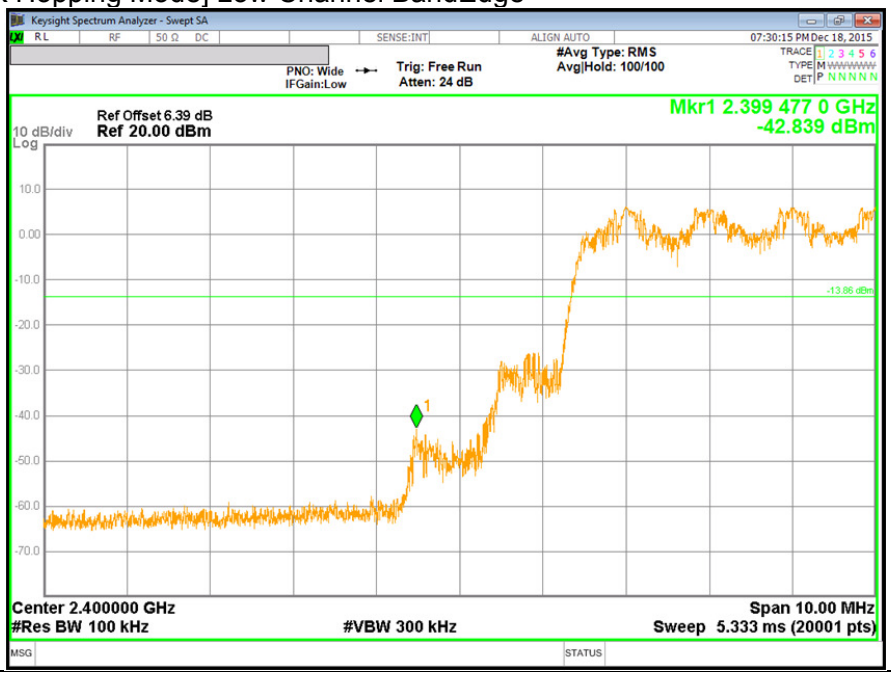
BandEdge Emission at PI/4-DQPSK Hopping Mode

[PI/4-DQPSK Hopping Mode] Low Channel BandEdge



[PI/4-DQPSK Hopping Mode] High Channel BandEdge

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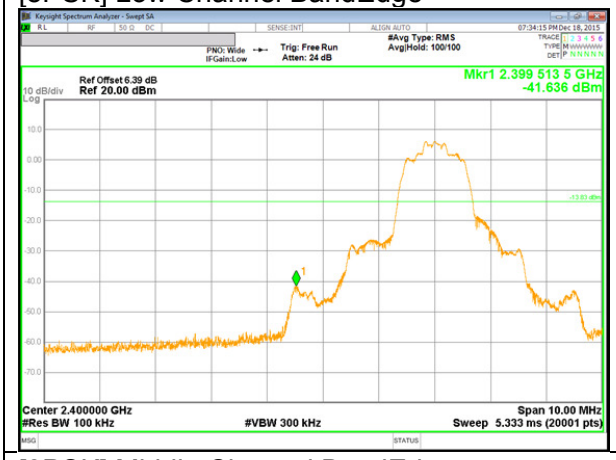
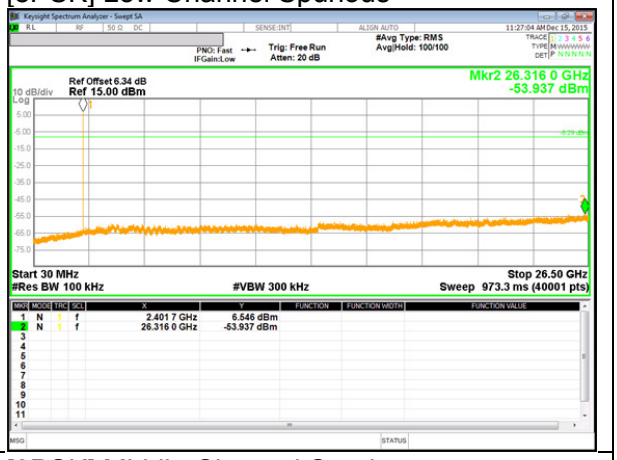
8PSK Mode

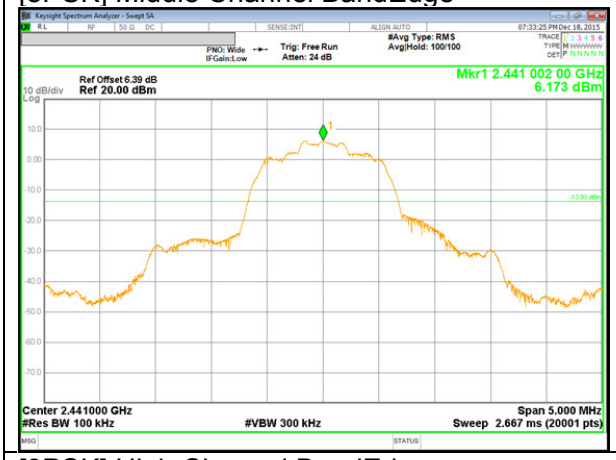
[8PSK] Low Channel BandEdge



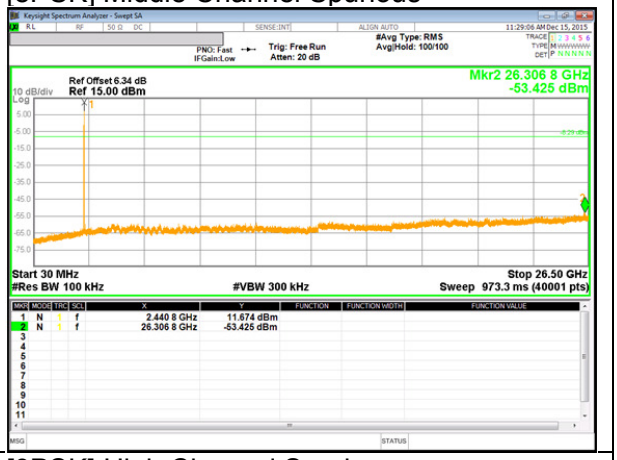
[8PSK] Low Channel Spurious



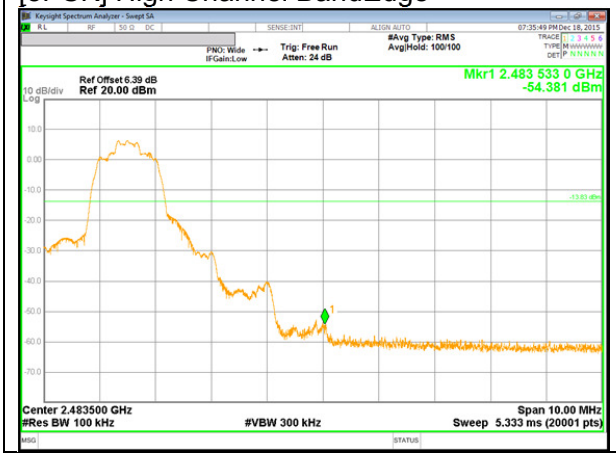
[8PSK] Middle Channel BandEdge



[8PSK] Middle Channel Spurious



[8PSK] High Channel BandEdge



[8PSK] High Channel Spurious

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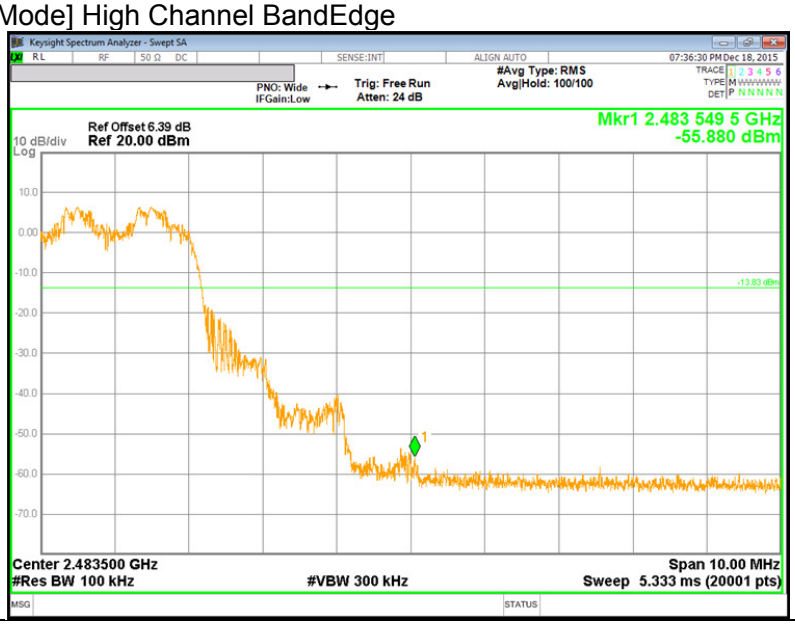
BandEdge Emission at 8PSK Hopping Mode

[8PSK Hopping Mode] Low Channel BandEdge

[8PSK Hopping Mode] High Channel BandEdge



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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
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. 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 band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 1/T (on time) for average measurement.

GFSK = 1/T = 1 / 0.0029S = 350Hz.

