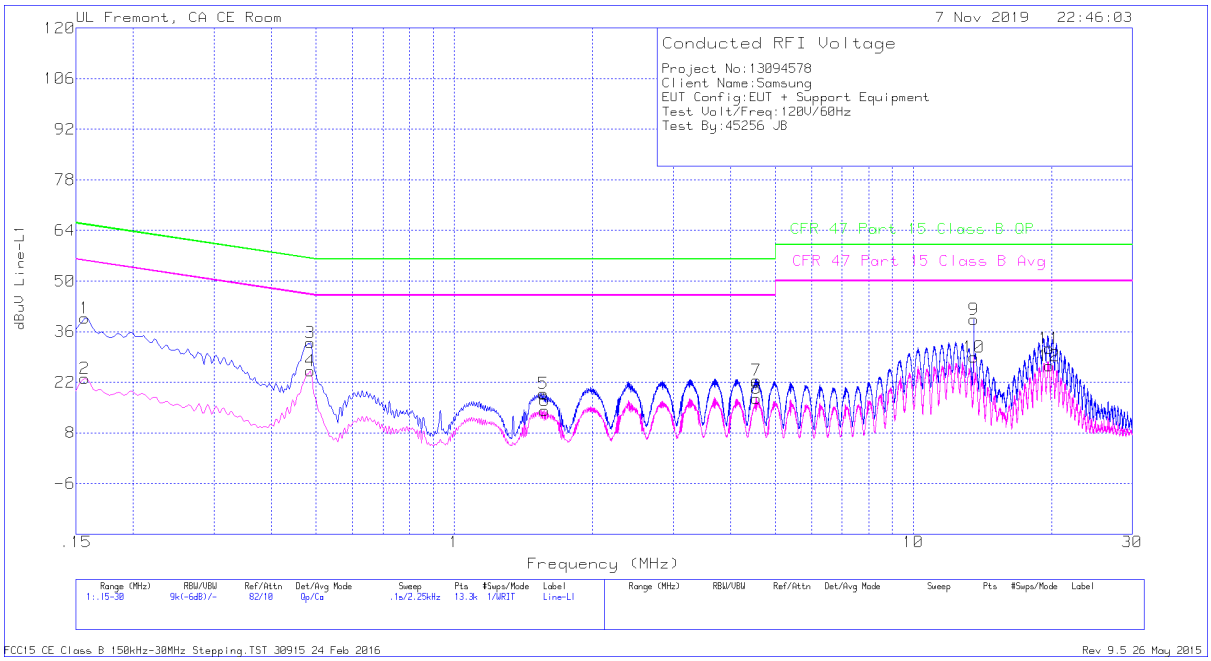
AC Power Line Norm

LINE 1 RESULTS

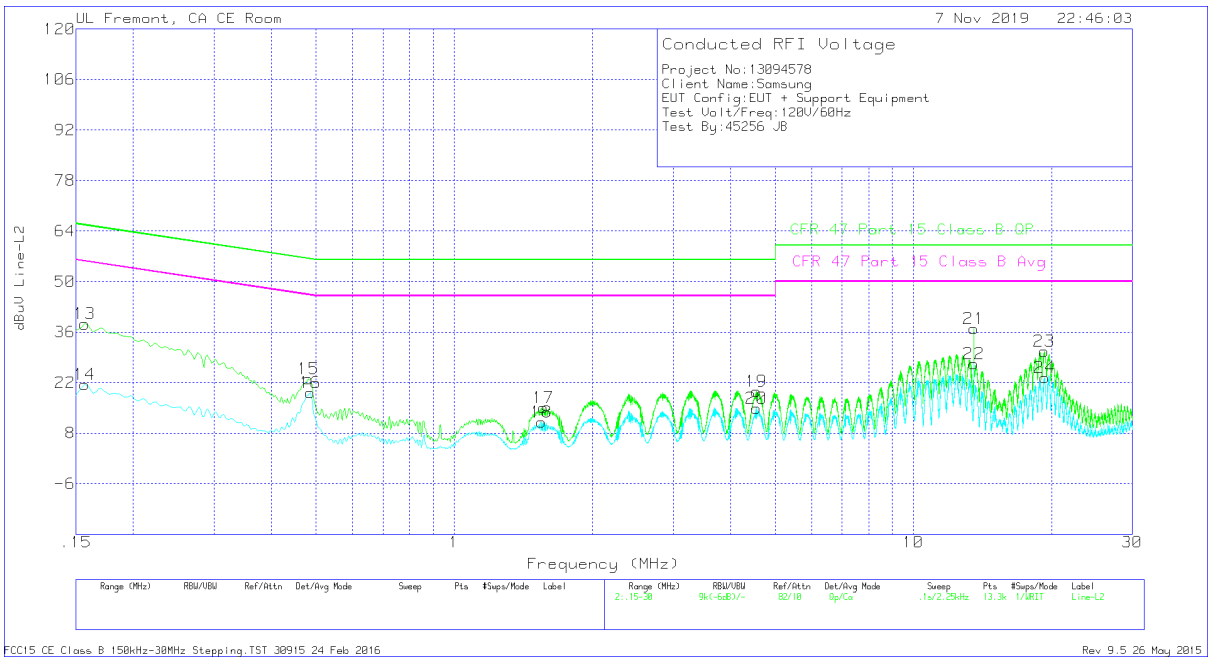


Trace Markers

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	.15675	29.47	Qp	.1	0	10.1	39.67	65.63	-25.96	-	-
2	.15675	12.78	Ca	.1	0	10.1	22.98	-	-	55.63	-32.65
3	.48525	22.8	Qp	0	0	10.1	32.9	56.25	-23.35	-	-
4	.48525	15.03	Ca	0	0	10.1	25.13	-	-	46.25	-21.12
5	1.563	8.75	Qp	0	.1	10.1	18.95	56	-37.05	-	-
6	1.5765	4.02	Ca	0	.1	10.1	14.22	-	-	46	-31.78
7	4.56	12.41	Qp	0	.1	10.1	22.61	56	-33.39	-	-
8	4.55775	7.27	Ca	0	.1	10.1	17.47	-	-	46	-28.53
9	13.56	28.84	Qp	.1	.2	10.2	39.34	60	-20.66	-	-
10	13.56	18.44	Ca	.1	.2	10.2	28.94	-	-	50	-21.06
11	19.76775	20.73	Qp	.1	.3	10.3	31.43	60	-28.57	-	-
12	19.76775	15.77	Ca	.1	.3	10.3	26.47	-	-	50	-23.53

Qp - Quasi-Peak detector
Ca - CISPR average detection
