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Job Number:	1001531435
Project Number:	12CA39742
File Number:	MC15343
Date:	July 24, 2012
Model:	KLIK1

Electromagnetic Compatibility Test Report

For

Chamberlain Group Inc.

Test Report Details

Tests Performed By:	**UL LLC** **333 Pfingsten Rd.** **Northbrook, IL 60062**
Tests Performed For:	**Chamberlain Group Inc.** **845 Larch Av** **Elmhurst, IL 60126**
Applicant Contact: Phone: E-mail:	**Hank Sieradzki** **(630) 993-6564** **Hank.Sieradzki@chamberlaingroup.com**
Test Report Date:	**May 25, 2012**
Product Type:	**Universal Periodic Transmitter**
Product standards	**FCC Part 15, Subpart C, 15.231 & RSS-210**
Model Number:	**KLIK1**
EUT Category:	**Wireless Device**
Testing Start Date:	**July 10, 2012**
Date Testing Complete:	**July 19, 2012**
Overall Results:	**Compliant**

UL LLC reports apply only to the specific samples tested under stated test conditions. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL LLC shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL LLC issued reports. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

This report may contain test results that are not covered by the NVLAP or A2LA accreditation. The scope of accreditation is limited to the specific tests that are listed on the NVLAP and/or A2LA websites referenced at the end of this report.

Report Directory

Report Revision History

Revision Date	Description	Revised By	Revision Reviewed By
none			

1.0 G E N E R A L - Product Description

1.1 Equipment Description

The equipment under test is a universal transmitter used with various brand garage door operators. The transmitter uses 300MHz, 310MHz, 315MHz, 318MHz, 372.5MHz and 390MHz. It is user programmable for use with specific garage door operators.

1.2 Device Configuration During Test

1.2.1 Equipment Used During Test:

Use	Product Type	Manufacturer	Model	Comments
EUT	Periodic Transmitter	Chamberlain Group Inc.	KLIK1	During testing this device was referenced by CLICKER2

Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)

1.2.2 Input/Output Ports:

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	None

Note:
AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

1.2.3 Power Interface:

Mode # /Rated	Voltage (V)	Current (A)	Power (W)	Frequency (DC/AC-Hz)	Phases (#)	Comments
1	3	-	-	dc	-	Battery Operated

1.3 EUT Configurations

Mode #	Description
1	EUT with fresh batteries set to transmit.

1.4 EUT Operation Modes

Mode #	Description
1	EUT transmitting per specific configuration

1.5 Rational for EUT Configuration

Mode #	Description
1	The Fundamental frequencies were measured in various axis (X, Y, and Z) and worst case axis for 300MHz, 310MHz, 315MHz and 318MHz was X-Axis and for 372.5MHz and 390MHz was Y-Axis. Below is a list of possible configurations. Only configurations in highlighted in green were tested. Configurations that were not tested had same power amplifier setting, same frequency and same duty cycle number as the ones above.

CONFIG#	Frequency
14#	300MHz
8#	310MHz
10# - same as above	310MHz
7#	310MHz
18#	310MHz
16#	310MHz
8#	315MHz
10# - same as above	315MHz
3#	315MHz
5#	315MHz
12#	315MHz
1#	318MHz
9#	372.5MHz
8#	390MHz
10# - same as above	390MHz
2#	390MHz
6#	390MHz
19#	390MHz
15#	390MHz
11#	390MHz
4#	390MHz
13#	390MHz
17# - same as above	390MHz

2.0 Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL LLC in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

2.1 Deviations from standard test methods

None

2.2 Device Modifications Necessary for Compliance

None

2.3 Reference Standards

Standard Number	Standard Name	Standard Date
FCC Part 15, Subpart C, 15.231	Code of Federal Regulations, Part 15, Radio Frequency Devices	2012
RSS-210	License - exempt Radio Apparatus (All Frequency Bands): Category I Equipment	Issue 8

2.4 Results Summary

Requirement – Test	Result (Compliant / Non-Compliant)*
Line Conducted Emissions	N/A – EUT is battery operated only
Occupied Bandwidth	Compliant
Cease Operation	Compliant
Pulse Train and Duty Cycle	Compliant
Fundamental Frequency & Spurious Radiated Emissions	Compliant

Test Engineer:

Bartlomiej Mucha (Ext.41216)
Staff Engineer
International EMC Services
Conformity Assessment Services

Reviewer:

Michael Ferrer(Ext.41312)
Senior Project Engineer
International EMC Services
Conformity Assessment Services

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

FCC	47 CFR Part 15 – Intentional Radiators
IC	RSS-210 and RSS-Gen License - exempt Radio Apparatus

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

Ambient Temperature, °C	22.5 ± 2.5	Relative Humidity, %	45 ± 15	Barometric Pressure, mBar	950 ± 150

Sample Calculations
Radiated Field Strength and Conducted Emissions data contained within this report is calculated on the following basis:

Field Strength (dBuV/m) = Meter Reading (dBuV) + AF (dB/m) + (-Gain (dB)) + Cable Loss (dB)
Conducted Voltage (dBuV) = Meter Reading (dBuV) + Cable Loss (dB) + LISN IL (dB)
Conducted Current (dBuA) = Meter Reading (dBuV) + Cable Loss (dB) - Transducer Factor (dBohms)

4.1 Configuration 14# Test Data

4.1.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (300MHz: 750kHz)	

Table 1 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

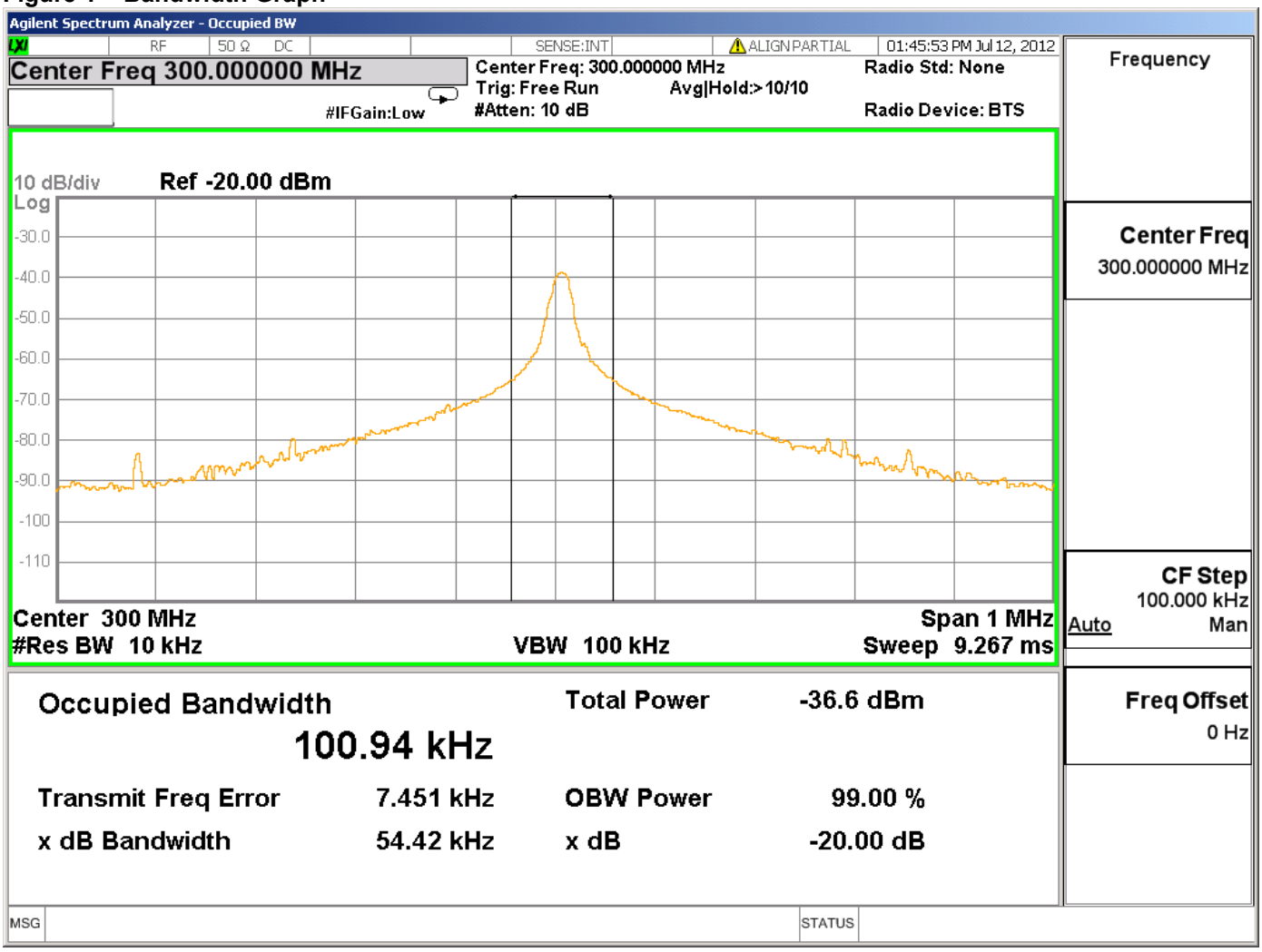
Table 2 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 3 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
300MHz	54.42	100.94

Figure 1 – Bandwidth Graph



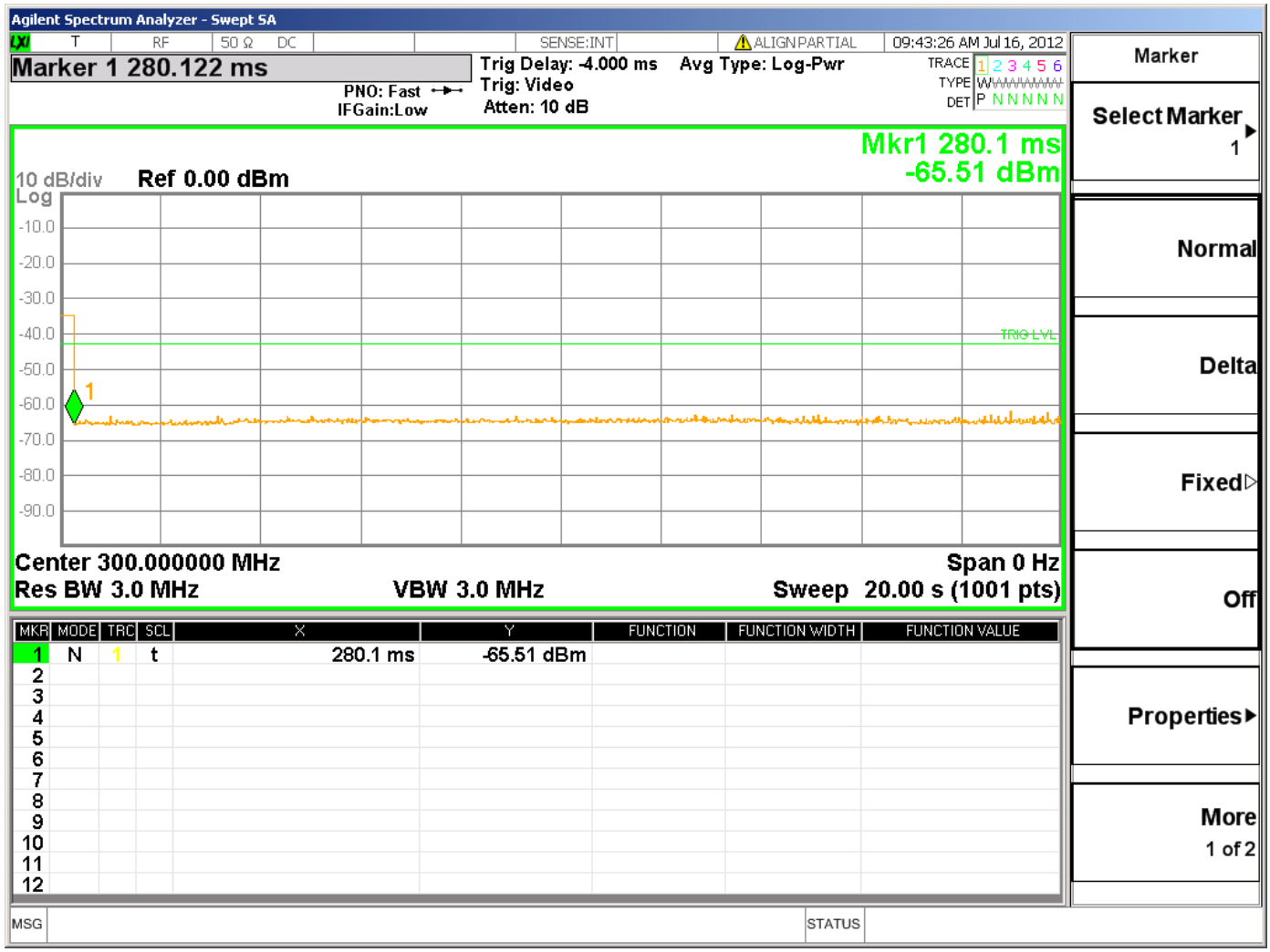
4.1.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 4 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 2 Cease Operation Graph



4.1.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

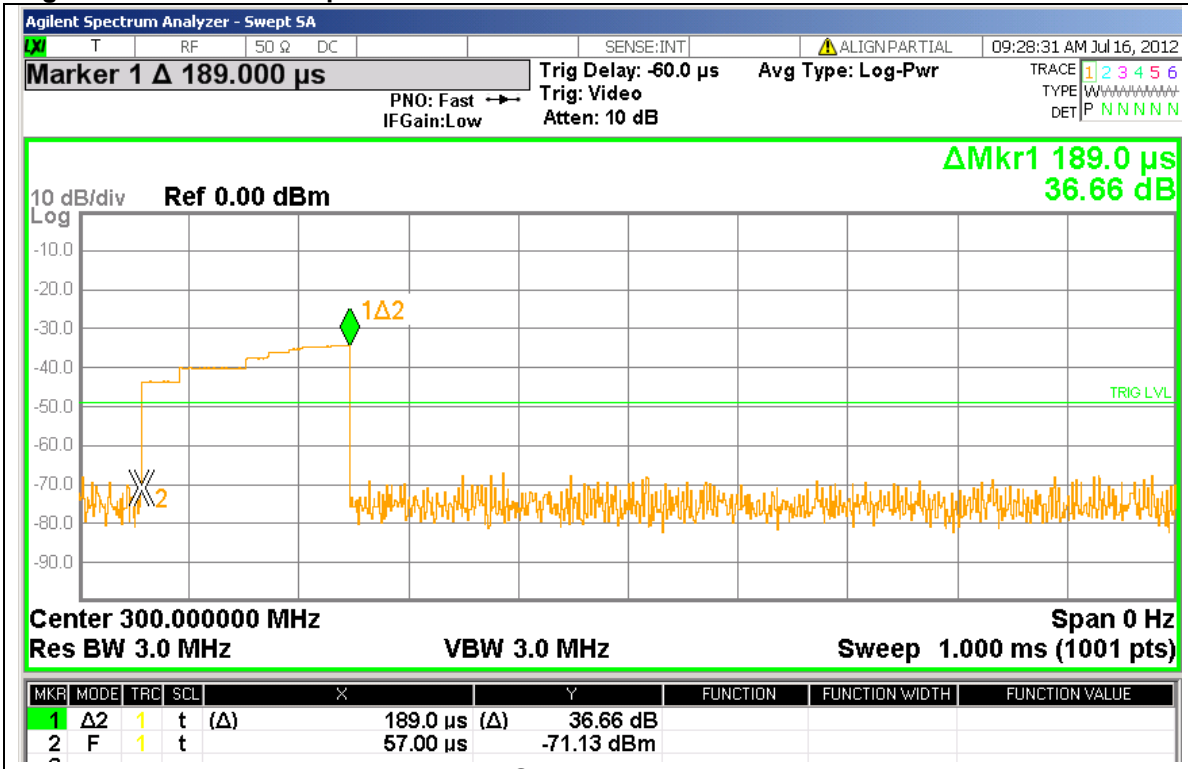
Table 5 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

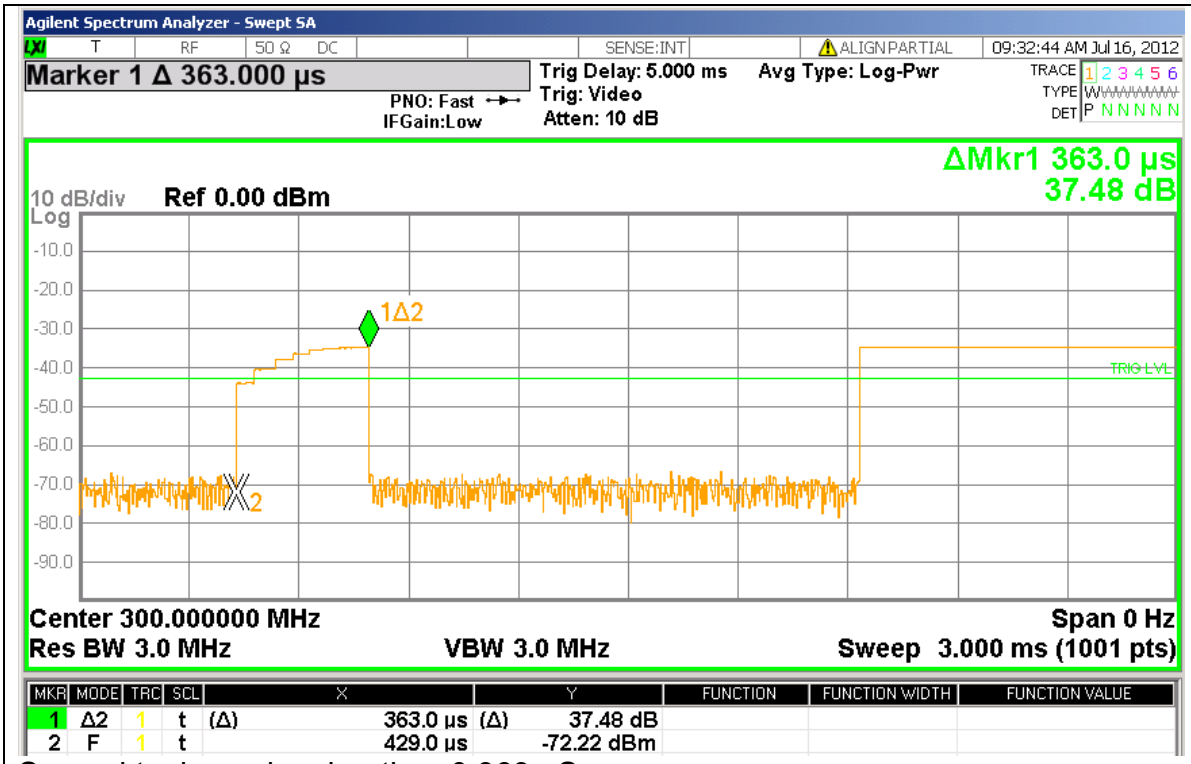
Table 6 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
300MHz	(10x1.491)+(10x1.491)+(10x1.491)+0.363	100ms	-6.9
Worst Case Duty Cycle: Worst case duty cycle was calculated by adding three sets of bursts over 100mS and the second tuning pulse. The manufacturer declares the worst case duty cycle at 8.1dB. The measured duty cycle is used for all radiated emissions.			

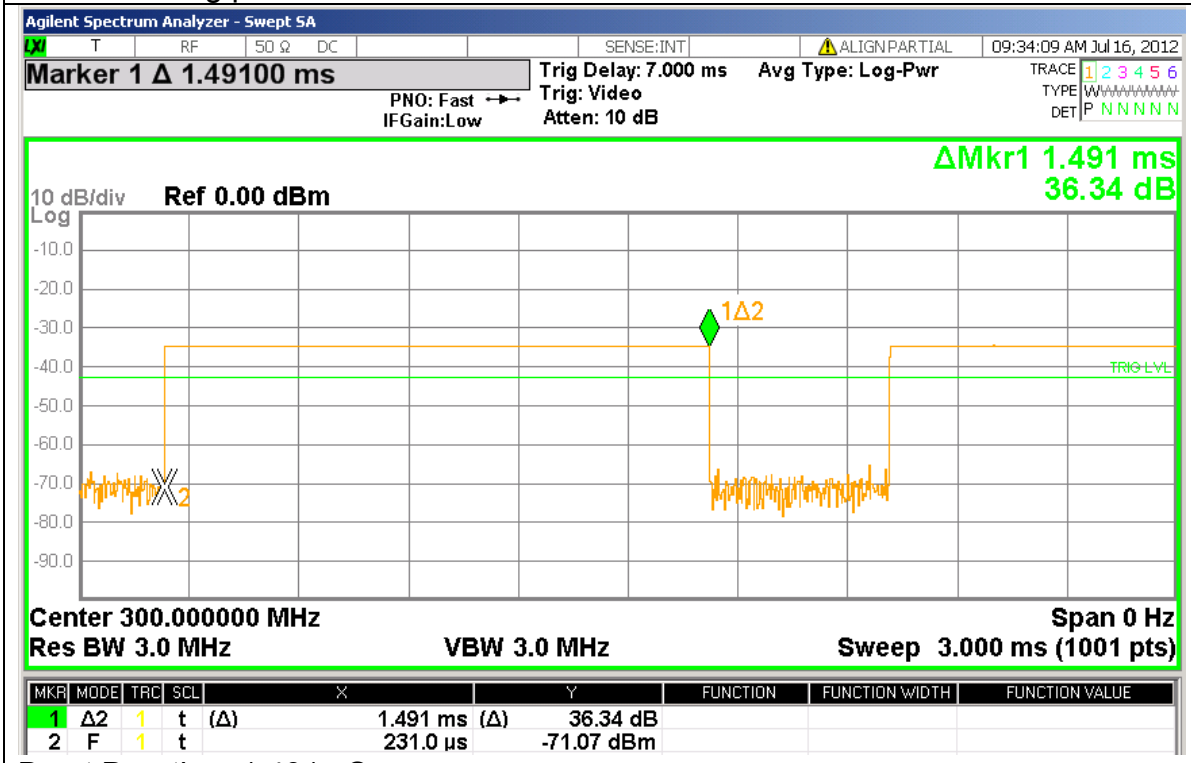
Figure 3 Pulse Train Graphs



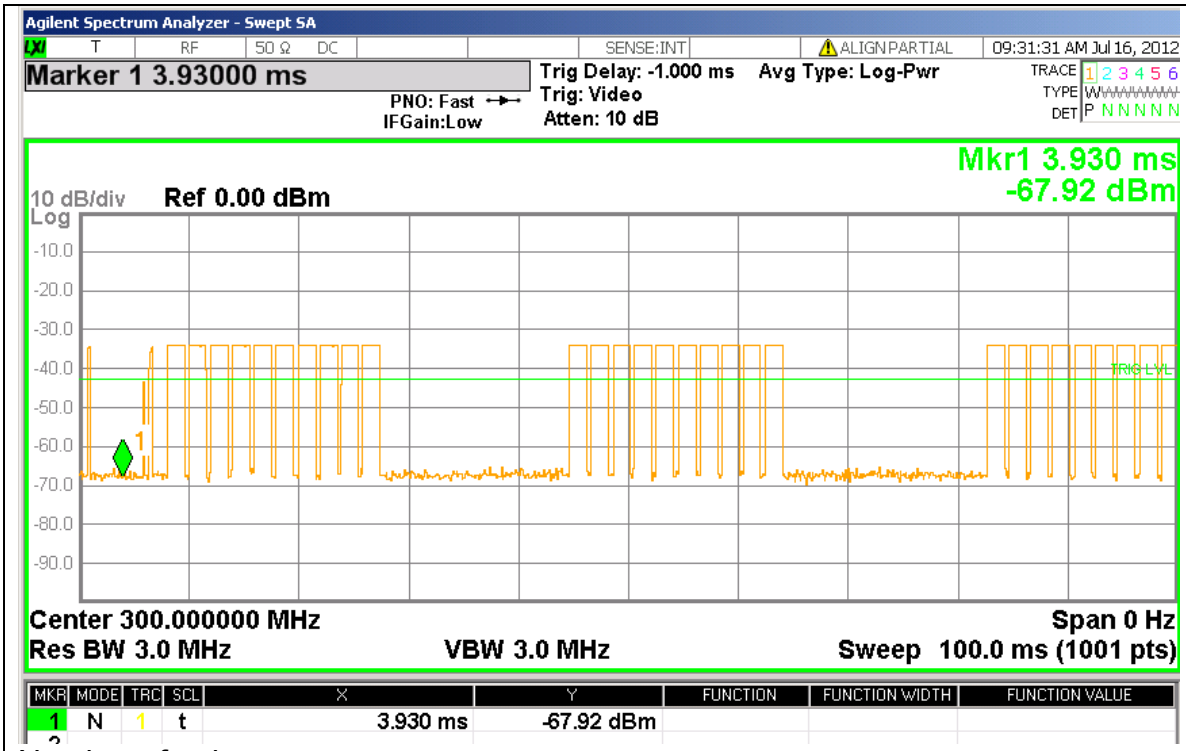
First tuning pulse duration: 0.189mS



Second tuning pulse duration: 0.363mS



Burst Duration: 1.491mS



Number of pulses

4.1.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
300	74.67	94.67

Supplementary information: See section 4.1.3 for duty cycle information.

Figure 4 Radiated Emissions Graph (Below 1GHz)

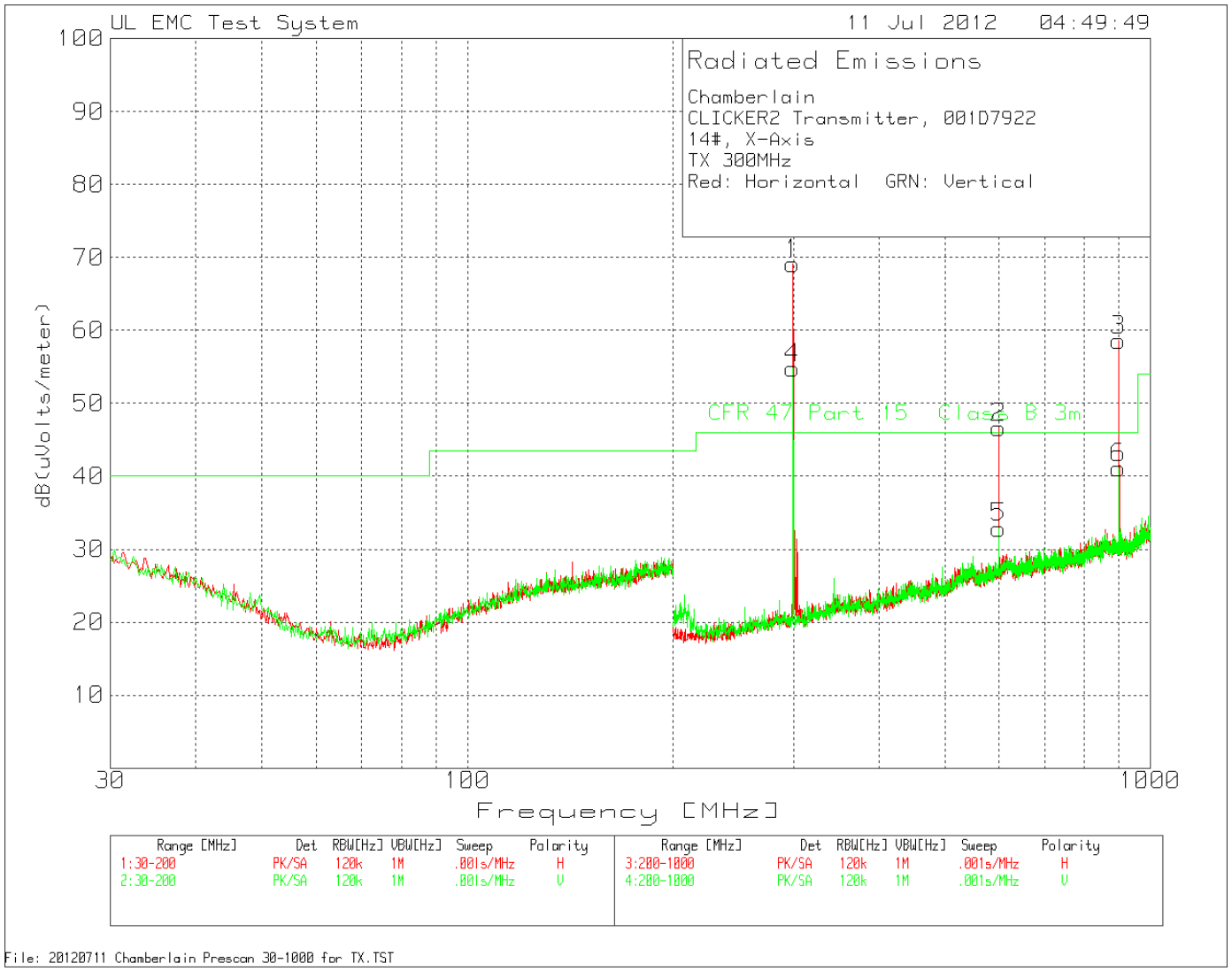


Figure 5 Radiated Emissions Graph (Above 1GHz)

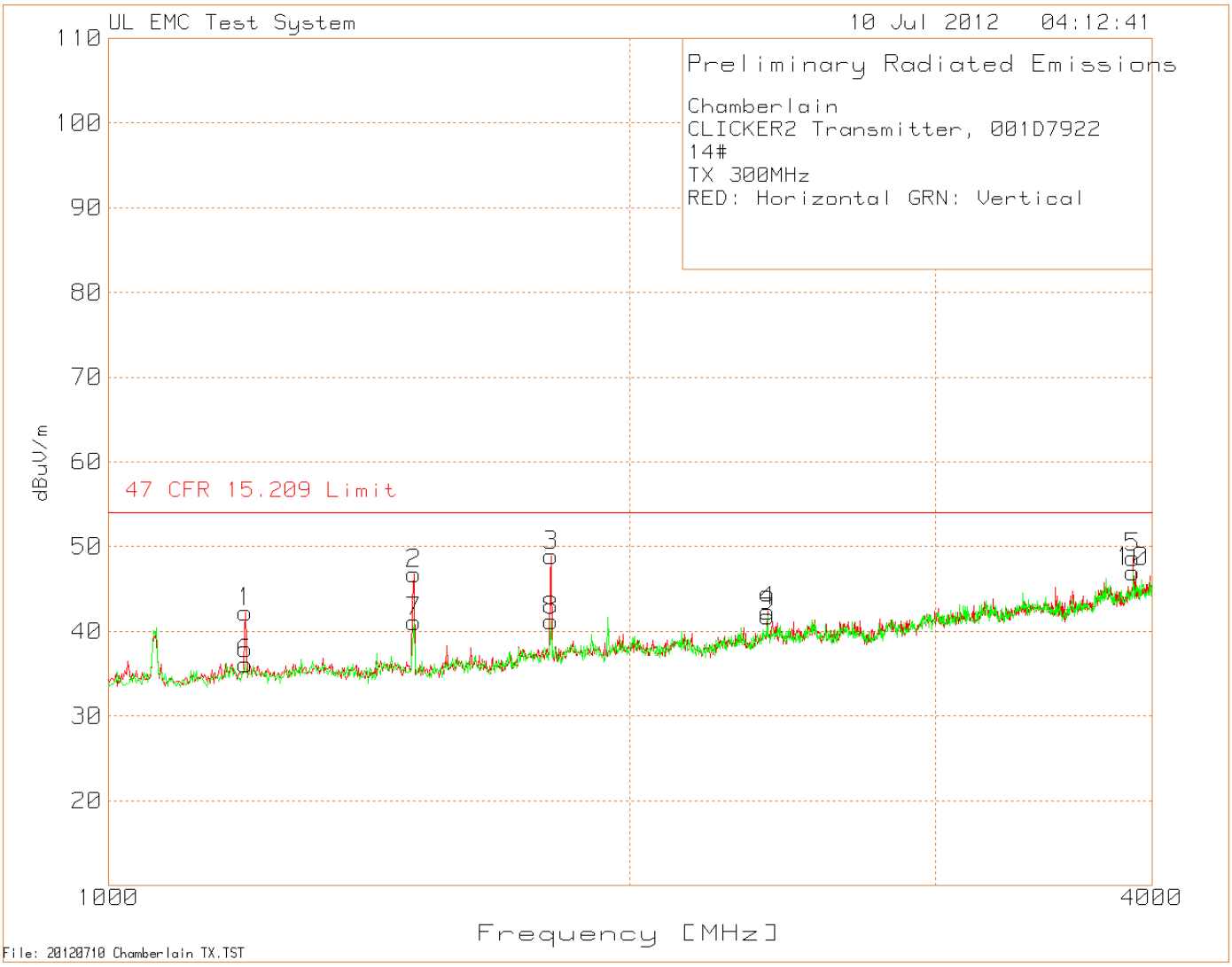


Table 7 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
300.011218	58.73	PK	13.9	2	74.63	-6.9	67.73	74.67	-6.94	306	102	Horz	X
300.011218	43.72	PK	13.9	2	59.62	-6.9	52.72	74.67	-21.95	30	142	Vert	X
300.011218	50.42	PK	13.9	2	66.32	-6.9	59.42	74.67	-15.25	192	202	Horz	Y
300.011218	55.96	PK	13.9	2	71.86	-6.9	64.96	74.67	-9.71	114	177	Vert	Y
300.011218	54.74	PK	13.9	2	70.64	-6.9	63.74	74.67	-10.93	29	114	Horz	Z
300.011218	55.91	PK	13.9	2	71.81	-6.9	64.91	74.67	-9.76	117	166	Vert	Z
600.019231	27.96	PK	19.9	3	50.86	-6.9	43.96	54.67	-10.71	14	134	Horz	X
600.019231	16.55	PK	19.9	3	39.45	-6.9	32.55	54.67	-22.12	113	144	Vert	X
900.032051	31.88	PK	23.1	3.7	58.68	-6.9	51.78	54.67	-2.89	56	157	Horz	X
900.032051	21.08	PK	23.1	3.7	47.88	-6.9	40.98	54.67	-13.69	338	164	Vert	X
1200.1894	75.22	PK	25	-56.73	43.49	-6.9	36.59	54	-17.41	12	137	Horz	X
1500.1473	84.12	PK	25.2	-55.88	53.44	-6.9	46.54	54	-7.46	108	102	Horz	X
1800.1293	81.08	PK	27	-55.13	52.95	-6.9	46.05	54	-7.95	356	126	Horz	X
1200.133	74.03	PK	25	-56.73	42.3	-6.9	35.4	54	-18.6	*	125	Horz	X
1500.334	77.43	PK	25.2	-55.89	46.74	-6.9	39.84	54	-14.16	*	110	Horz	X
1800.534	77.02	PK	27	-55.14	48.88	-6.9	41.98	54	-12.02	*	125	Horz	X
2400.934	65.41	PK	28.7	-51.7	42.41	-6.9	35.51	54	-18.49	*	110	Horz	X
3901.935	67.94	PK	32.7	-51.99	48.65	-6.9	41.75	54	-12.25	*	110	Horz	X
1200.133	67.91	PK	25	-56.73	36.18	-6.9	29.28	54	-24.72	*	125	Vert	X
1500.334	71.84	PK	25.2	-55.89	41.15	-6.9	34.25	54	-19.75	*	125	Vert	X
1800.534	69.33	PK	27	-55.14	41.19	-6.9	34.29	54	-19.71	*	100	Vert	X
2400.934	64.81	PK	28.7	-51.7	41.81	-6.9	34.91	54	-19.09	*	125	Vert	X
3901.935	66.26	PK	32.7	-51.99	46.97	-6.9	40.07	54	-13.93	*	100	Vert	X
*Prescan Data Used													