The spectrum from 1 GHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

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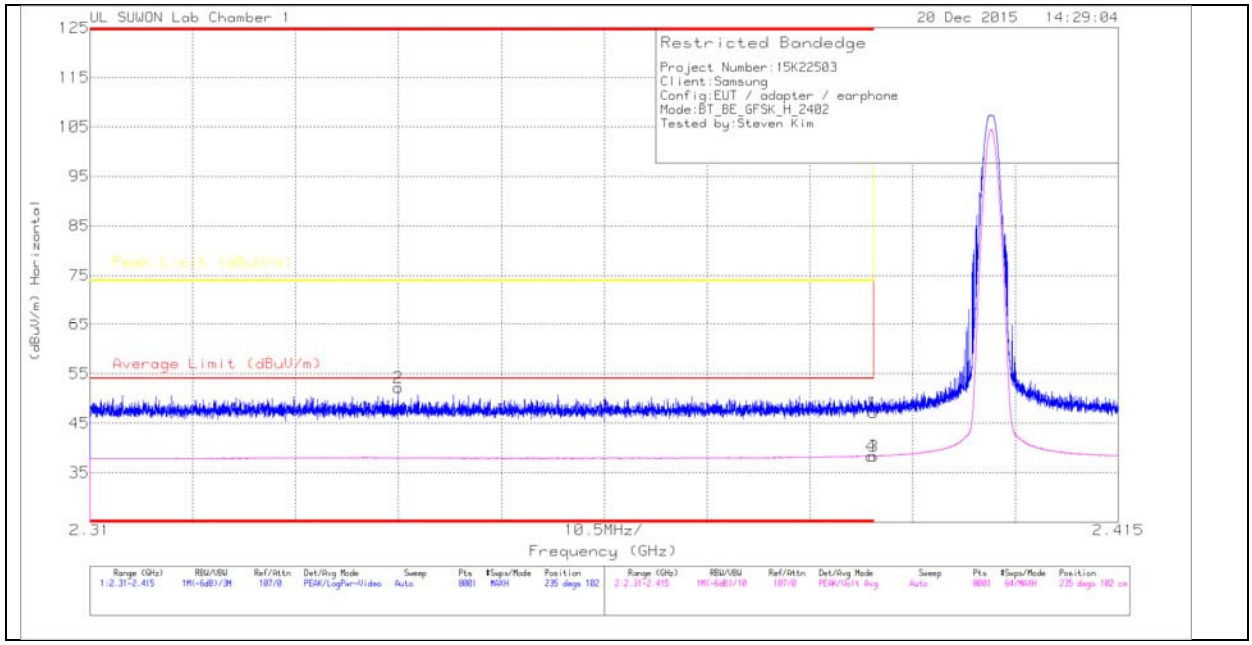
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.39	44.26	Pk	31.8	-29	47.06	-	-	74	-26.94	235	102	H	1
2	* 2.341	49.51	Pk	31.7	-29	52.21	-	-	74	-21.79	235	102	H	2
3	* 2.39	35.53	V1TV	31.8	-29	38.33	54	-15.67	-	-	235	102	H	3
4	* 2.39	35.57	V1TV	31.8	-29	38.37	54	-15.63	-	-	235	102	H	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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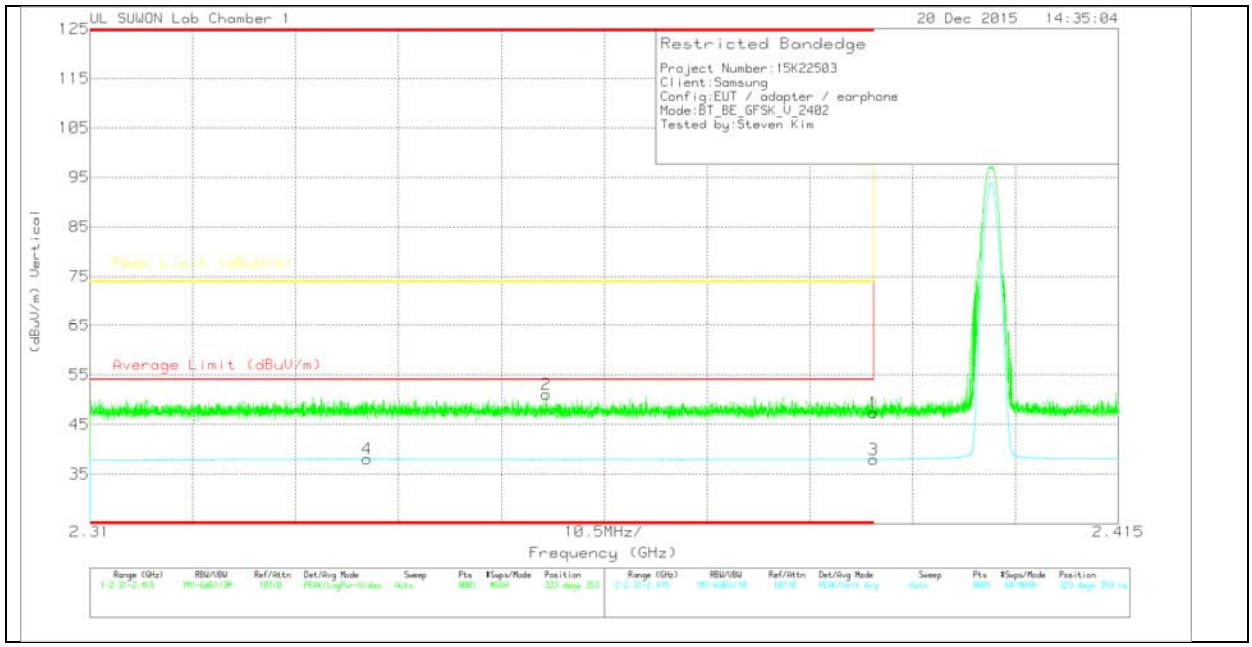
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.39	44.52	Pk	31.8	-29	47.32	-	-	74	-26.68	323	353	V	1
2	* 2.357	48.33	Pk	31.7	-29	51.03	-	-	74	-22.97	323	353	V	2
3	* 2.39	35.15	V1TV	31.8	-29	37.95	54	-16.05	-	-	323	353	V	3
4	* 2.338	35.35	V1TV	31.7	-29	38.05	54	-15.95	-	-	323	353	V	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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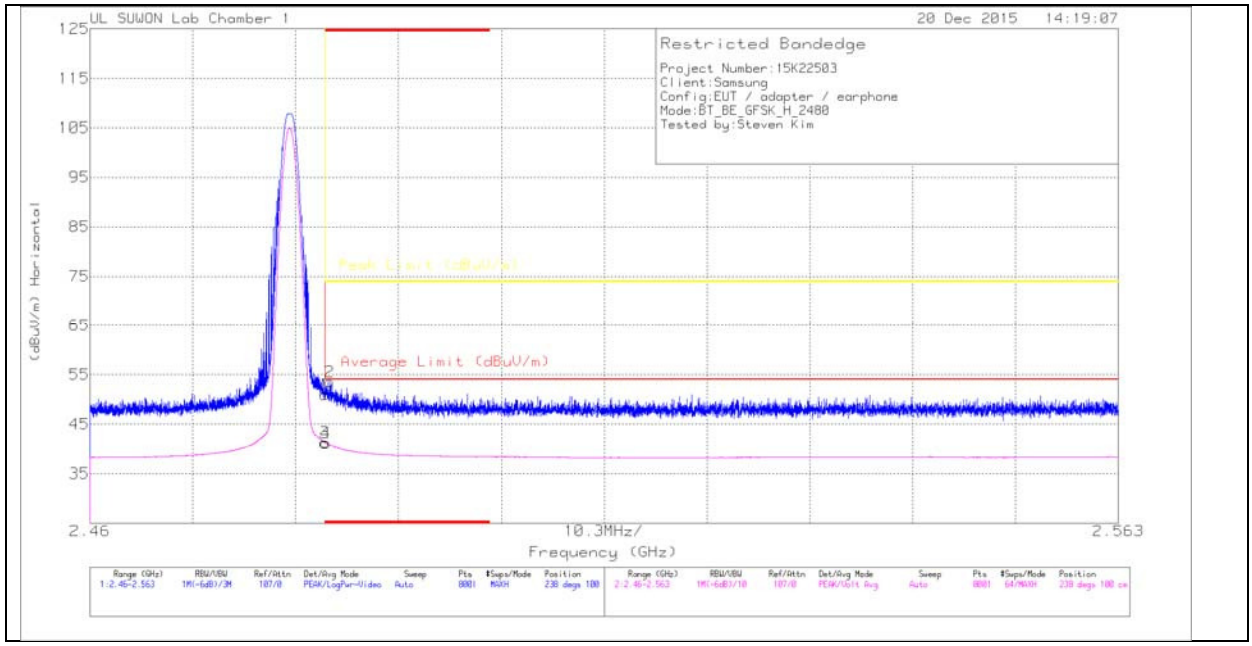
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.484	47.82	Pk	32	-28.9	50.92	-	-	74	-23.08	238	100	H	1
2	* 2.484	50.43	Pk	32	-28.9	53.53	-	-	74	-20.47	238	100	H	2
3	* 2.484	38.19	V1TV	32	-28.9	41.29	54	-12.71	-	-	238	100	H	3