NOTE: Markers 9 and 10, 13.56MHz is an external NFC signal unrelated to the EUT.

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	.15675	28.07	Qp	.1	0	10.1	38.27	65.63	-27.36	-	-
14	.15675	11.31	Ca	.1	0	10.1	21.51	-	-	55.63	-34.12
15	.48075	12.97	Qp	0	0	10.1	23.07	56.33	-33.26	-	-
16	.48525	9.06	Ca	0	0	10.1	19.16	-	-	46.25	-27.09
17	1.563	4.82	Qp	0	.1	10.1	15.02	56	-40.98	-	-
18	1.55175	.89	Ca	0	.1	10.1	11.09	-	-	46	-34.91
19	4.56	9.41	Qp	0	.1	10.1	19.61	56	-36.39	-	-
20	4.55775	4.63	Ca	0	.1	10.1	14.83	-	-	46	-31.17
21	13.56	26.54	Qp	.1	.2	10.2	37.04	60	-22.96	-	-
22	13.56	16.68	Ca	.1	.2	10.2	27.18	-	-	50	-22.82
23	19.30875	19.94	Qp	.1	.3	10.3	30.64	60	-29.36	-	-
24	19.32225	12.66	Ca	.1	.3	10.3	23.36	-	-	50	-26.64

Qp - Quasi-Peak detector
Ca - CISPR average detection
NOTE: Markers 21 and 22, 13.56MHz is an external NFC signal unrelated to the EUT.