4.2 Configuration 8# Test Data

4.2.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (310MHz: 775.0kHz, 315MHz: 787.5kHz, 390MHz: 975.0kHz)	

Table 8 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 9 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 10 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
310MHz	51.20	100.85
315MHz	54.16	97.4
390MHz	50.25	92.436

Figure 6 – Bandwidth Graph for 310MHz

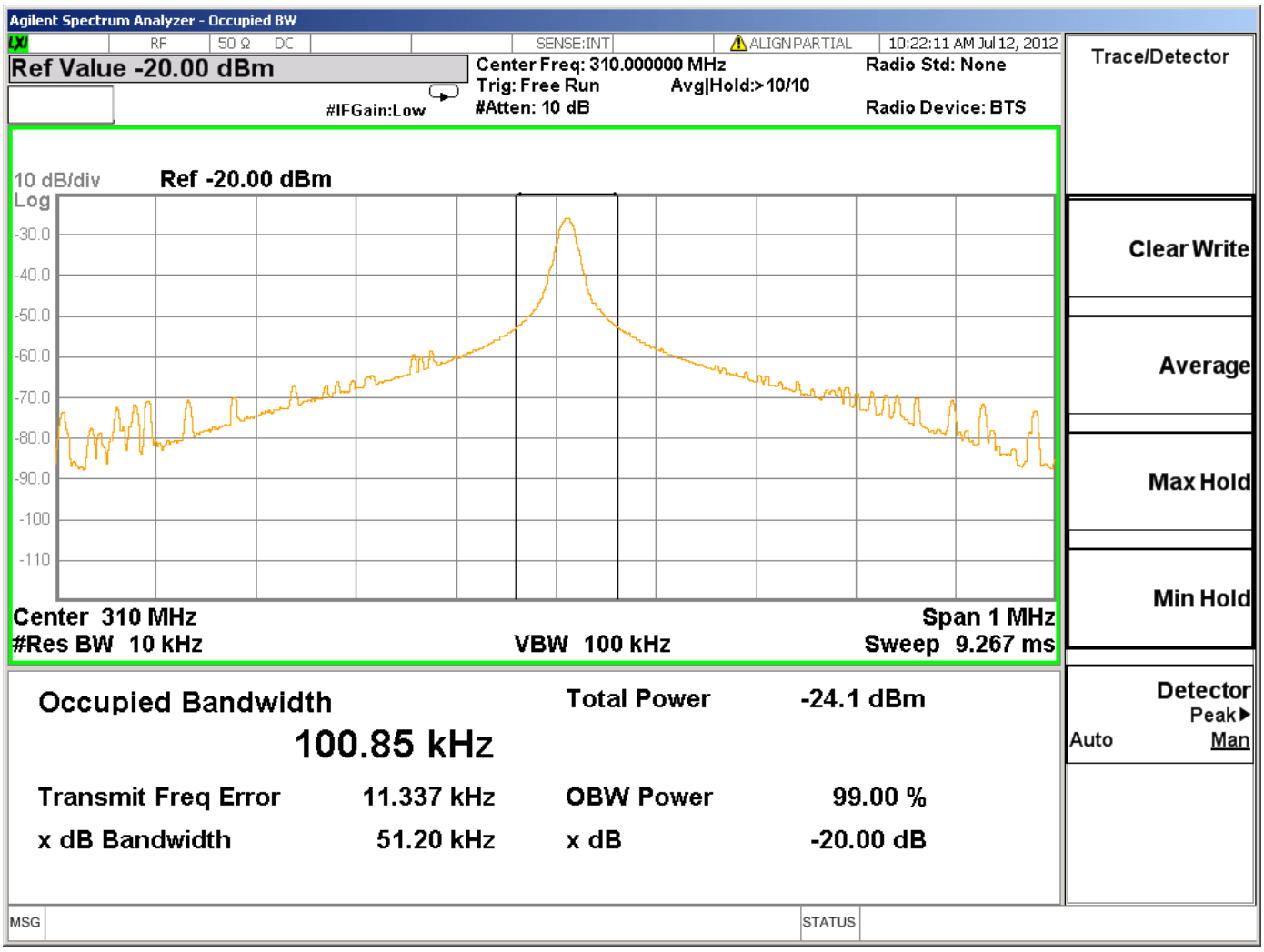


Figure 7 – Bandwidth Graph for 315MHz

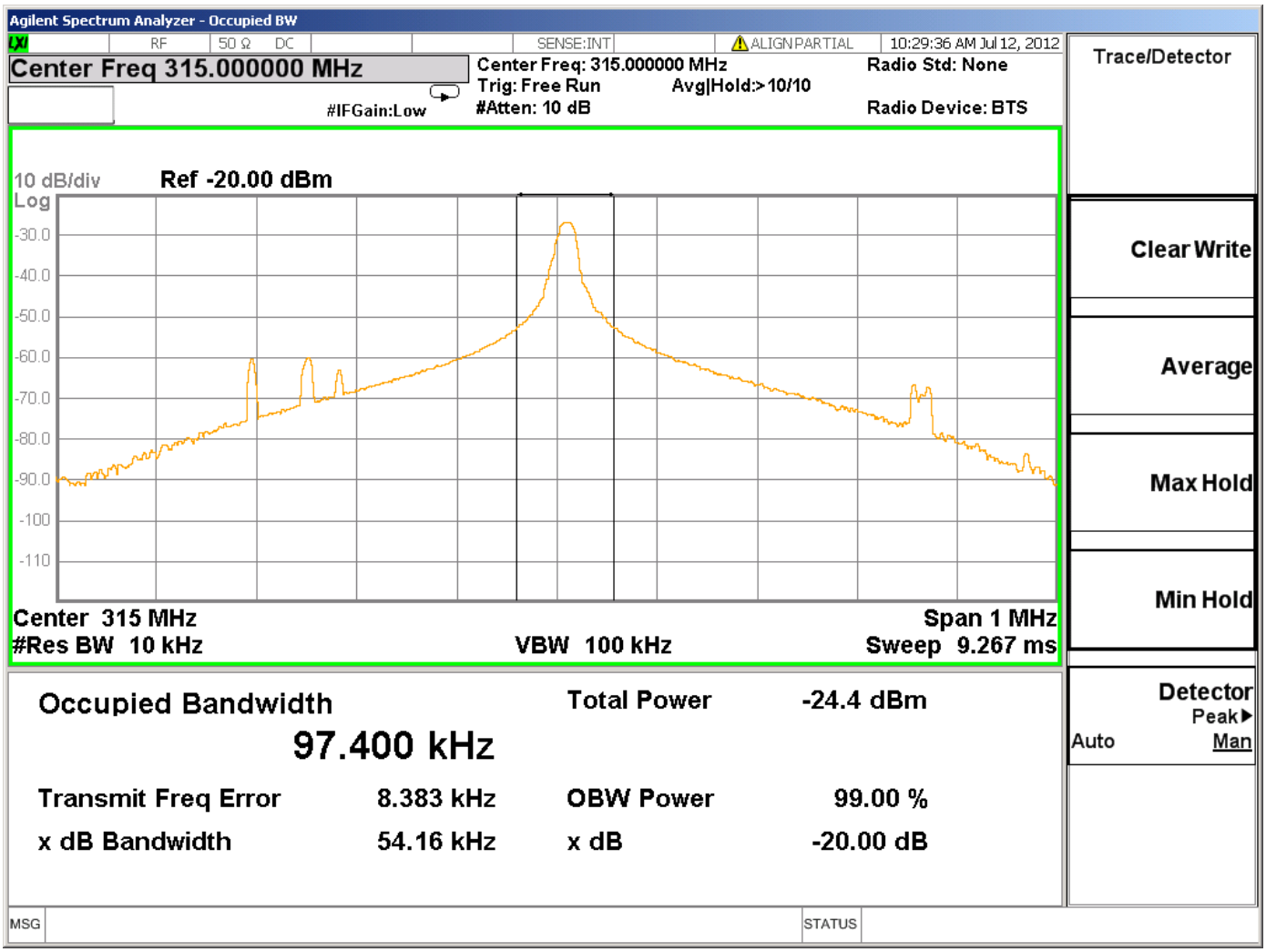
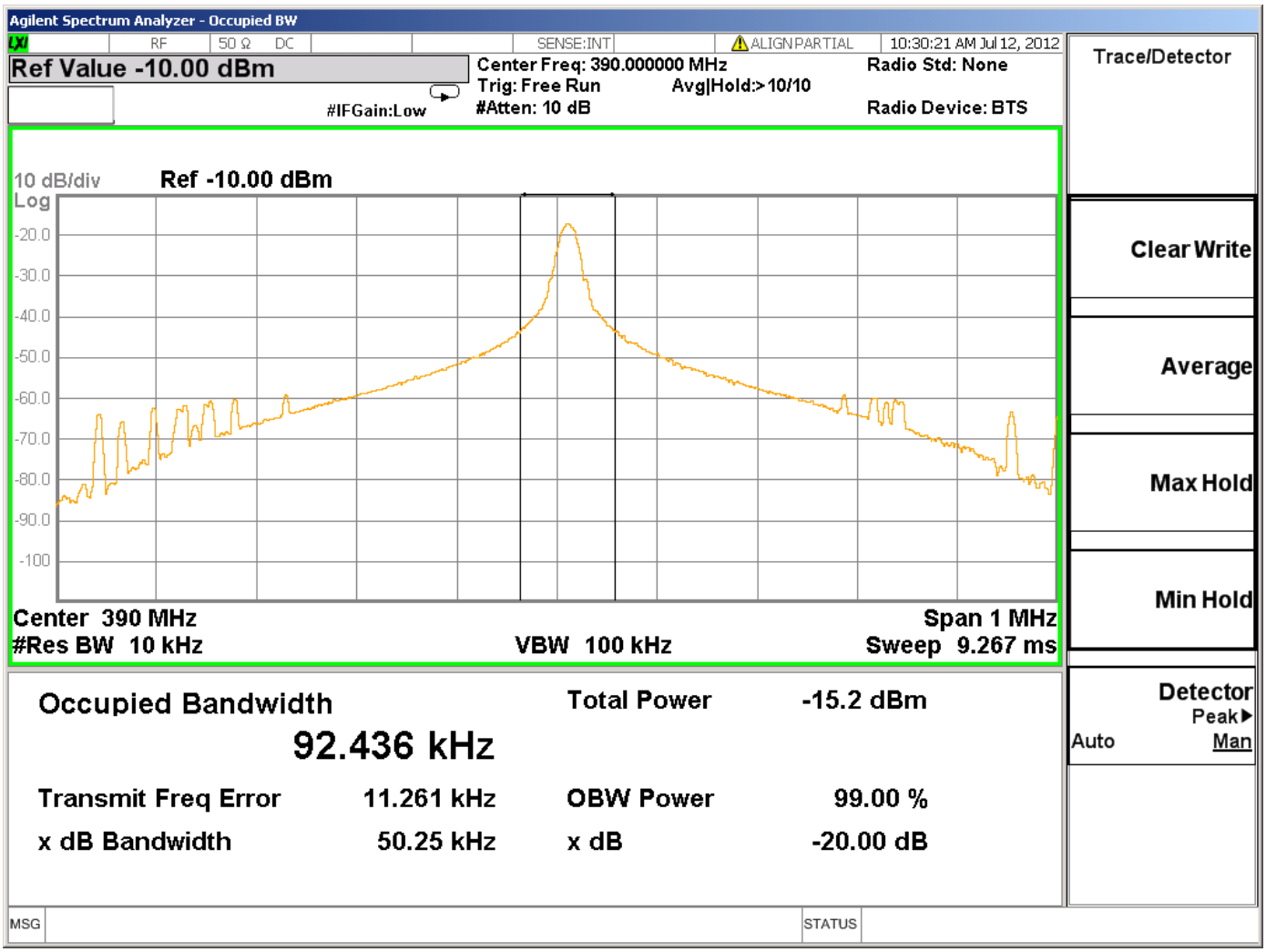


Figure 8 – Bandwidth Graph for 390MHz



4.2.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 11 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 9 Cease Operation Graph for 310MHz

Figure 10 Cease Operation Graph for 315MHz

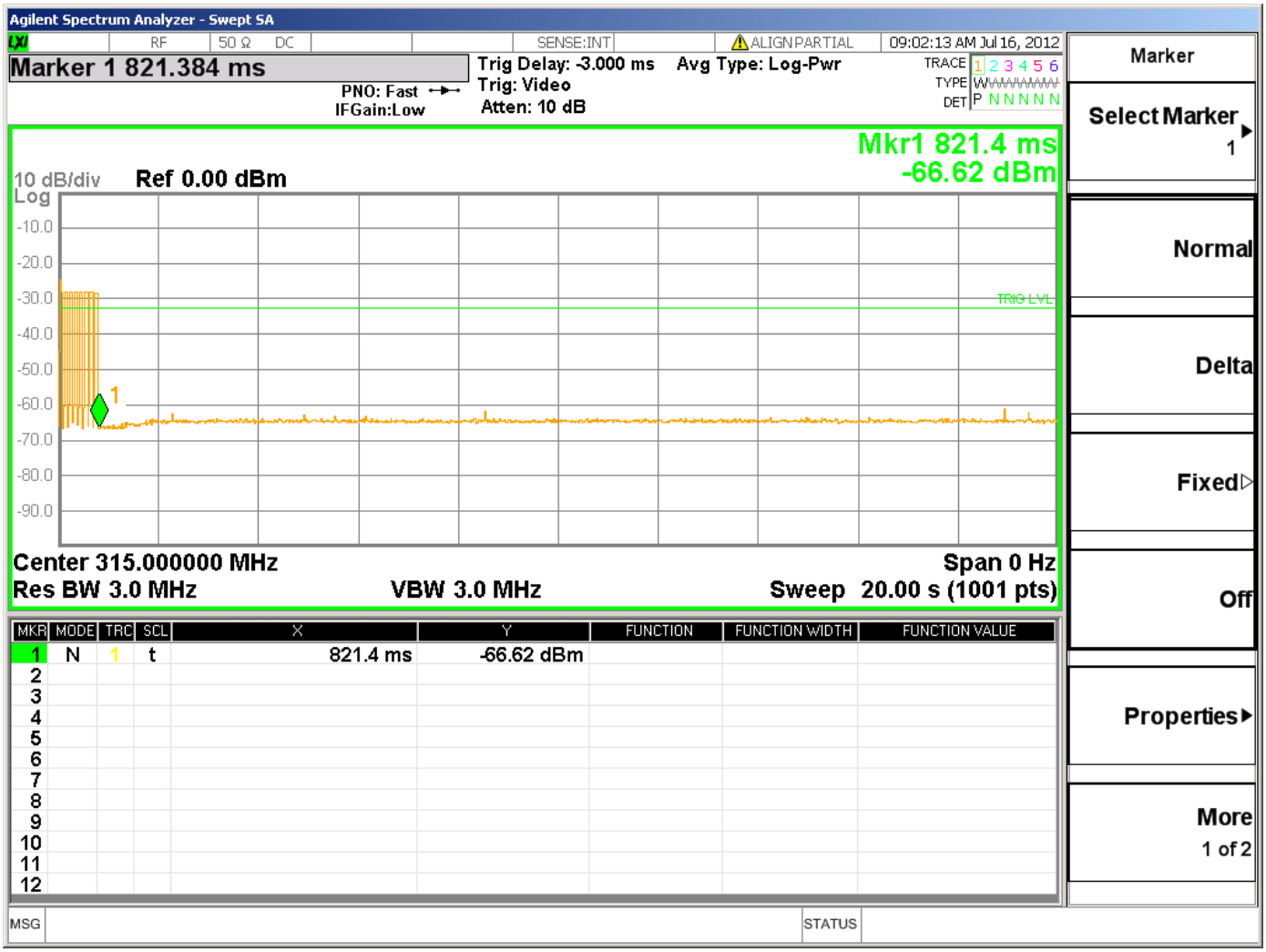
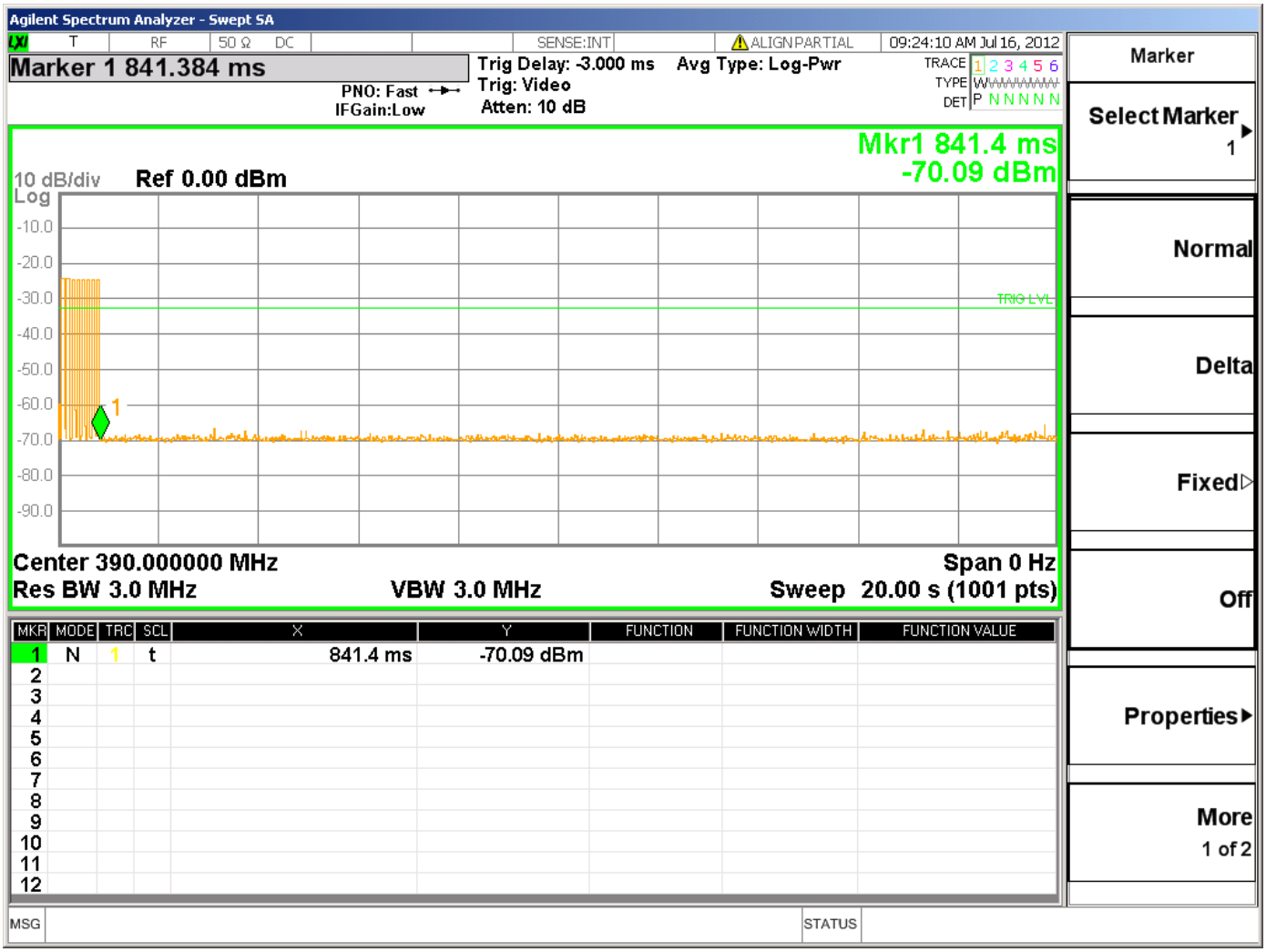


Figure 11 Cease Operation Graph for 390MHz



4.2.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

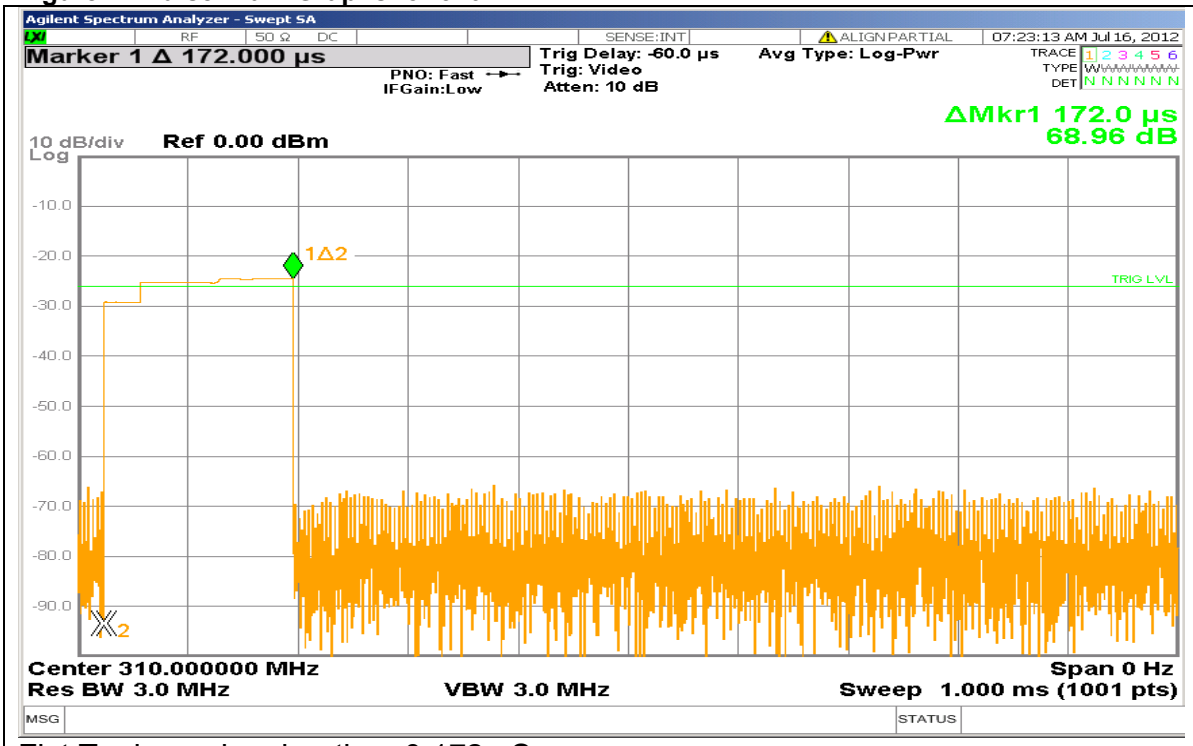
Table 12 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

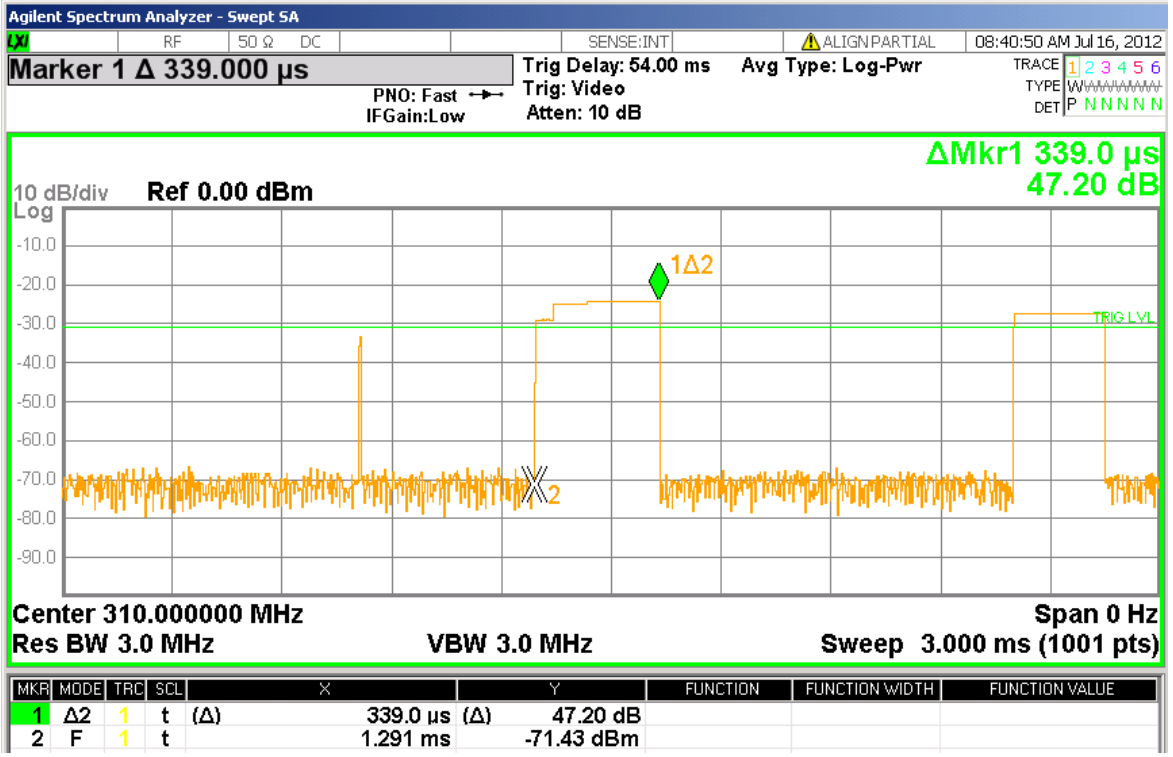
Table 13 Pulse Train Calculation

TX Frequency	Total TX time mS	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
310MHz	(42x0.252)+(10x0.504)+0.172+0.339	100ms	-15.84
315MHz	(36x0.255)+(13x0.501)+0.133+0.330	100ms	-15.83
390MHz	(44x0.252)+(9x0.504)+0.333	100ms	-15.94
Worst Case Duty Cycle: For 310MHz and 315MHz worst case duty cycle was calculated over 100mS and the two initial tuning pulses were included in the tx on time. For 390MHz worst case duty cycle was calculated over 100mS and only second tuning pulse was included. Manufacturer declared the duty cycle as -16.19dB. Measured duty cycle is used for all emissions data.			