4	* 2.484	38.11	V1TV	32	-28.9	41.21	54	-12.79	-	-	238	100	H	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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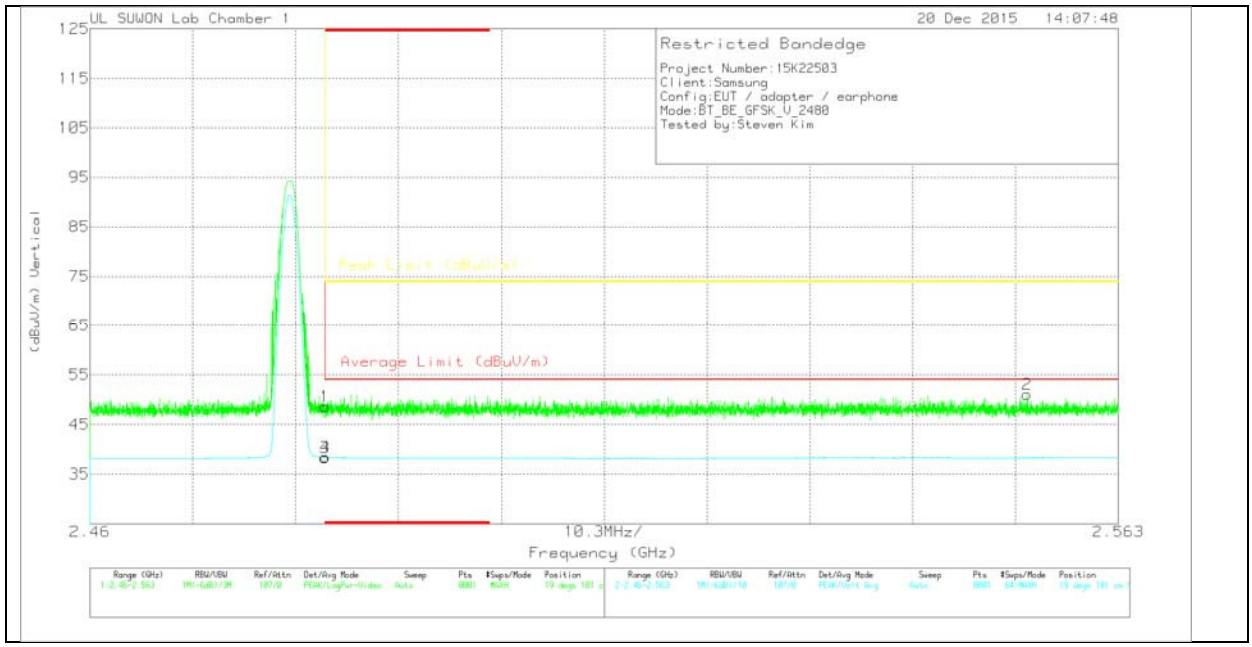
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.484	45.53	Pk	32	-28.9	48.63	-	-	74	-25.37	19	181	V	1
2	2.554	47.86	Pk	32	-28.8	51.06	-	-	74	-22.94	19	181	V	2
3	* 2.484	35.28	V1TV	32	-28.9	38.38	54	-15.62	-	-	19	181	V	3
4	* 2.484	35.3	V1TV	32	-28.9	38.4	54	-15.6	-	-	19	181	V	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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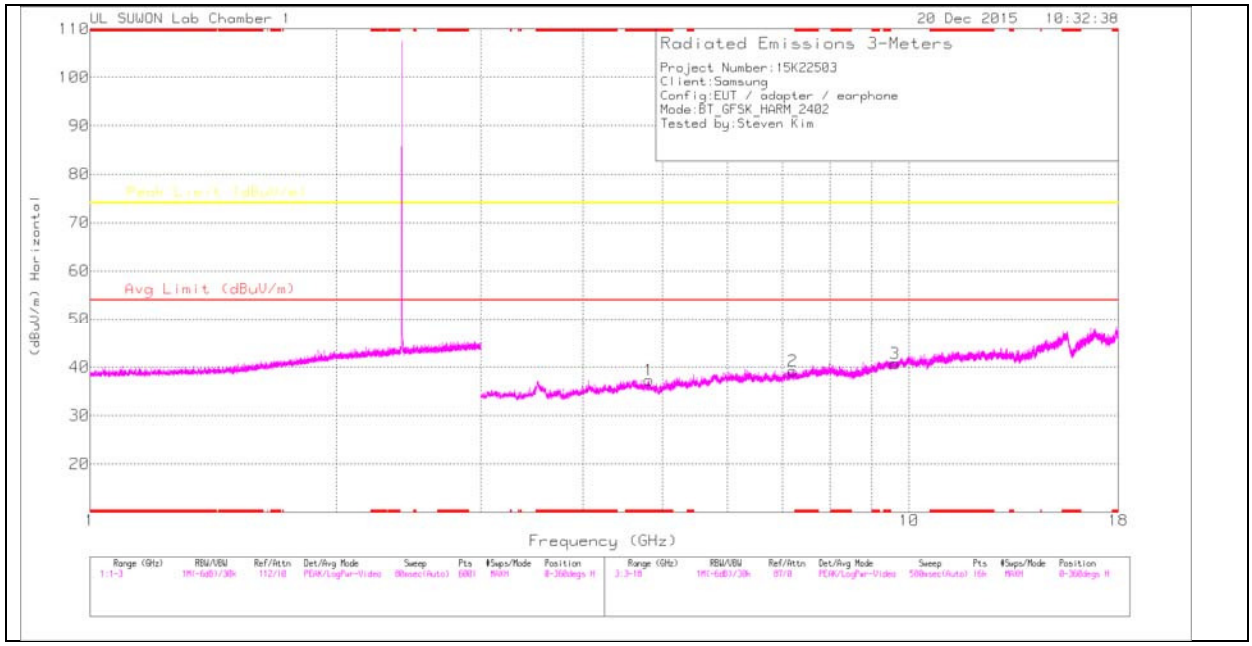
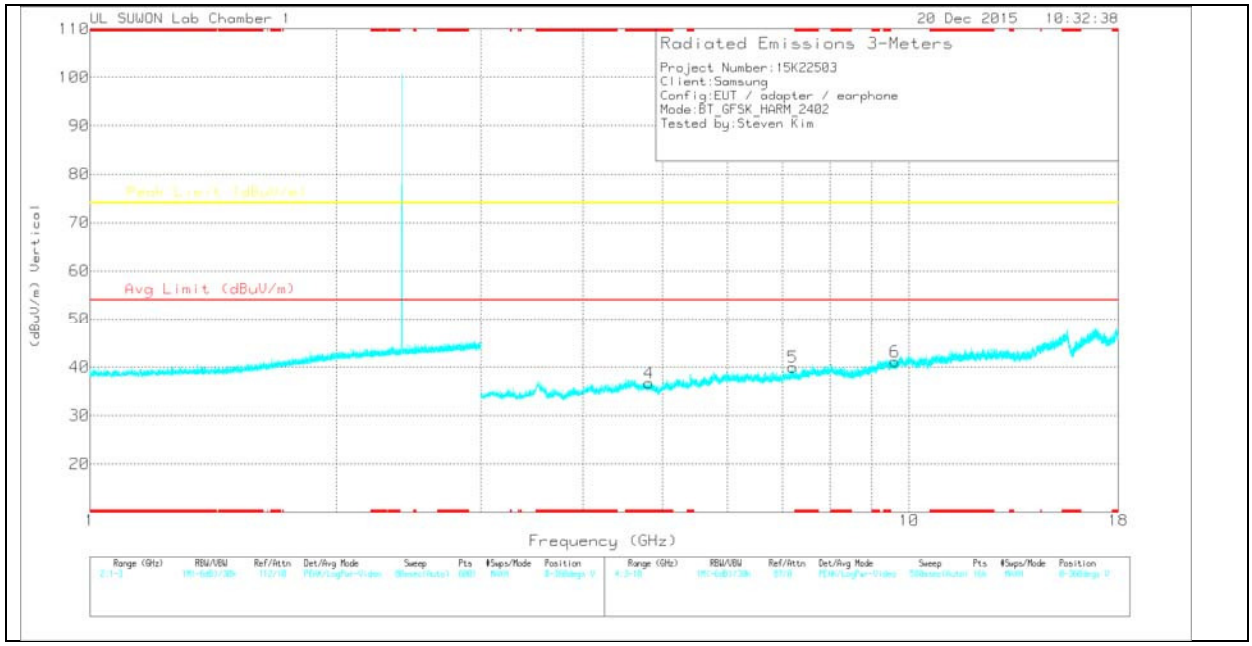
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.815	37.16	Pk	34	-33.8	37.36	-	-	74	-36.64	0-360	100	H
2	7.204	34.37	Pk	35.7	-30.8	39.27	-	-	74	-34.73	0-360	100	H
3	9.614	31	Pk	37	-27.2	40.8	-	-	74	-33.2	0-360	200	H
4	* 4.816	36.49	Pk	34	-33.8	36.69	-	-	74	-37.31	0-360	100	V
5	7.205	35.13	Pk	35.7	-30.8	40.03	-	-	74	-33.97	0-360	100	V
6	9.61	31.46	Pk	37	-27.3	41.16	-	-	74	-32.84	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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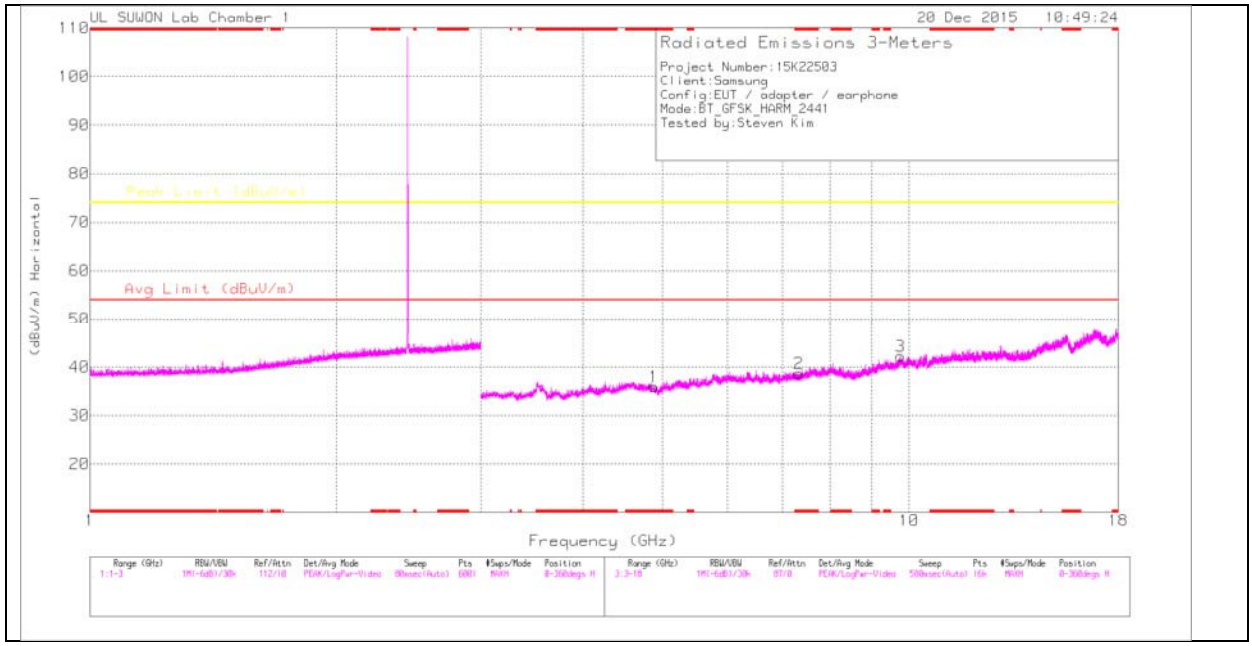
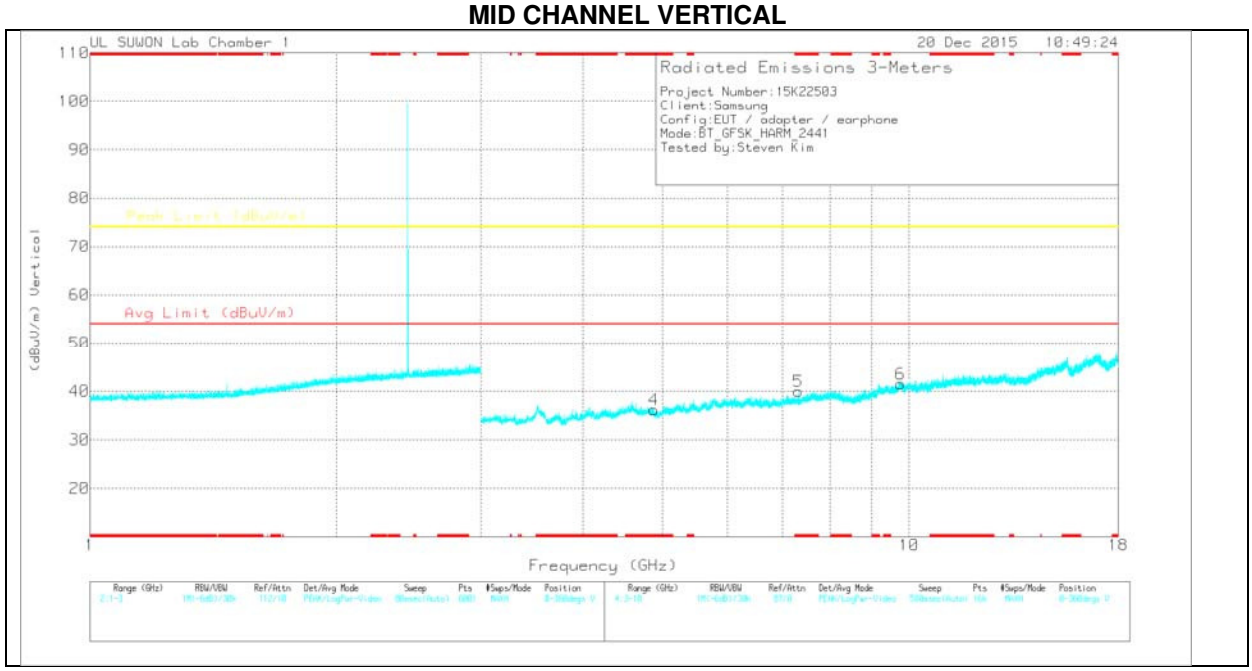
MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.883	35.94	Pk	34	-34	35.94	-	-	74	-38.06	0-360	200	H
2	* 7.337	33.76	Pk	35.8	-30.8	38.76	-	-	74	-35.24	0-360	200	H
3	9.759	31.64	Pk	37.2	-26.6	42.24	-	-	74	-31.76	0-360	100	H
4	* 4.882	36.17	Pk	34	-34	36.17	-	-	74	-37.83	0-360	100	V
5	* 7.323	35.1	Pk	35.8	-30.9	40	-	-	74	-34	0-360	100	V
6	9.762	30.95	Pk	37.2	-26.6	41.55	-	-	74	-32.45	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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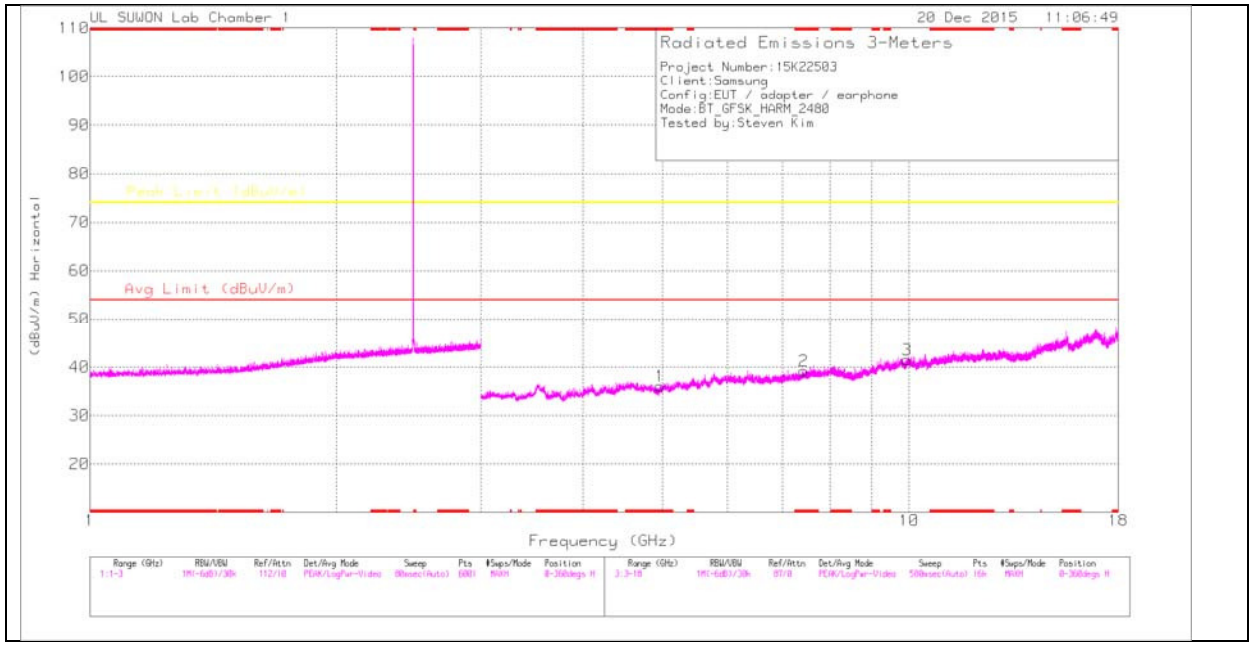
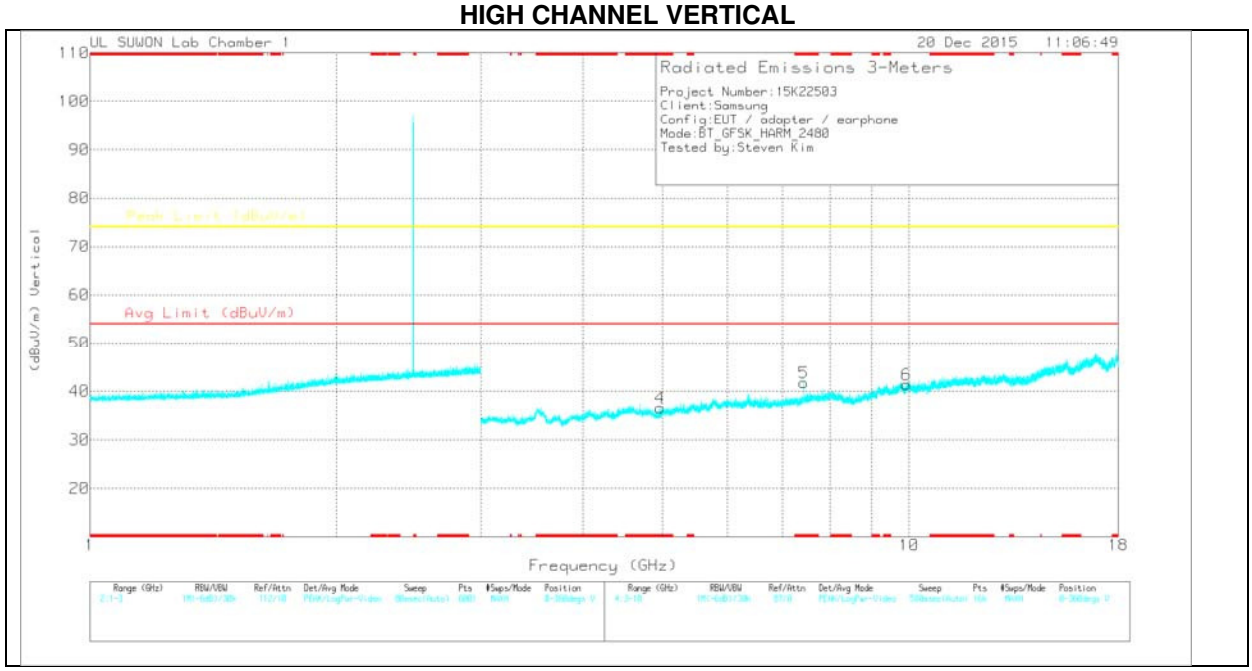
HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.963	36.01	Pk	34	-34	36.01	-	-	74	-37.99	0-360	200	H
2	* 7.44	34.11	Pk	35.8	-30.7	39.21	-	-	74	-34.79	0-360	200	H
3	9.941	30.81	Pk	37.4	-26.7	41.51	-	-	74	-32.49	0-360	100	H
4	* 4.96	36.59	Pk	34	-34	36.59	-	-	74	-37.41	0-360	100	V
5	* 7.44	36.61	Pk	35.8	-30.7	41.71	-	-	74	-32.29	0-360	100	V
6	9.931	30.91	Pk	37.4	-26.9	41.41	-	-	74	-32.59	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 7.44	45.39	PK2	35.8	-30.7	50.49	-	-	74	-23.51	309	257	V
* 7.44	30.17	VA1T	35.8	-30.7	35.27	54	-18.73	-	-	309	257	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK2 - Maximum Peak