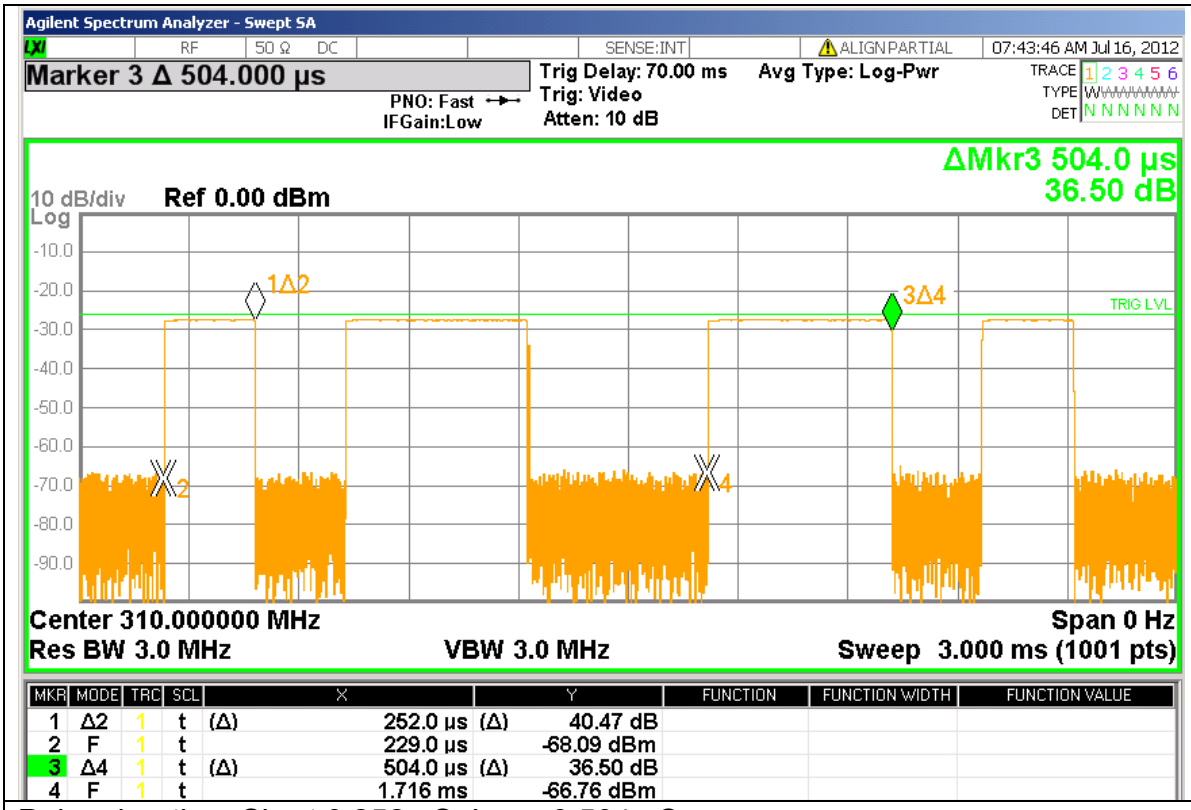
Figure 12 Pulse Train Graphs for 310MHz



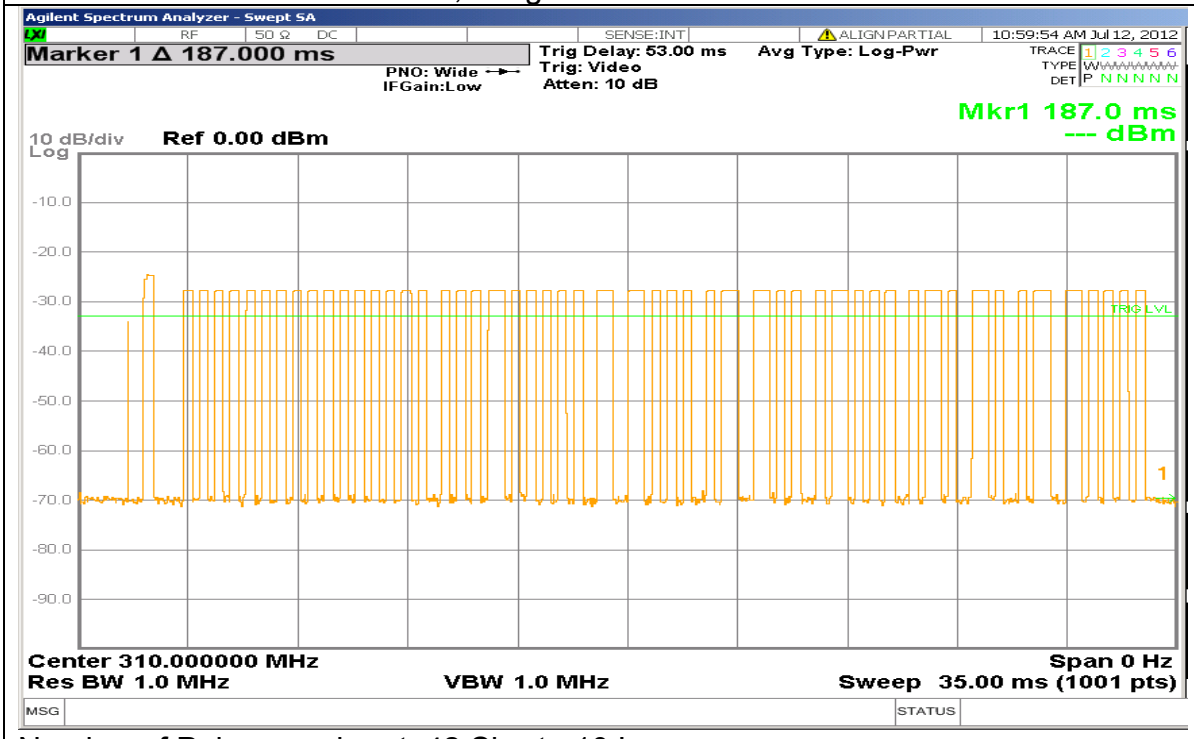
Fist Tuning pulse duration: 0.172mS



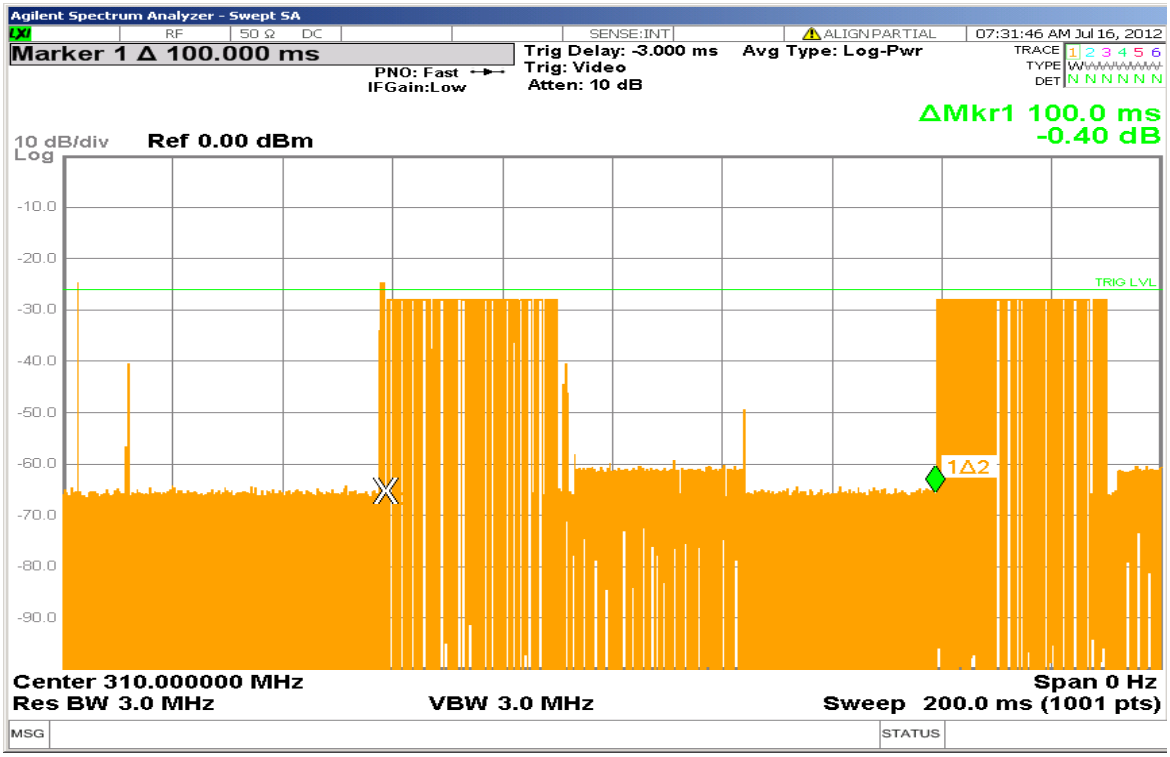
Second tuning pulse duration: 0.339mS



Pulse duration: Short 0.252mS, Long 0.504mS

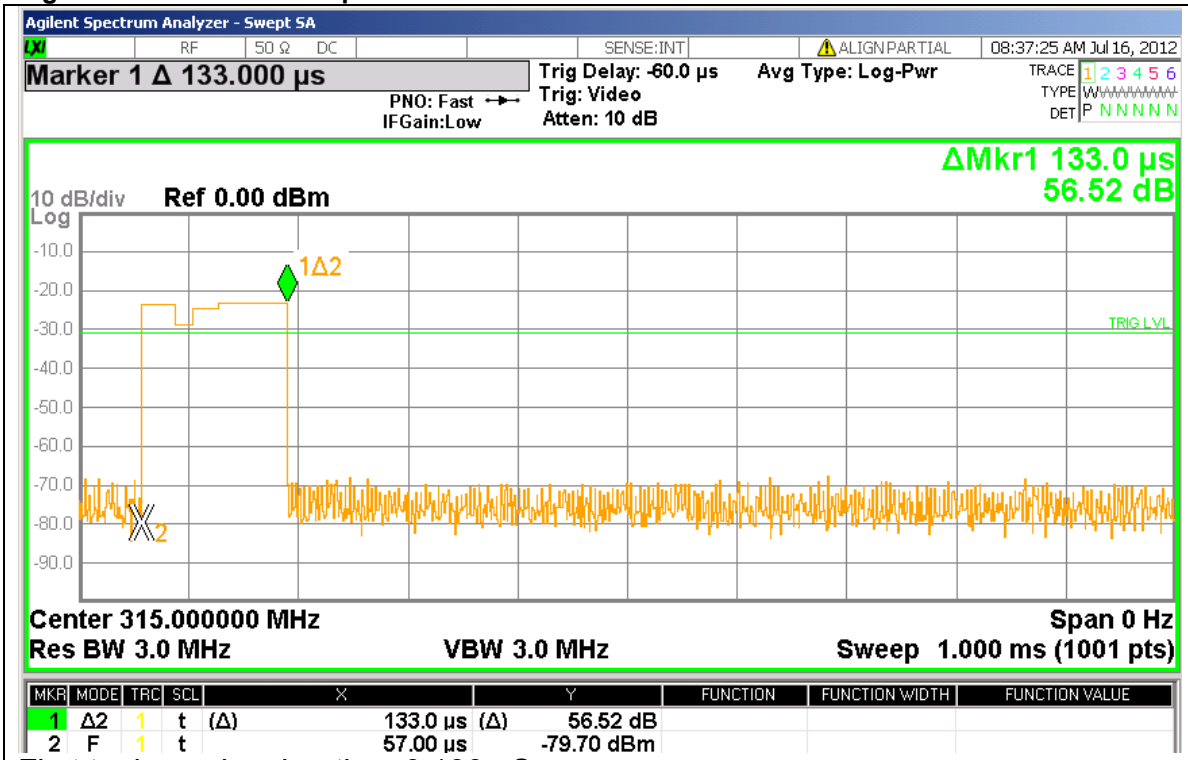


Number of Pulses per burst: 42 Short , 10 Long

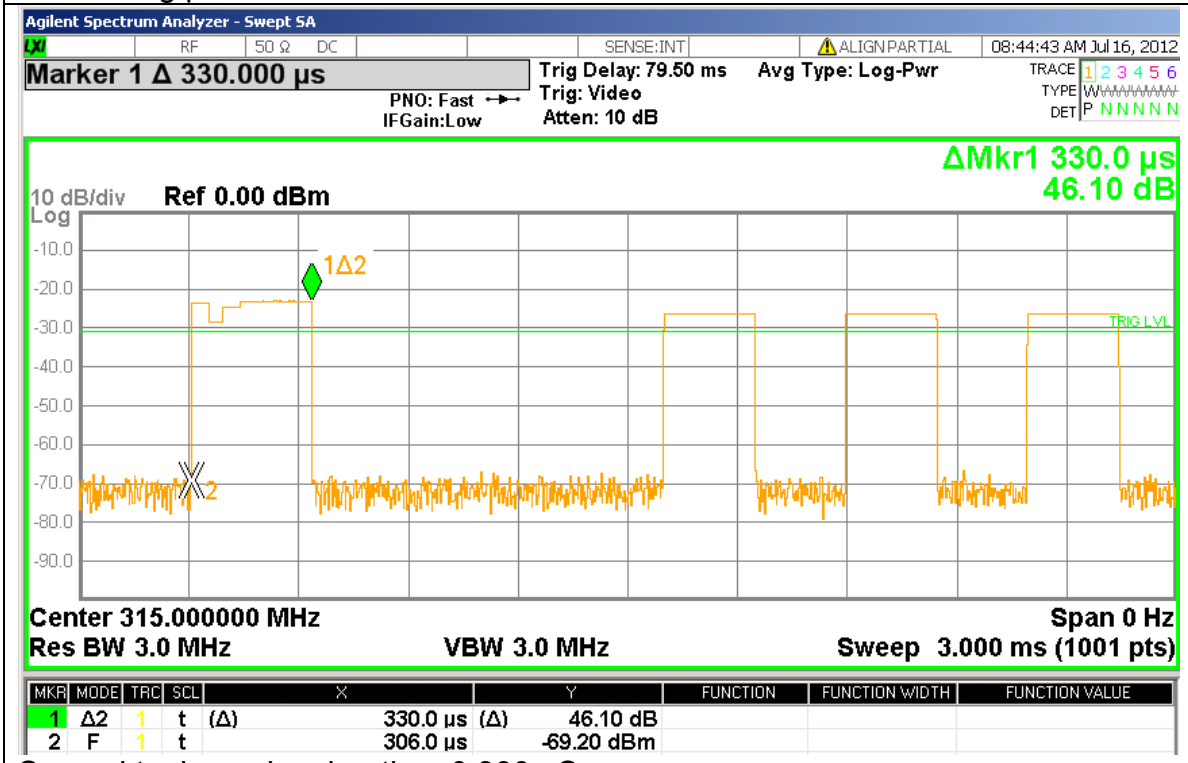


Period between to message pulses

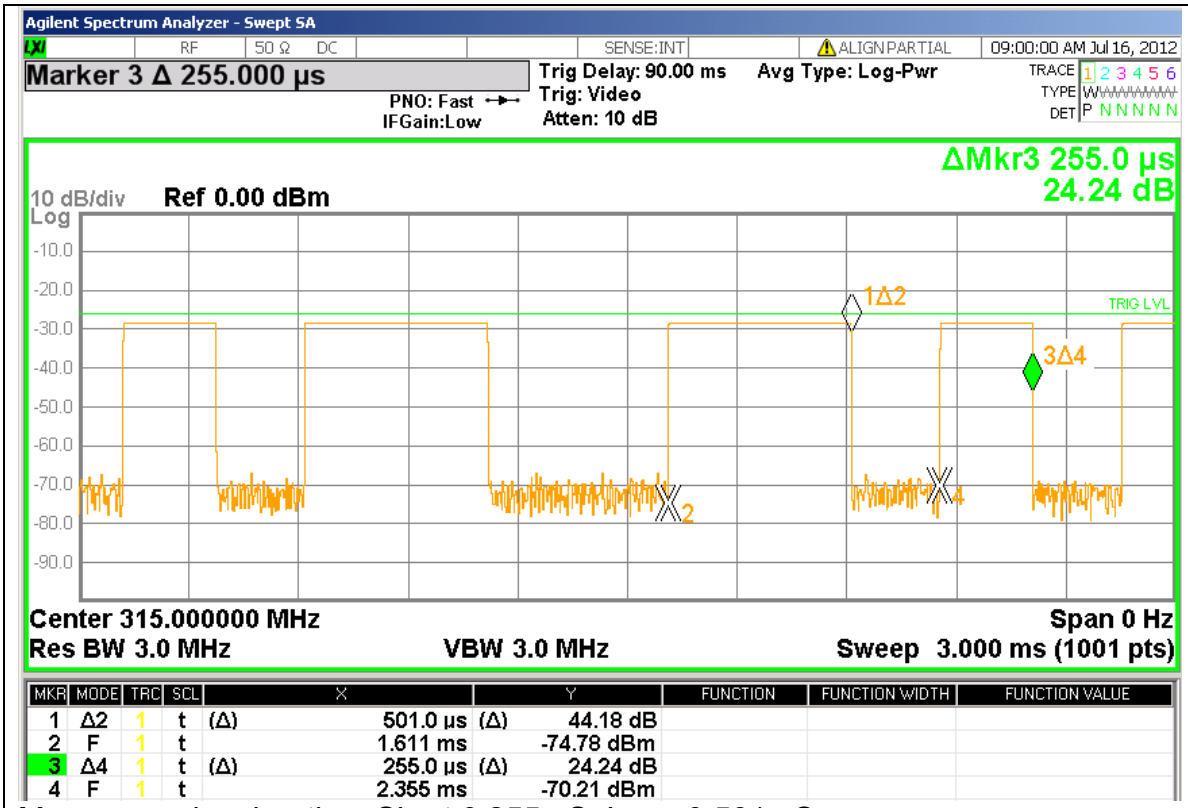
Figure 13 Pulse Train Graphs for 315MHz



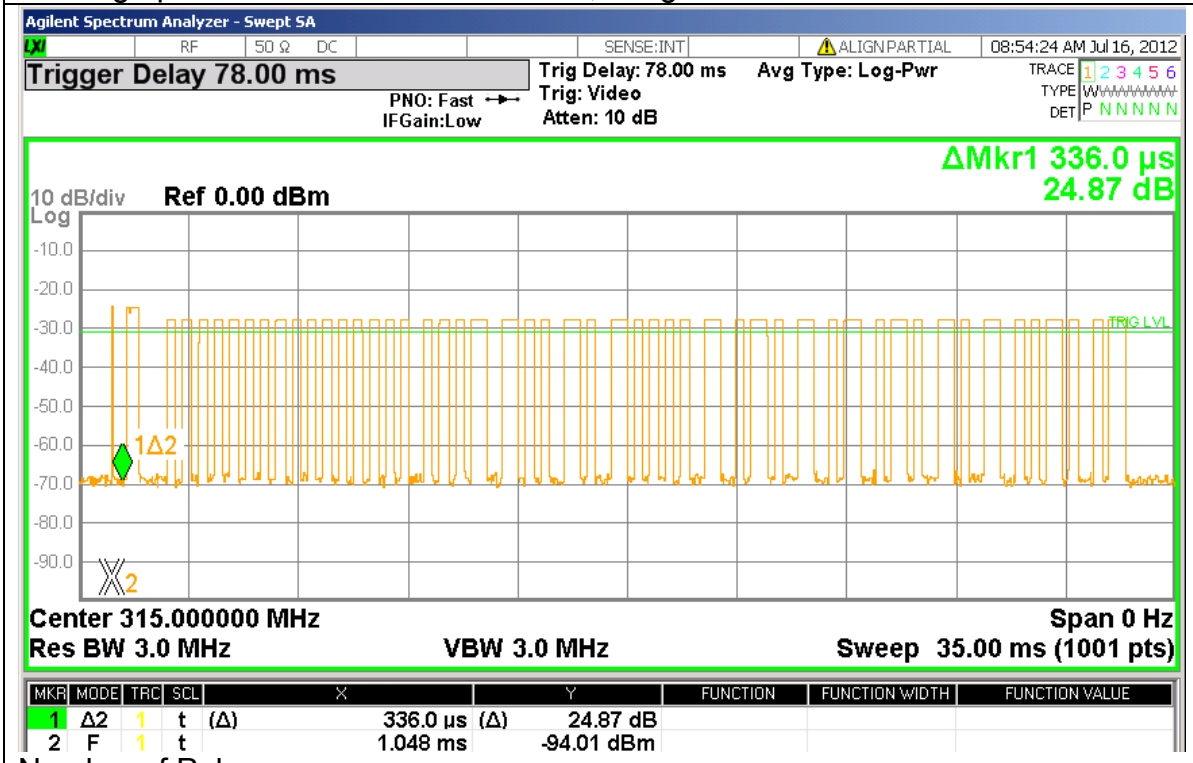
First tuning pulse duration: 0.133mS



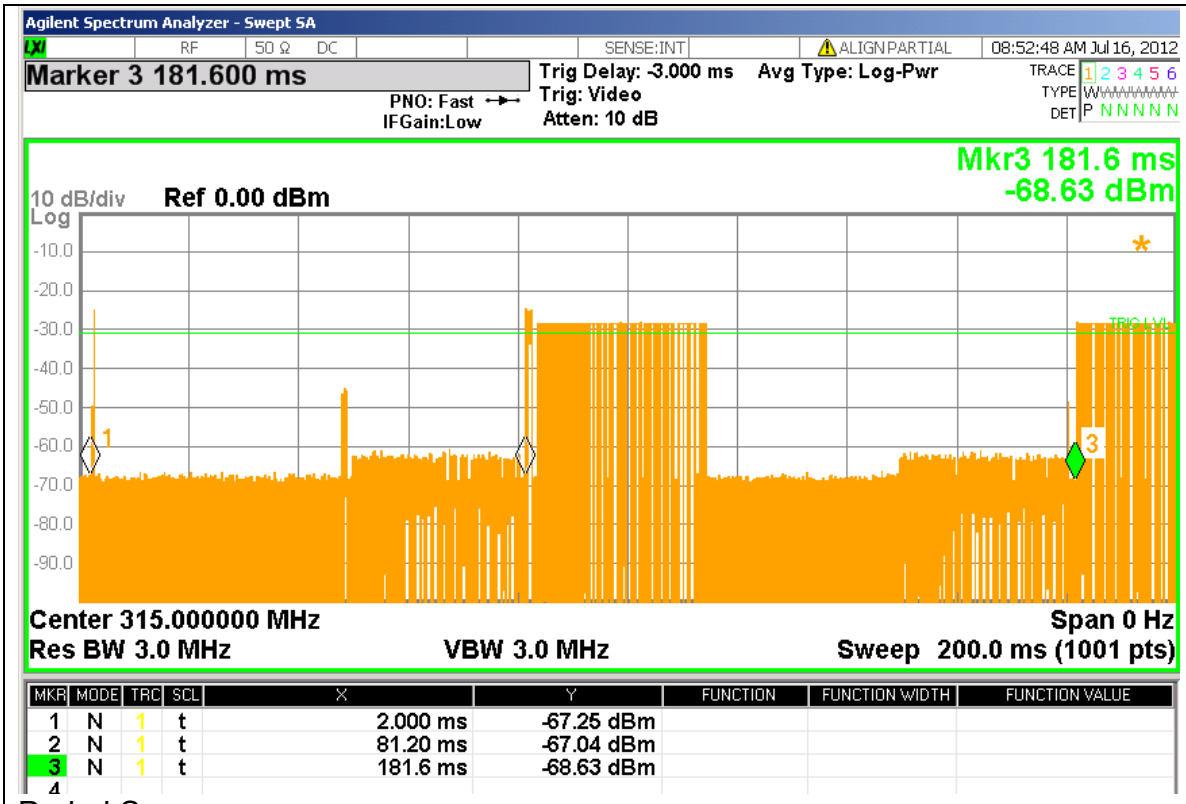
Second tuning pulse duration: 0.330mS



Message pulse duration: Short 0.255mS, Long 0.501mS

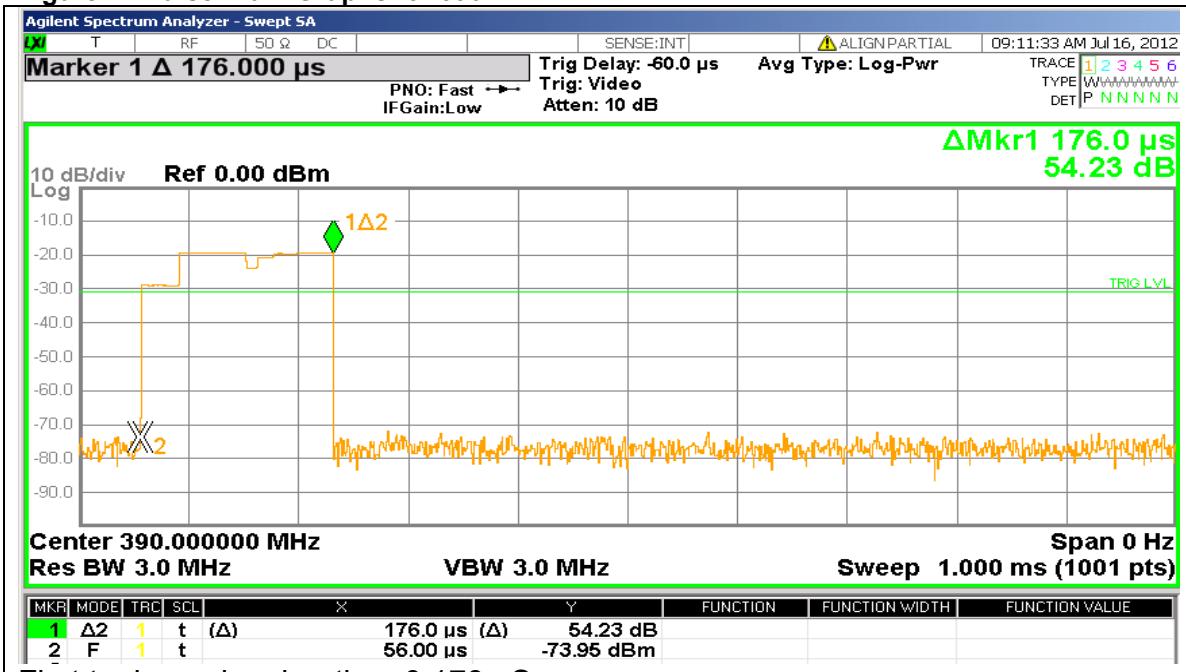


Number of Pulses:

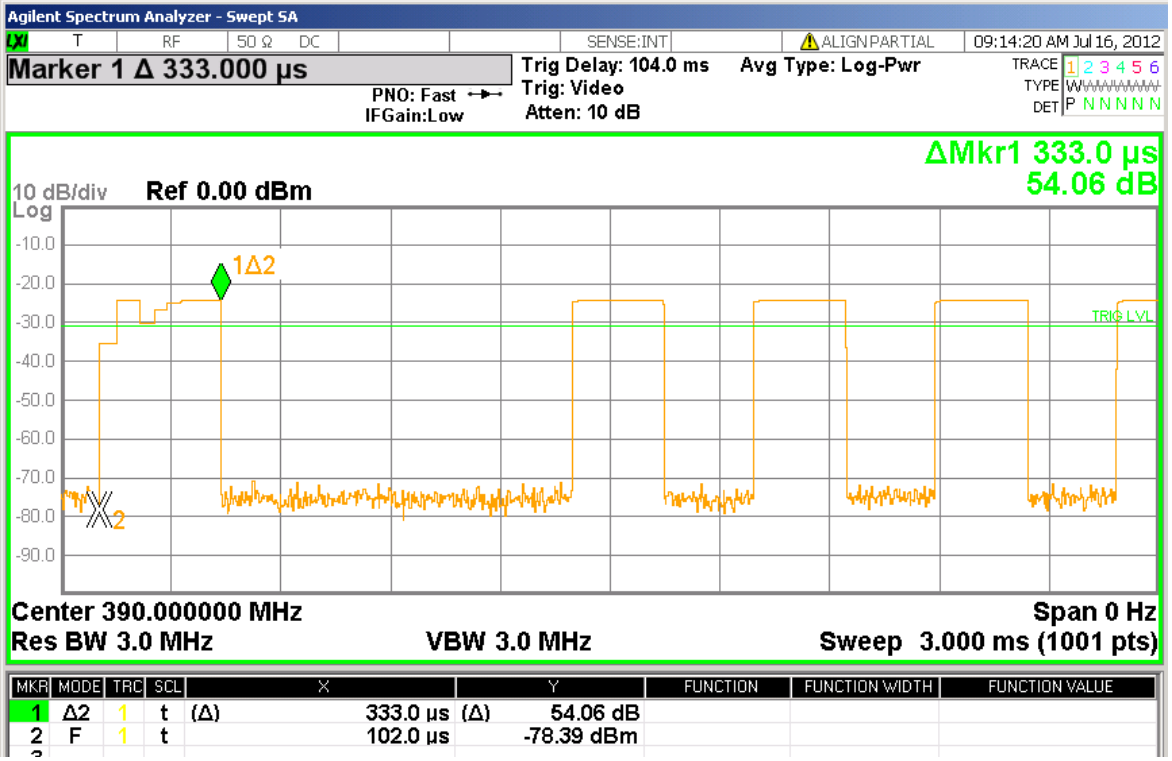


Period Sweep

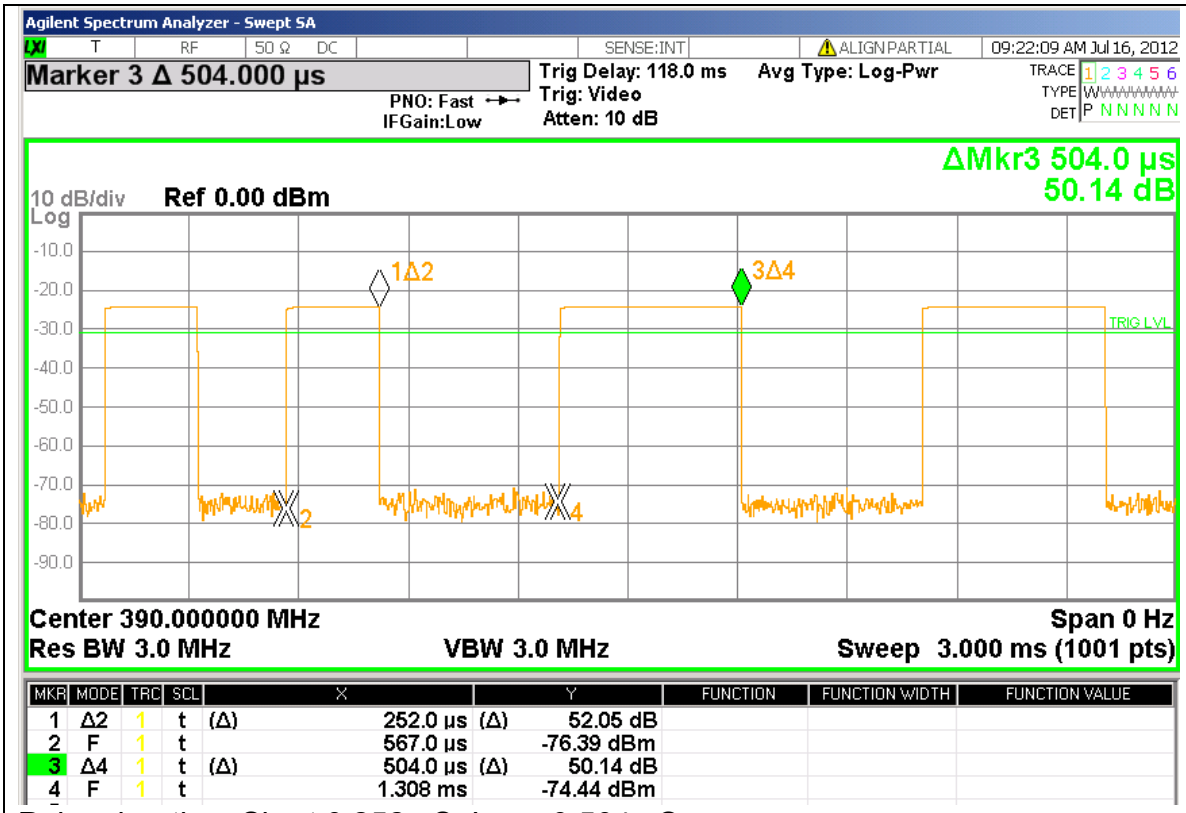
Figure 14 Pulse Train Graphs for 390MHz



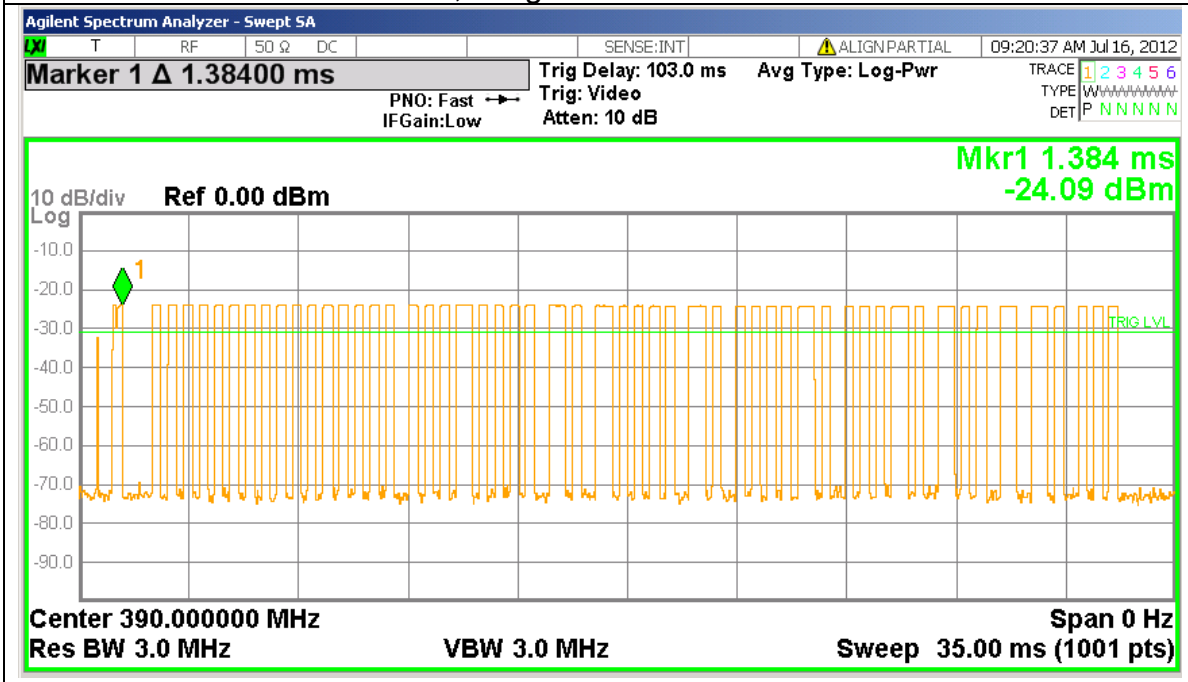
First tuning pulse duration: 0.176mS



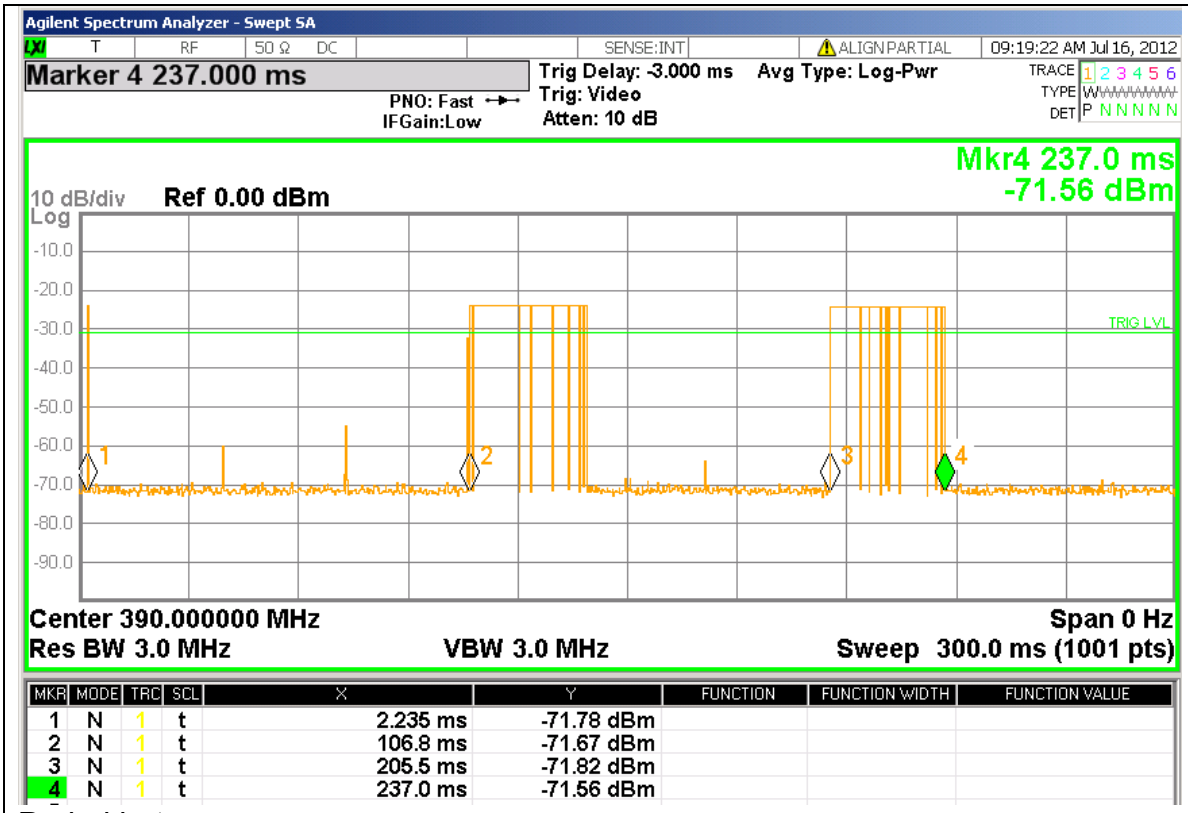
Second tuning pulse duration: 0.333mS



Pulse duration: Short 0.252mS, Long 0.504mS



Number of pulses: 44 Short, 9 Long



Period between messages

4.2.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	47 CFR Part 15 subpart C, and RSS-210	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance
	1GHz – 4GHz	3 meter distance

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
310	75.32	95.32
315	75.62	95.62
390	79.24	99.24

Supplementary information: See section 4.2.3 for duty cycle information.