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

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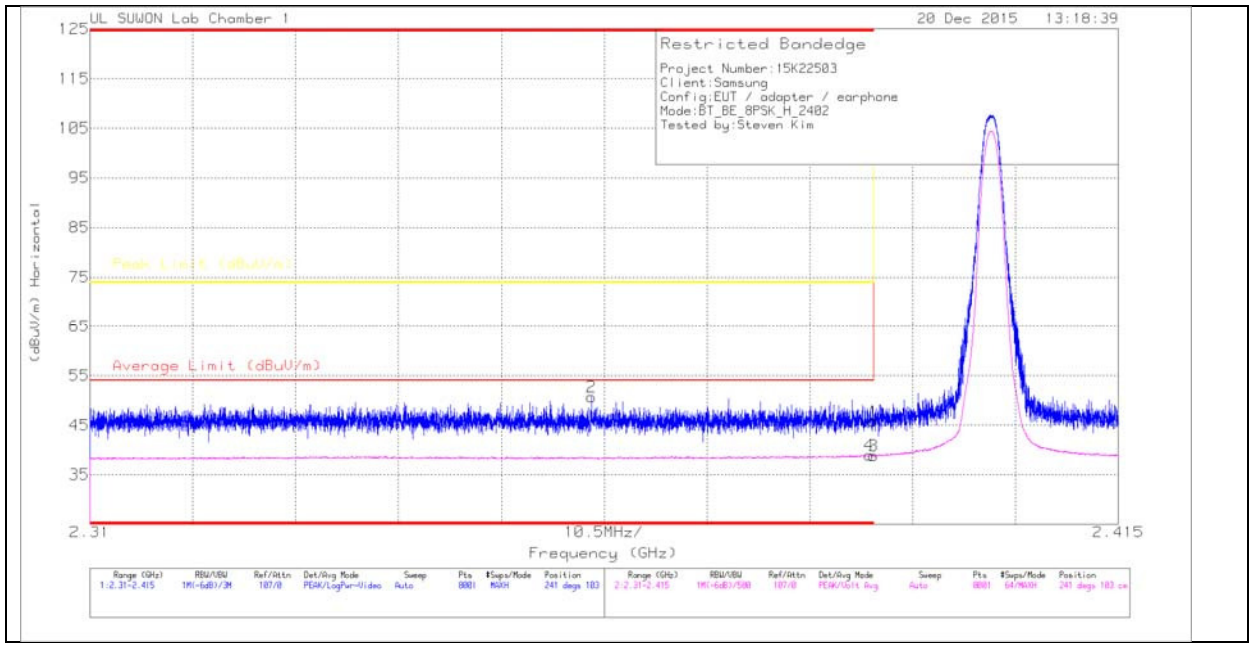
9.2.2. ENHANCED DATA RATE 8PSK MODULATION RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.39	42.96	Pk	31.8	-29	45.76	-	-	74	-28.24	241	103	H	1
2	* 2.361	48.02	Pk	31.7	-29	50.72	-	-	74	-23.28	241	103	H	2
3	* 2.39	36.06	V1TV	31.8	-29	38.86	54	-15.14	-	-	241	103	H	3
4	* 2.39	36.13	V1TV	31.8	-29	38.93	54	-15.07	-	-	241	103	H	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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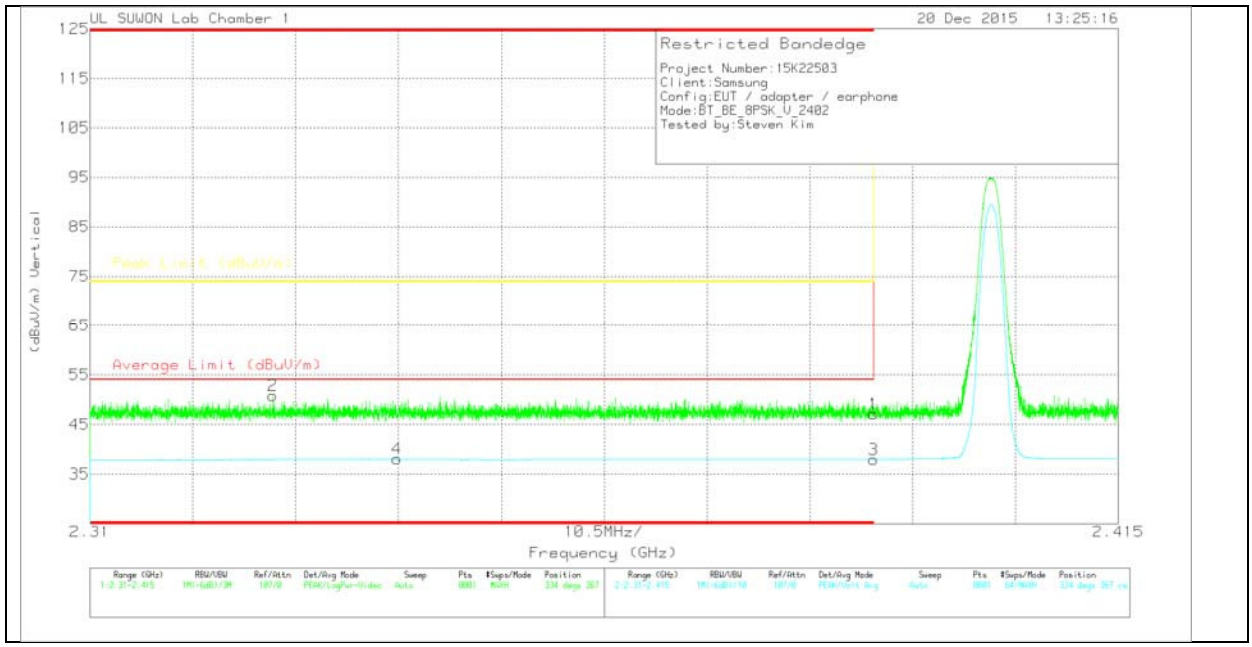
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.39	44.26	Pk	31.8	-29	47.06	-	-	74	-26.94	334	367	V	1
2	* 2.329	48.16	Pk	31.7	-29	50.86	-	-	74	-23.14	334	367	V	2
3	* 2.39	35.17	V1TV	31.8	-29	37.97	54	-16.03	-	-	334	367	V	3
4	* 2.341	35.33	V1TV	31.7	-29	38.03	54	-15.97	-	-	334	367	V	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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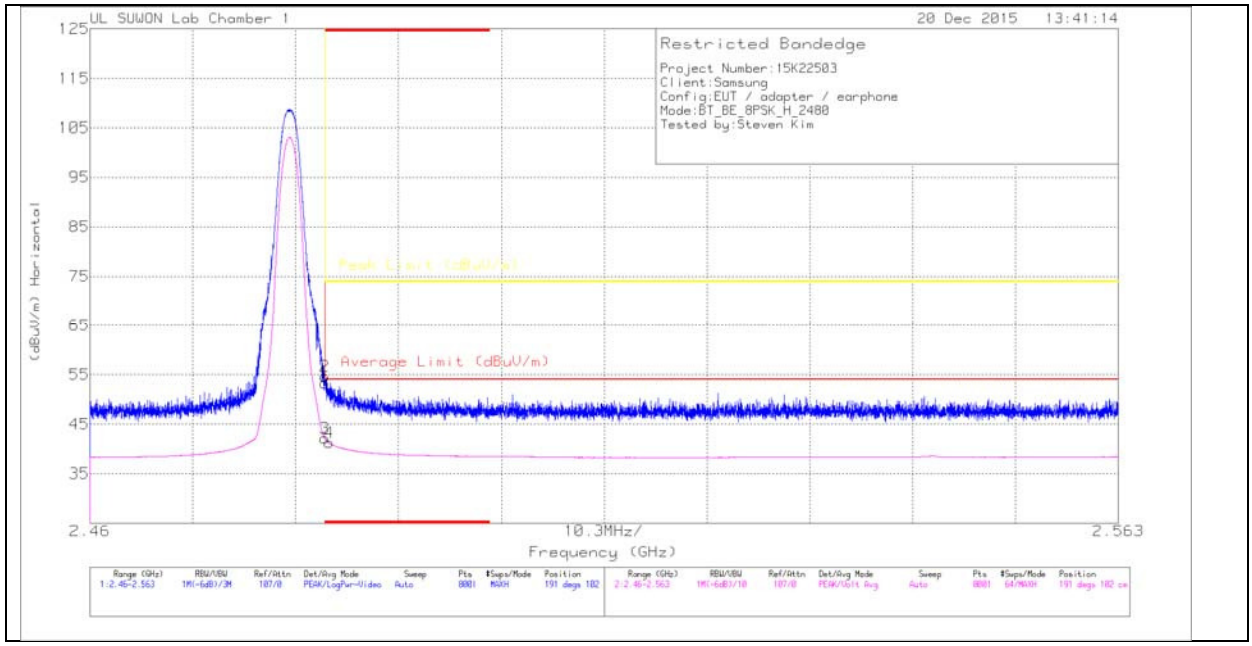
AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.484	50.16	Pk	32	-28.9	53.26	-	-	74	-20.74	191	102	H	1
2	* 2.484	51.6	Pk	32	-28.9	54.7	-	-	74	-19.3	191	102	H	2
3	* 2.484	39.1	V1TV	32	-28.9	42.2	54	-11.8	-	-	191	102	H	3
4	* 2.484	38.17	V1TV	32	-28.9	41.27	54	-12.73	-	-	191	102	H	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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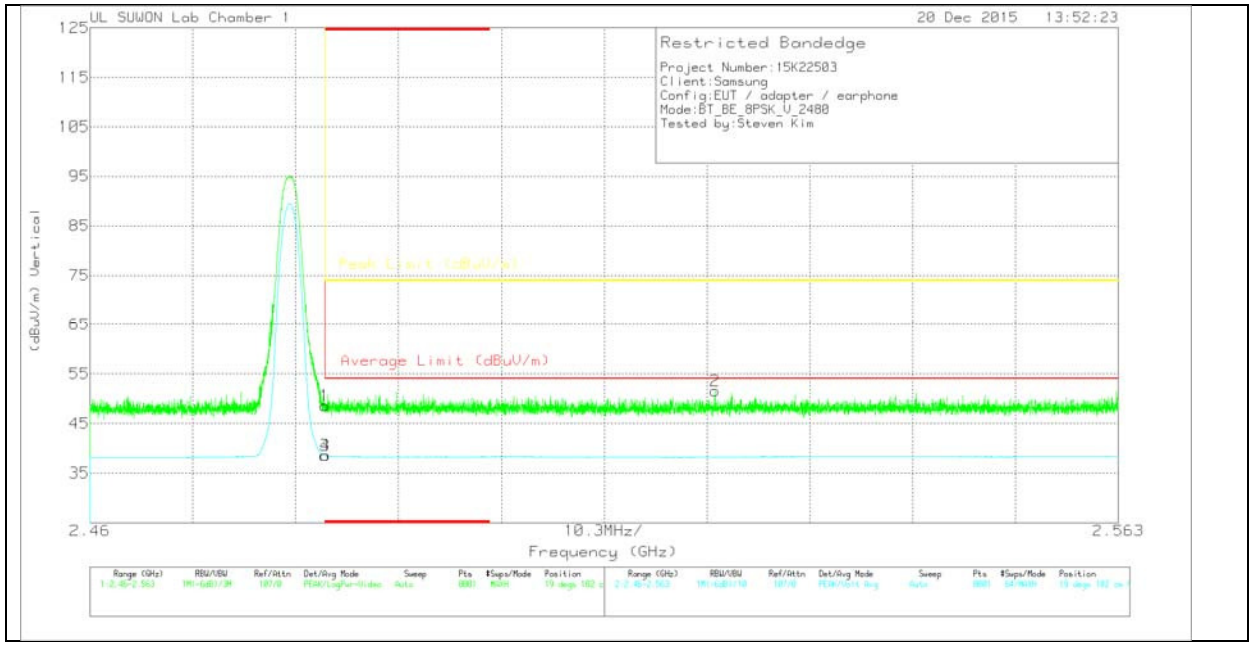
VERTICAL PEAK AND AVERAGE PLOT



VERTICAL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_2	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	* 2.484	45.53	Pk	32	-28.9	48.63	-	-	74	-25.37	19	182	V	1
2	2.523	48.43	Pk	32	-28.9	51.53	-	-	74	-22.47	19	182	V	2
3	* 2.484	35.45	V1TV	32	-28.9	38.55	54	-15.45	-	-	19	182	V	3
4	* 2.484	35.42	V1TV	32	-28.9	38.52	54	-15.48	-	-	19	182	V	4

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

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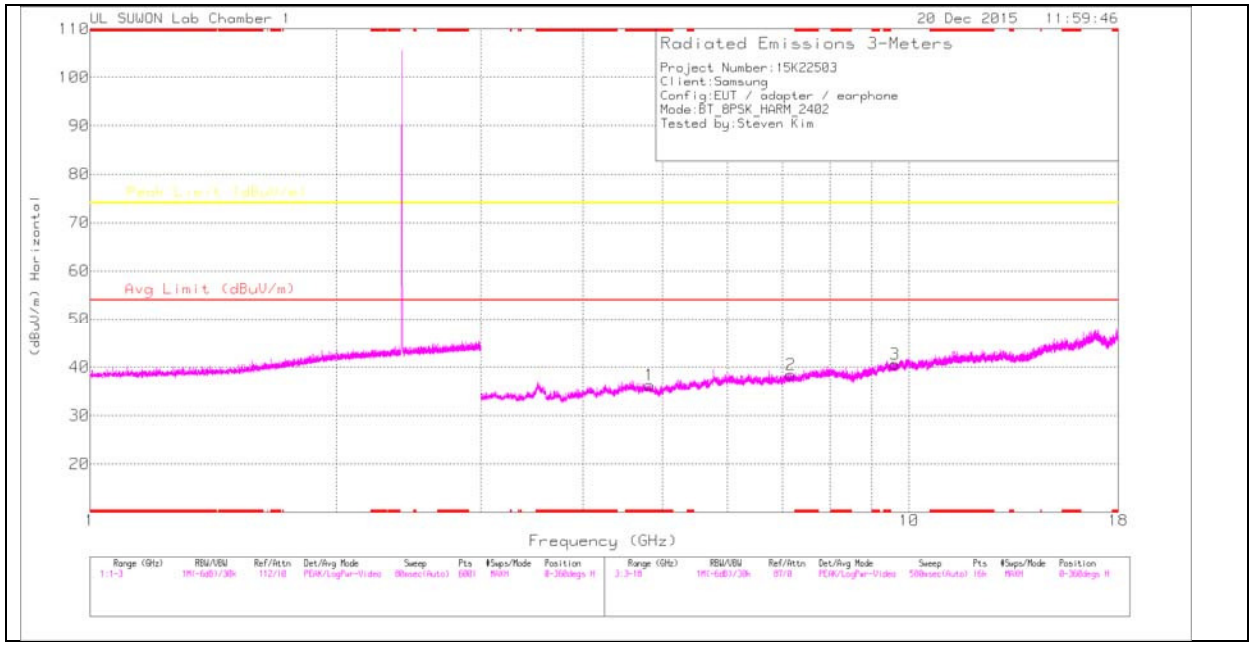
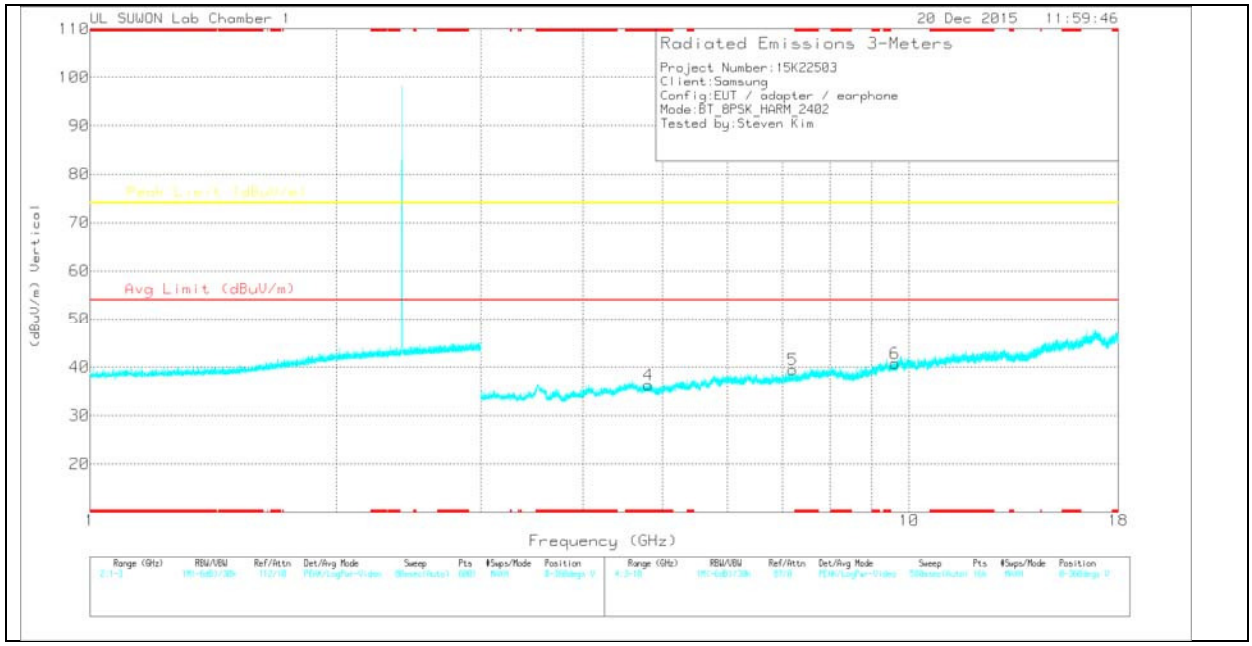
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL



LOW CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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LOW CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.825	36.07	PK	34	-33.8	36.27	-	-	74	-37.73	0-360	200	H
2	7.174	33.7	PK	35.7	-30.9	38.5	-	-	74	-35.5	0-360	200	H
3	9.611	30.86	PK	37	-27.3	40.56	-	-	74	-33.44	0-360	200	H
4	* 4.803	36.09	PK	34	-33.8	36.29	-	-	74	-37.71	0-360	200	V
5	7.205	34.63	PK	35.7	-30.8	39.53	-	-	74	-34.47	0-360	100	V
6	9.614	30.94	PK	37	-27.2	40.74	-	-	74	-33.26	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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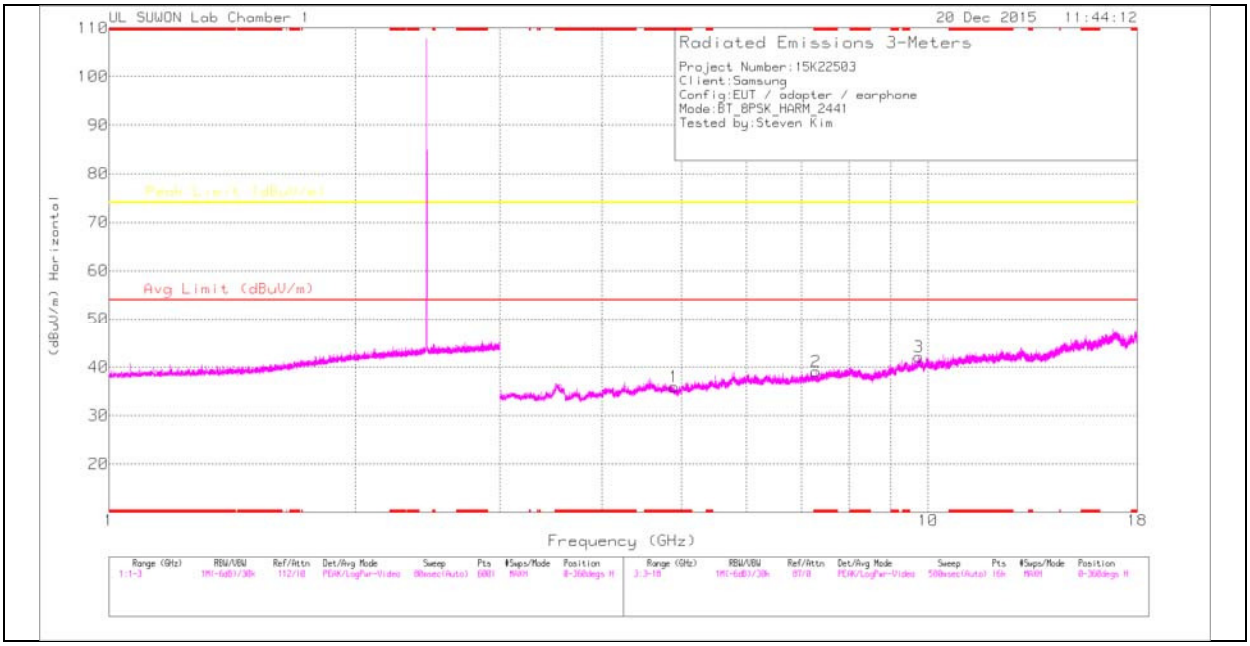
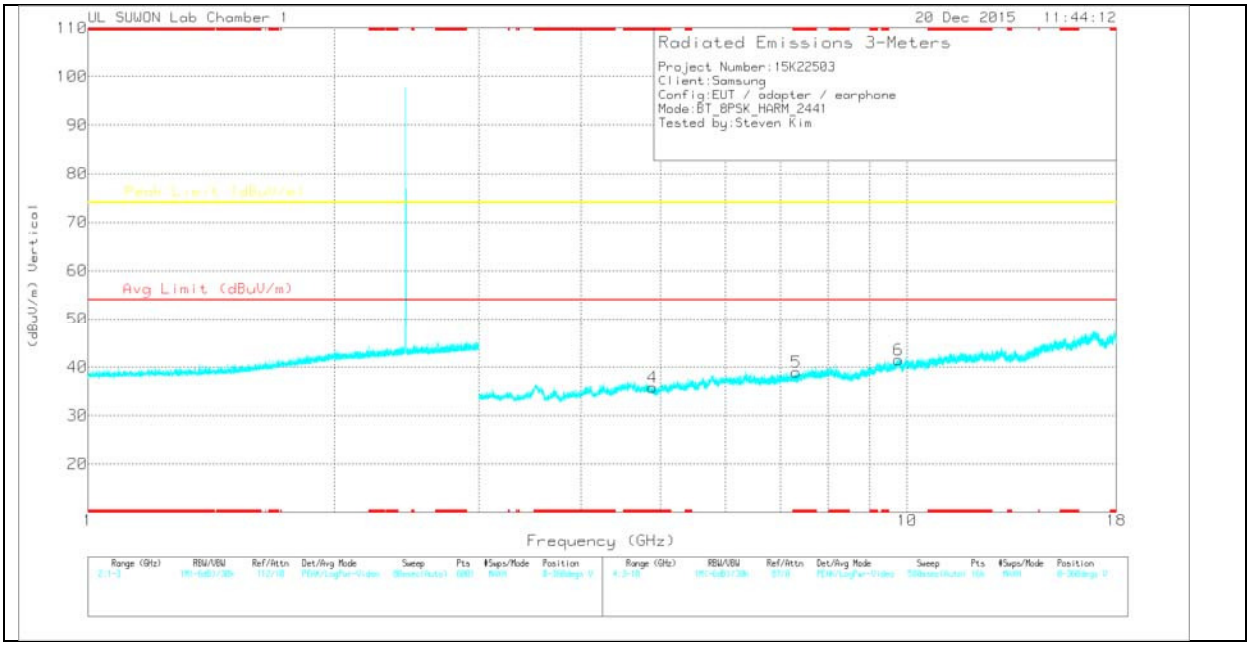
MID CHANNEL HORIZONTAL