Figure 15 Radiated Emissions Graph (Below 1GHz), X-Axis

Figure 16 Radiated Emissions Graph (Below 1GHz), Y-Axis

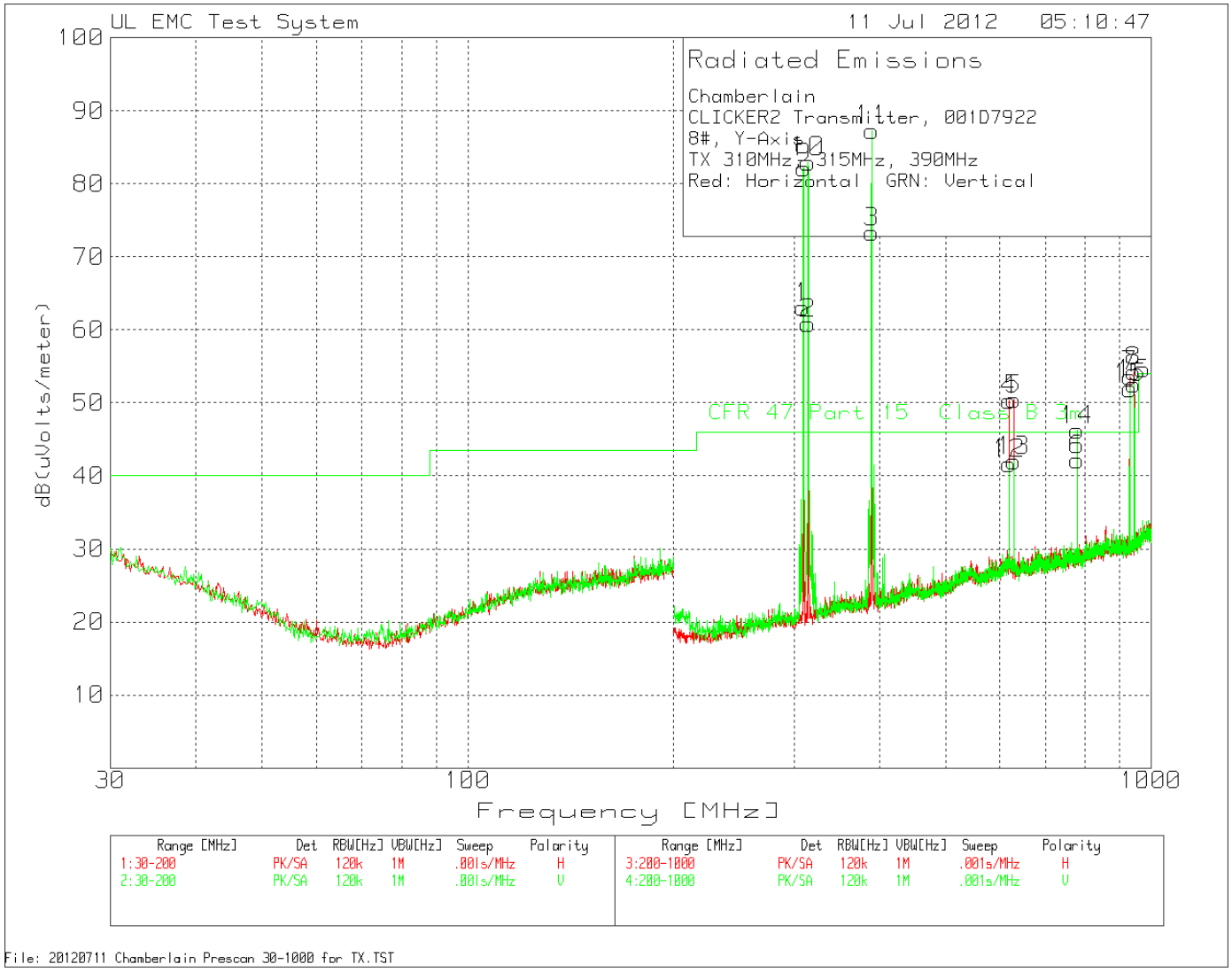


Figure 17 Radiated Emissions Graph (Above 1GHz), X-Axis

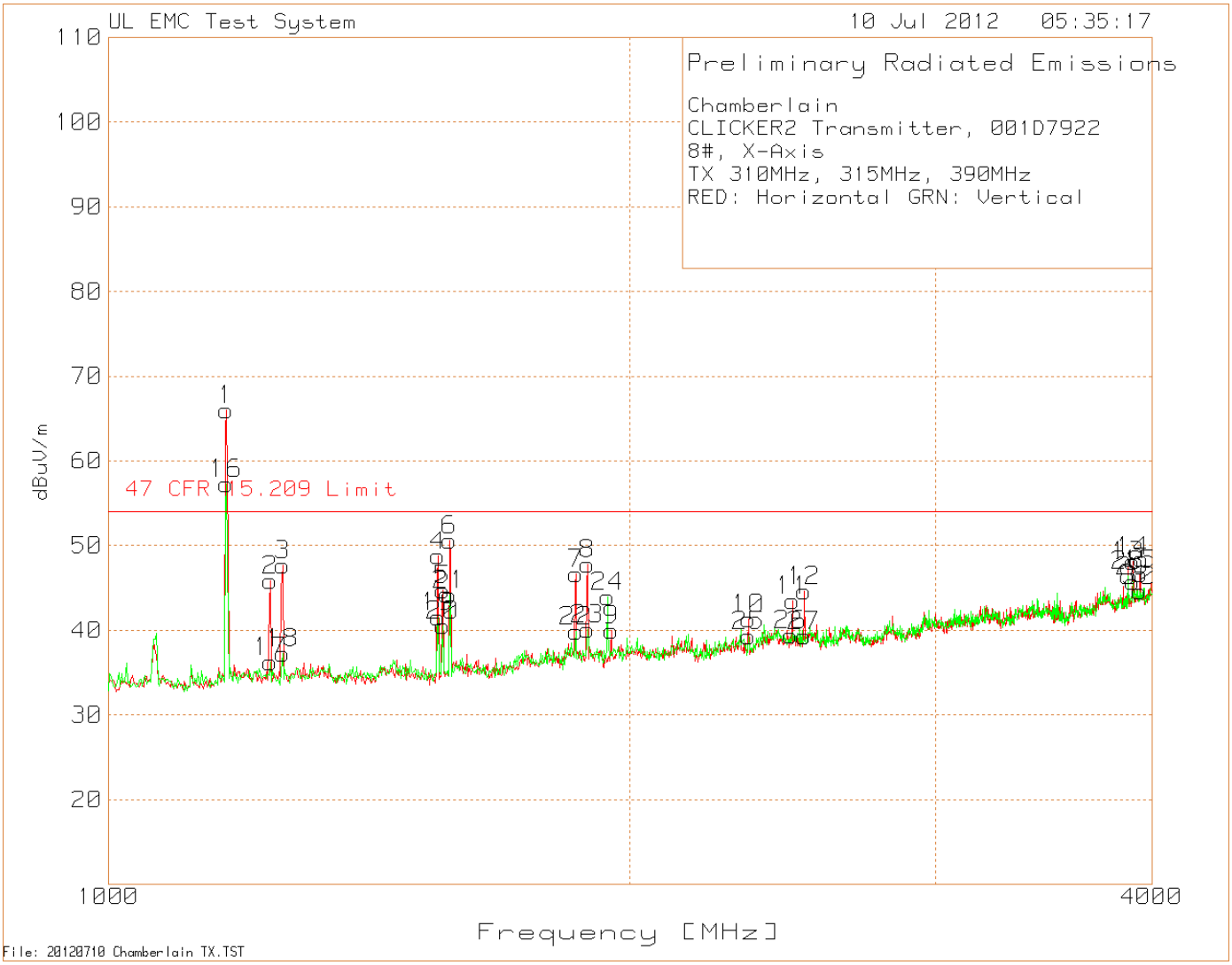


Figure 18 Radiated Emissions Graph (Above 1GHz), Y-Axis

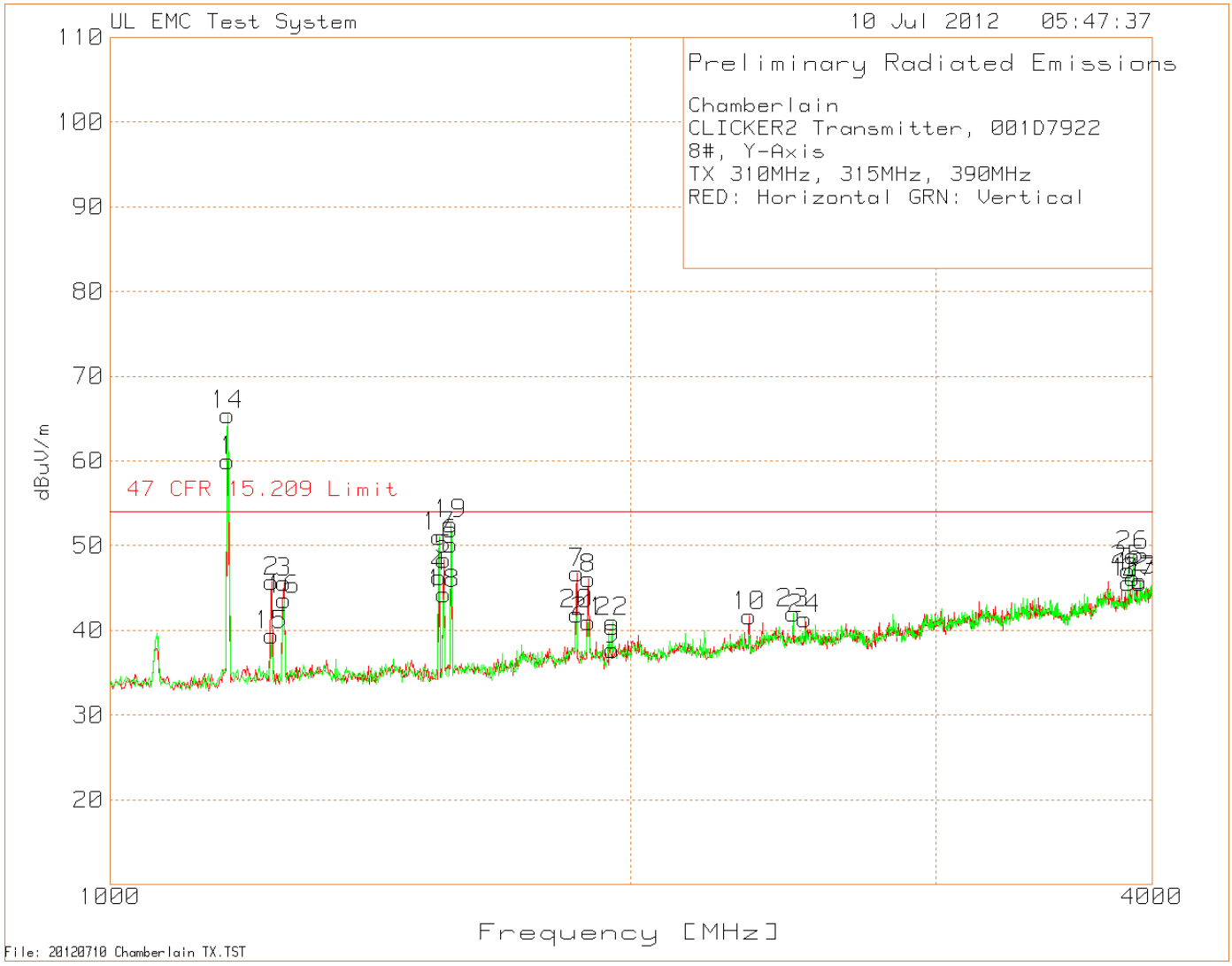


Table 14 - Radiated Emissions Data Points 310MHz

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
310.015397	66.91	PK	14.1	2.1	83.11	-15.84	67.27	75.32	-8.05	303	102	Horz	X
310.014423	52.24	PK	14.1	2.1	68.44	-15.84	52.6	75.32	-22.72	198	126	Vert	X
310.009615	59.49	PK	14.1	2.1	75.69	-15.84	59.85	75.32	-15.47	25	208	Horz	Y
310.009615	64.5	PK	14.1	2.1	80.7	-15.84	64.86	75.32	-10.46	124	177	Vert	Y
310.011218	63.17	PK	14.1	2.1	79.37	-15.84	63.53	75.32	-11.79	30	103	Horz	Z
310.011218	64.73	PK	14.1	2.1	80.93	-15.84	65.09	75.32	-10.23	125	164	Vert	Z
620.023782	20.95	PK	20.3	3	44.25	-15.84	28.41	46	-17.59	251	288	Vert	X
620.023782	30.62	PK	20.3	3	53.92	-15.84	38.08	46	-7.92	9	134	Horz	X
930.038974	34.16	PK	23.6	3.8	61.56	-15.84	45.72	55.32	-9.6	19	158	Horz	X
930.038974	21.16	PK	23.6	3.8	48.56	-15.84	32.72	55.32	-22.6	269	162	Vert	X
1240.16	77.76	PK	25.1	-56.96	45.9	-15.84	30.06	54	-23.94	*	136	Horz	X
1550.367	79.57	PK	25.2	-56.02	48.75	-15.84	32.91	54	-21.09	*	136	Horz	X
1860.574	73.95	PK	27.2	-54.44	46.71	-15.84	30.87	54	-23.13	*	125	Horz	X
2480.987	67.25	PK	28.8	-52.57	43.48	-15.84	27.64	54	-26.36	*	136	Horz	X
1240.16	68.12	PK	25.1	-56.96	36.26	-15.84	20.42	54	-33.58	*	125	Vert	X
1550.367	72.34	PK	25.2	-56.02	41.52	-15.84	25.68	54	-28.32	*	125	Vert	X
1860.574	67.16	PK	27.2	-54.44	39.92	-15.84	24.08	54	-29.92	*	125	Vert	X
2474.983	63.05	PK	28.8	-52.45	39.4	-15.84	23.56	54	-30.44	*	100	Vert	X
* Prescan Data Used													

Table 15 - Radiated Emissions Data Points 315MHz

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
315.014423	66.95	PK	14.2	2.1	83.25	-15.83	67.42	75.62	-8.2	118	105	Horz	X
315.014423	52.33	PK	14.2	2.1	68.63	-15.83	52.8	75.62	-22.82	186	123	Vert	X
315.011218	59.49	PK	14.2	2.1	75.79	-15.83	59.96	75.62	-15.66	23	216	Horz	Y
315.011218	64.96	PK	14.2	2.1	81.26	-15.83	65.43	75.62	-10.19	112	164	Vert	Y
315.012821	62.88	PK	14.2	2.1	79.18	-15.83	63.35	75.62	-12.27	36	104	Horz	Z
315.011218	64.89	PK	14.2	2.1	81.19	-15.83	65.36	75.62	-10.26	111	160	Vert	Z
630.023205	27.37	PK	20.6	3	50.97	-15.83	35.14	46	-10.86	171	130	Horz	X
630.023205	19.56	PK	20.6	3	43.16	-15.83	27.33	46	-18.67	264	143	Vert	X
945.0392	33.72	PK	23.6	3.8	61.12	-15.83	45.29	55.62	-10.33	233	160	Horz	X
945.0392	23.01	PK	23.6	3.8	50.41	-15.83	34.58	55.62	-21.04	135	157	Vert	X
1260.173	79.53	PK	25.1	-56.92	47.71	-15.83	31.88	54	-22.12	*	125	Horz	X
1574.383	80.61	PK	25.3	-55.3	50.61	-15.83	34.78	54	-19.22	*	136	Horz	X
1890.594	74.76	PK	27.4	-54.32	47.84	-15.83	32.01	54	-21.99	*	125	Horz	X
2521.014	67.89	PK	28.9	-52.19	44.6	-15.83	28.77	54	-25.23	*	136	Horz	X
1260.173	69.14	PK	25.1	-56.92	37.32	-15.83	21.49	54	-32.51	*	100	Vert	X
1574.383	74.17	PK	25.3	-55.3	44.17	-15.83	28.34	54	-25.66	*	125	Vert	X
1890.594	67.05	PK	27.4	-54.32	40.13	-15.83	24.3	54	-29.7	*	125	Vert	X
2521.014	62.59	PK	28.9	-52.19	39.3	-15.83	23.47	54	-30.53	*	100	Vert	X
* Prescan Data Used													

Table 16 - Radiated Emissions Data Points 390MHz

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.016026	68.4	PK	16.1	2.3	86.8	-15.94	70.86	79.24	-8.38	275	102	Horz	X
390.014423	53.36	PK	16.1	2.3	71.76	-15.94	55.82	79.24	-23.42	356	259	Vert	X
390.017628	61.5	PK	16.1	2.3	79.9	-15.94	63.96	79.24	-15.28	46	174	Horz	Y
390.017628	69.63	PK	16.1	2.3	88.03	-15.94	72.09	79.24	-7.15	104	141	Vert	Y
390.016026	64.78	PK	16.1	2.3	83.18	-15.94	67.24	79.24	-12	36	103	Horz	Z
390.016026	69.56	PK	16.1	2.3	87.96	-15.94	72.02	79.24	-7.22	313	131	Vert	Z
780.027995	21.91	PK	21.8	3.4	47.11	-15.94	31.17	46	-14.83	179	102	Horz	Y
780.027995	17.11	PK	21.8	3.4	42.31	-15.94	26.37	46	-19.63	116	144	Vert	Y
1170.0812	95.17	PK	24.8	-57.24	62.73	-15.94	46.79	54	-7.21	360	132	Horz	Y
1169.9549	99.08	PK	24.8	-57.24	66.64	-15.94	50.7	54	-3.3	20	140	Vert	Y
1560.374	78.85	PK	25.2	-55.65	48.4	-15.94	32.46	54	-21.54	*	99	Horz	Y
1950.634	64.67	PK	27.4	-54.39	37.68	-15.94	21.74	54	-32.26	*	125	Horz	Y
2340.894	66.33	PK	28.3	-52.9	41.73	-15.94	25.79	54	-28.21	*	99	Horz	Y
3901.935	65.48	PK	32.7	-51.99	46.19	-15.94	30.25	54	-23.75	*	125	Horz	Y
1560.374	74.75	PK	25.2	-55.65	44.3	-15.94	28.36	54	-25.64	*	100	Vert	Y
1950.634	67.96	PK	27.4	-54.39	40.97	-15.94	25.03	54	-28.97	*	100	Vert	Y
3901.935	68.12	PK	32.7	-51.99	48.83	-15.94	32.89	54	-21.11	*	125	Vert	Y
* Prescan Data Used													

4.3 Configuration 7# Test Data

4.3.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (310MHz: 775.0kHz)	

Table 17 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

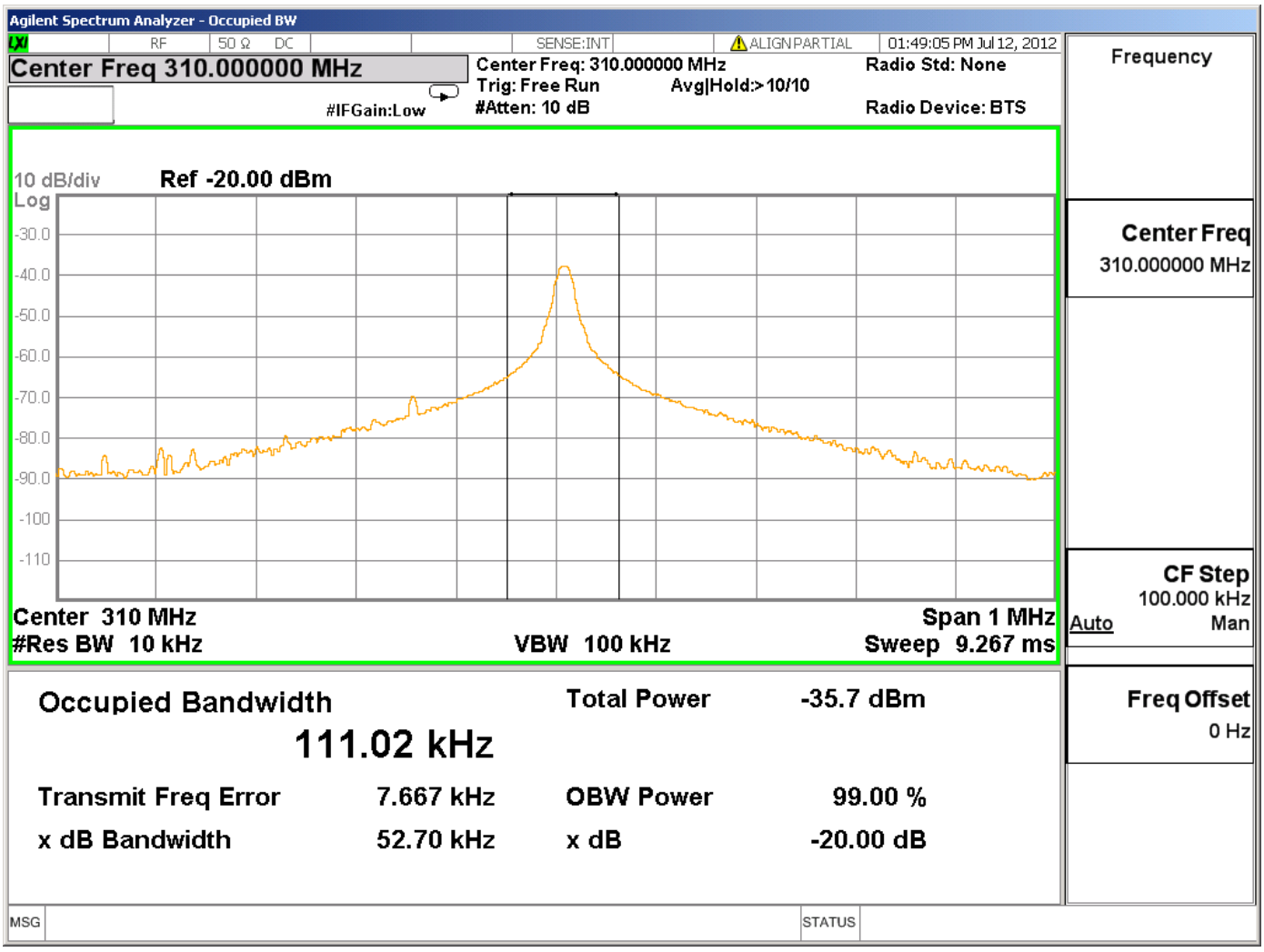
Table 18 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 19 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
310MHz	52.70	111.02

Figure 19 – Bandwidth Graph



4.3.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 20 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 20 Cease Operation Graph

4.3.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

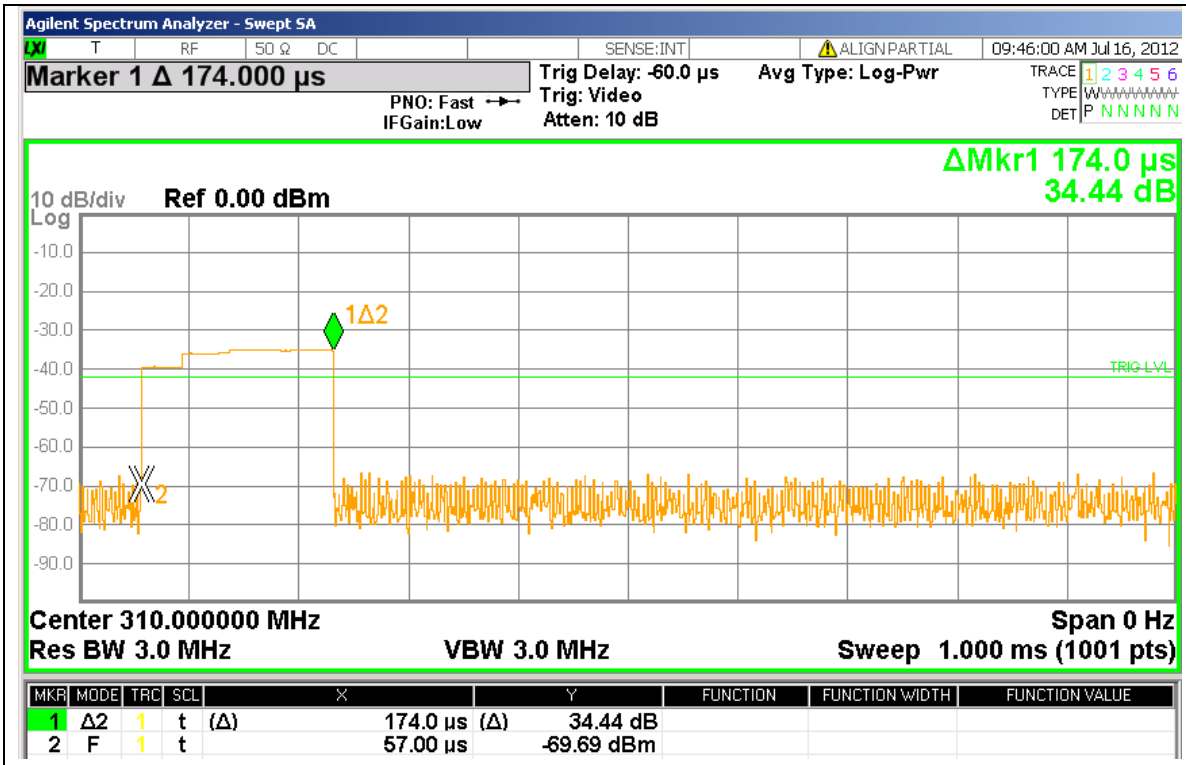
Table 21 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

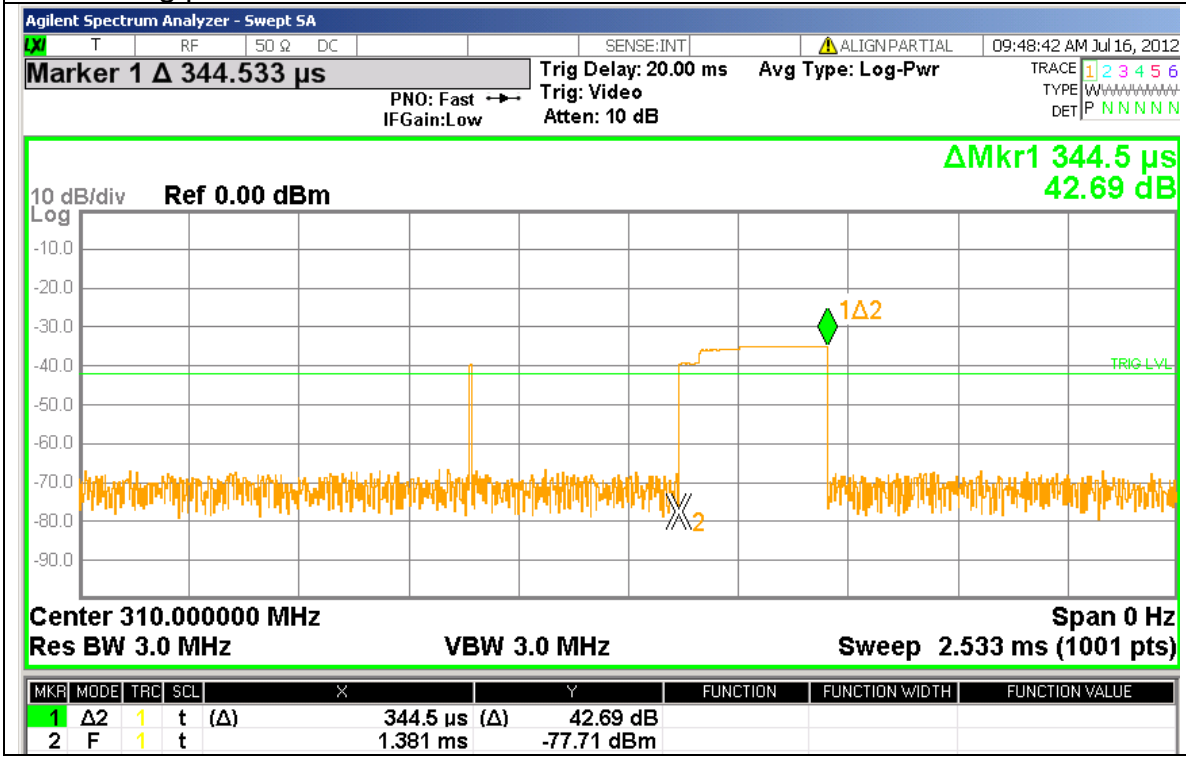
Table 22 Pulse Train Calculation

TX Frequency	Total TX time mS	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
310MHz	(48x0.204)+(30x0.402mS)+0.174+0.3445	100ms	-13.0dB
Worst Case Duty Cycle: Worst case duty cycle was determined at 100ms. The manufacturer declares worst case duty cycle at -12.36dB and this is used for radiated emissions data.			

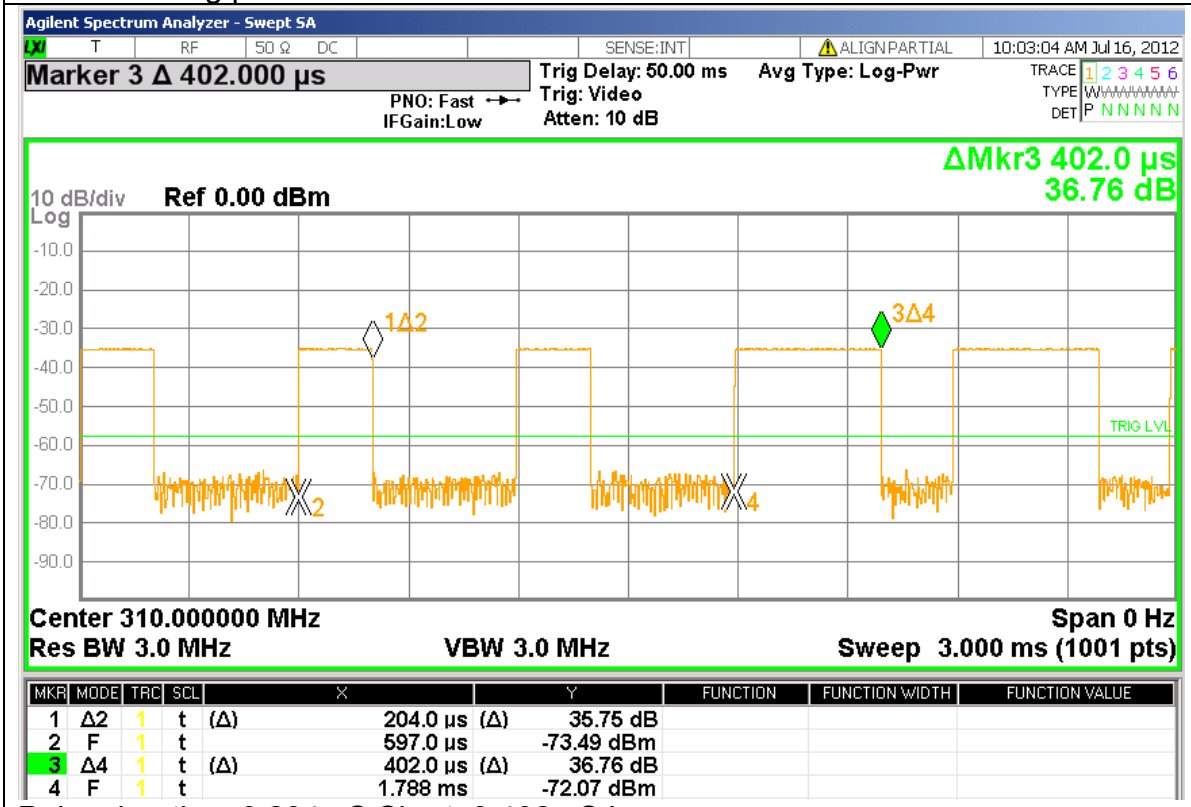
Figure 21 Pulse Train Graphs



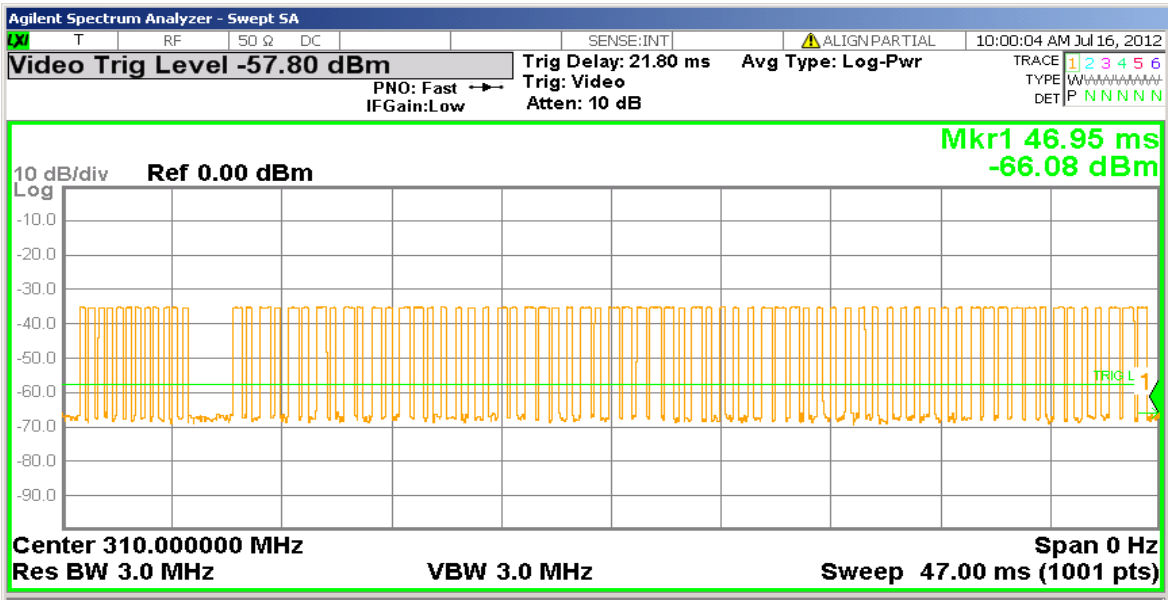
First tuning pulse duration: 0.174mS



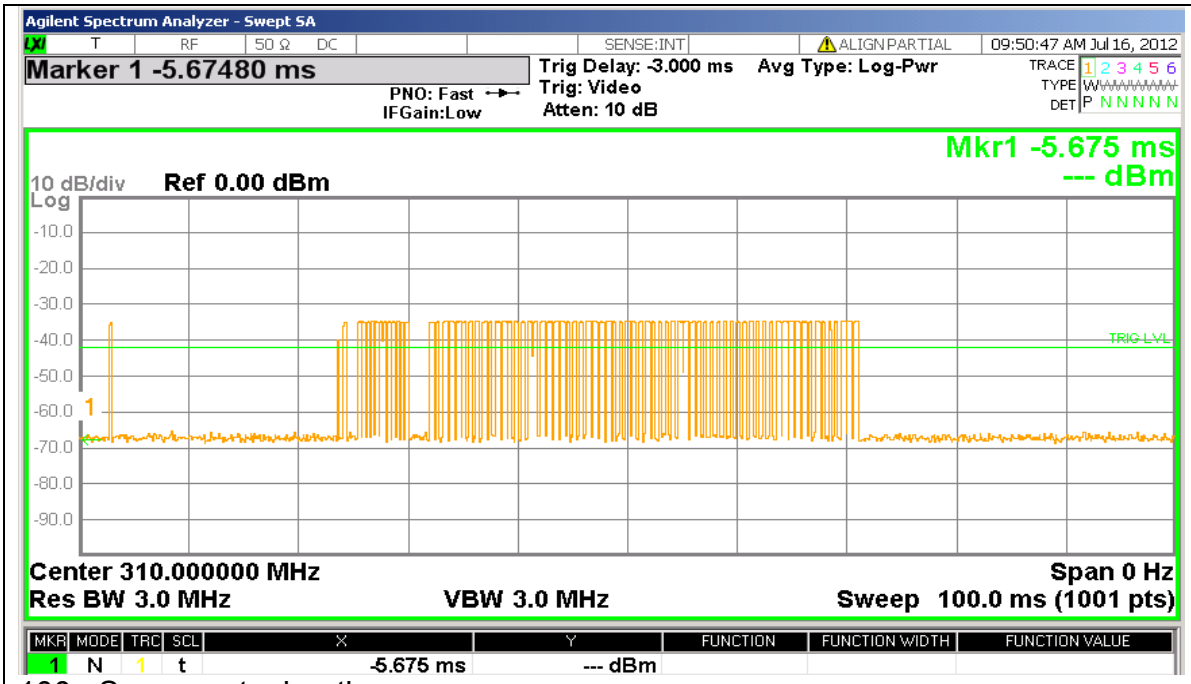
Second tuning pulse duration: 0.3445mS



Pulse duration: 0.204mS Short, 0.402mS Long



Number of Pulses: Short 48, Long 30



100mS sweep, tx duration.

4.3.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
310	75.32	95.32

Supplementary information: See section 4.3.3 for duty cycle information.

Figure 22 Radiated Emissions Graph (Below 1GHz)

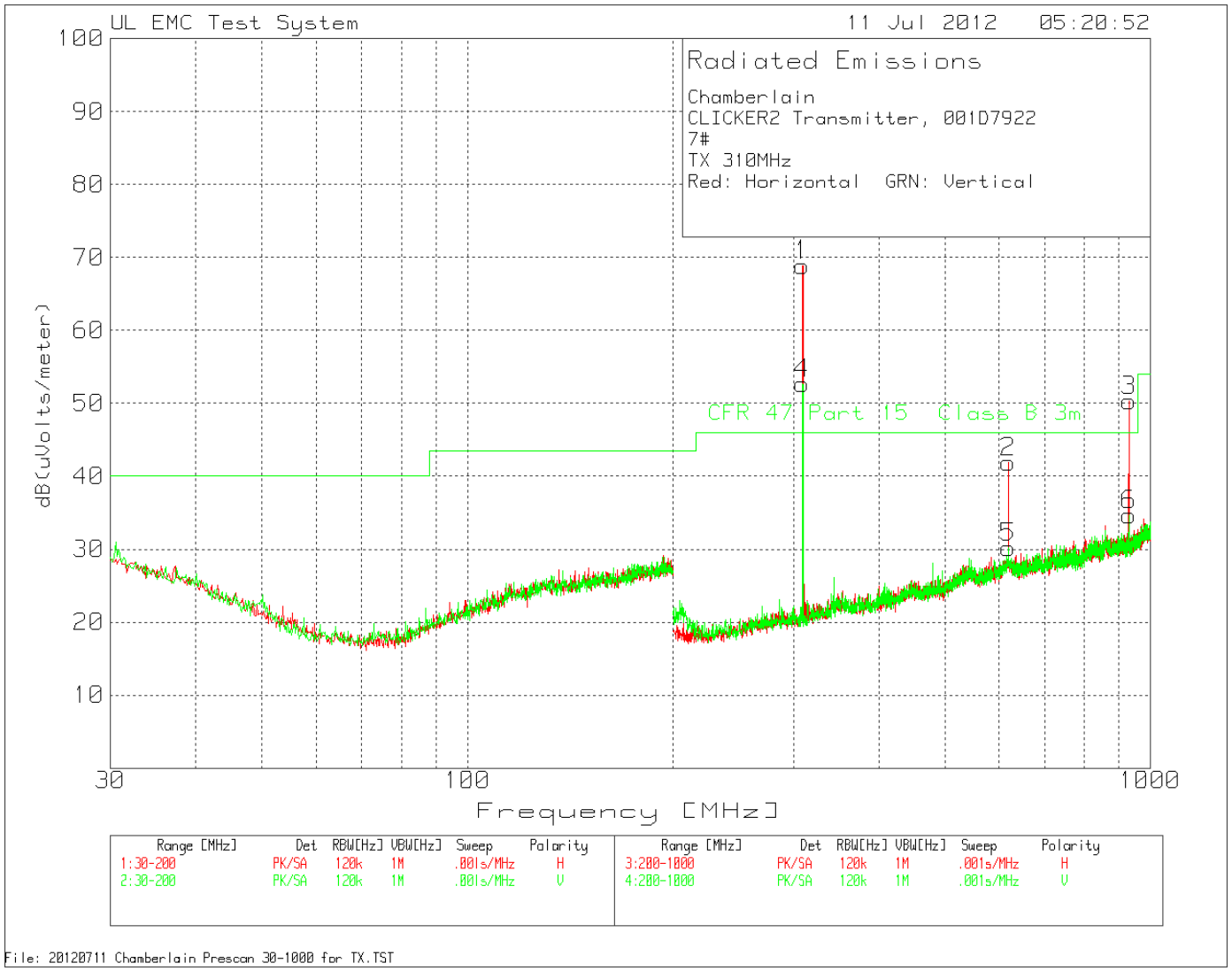


Figure 23 Radiated Emissions Graph (Above 1GHz)

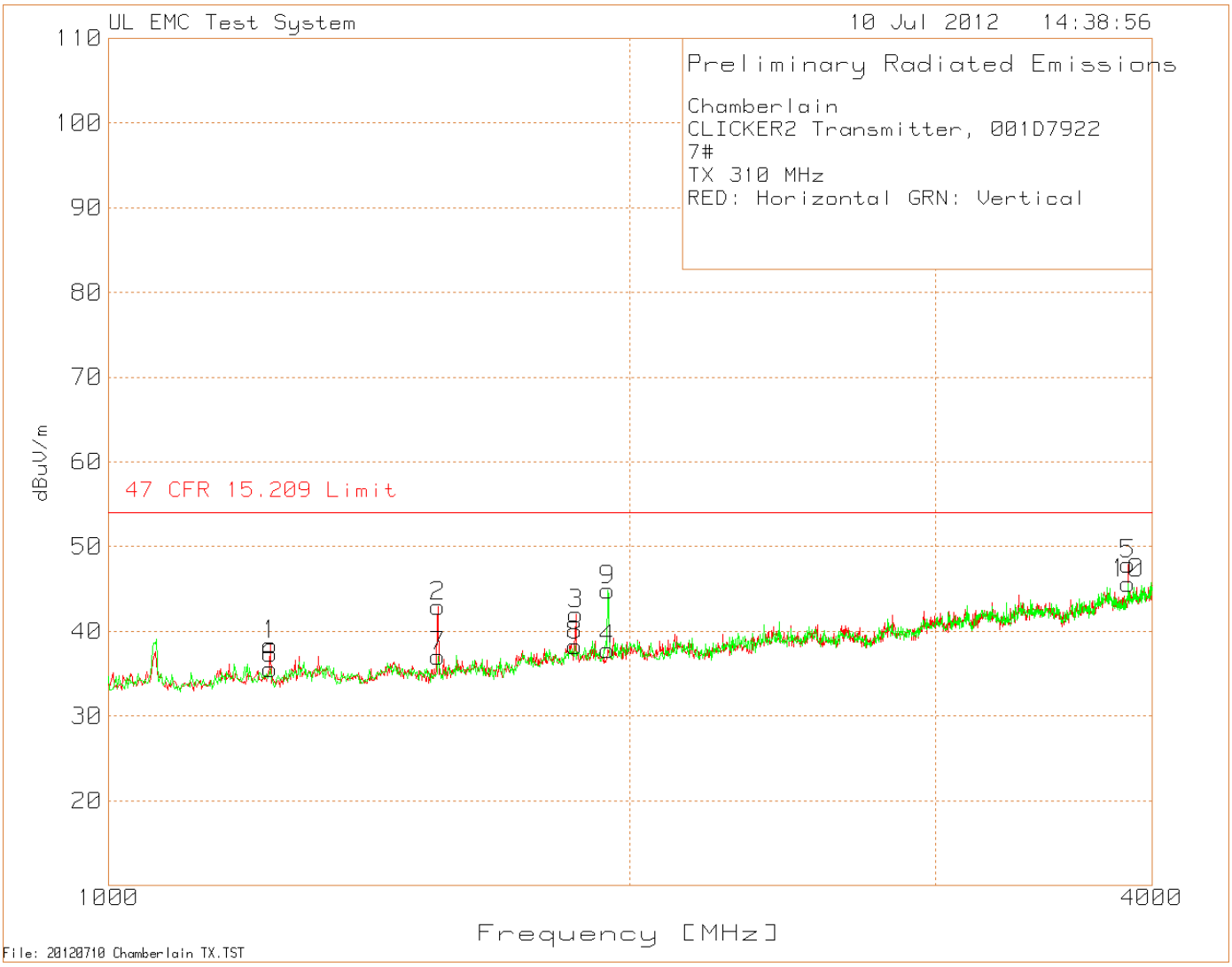


Table 23 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
310.0024	58.75	PK	14.1	2.1	74.95	-12.36	62.59	75.32	-12.73	98	102	Horz	X
310.0024	45.24	PK	14.1	2.1	61.44	-12.36	49.08	75.32	-26.24	181	127	Vert	X
620.003987	21.49	PK	20.3	3	44.79	-12.36	32.43	46	-13.57	162	129	Horz	X
619.9867	9.14	PK	20.3	3	32.44	-12.36	20.08	46	-25.92	*	101	Vert	X
930.00559	26.76	PK	23.6	3.8	54.16	-12.36	41.8	46	-4.2	30	157	Horz	X
930.00559	18.87	PK	23.6	3.8	46.27	-12.36	33.91	46	-12.09	284	162	Vert	X
1240.16	70.3	PK	25.1	-56.96	38.44	-12.36	26.08	54	-27.92	*	125	Horz	X
1550.367	73.7	PK	25.2	-56.02	42.88	-12.36	30.52	54	-23.48	*	99	Horz	X
1860.574	69.29	PK	27.2	-54.44	42.05	-12.36	29.69	54	-24.31	*	125	Horz	X
1942.628	64.94	PK	27.4	-54.48	37.86	0	37.86	54	-16.14	**	125	Horz	X
3875.917	67.02	PK	32.7	-51.81	47.91	0	47.91	54	-6.09	**	125	Horz	X
1240.16	67.47	PK	25.1	-56.96	35.61	-12.36	23.25	54	-30.75	*	125	Vert	X
1550.367	67.89	PK	25.2	-56.02	37.07	-12.36	24.71	54	-29.29	*	125	Vert	X
1858.572	65.47	PK	27.2	-54.4	38.27	-12.36	25.91	54	-28.09	*	125	Vert	X
1940.627	72.03	PK	27.4	-54.54	44.89	0	44.89	54	-9.11	**	100	Vert	X
3875.917	64.73	PK	32.7	-51.81	45.62	0	45.62	54	-8.38	**	125	Vert	X
* Prescan Data Only													
** Not From EUT													

4.4 Configuration 18# Test Data

4.4.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (310MHz: 775.0kHz)	

Table 24 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

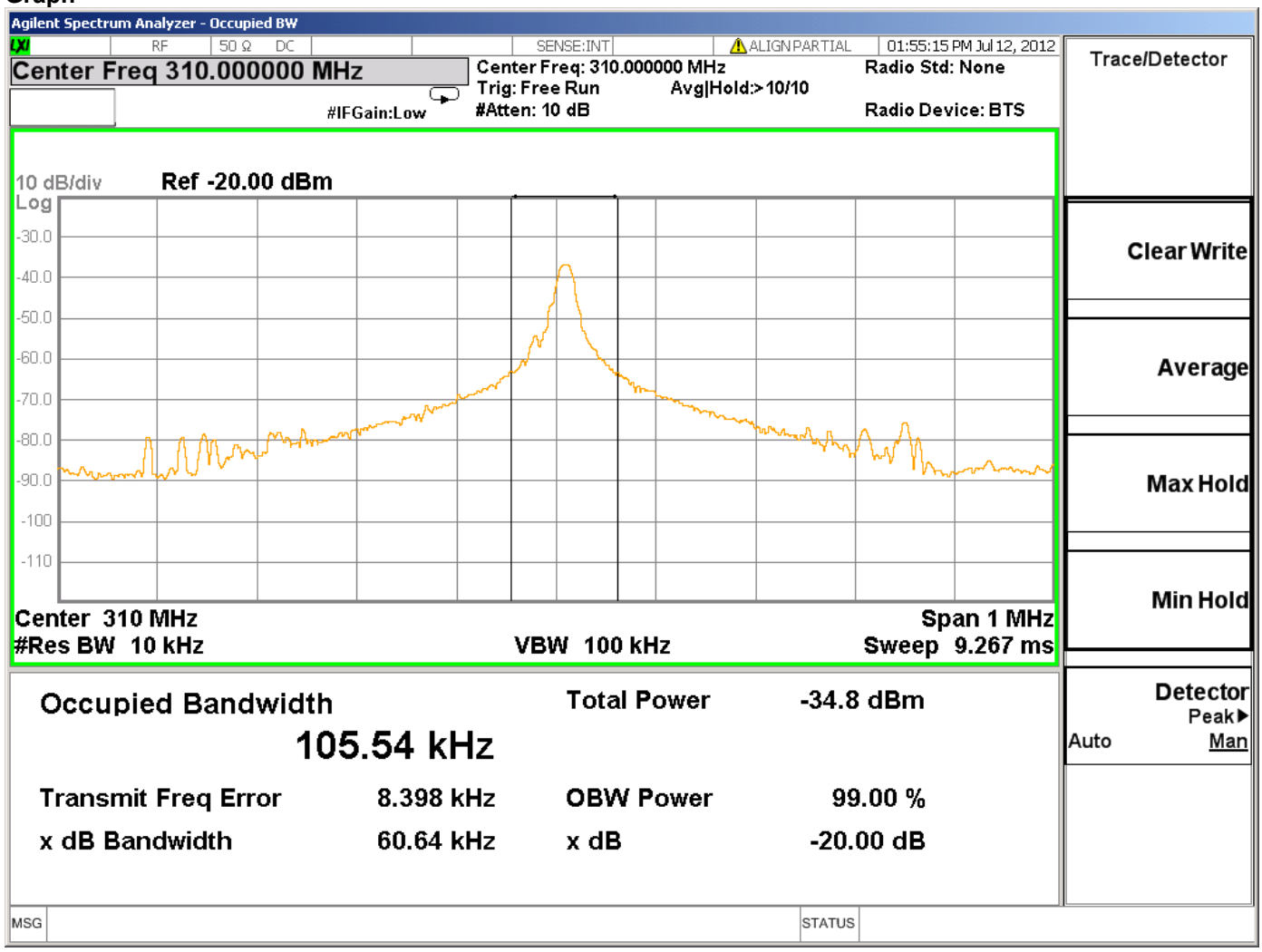
Table 25 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 26 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
310MHz	60.64	105.54

Figure 24 – Bandwidth Graph



4.4.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 27 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 25 Cease Operation Graph

4.4.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

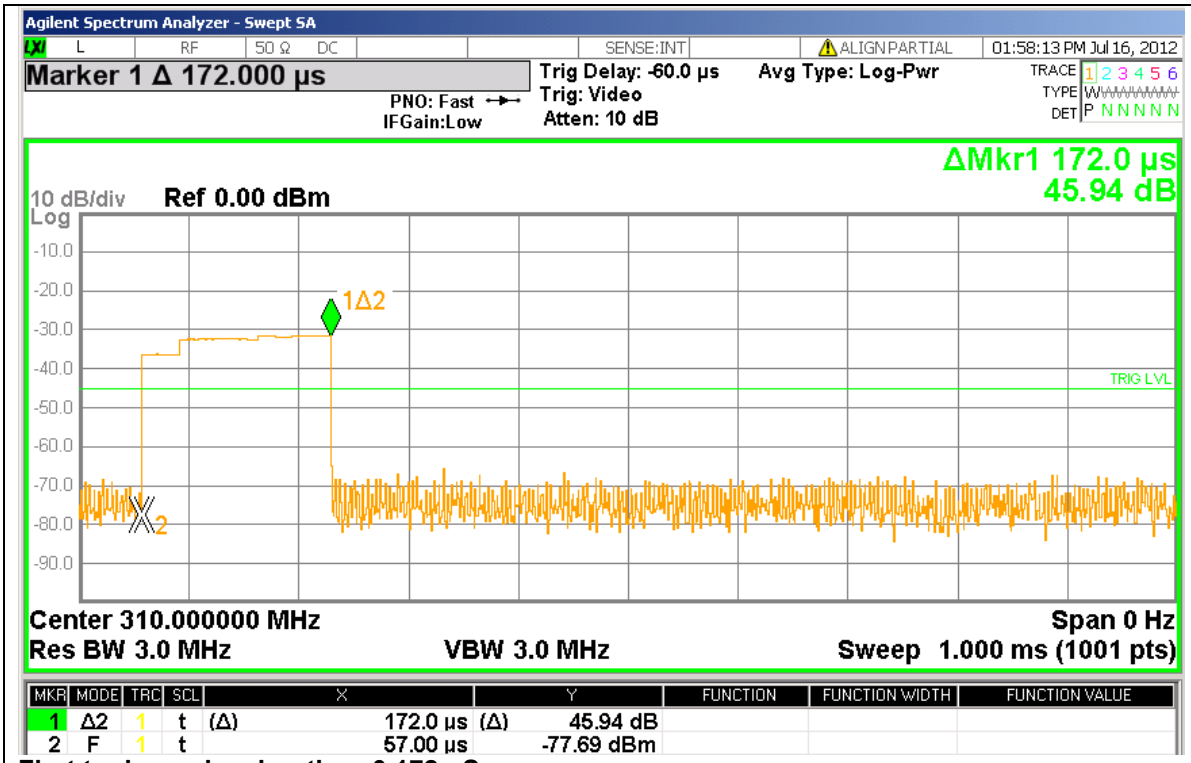
Table 28 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 29 Pulse Train Calculation

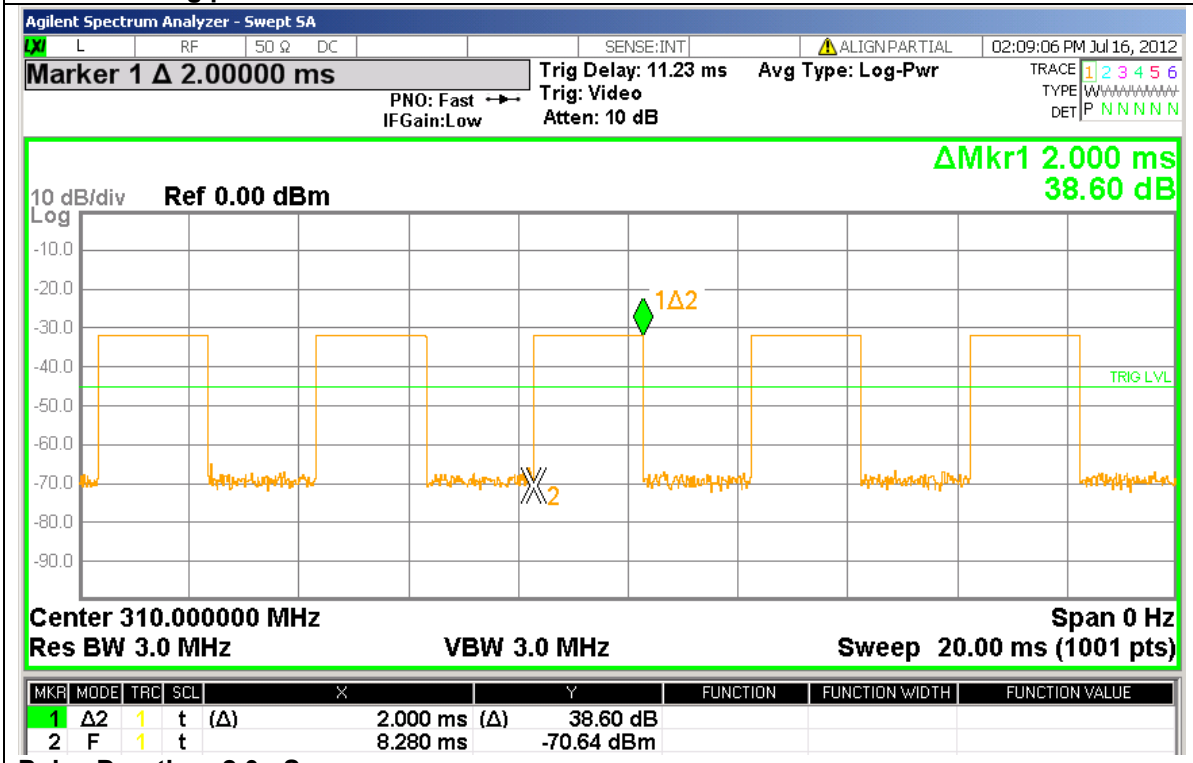
TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
310MHz	(8x2.0mS)	63.3mS	-11.95
Worst Case Duty Cycle: The worst case duty cycle was calculated over one message period. Manufacturer declared worst case duty cycle is -12.2dB. The measured duty cycle is used for all radiated emissions measurements.			

Figure 26 Pulse Train Graphs

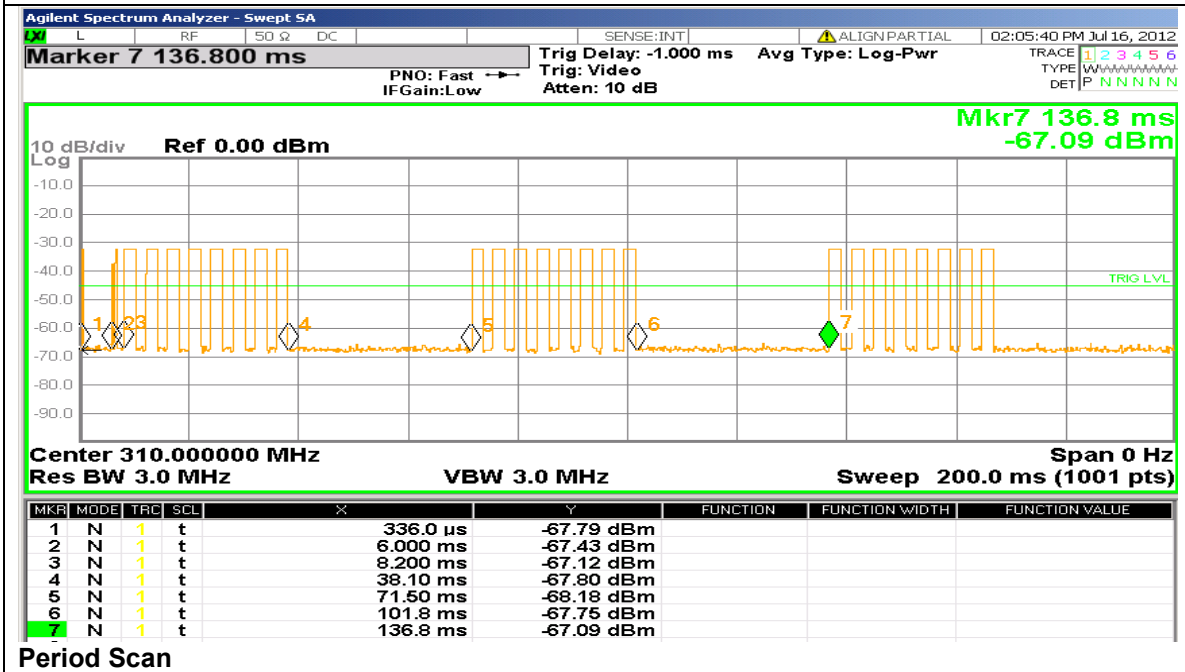


First tuning pulse duration: 0.172mS

Second tuning pulse duration: 0.344mS



Pulse Duration: 2.0mS



Period Scan

4.4.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
310	75.32	95.32

Supplementary information: See section 4.4.3 for duty cycle information.

Figure 27 Radiated Emissions Graph (Below 1GHz)

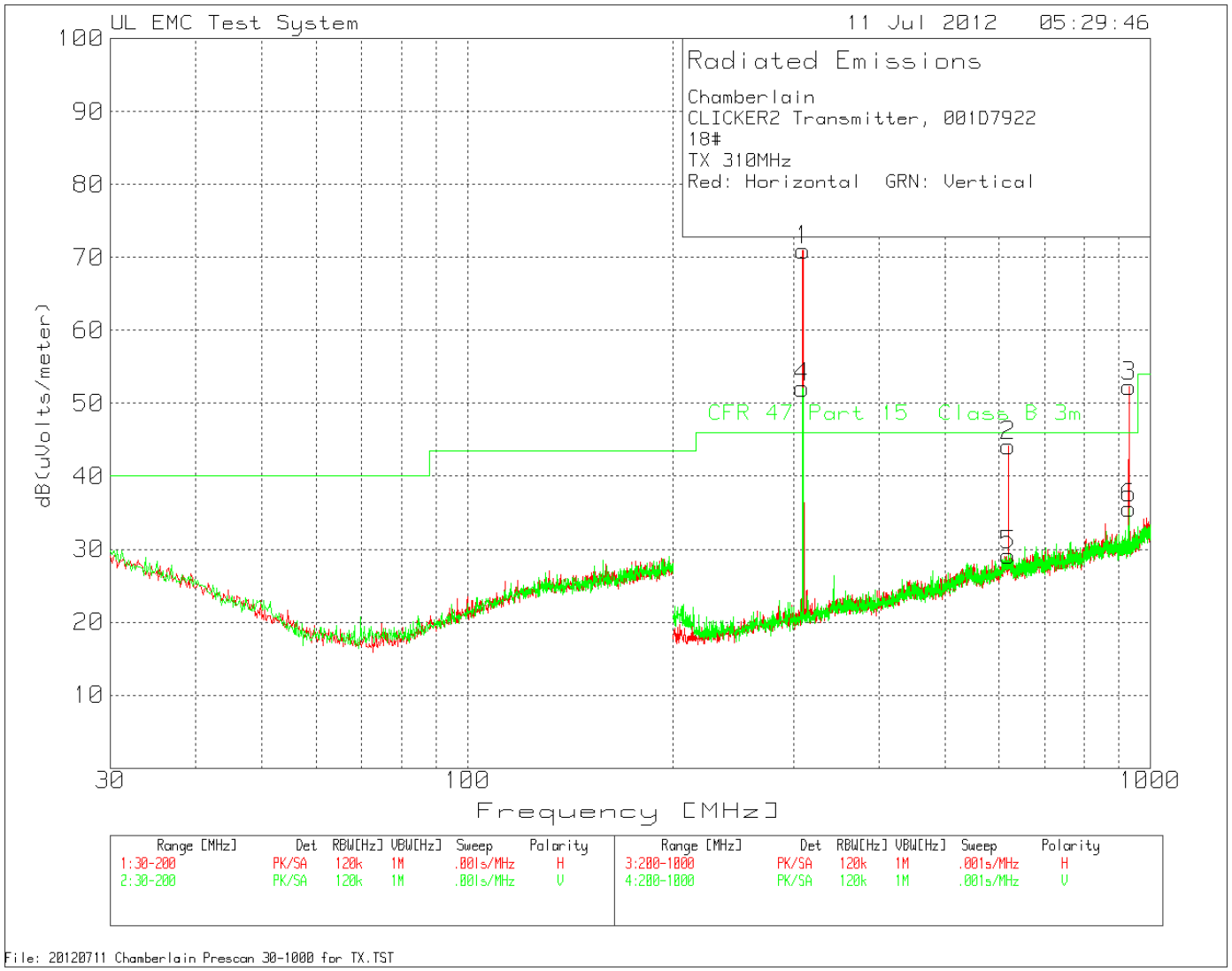


Figure 28 Radiated Emissions Graph (Above 1GHz)

Table 30 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
310.007997	60.96	PK	14.1	2.1	77.16	-11.95	65.21	75.32	-10.11	91	102	Horz	X
310.007997	45.9	PK	14.1	2.1	62.1	-11.95	50.15	75.32	-25.17	169	127	Vert	X
620.0163	23.76	PK	20.3	3	47.06	-11.95	35.11	46	-10.89	8	134	Horz	X
619.9867	11.39	PK	20.3	3	34.69	-11.95	22.74	46	-23.26	*	101	Vert	X
930.022187	28.15	PK	23.6	3.8	55.55	-11.95	43.6	46	-2.4	7	158	Horz	X
930.022187	19.4	PK	23.6	3.8	46.8	-11.95	34.85	46	-11.15	280	166	Vert	X
1240.16	71.94	PK	25.1	-56.96	40.08	-11.95	28.13	54	-25.87	*	125	Horz	X
1550.367	76.23	PK	25.2	-56.02	45.41	-11.95	33.46	54	-20.54	*	100	Horz	X
1860.574	70.14	PK	27.2	-54.44	42.9	-11.95	30.95	54	-23.05	*	125	Horz	X
1942.628	66.35	PK	27.4	-54.48	39.27	-11.95	27.32	54	-26.68	**	100	Horz	X
3875.917	66.29	PK	32.7	-51.81	47.18	-11.95	35.23	54	-18.77	*	125	Horz	X
1237.158	66.9	PK	25.1	-57.01	34.99	-11.95	23.04	54	-30.96	*	100	Vert	X
1550.367	68.32	PK	25.2	-56.02	37.5	-11.95	25.55	54	-28.45	*	125	Vert	X
1860.574	65.59	PK	27.2	-54.44	38.35	-11.95	26.4	54	-27.6	*	100	Vert	X
1942.628	71.21	PK	27.4	-54.48	44.13	-11.95	32.18	54	-21.82	**	100	Vert	X
3875.917	65.65	PK	32.7	-51.81	46.54	-11.95	34.59	54	-19.41	*	125	Vert	X
* Prescan Data Used													
** Not from EUT													

4.5 Configuration 16# Test Data

4.5.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (310MHz: 775.0kHz)	

Table 31 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

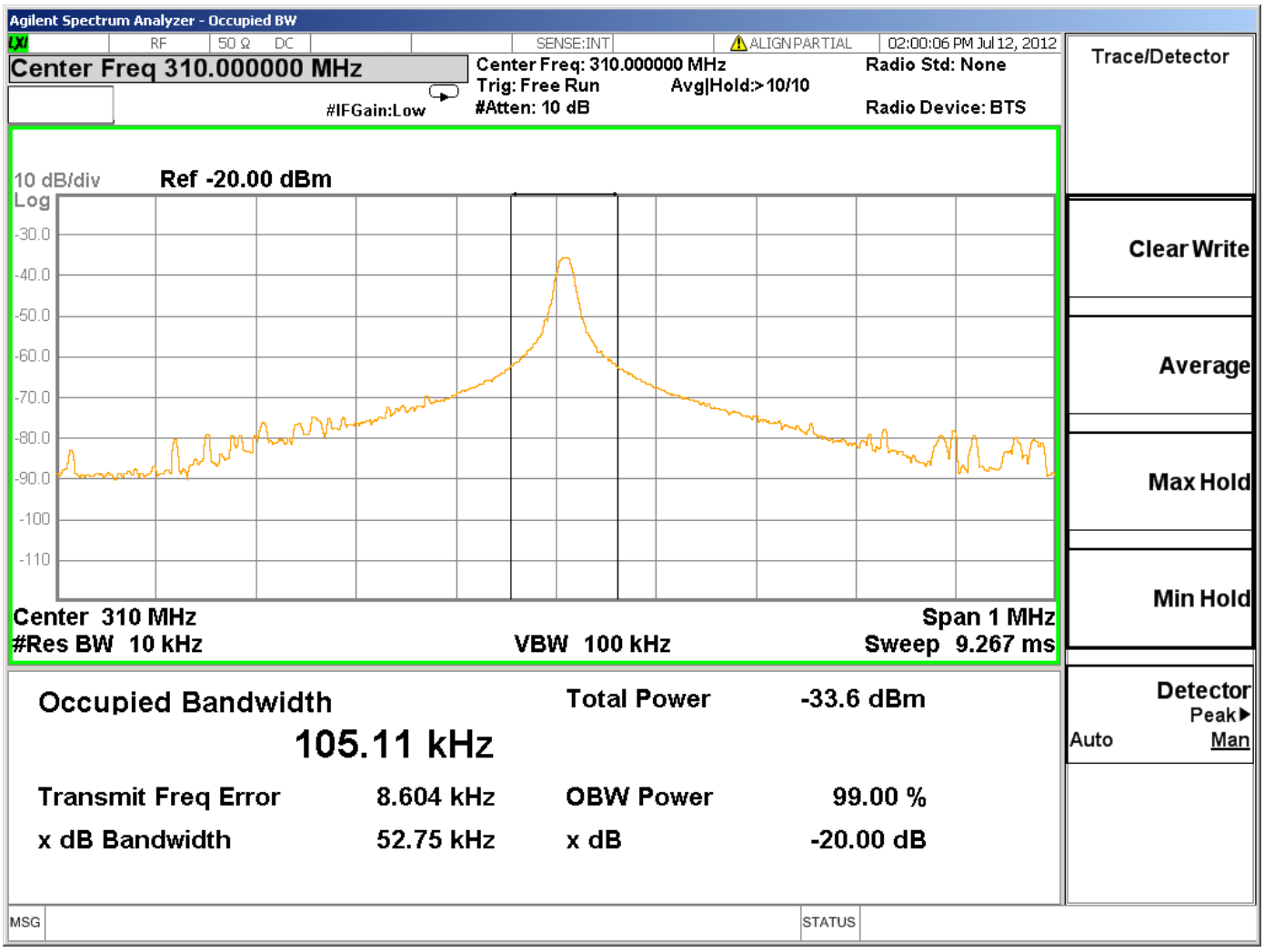
Table 32 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 33 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
310MHz	52.75	105.11

Figure 29 – Bandwidth Graph



4.5.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 34 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 30 Cease Operation Graph

4.5.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

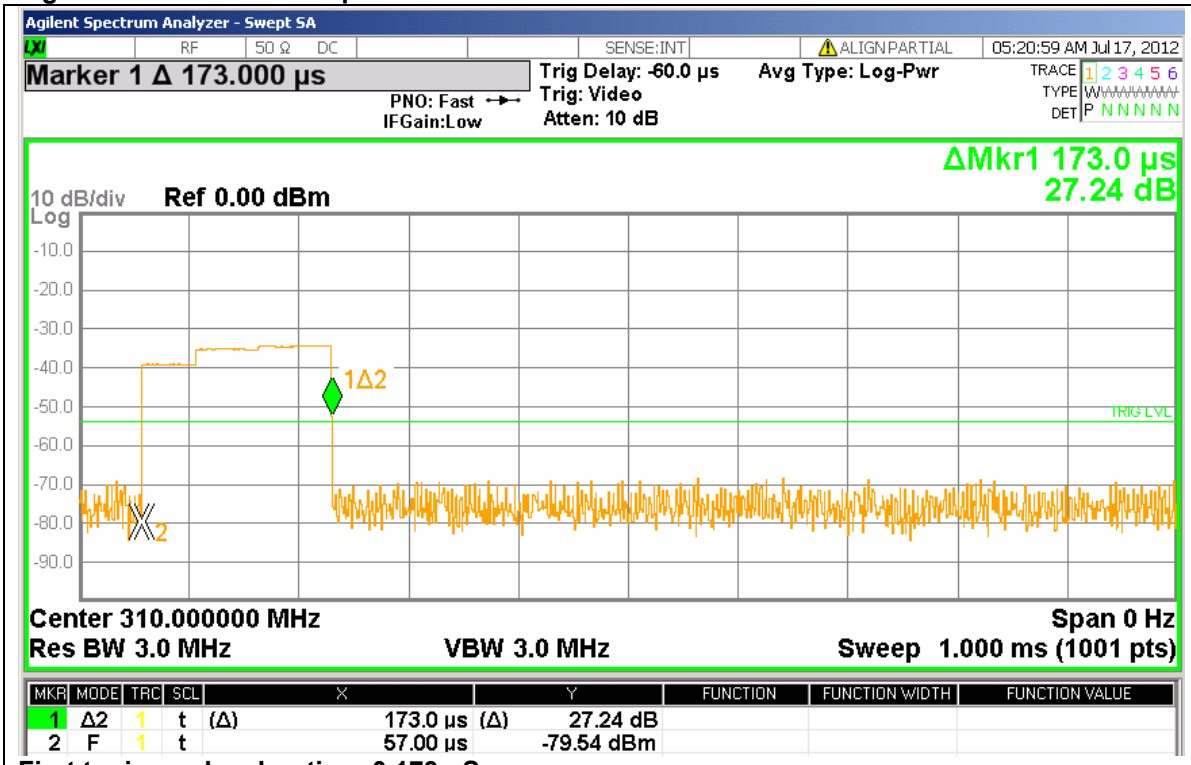
Table 35 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

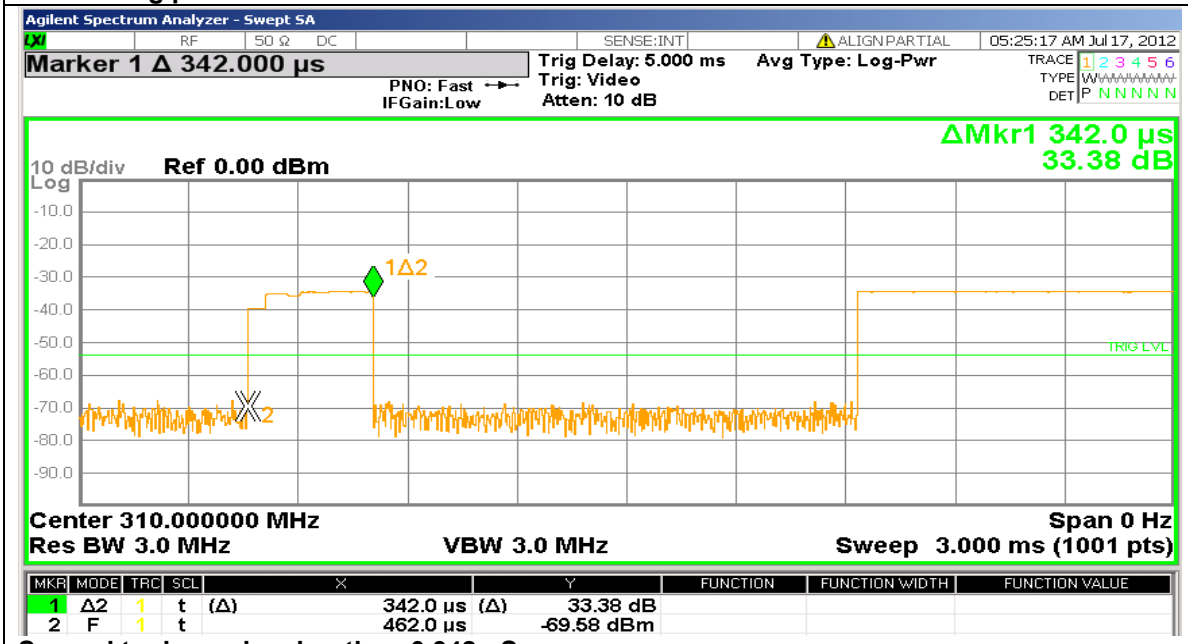
Table 36 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
310MHz	10x1.495	36.5mS	-7.75
Worst Case Duty Cycle: Worst case duty cycle was calculated over single message period and it did not include the tuning pulses. The manufacturer declared worst case duty cycle is -8.1dB. The measured value is used for all radiated emissions data.			