MID CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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MID CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.895	35.97	Pk	34	-34	35.97	-	-	74	-38.03	0-360	200	H
2	* 7.293	34.25	Pk	35.7	-30.9	39.05	-	-	74	-34.95	0-360	200	H
3	9.747	31.85	Pk	37.2	-26.9	42.15	-	-	74	-31.85	0-360	100	H
4	* 4.889	35.81	Pk	34	-34	35.81	-	-	74	-38.19	0-360	100	V
5	* 7.323	34.03	Pk	35.8	-30.9	38.93	-	-	74	-35.07	0-360	100	V
6	9.762	30.85	Pk	37.2	-26.6	41.45	-	-	74	-32.55	0-360	200	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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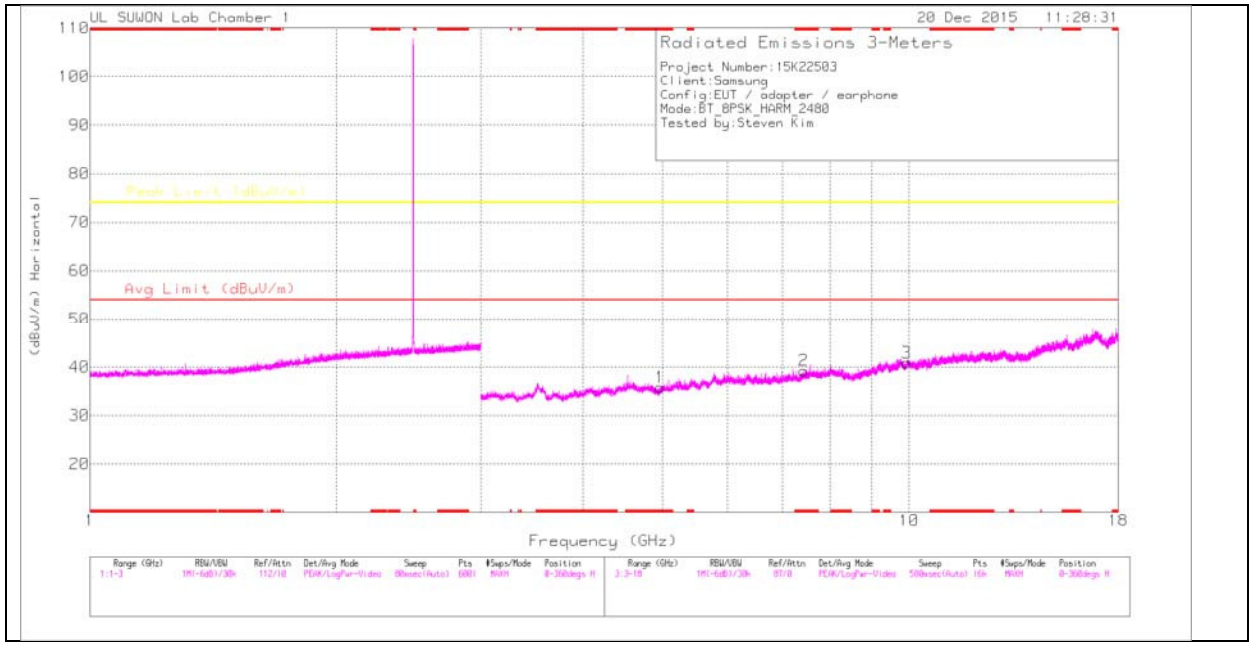
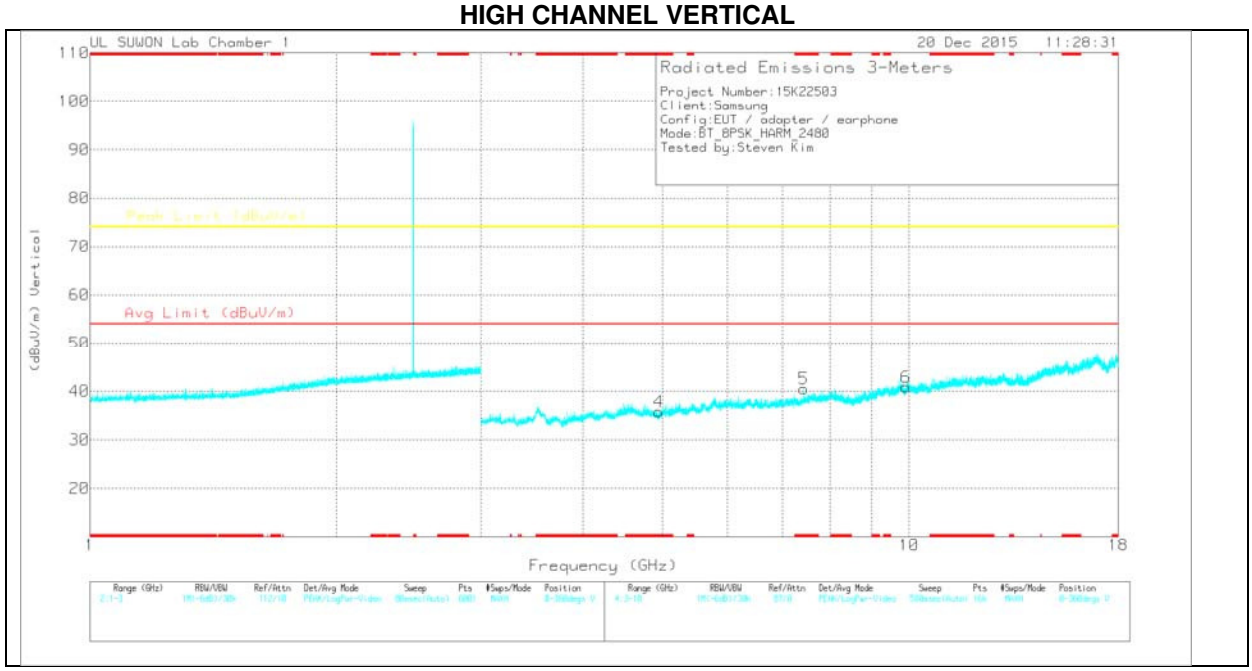
HIGH CHANNEL HORIZONTAL



HIGH CHANNEL VERTICAL



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

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HIGH CHANNEL DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	3117(00168717)_150619	Path_3	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.962	35.87	PK	34	-34	35.87	-	-	74	-38.13	0-360	200	H
2	* 7.44	34.19	PK	35.8	-30.7	39.29	-	-	74	-34.71	0-360	200	H
3	9.919	30.73	PK	37.4	-27.2	40.93	-	-	74	-33.07	0-360	100	H
4	* 4.951	35.79	PK	34	-34	35.79	-	-	74	-38.21	0-360	200	V
5	* 7.44	35.45	PK	35.8	-30.7	40.55	-	-	74	-33.45	0-360	100	V
6	9.917	30.78	PK	37.4	-27.3	40.88	-	-	74	-33.12	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK – Peak Detector

Note: Only peak measurement was performed. Because peak measurement result of unwanted emission is less than average limit (54dBuV/m).

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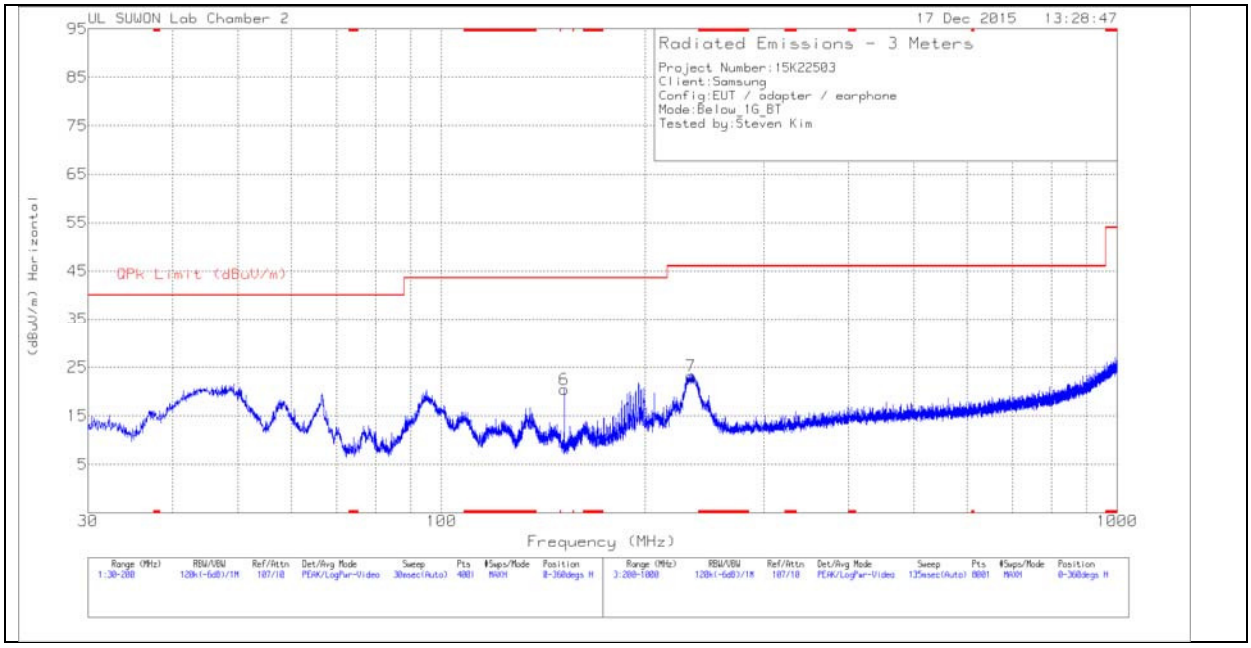
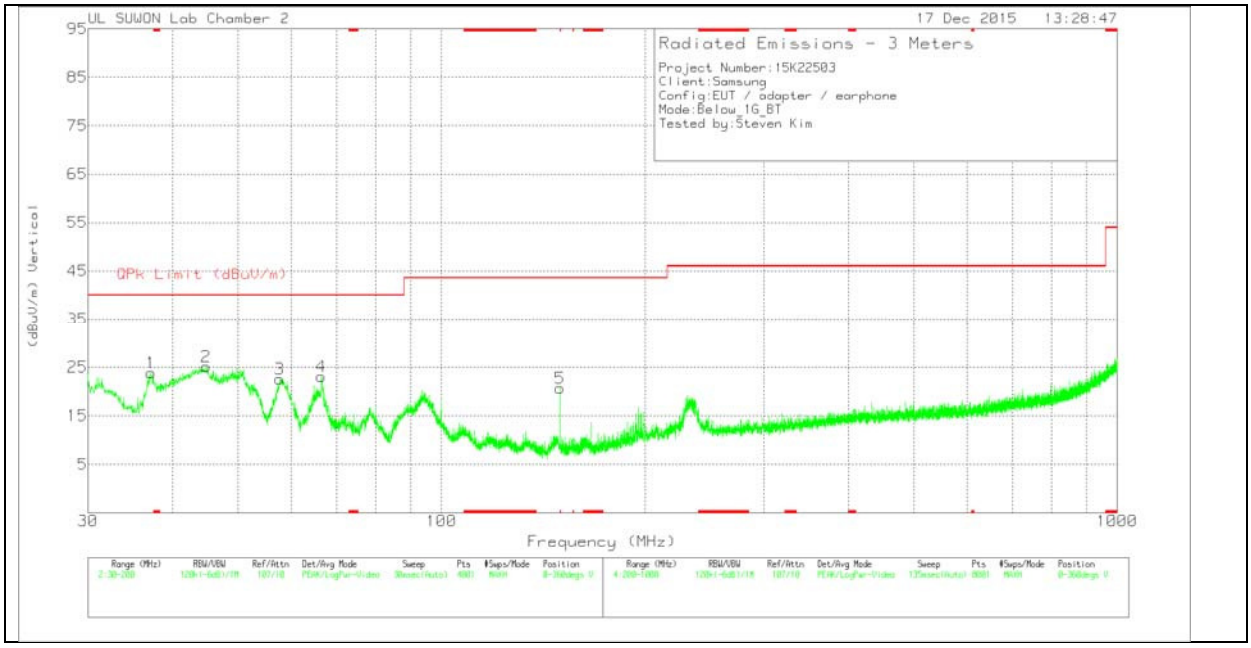
9.3. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