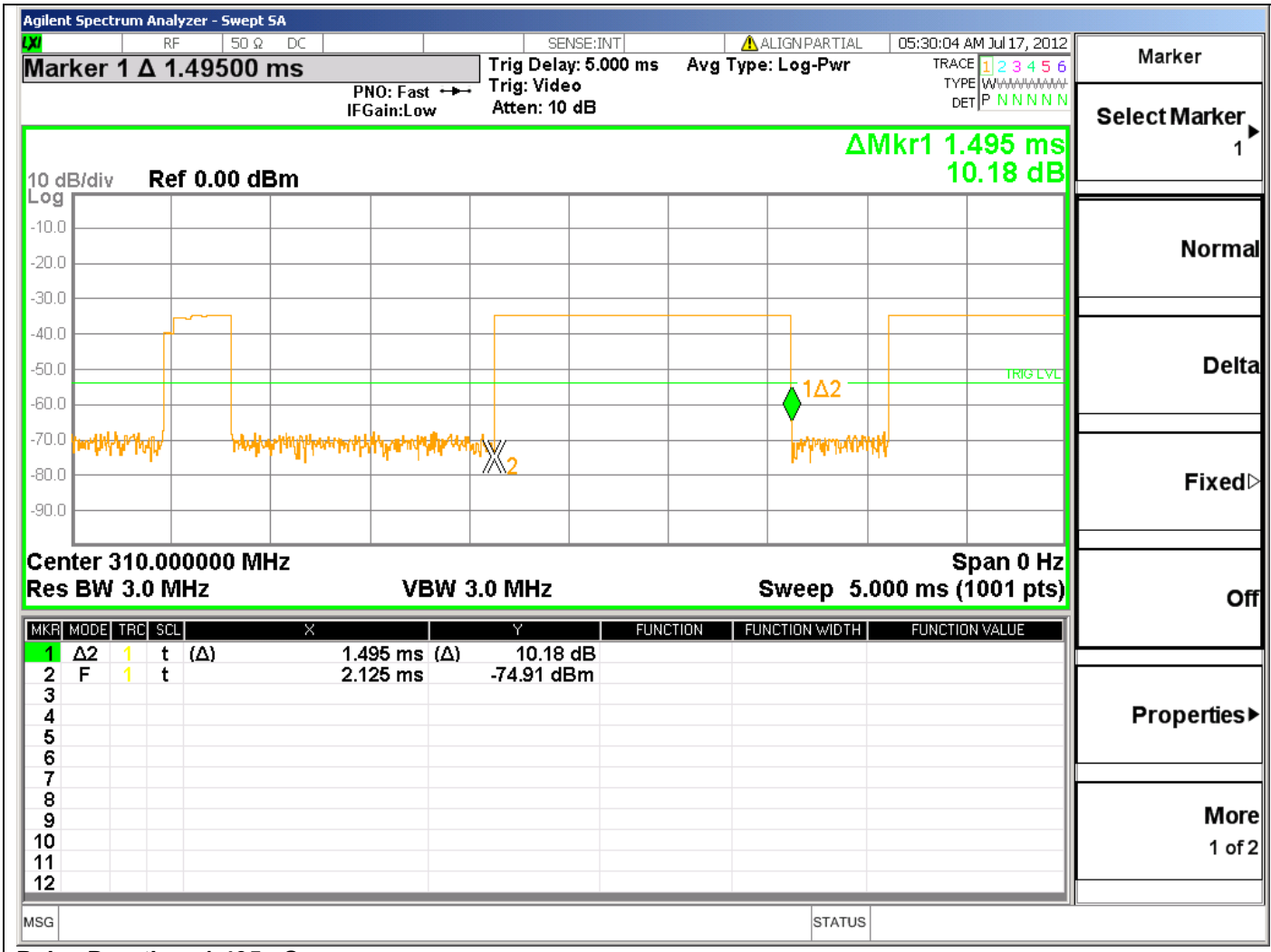
Figure 31 Pulse Train Graphs



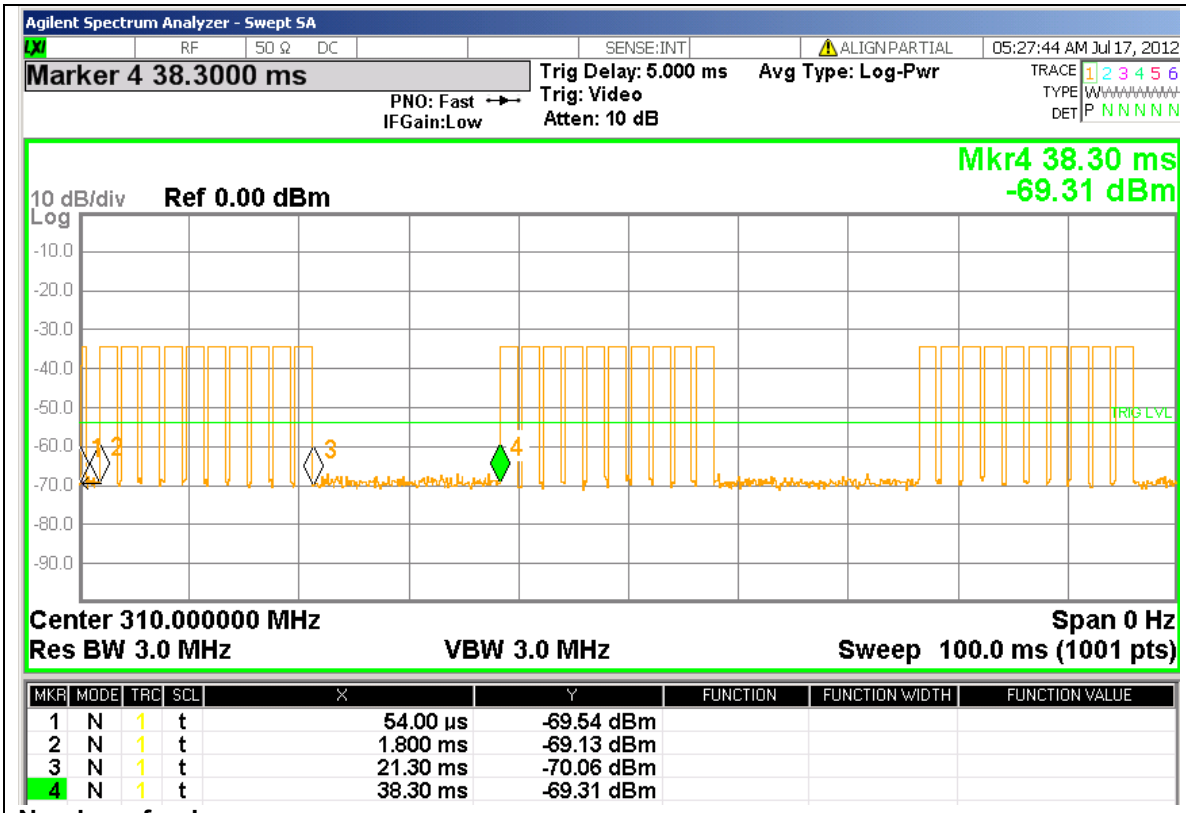
First tuning pulse duration: 0.173mS



Second tuning pulse duration: 0.342mS



Pulse Duration: 1.495mS



Number of pulses

4.5.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	47 CFR Part 15 subpart C, and RSS-210	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance
	1GHz – 4GHz	3 meter distance

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
310	75.32	95.32

Supplementary information: See section4.5.3 for duty cycle information.

Figure 32 Radiated Emissions Graph (Below 1GHz)

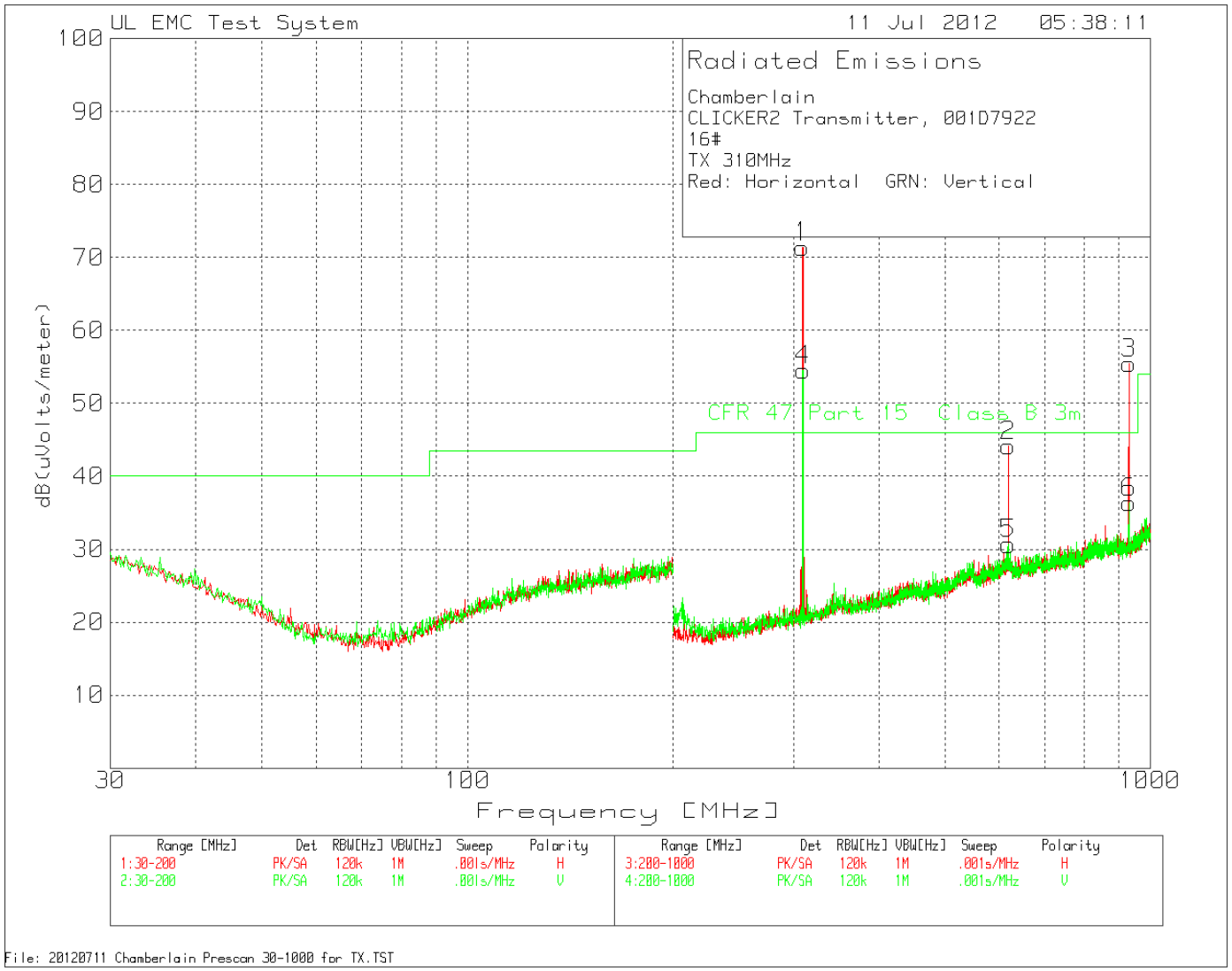


Figure 33 Radiated Emissions Graph (Above 1GHz)

Table 37 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
310.0072	61.43	PK	14.1	2.1	77.63	-7.75	69.88	75.32	-5.44	87	102	Horz	X
310.0072	46.21	PK	14.1	2.1	62.41	-7.75	54.66	75.32	-20.66	166	117	Vert	X
620.013305	24.7	PK	20.3	3	48	-7.75	40.25	46	-5.75	12	133	Horz	X
619.9867	11.78	PK	20.3	3	35.08	-7.75	27.33	46	-18.67	*	101	Vert	X
930.01809	28.83	PK	23.6	3.8	56.23	-7.75	48.48	55.32	-6.84	12	154	Horz	X
930.01809	19.75	PK	23.6	3.8	47.15	-7.75	39.4	55.32	-15.92	285	165	Vert	X
1240.16	72.6	PK	25.1	-56.96	40.74	-7.75	32.99	54	-21.01	*	125	Horz	X
1550.367	75.82	PK	25.2	-56.02	45	-7.75	37.25	54	-16.75	*	103	Horz	X
1860.574	69.95	PK	27.2	-54.44	42.71	-7.75	34.96	54	-19.04	*	125	Horz	X
3875.917	67.48	PK	32.7	-51.81	48.37	-7.75	40.62	54	-13.38	*	103	Horz	X
1242.161	66.67	PK	25.1	-56.92	34.85	-7.75	27.1	54	-26.9	*	125	Vert	X
1550.367	69.6	PK	25.2	-56.02	38.78	-7.75	31.03	54	-22.97	*	125	Vert	X
1860.574	65.04	PK	27.2	-54.44	37.8	-7.75	30.05	54	-23.95	*	100	Vert	X
3875.917	65.47	PK	32.7	-51.81	46.36	-7.75	38.61	54	-15.39	*	125	Vert	X
* Prescan Data Used													

4.6 Configuration 3# Test Data

4.6.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (315MHz: 787.5kHz)	

Table 38 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

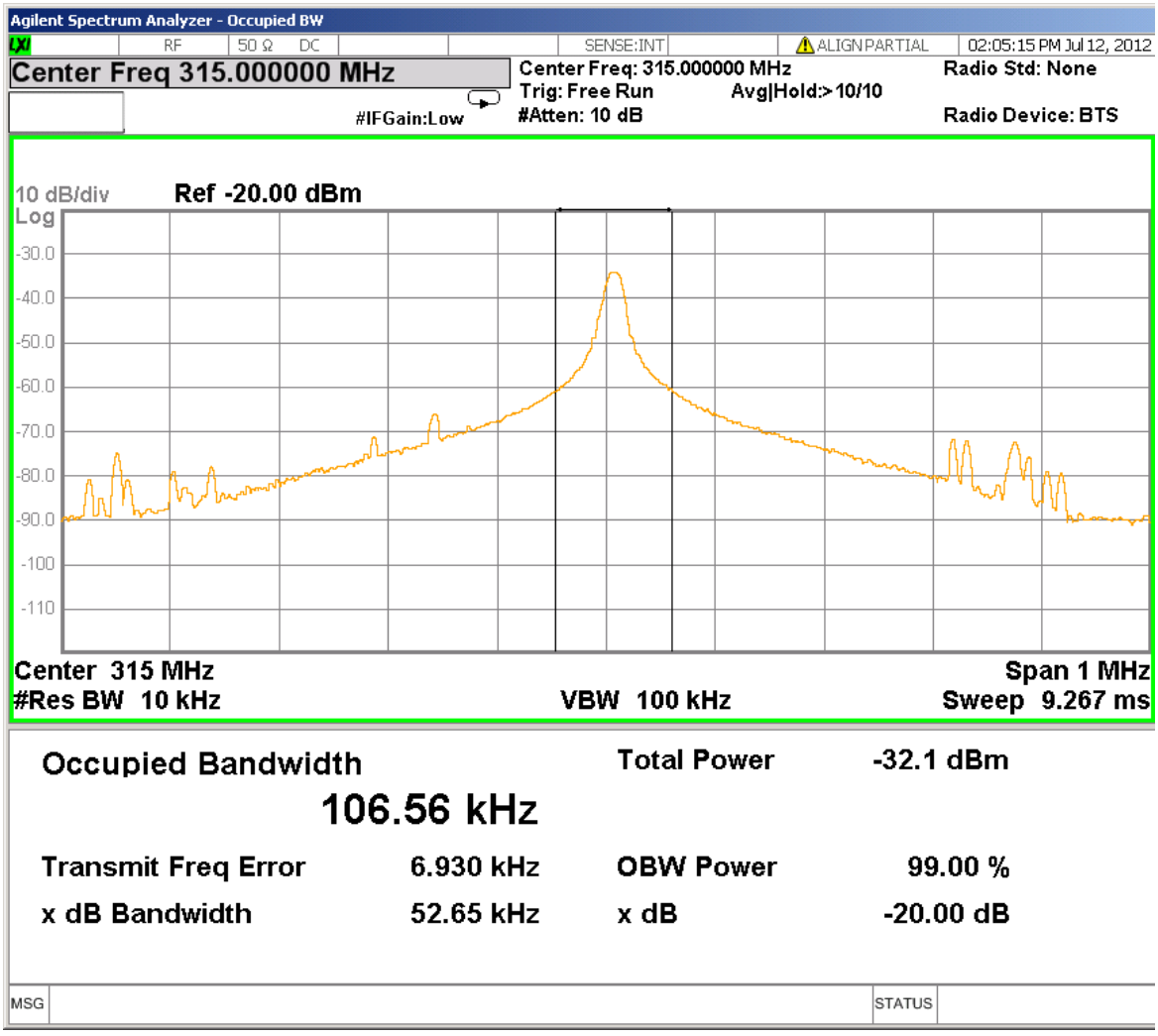
Table 39 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 40 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
315MHz	52.65	106.56

Figure 34 – Bandwidth Graph



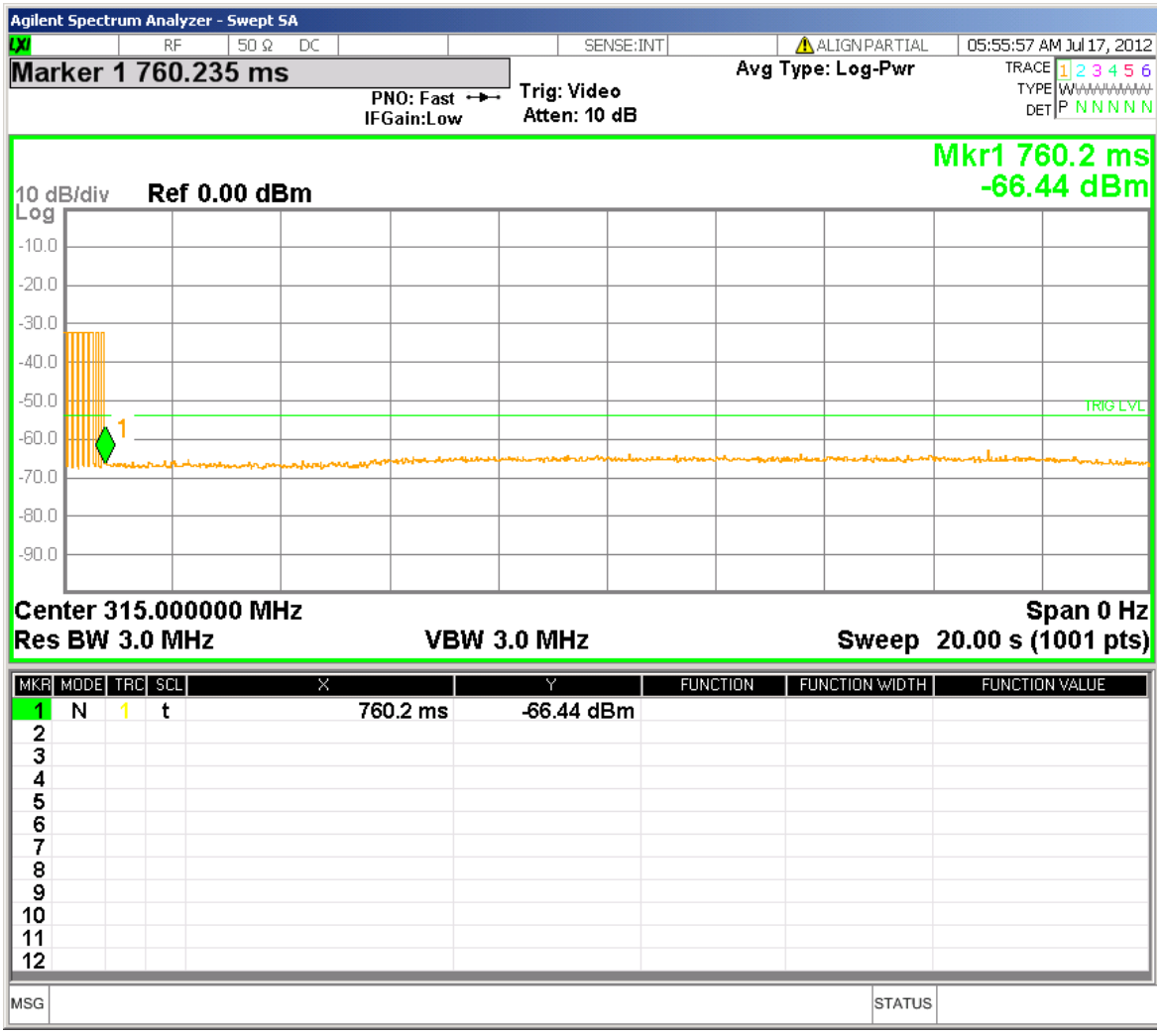
4.6.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 41 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 35 Cease Operation Graph



4.6.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

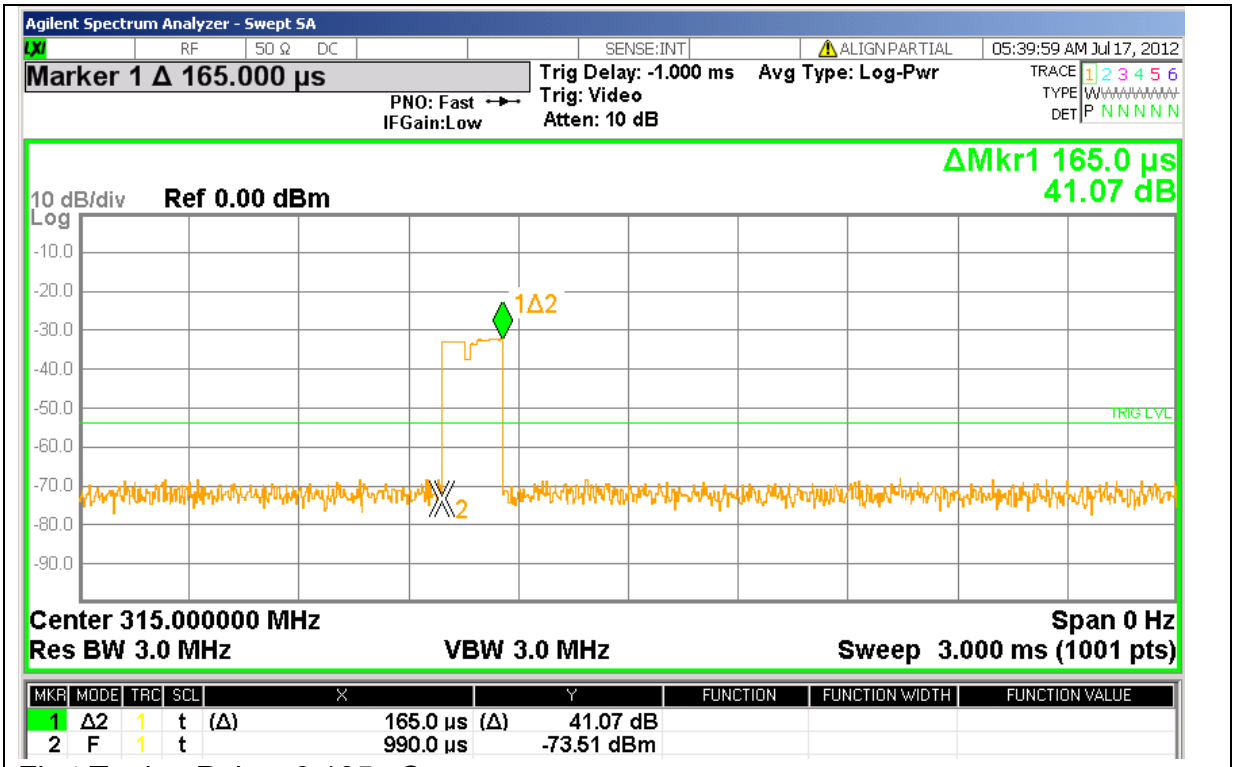
Table 42 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

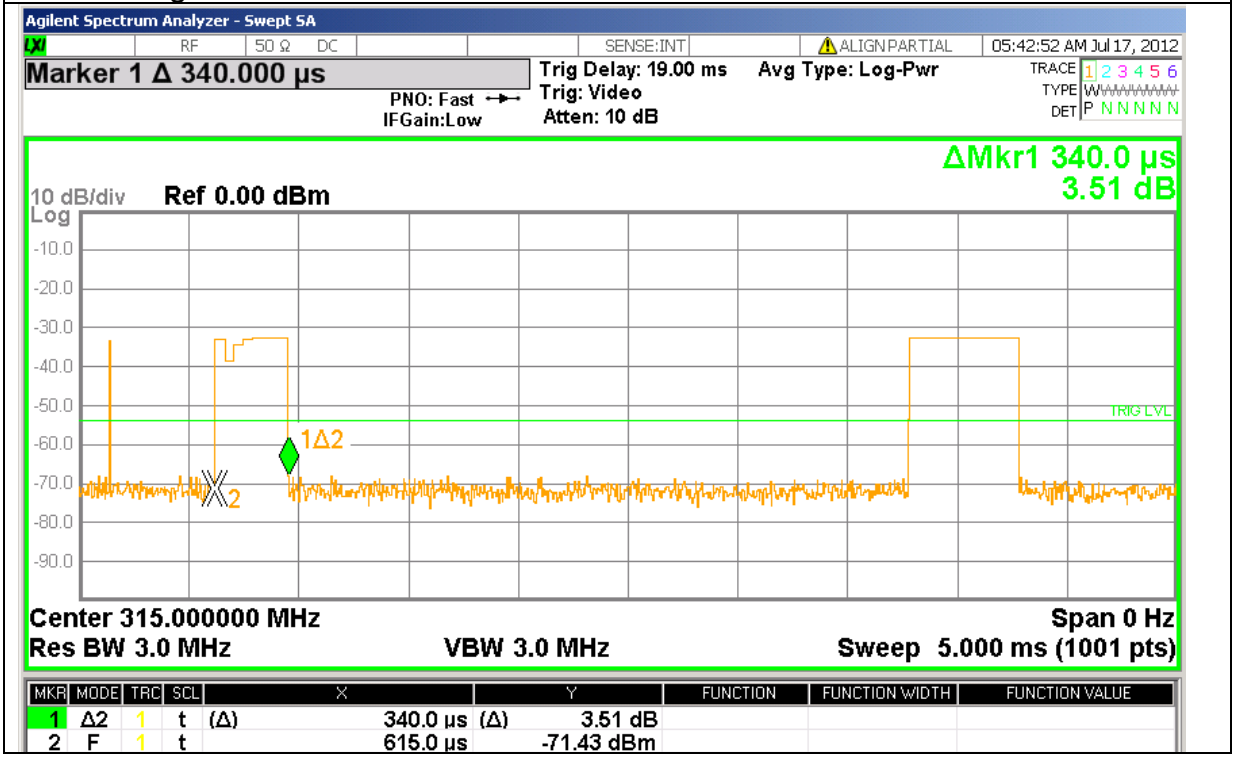
Table 43 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
315MHz	(6x0.5)+(10x1.0)+(5x1.495)	97.8ms	-13.5
Worst Case Duty Cycle: -13.5dB, Duty cycle was calculated over one period using only the message pulses and over 100mS including the tuning pulses. In both cases the calculation produces the same duty cycle number. Manufacturer declared duty cycle is -13.55dB. Measured value is used for all emissions data.			

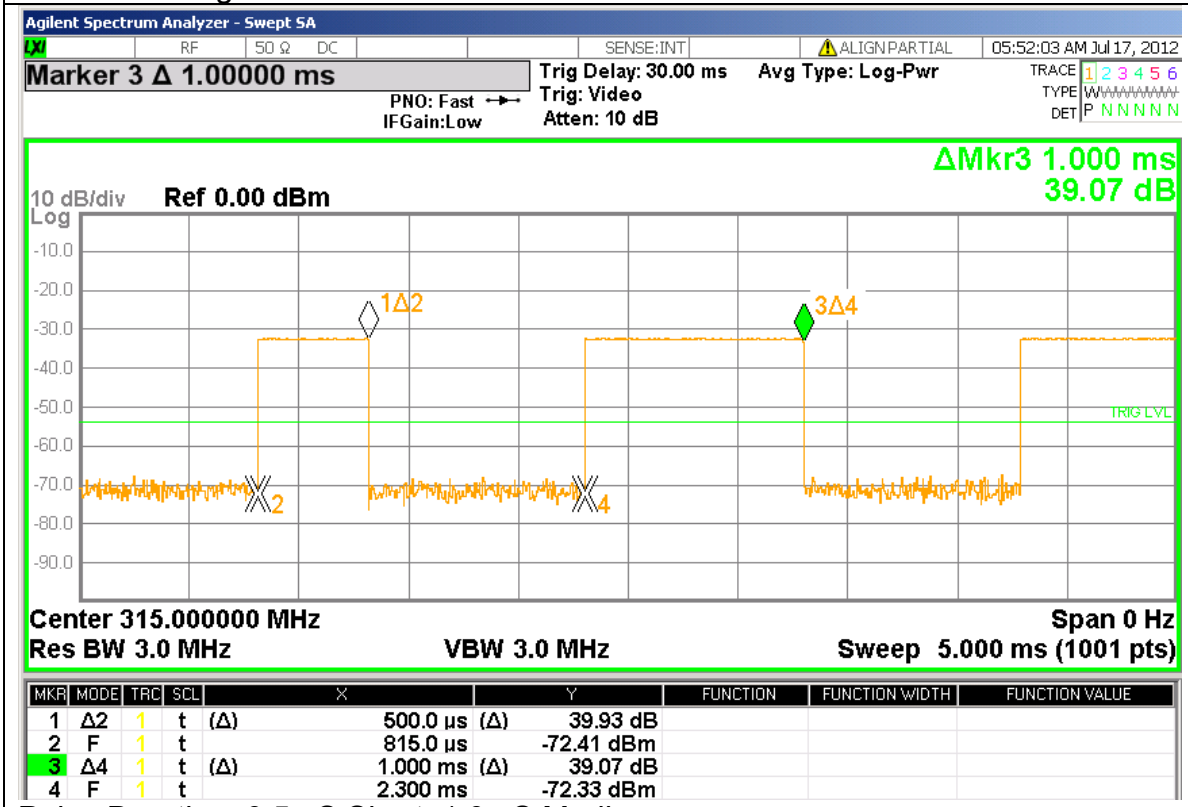
Figure 36 Pulse Train Graphs



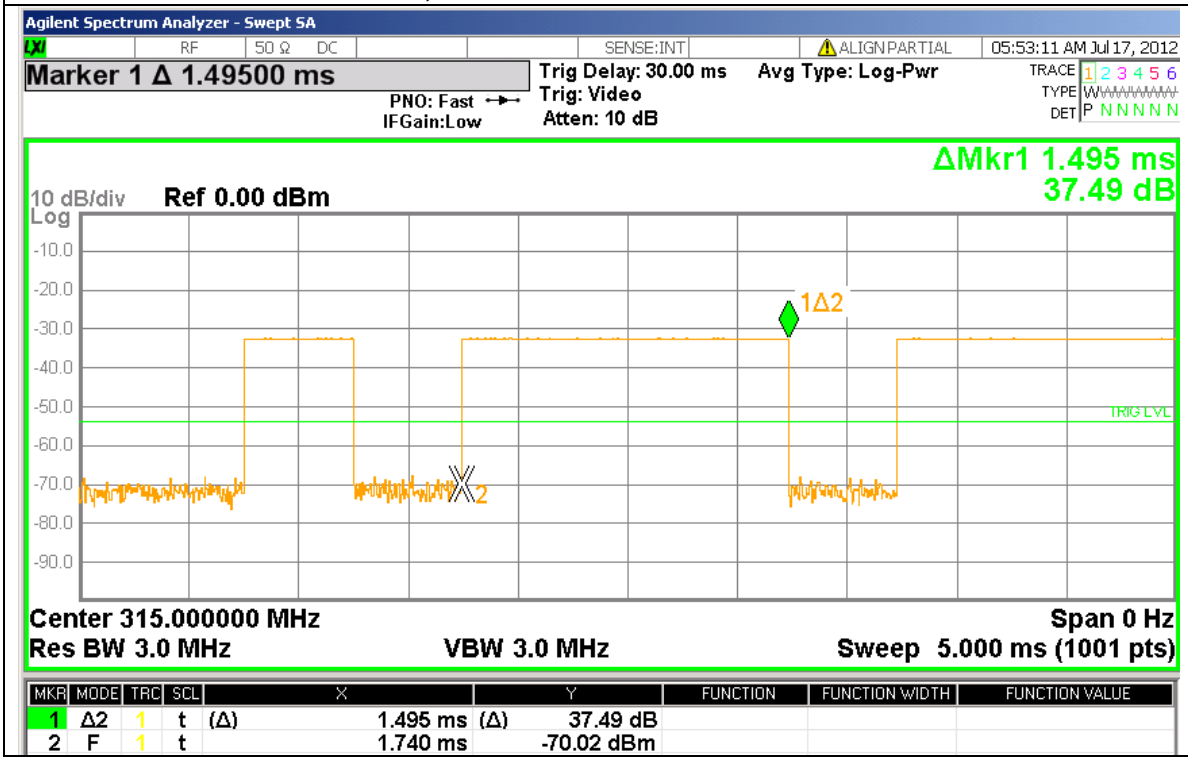
First Tuning Pulse: 0.165mS



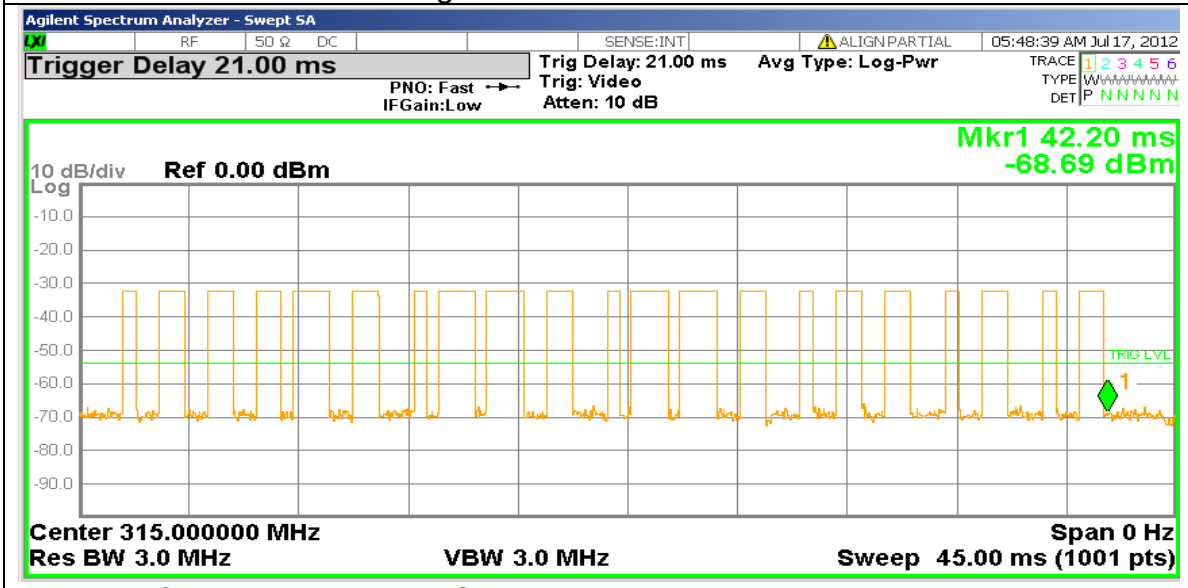
Second Tuning Pulse: 0.340mS



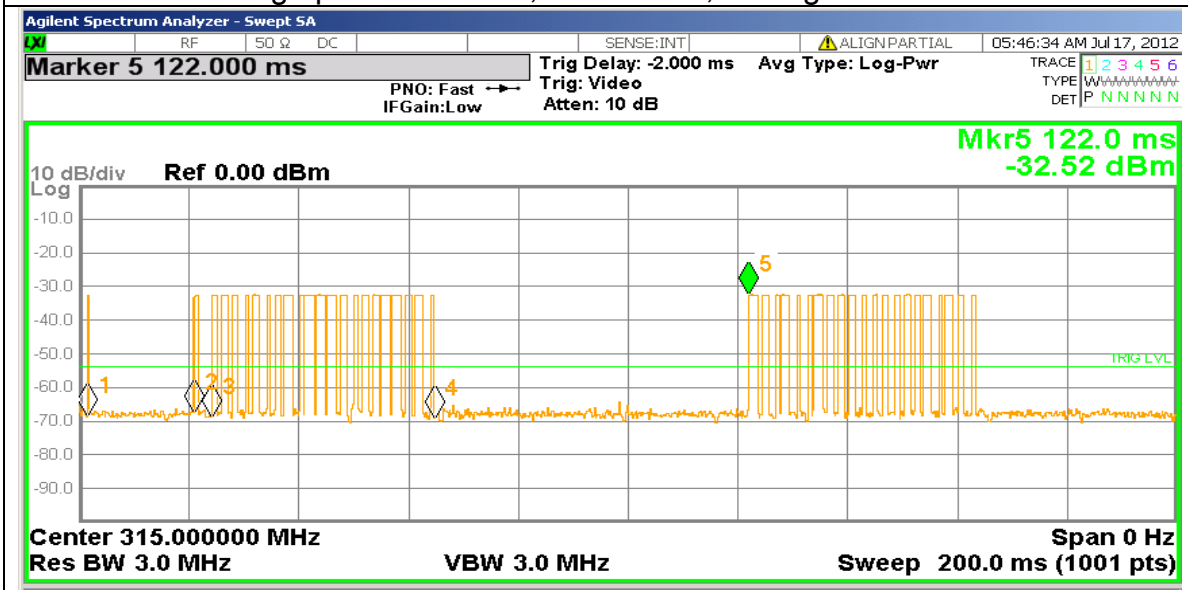
Pulse Duration: 0.5mS Short, 1.0mS Medium



Pulse Duration: 1.495mS Long



Number of message pulses: 6 Short, 10 Medium, 5 Long



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	1.455 ms	-68.58 dBm			
2	N	1	t	20.90 ms	-67.40 dBm			
3	N	1	t	24.20 ms	-68.86 dBm			
4	N	1	t	64.80 ms	-69.20 dBm			
5	N	1	t	122.0 ms	-32.52 dBm			

Period Sweep

4.6.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	47 CFR Part 15 subpart C, and RSS-210	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance
	1GHz – 4GHz	3 meter distance

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
315	75.62	95.62

Supplementary information: See section 4.6.3 for duty cycle information.

Figure 37 Radiated Emissions Graph (Below 1GHz)

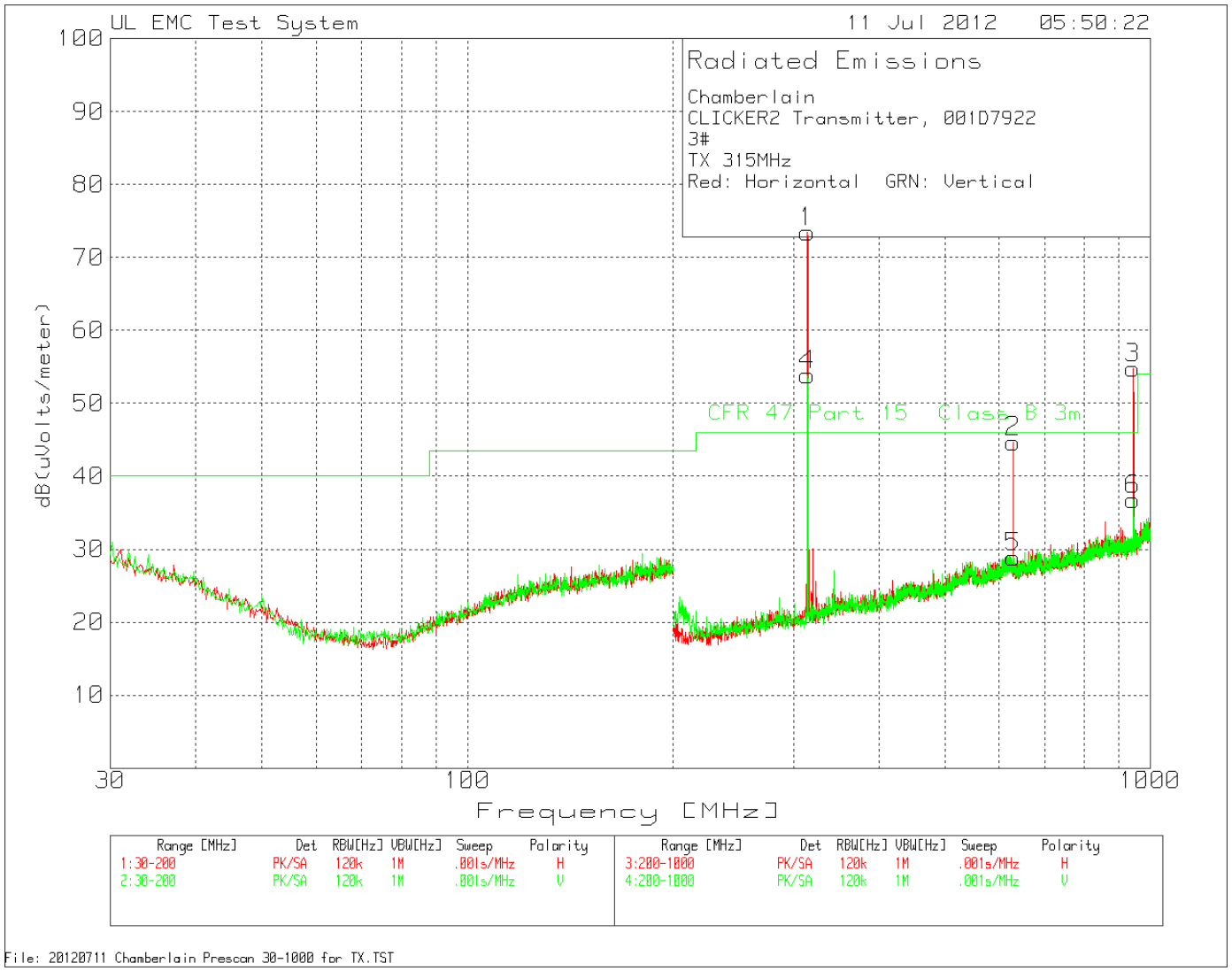


Figure 38 Radiated Emissions Graph (Above 1GHz)

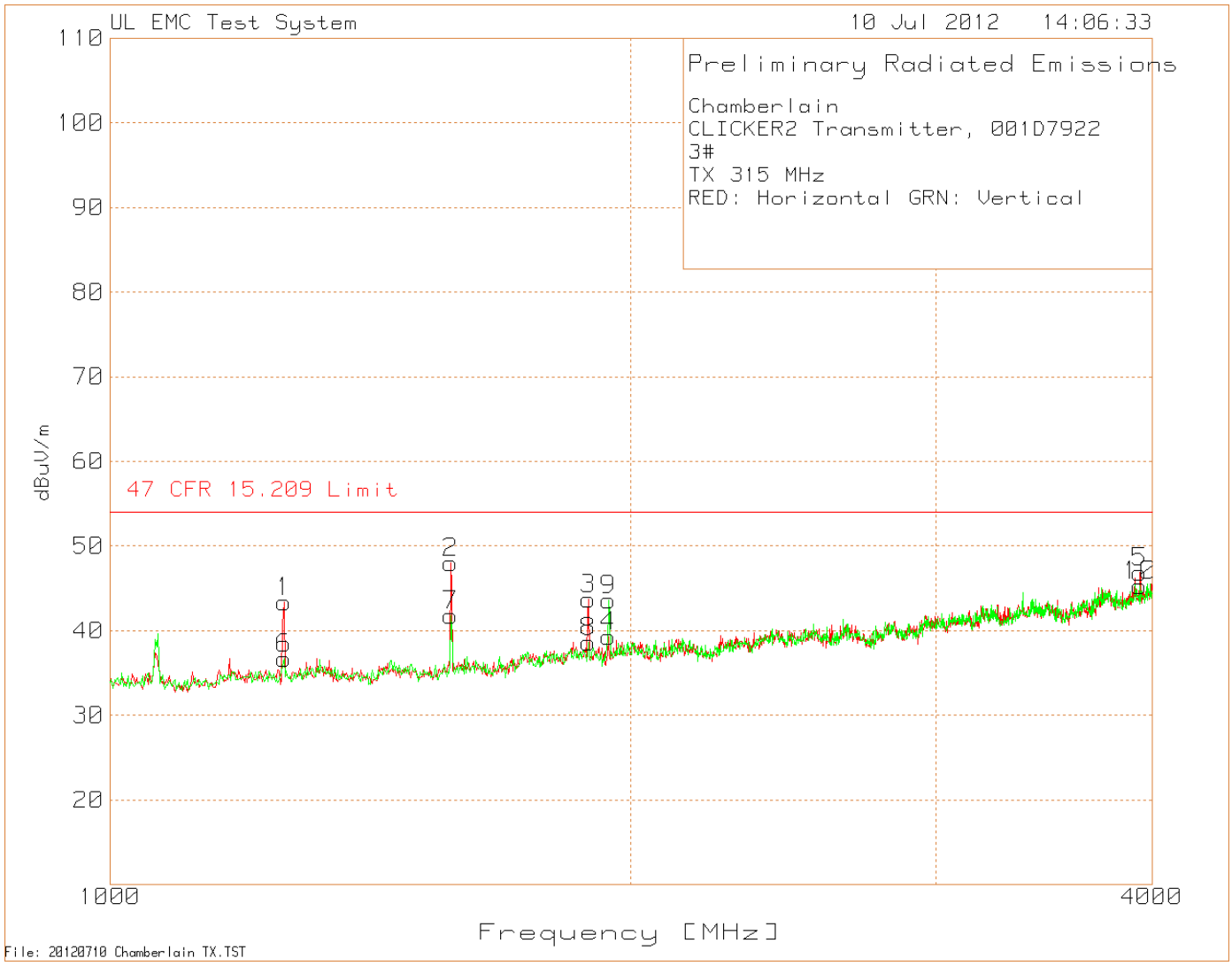


Table 44 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity	Axis
315.003995	62.29	PK	14.2	2.1	78.59	-13.5	65.09	75.62	-10.53	99	102	Horz	X
315.003995	47.61	PK	14.2	2.1	63.91	-13.5	50.41	75.62	-25.21	165	114	Vert	X
630.0077	25.85	PK	20.6	3	49.45	-13.5	35.95	46	-10.05	14	137	Horz	X
630.1133	11.2	PK	20.6	3	34.8	-13.5	21.3	46	-24.7	*	101	Vert	X
945.012203	29.63	PK	23.6	3.8	57.03	-13.5	43.53	46	-2.47	22	152	Horz	X
945.012203	19.85	PK	23.6	3.8	47.25	-13.5	33.75	46	-12.25	277	167	Vert	X
1260.173	75.15	PK	25.1	-56.92	43.33	-13.5	29.83	54	-24.17	*	125	Horz	X
1574.383	78.01	PK	25.3	-55.3	48.01	-13.5	34.51	54	-19.49	*	99	Horz	X
1890.594	70.6	PK	27.4	-54.32	43.68	-13.5	30.18	54	-23.82	*	125	Horz	X
1940.627	66.41	PK	27.4	-54.54	39.27	-13.5	25.77	54	-28.23	**	99	Horz	X
3937.959	66.37	PK	32.7	-52.17	46.9	-13.5	33.4	54	-20.6	*	99	Horz	X
1260.173	68.51	PK	25.1	-56.92	36.69	-13.5	23.19	54	-30.81	*	100	Vert	X
1574.383	71.79	PK	25.3	-55.3	41.79	-13.5	28.29	54	-25.71	*	125	Vert	X
1890.594	65.58	PK	27.4	-54.32	38.66	-13.5	25.16	54	-28.84	*	100	Vert	X
1942.628	70.68	PK	27.4	-54.48	43.6	-13.5	30.1	54	-23.9	**	125	Vert	X
3937.959	64.77	PK	32.7	-52.17	45.3	-13.5	31.8	54	-22.2	*	125	Vert	X
* Prescan data used													
** Not from EUT													

4.7 Configuration 5# Test Data

4.7.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (315MHz: 787.5kHz)	

Table 45 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

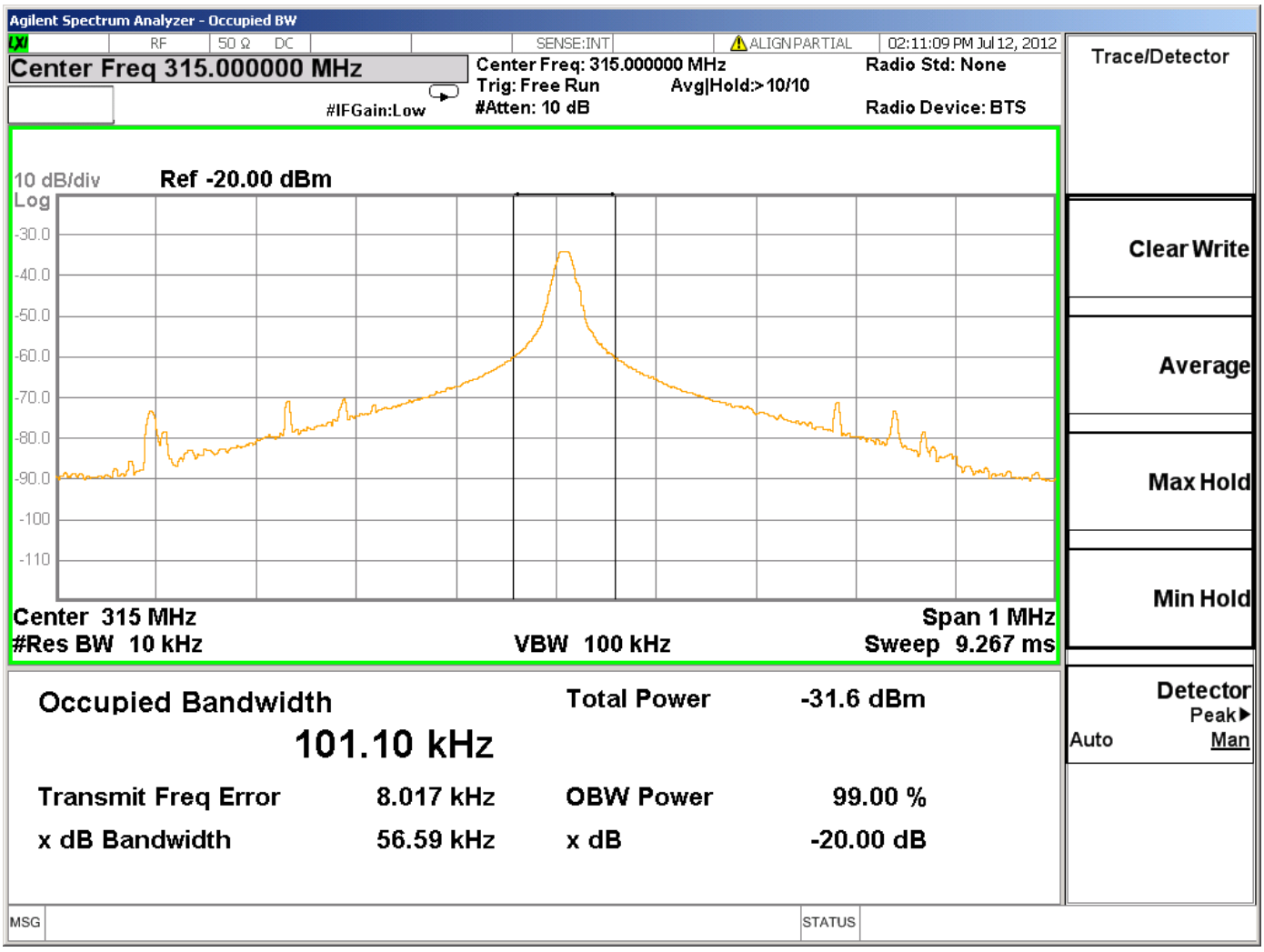
Table 46 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 47 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
315MHz	56.59	101.1

Figure 39 – Bandwidth Graph



4.7.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 48 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 40 Cease Operation Graph

4.7.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

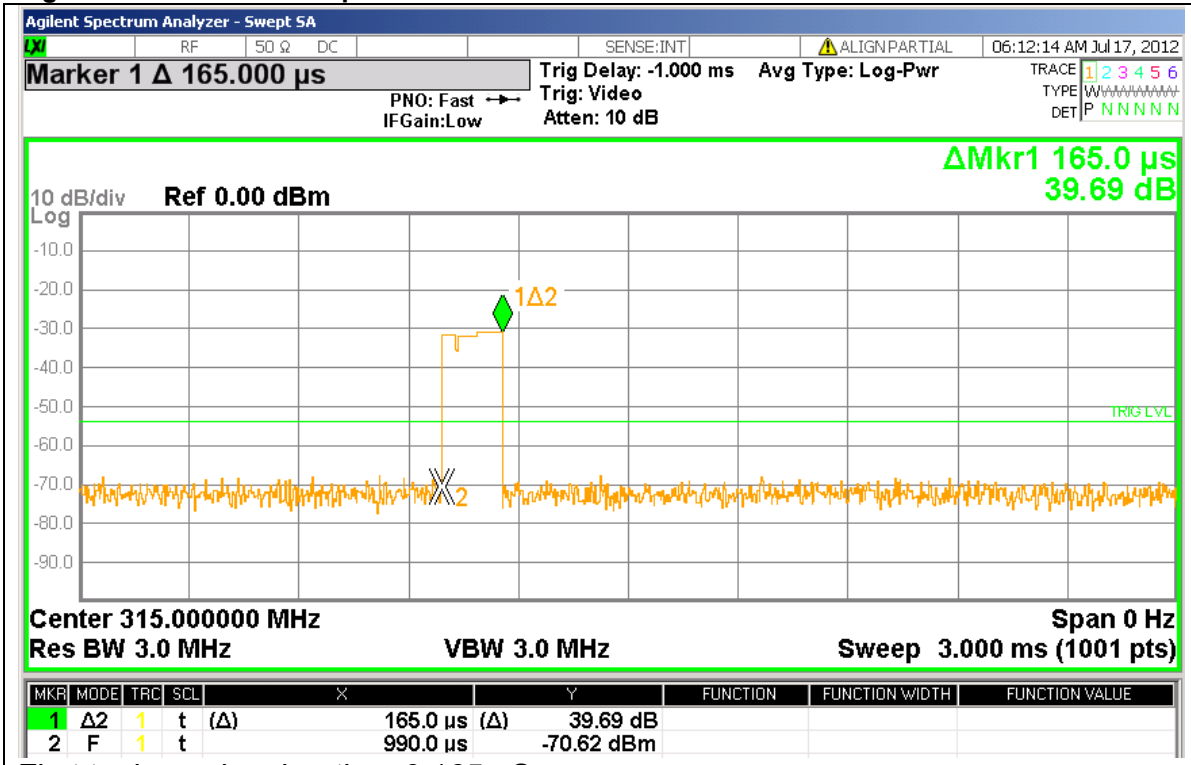
Table 49 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

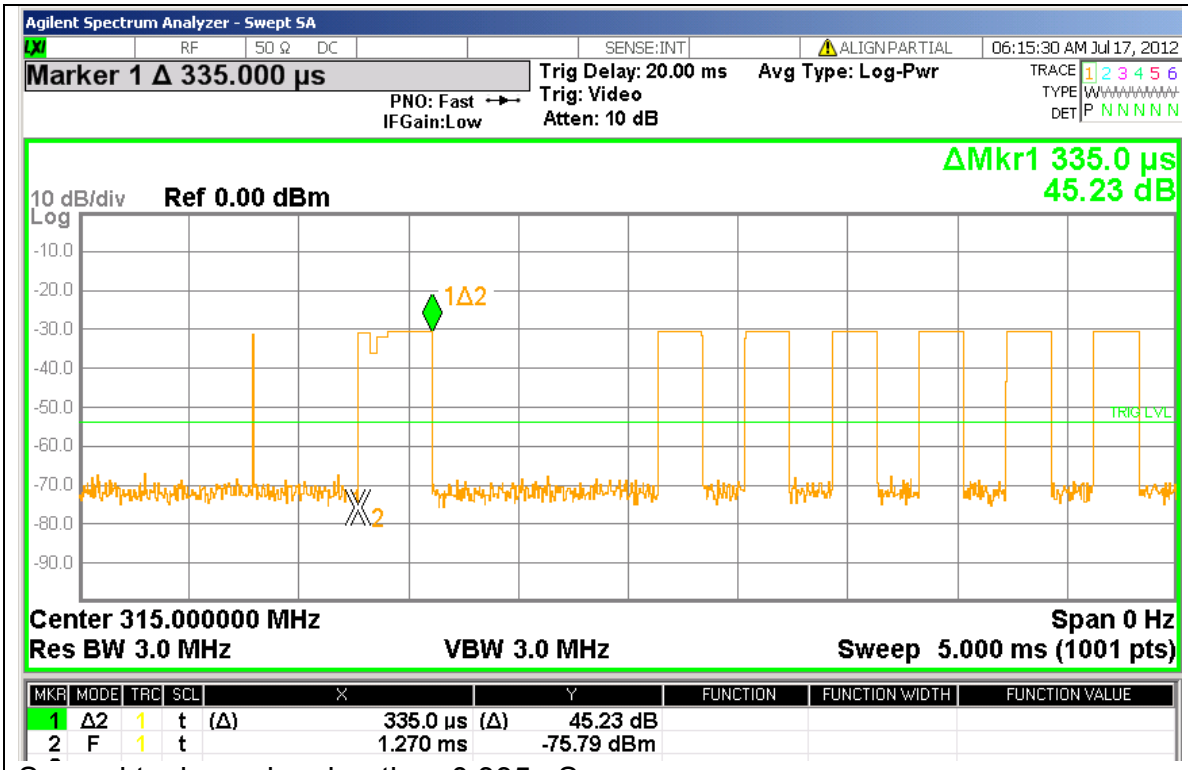
Table 50 Pulse Train Calculation

TX Frequency	Total TX time mS	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
315MHz	(49x0.204)+(28x0.402)+0.165+0.335	100ms	-13.25
Worst Case Duty Cycle: -13.25dB, worst case duty cycle was calculated over 100mS and it includes the tuning pulses. Manufacturer declared the worst case duty cycle at -12.36dB and it is used for radiated emissions data.			

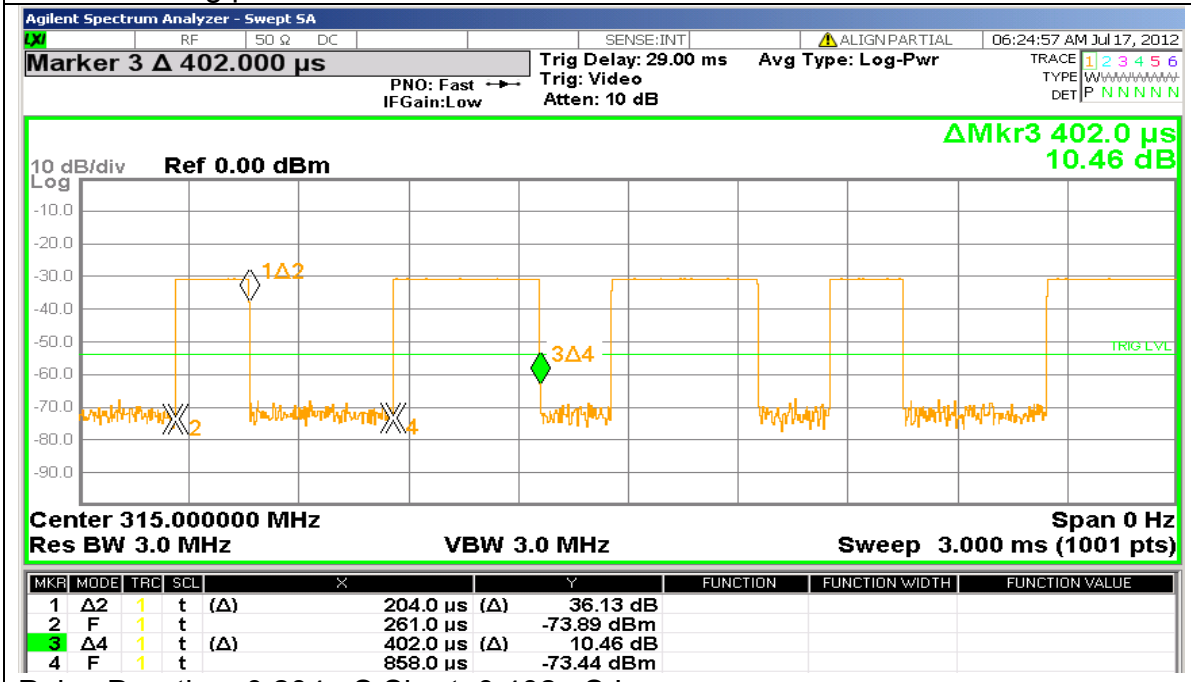
Figure 41 Pulse Train Graphs



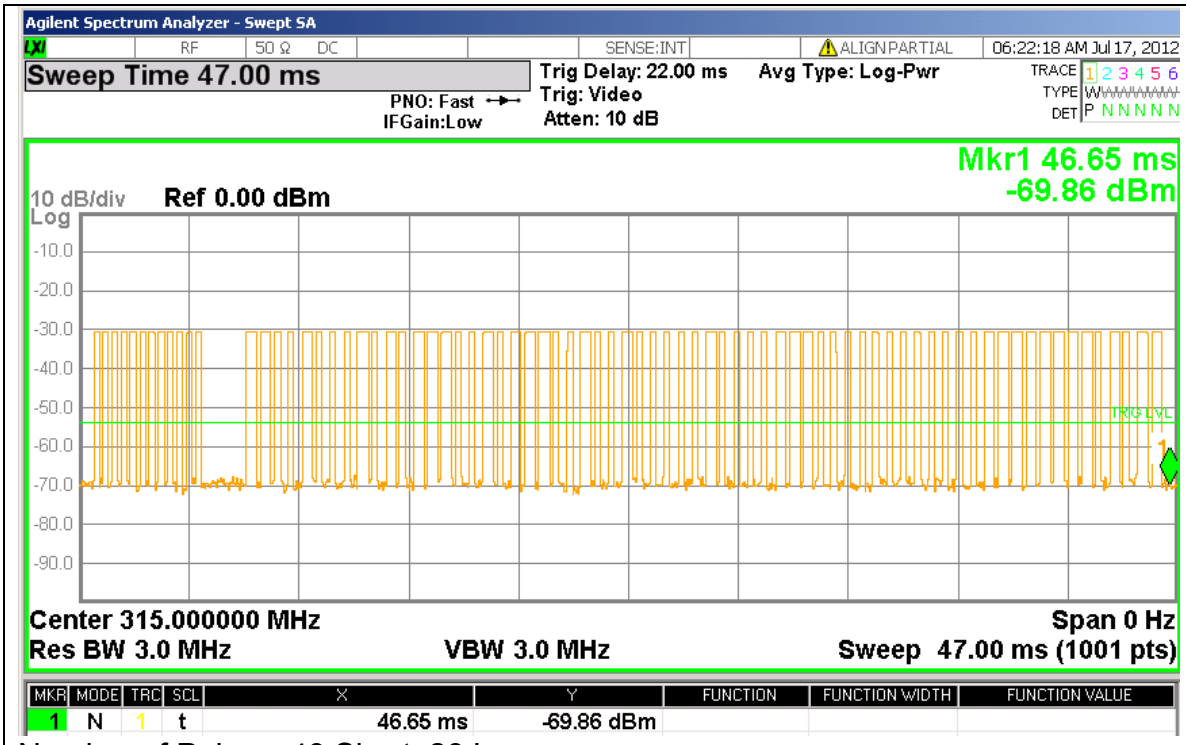
First tuning pulse duration: 0.165mS



Second tuning pulse duration: 0.335mS



Pulse Duration: 0.204mS Short, 0.402mS Long



Number of Pulses: 49 Short, 28 Long

Duty cycle was calculated over 100mS including tuning pulses.

4.7.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
315	75.62	55.62

Supplementary information: See section 4.7.3 for duty cycle information.

Figure 42 Radiated Emissions Graph (Below 1GHz)

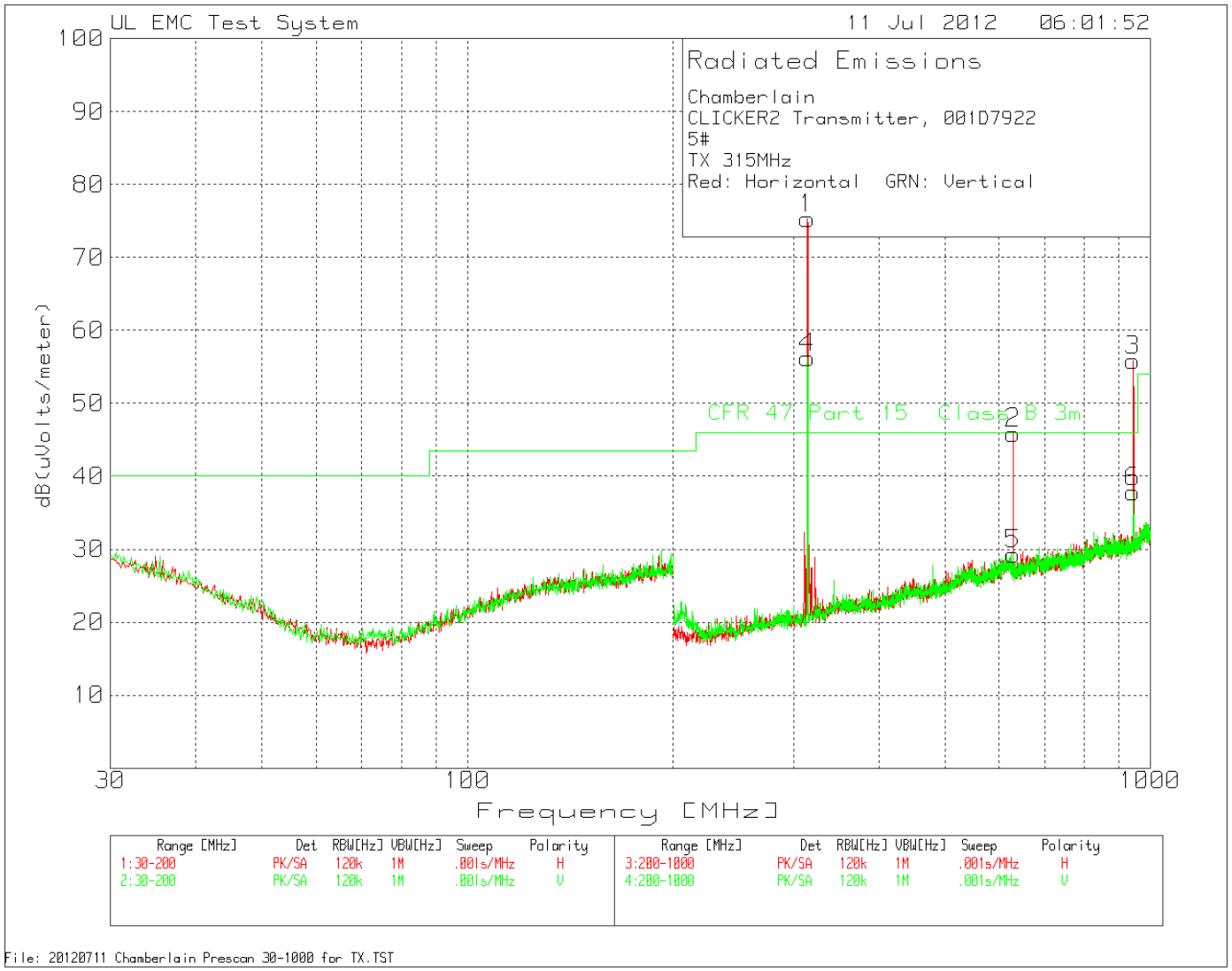


Figure 43 Radiated Emissions Graph (Above 1GHz)

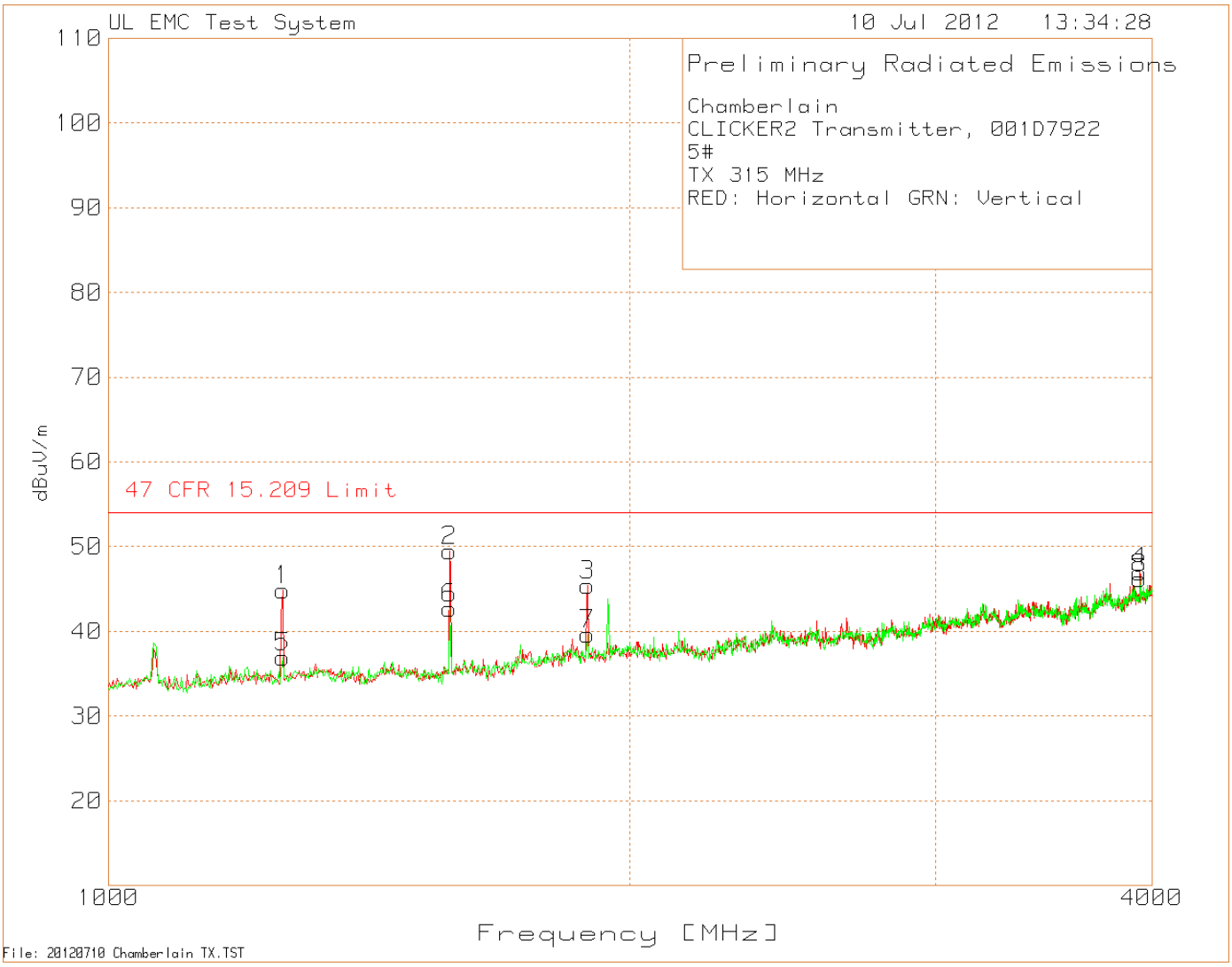


Table 51 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity	Axis
315.0072	64.17	PK	14.2	2.1	80.47	-12.36	68.11	75.62	-7.51	91	102	Horz	X
315.0072	49.58	PK	14.2	2.1	65.88	-12.36	53.52	75.62	-22.1	166	116	Vert	X
630.014892	28.76	PK	20.6	3	52.36	-12.36	40	46	-6	0	131	Horz	X
630.1133	13.61	PK	20.6	3	37.21	-12.36	24.85	46	-21.15	*	101	Vert	X
945.023695	31.36	PK	23.6	3.8	58.76	-12.36	46.4	55.62	-9.22	9	155	Horz	X
945.023695	22.86	PK	23.6	3.8	50.26	-12.36	37.9	55.62	-17.72	274	103	Vert	X
1260.173	76.69	PK	25.1	-56.92	44.87	-12.36	32.51	54	-21.49	*	125	Horz	X
1574.383	79.45	PK	25.3	-55.3	49.45	-12.36	37.09	54	-16.91	*	100	Horz	X
1890.594	72.3	PK	27.4	-54.32	45.38	-12.36	33.02	54	-20.98	*	125	Horz	X
3937.959	66.42	PK	32.7	-52.17	46.95	-12.36	34.59	54	-19.41	*	100	Horz	X
1260.173	68.71	PK	25.1	-56.92	36.89	-12.36	24.53	54	-29.47	*	100	Vert	X
1574.383	72.72	PK	25.3	-55.3	42.72	-12.36	30.36	54	-23.64	*	125	Vert	X
1890.594	66.6	PK	27.4	-54.32	39.68	-12.36	27.32	54	-26.68	*	100	Vert	X
3937.959	65.62	PK	32.7	-52.17	46.15	-12.36	33.79	54	-20.21	*	125	Vert	X
* Prescan Data used													