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BELOW 1 GHz TABLE

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	VULB9163-749	Below_1G	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	152.0175	42.59	Pk	8.3	-30.5	20.39	43.52	-23.13	0-360	200	H
1	37.1825	43	Pk	11.6	-30.8	23.8	40	-16.2	0-360	100	V
2	44.875	41.9	Pk	13.9	-30.7	25.1	40	-14.9	0-360	100	V
3	57.6675	40.17	Pk	13.1	-30.7	22.57	40	-17.43	0-360	100	V
4	66.4225	42.93	Pk	10.8	-30.7	23.03	40	-16.97	0-360	100	V
5	149.7225	42.88	Pk	8.2	-30.4	20.68	43.52	-22.84	0-360	300	V

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.

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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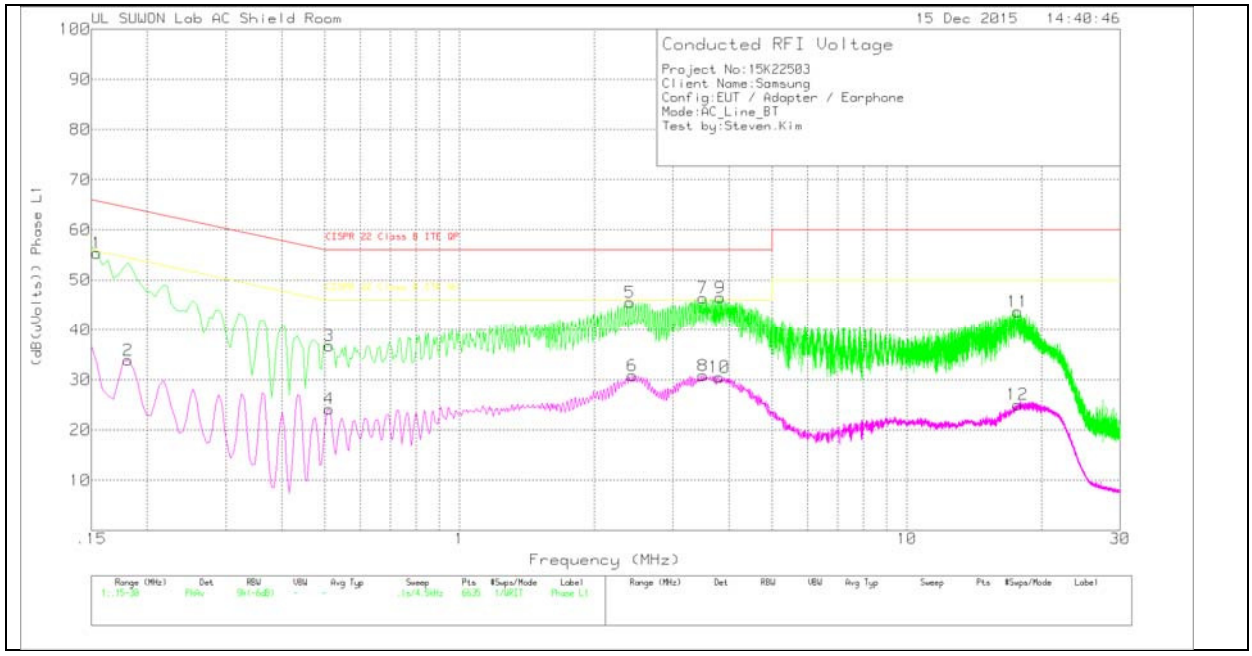
WORST EMISSIONS

LINE 1 PLOT



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LINE 1 RESULTS

Trace Markers

Phase L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_L1	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
1	.1545	45.49	Pk	9.9	0	55.39	65.75	-10.36	-	-
2	.1815	23.79	Av	10.1	0	33.89	-	-	54.42	-20.53
3	.51	26.56	Pk	10.2	0	36.76	56	-19.24	-	-
4	.51	14	Av	10.2	0	24.2	-	-	46	-21.8
5	2.4045	35.66	Pk	9.8	.1	45.56	56	-10.44	-	-
6	2.436	20.91	Av	9.8	.1	30.81	-	-	46	-15.19
7	3.498	36.56	Pk	9.8	.1	46.46	56	-9.54	-	-
8	3.5025	20.93	Av	9.8	.1	30.83	-	-	46	-15.17
9	3.8265	36.61	Pk	9.8	.1	46.51	56	-9.49	-	-
10	3.8085	20.61	Av	9.8	.1	30.51	-	-	46	-15.49
11	17.691	33.2	Pk	10.3	.2	43.7	60	-16.3	-	-
12	17.6865	14.56	Av	10.3	.2	25.06	-	-	50	-24.94

Pk - Peak detector

Av - Average detection

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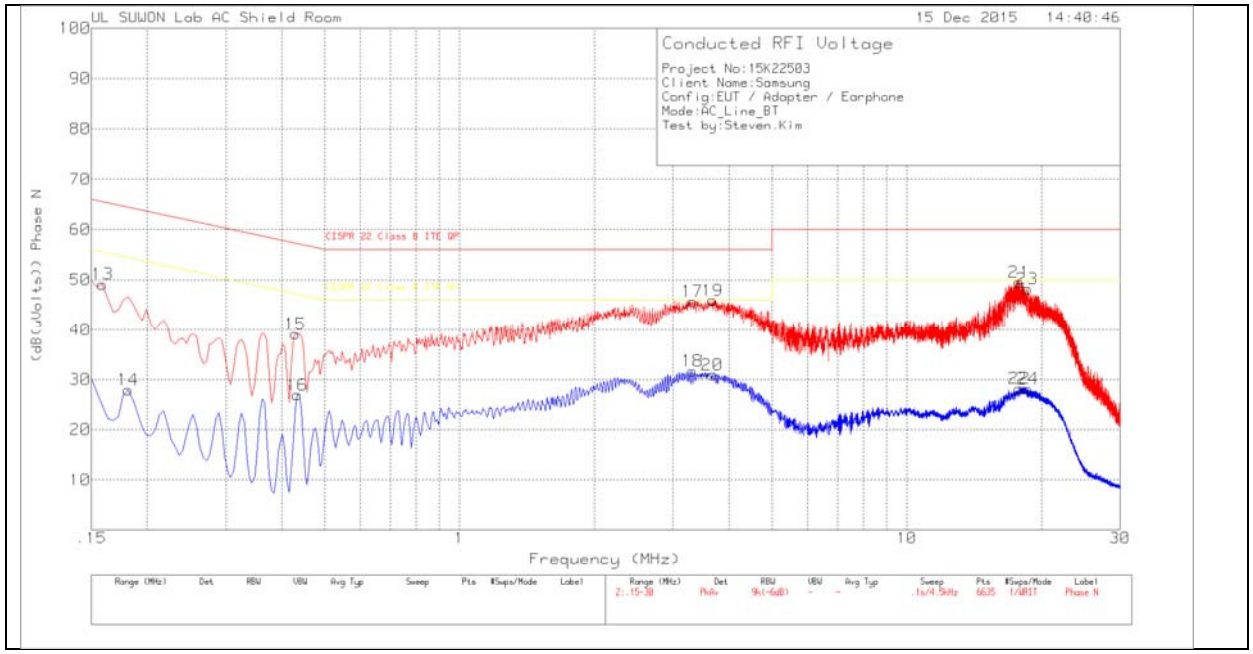
LINE 2 PLOT



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LINE 2 RESULTS

Trace Markers

Phase N .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	101837_with ex-cord_N	CE Shield Room	Corrected Reading (dB(uVolts))	CISPR 22 Class B ITE QP	Margin (dB)	CISPR 22 Class B ITE AV	Margin (dB)
13	.159	39.15	Pk	10	0	49.15	65.52	-16.37	-	-
14	.1815	17.85	Av	10.1	0	27.95	-	-	54.42	-26.47
15	.429	29.04	Pk	10.1	0	39.14	57.27	-18.13	-	-
16	.4335	16.84	Av	10.1	0	26.94	-	-	47.19	-20.25
17	3.3135	35.82	Pk	9.8	.1	45.72	56	-10.28	-	-
18	3.318	21.82	Av	9.8	.1	31.72	-	-	46	-14.28
19	3.678	36.02	Pk	9.8	.1	45.92	56	-10.08	-	-
20	3.6735	21.04	Av	9.8	.1	30.94	-	-	46	-15.06
21	17.844	38.88	Pk	10.5	.2	49.58	60	-10.42	-	-
22	17.8395	17.52	Av	10.5	.2	28.22	-	-	50	-21.78
23	18.5955	37.5	Pk	10.5	.2	48.2	60	-11.8	-	-
24	18.6405	17.49	Av	10.5	.2	28.19	-	-	50	-21.81

Pk - Peak detector

Av - Average detection

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