4.8 Configuration 12# Test Data

4.8.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (315MHz: 787.5kHz)	

Table 52 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

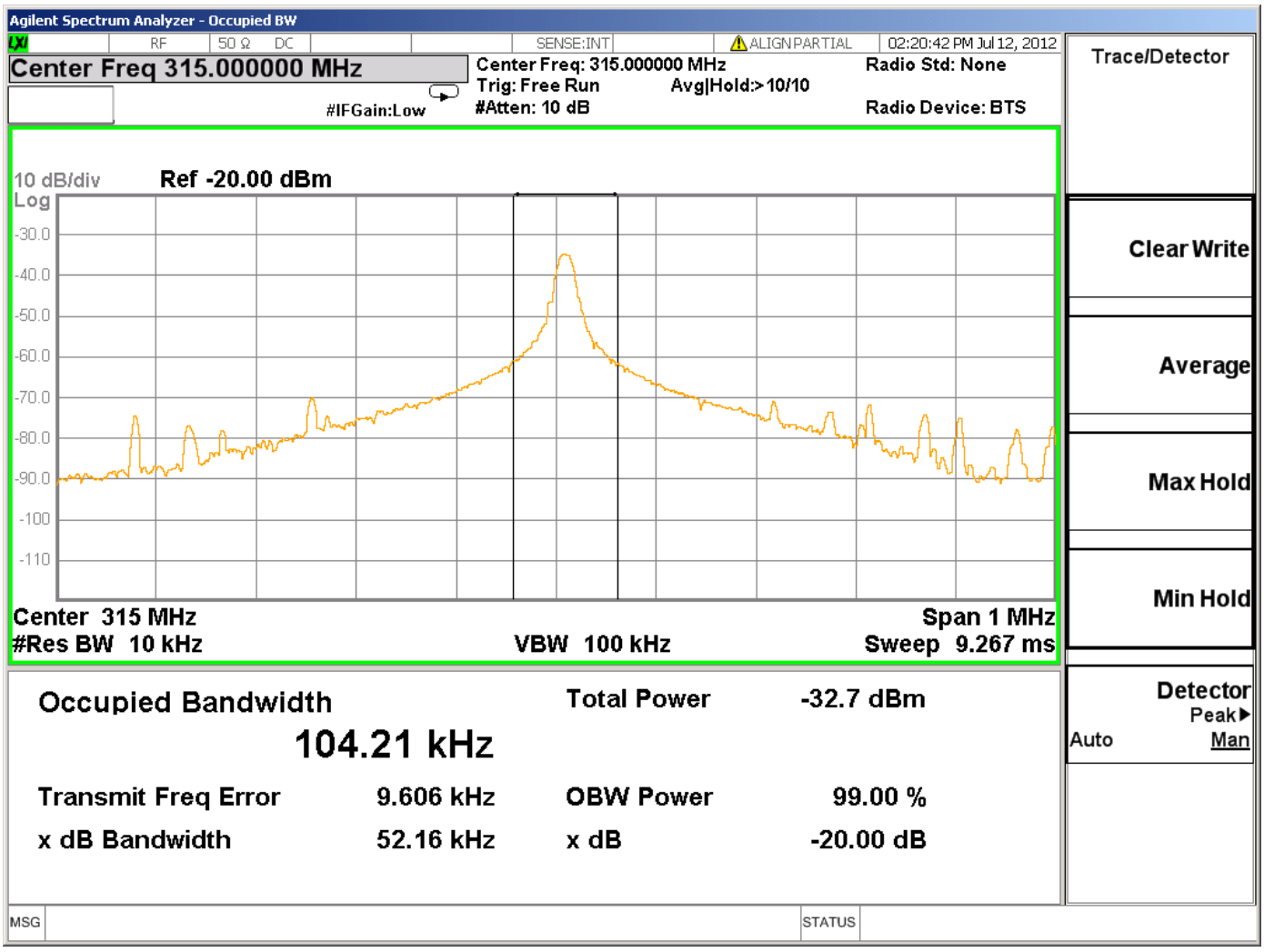
Table 53 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 54 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
315MHz	52.16	104.21

Figure 44 – Bandwidth Graph



4.8.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 55 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 45 Cease Operation Graph

4.8.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

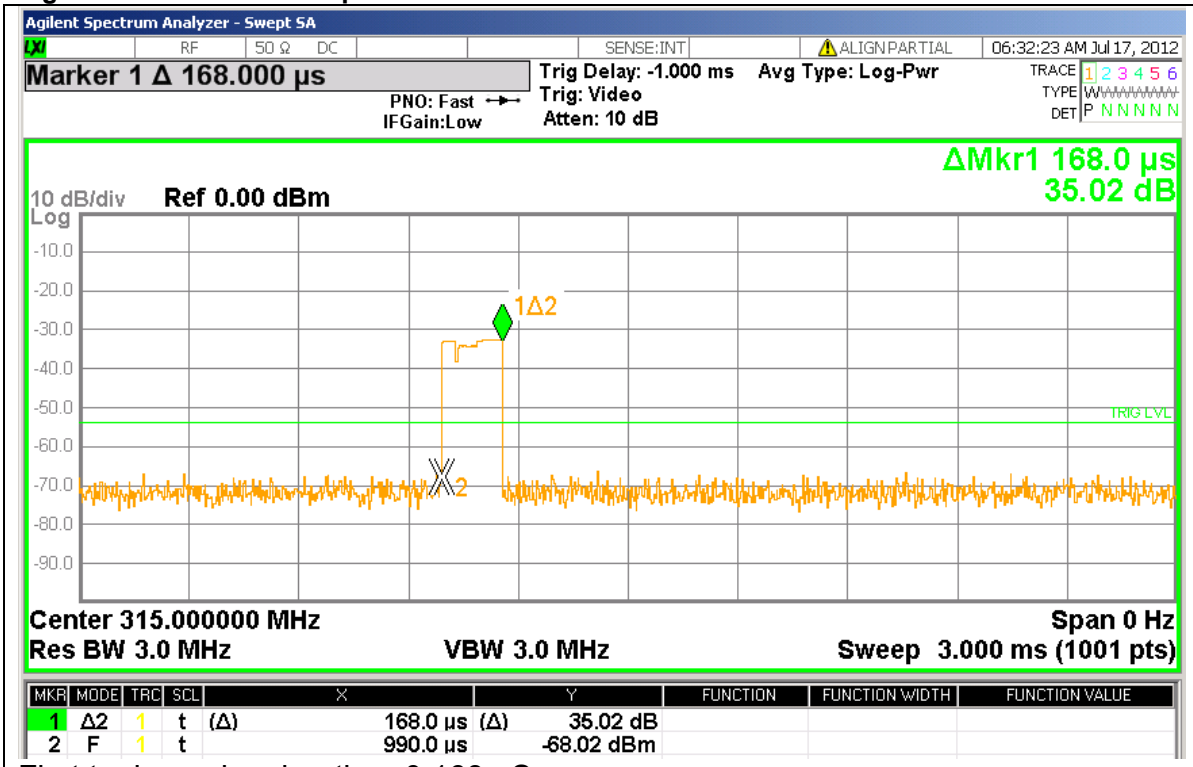
Table 56 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

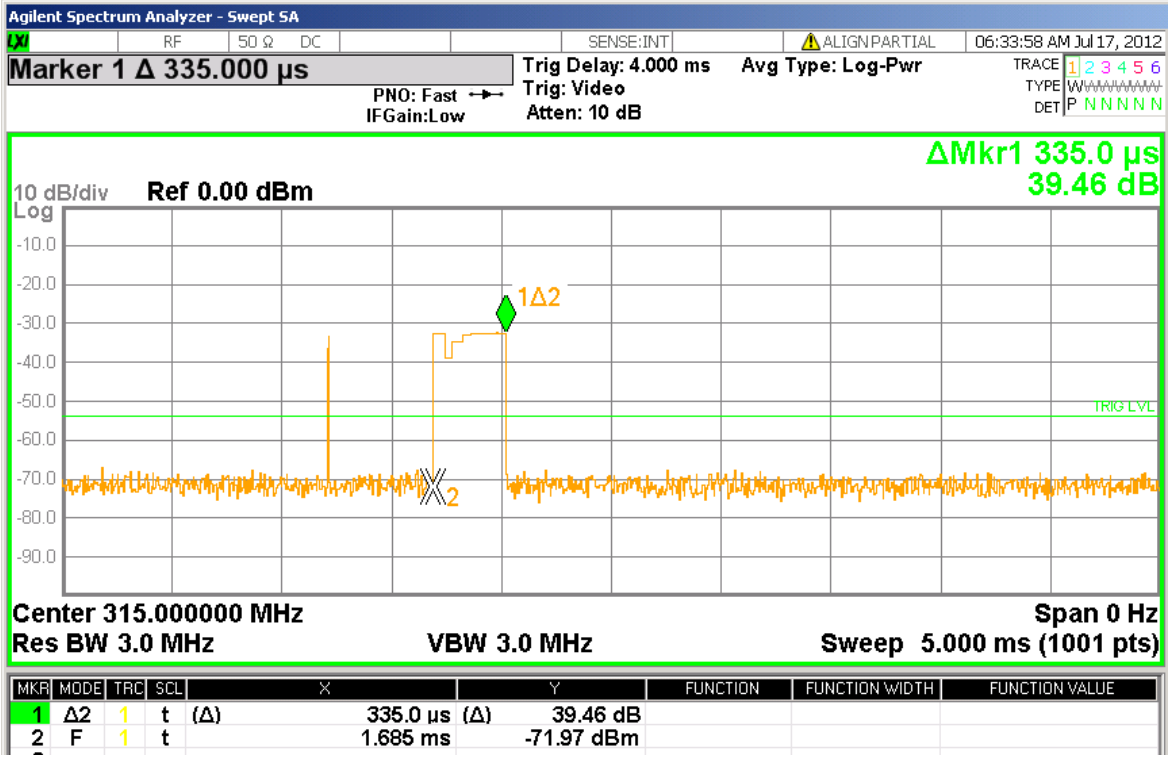
Table 57 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
315MHz	(2x1.002)+(9x2.982)	78.5mS	-8.69
Worst Case Duty Cycle: Worst case duty cycle was calculated over single period between messages and it did not include the tuning pulses. The manufacturer declares the duty cycle at -9.13dB. The measured duty cycle was used for all radiated emissions data.			

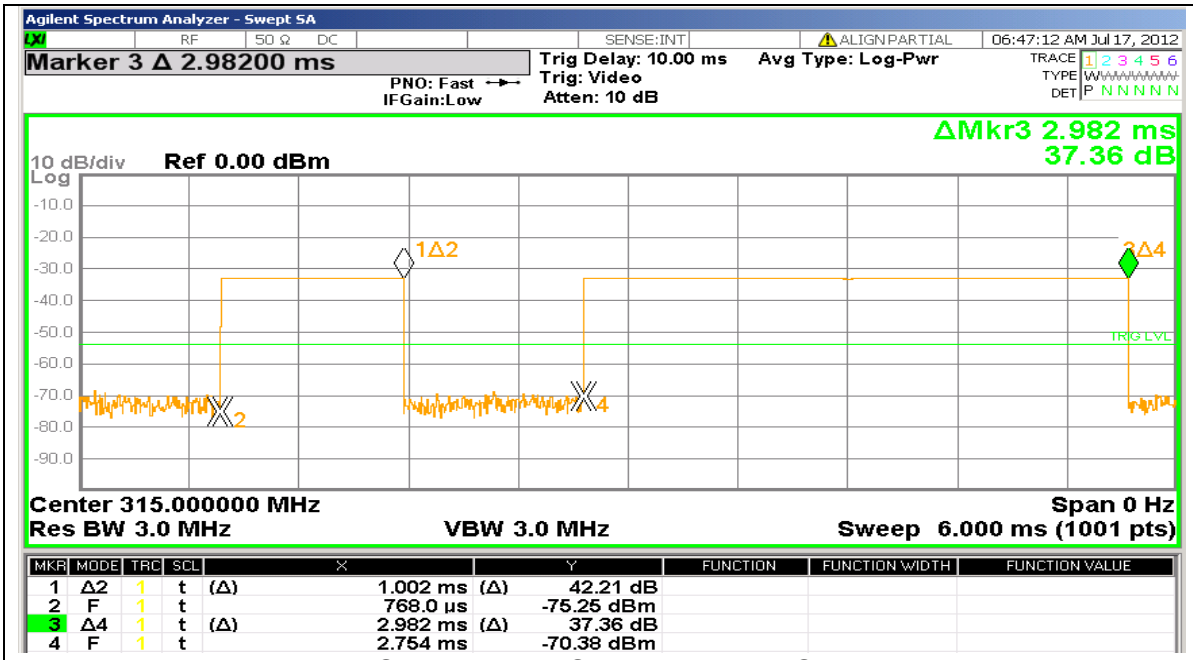
Figure 46 Pulse Train Graphs



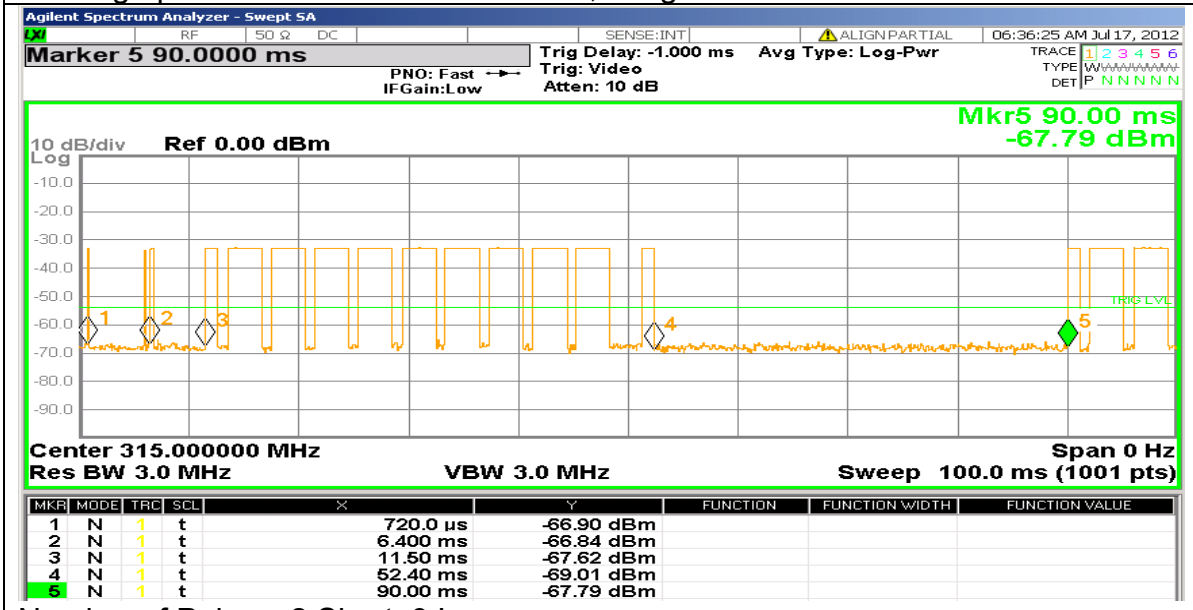
First tuning pulse duration: 0.168mS



Second tuning pulse duration: 0.335mS



Message pulse duration: Short 1.002mS, Long 2.982mS



Number of Pulses: 2 Short, 9 Long
Period: 89.28mS with tuning pulses and 78.5mS without tuning pulses

4.8.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	47 CFR Part 15 subpart C, and RSS-210	
UL LPG	80-EM-S0029	
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance
	1GHz – 4GHz	3 meter distance

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
315	75.62	95.62

Supplementary information: See section 4.8.3 for duty cycle information.

Figure 47 Radiated Emissions Graph (Below 1GHz)

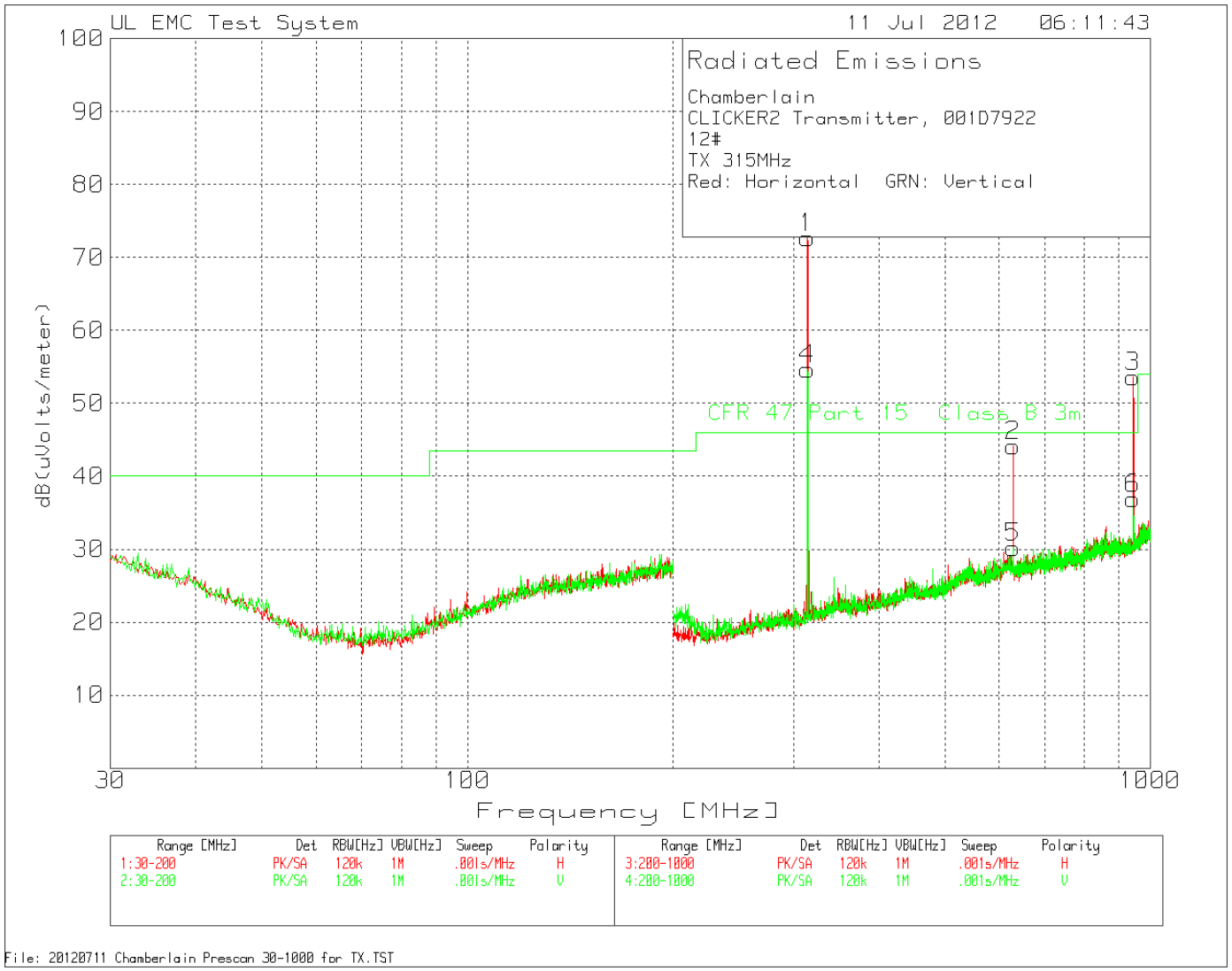


Figure 48 Radiated Emissions Graph (Above 1GHz)

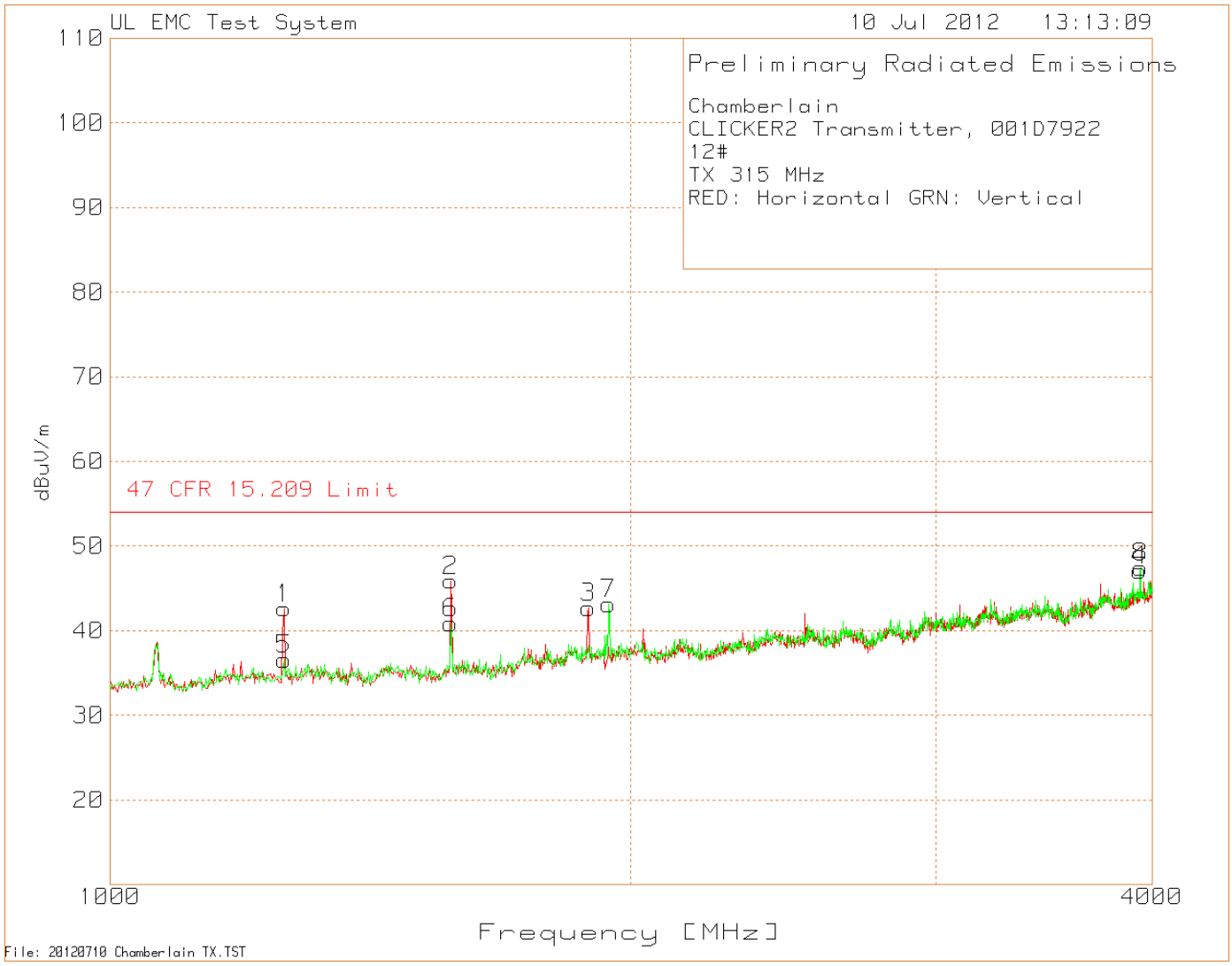


Table 58 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
315.005597	61.47	PK	14.2	2.1	77.77	-8.69	69.08	75.62	-6.54	92	104	Horz	X
315.005597	47.05	PK	14.2	2.1	63.35	-8.69	54.66	75.62	-20.96	171	113	Vert	X
630.010905	24.81	PK	20.6	3	48.41	-8.69	39.72	46	-6.28	16	129	Horz	X
630.1133	12.75	PK	20.6	3	36.35	-8.69	27.66	46	-18.34	*	103	Vert	X
945.019005	27.47	PK	23.6	3.8	54.87	-8.69	46.18	55.62	-9.44	8	152	Horz	X
945.019005	19.17	PK	23.6	3.8	46.57	-8.69	37.88	55.62	-17.74	273	164	Vert	X
1260.173	74.46	PK	25.1	-56.92	42.64	-8.69	33.95	54	-20.05	*	125	Horz	X
1574.383	75.92	PK	25.3	-55.3	45.92	-8.69	37.23	54	-16.77	*	135	Horz	X
1890.594	69.65	PK	27.4	-54.32	42.73	-8.69	34.04	54	-19.96	*	125	Horz	X
3937.959	66.56	PK	32.7	-52.17	47.09	-8.69	38.4	54	-15.6	*	135	Horz	X
1260.173	68.39	PK	25.1	-56.92	36.57	-8.69	27.88	54	-26.12	*	100	Vert	X
1574.383	70.89	PK	25.3	-55.3	40.89	-8.69	32.2	54	-21.8	*	125	Vert	X
1942.628	70.2	PK	27.4	-54.48	43.12	-8.69	34.43	54	-19.57	*	125	Vert	X
3939.96	66.9	PK	32.7	-52.13	47.47	-8.69	38.78	54	-15.22	*	125	Vert	X
* Prescan Data Used													

4.9 Configuration 1# Test Data

4.9.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (318MHz: 795.0kHz)	

Table 59 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

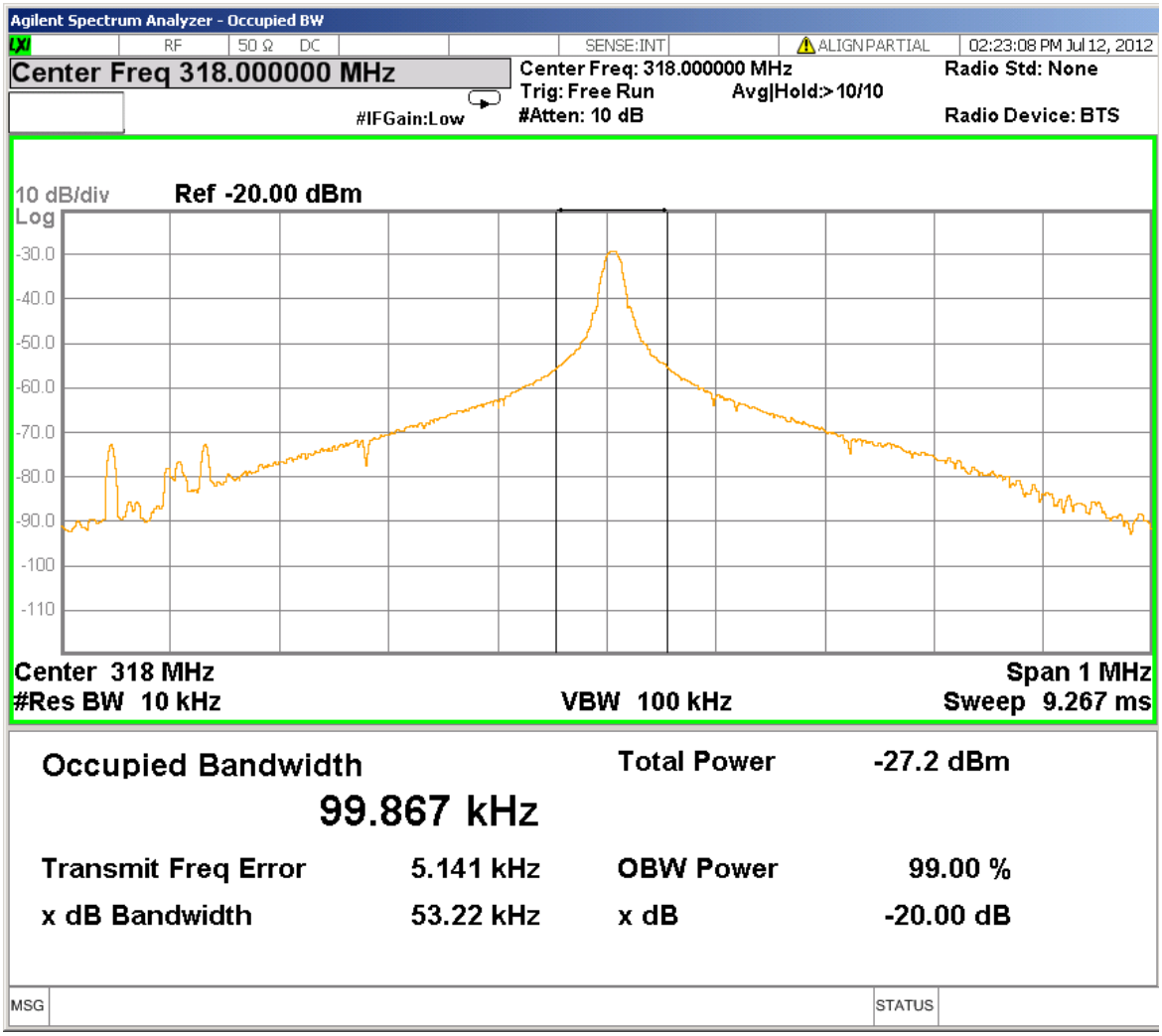
Table 60 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 61 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
318MHz	53.22	99.867

Figure 49 – Bandwidth Graph



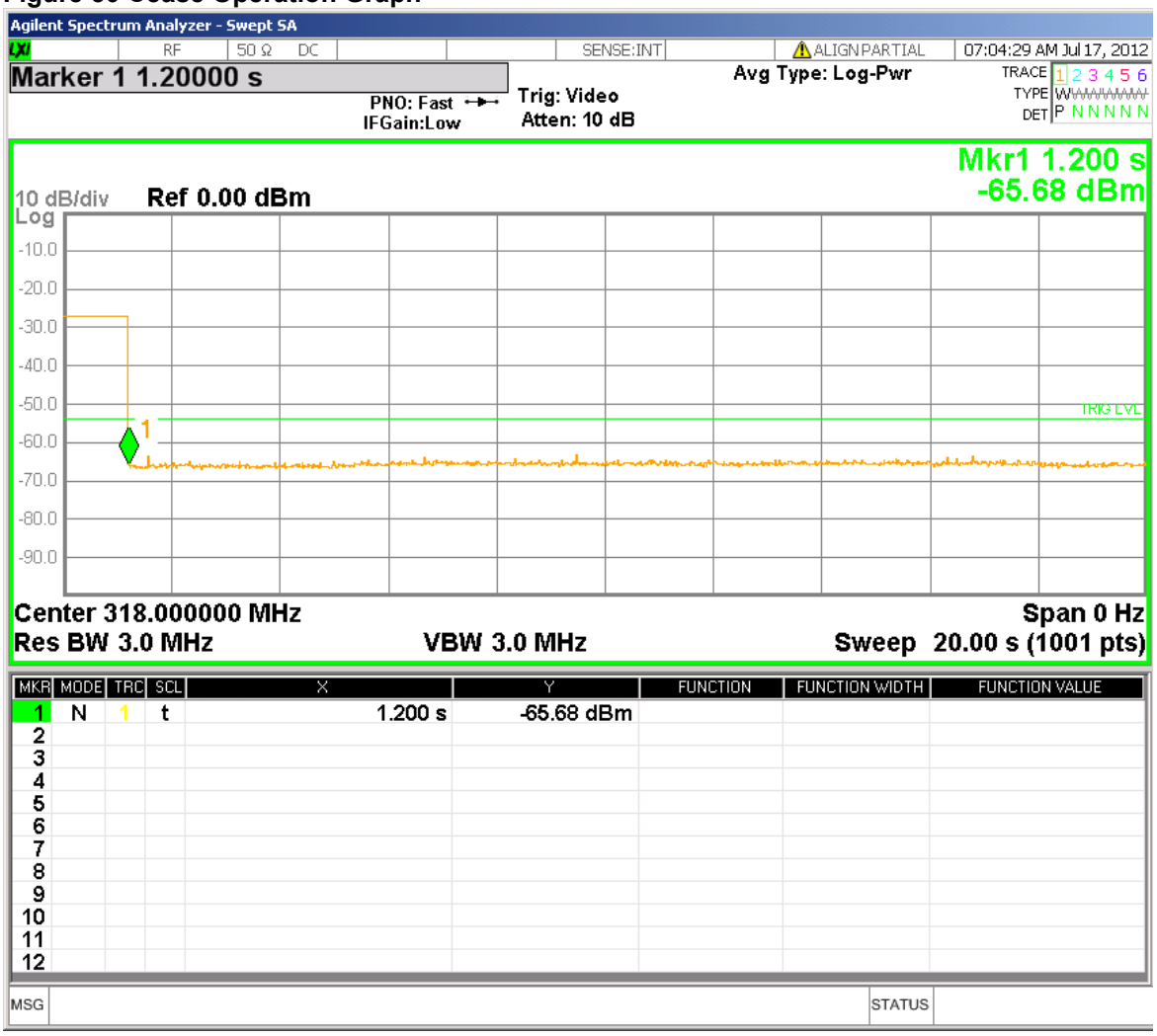
4.9.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 62 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 50 Cease Operation Graph



4.9.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

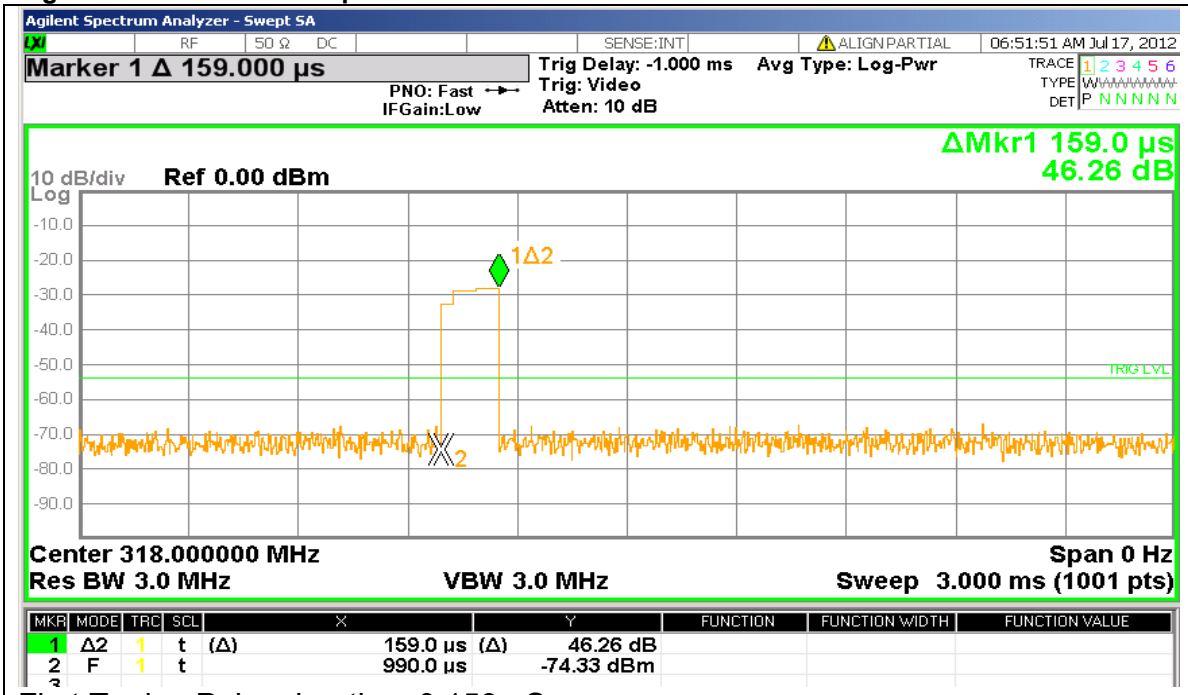
Table 63 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

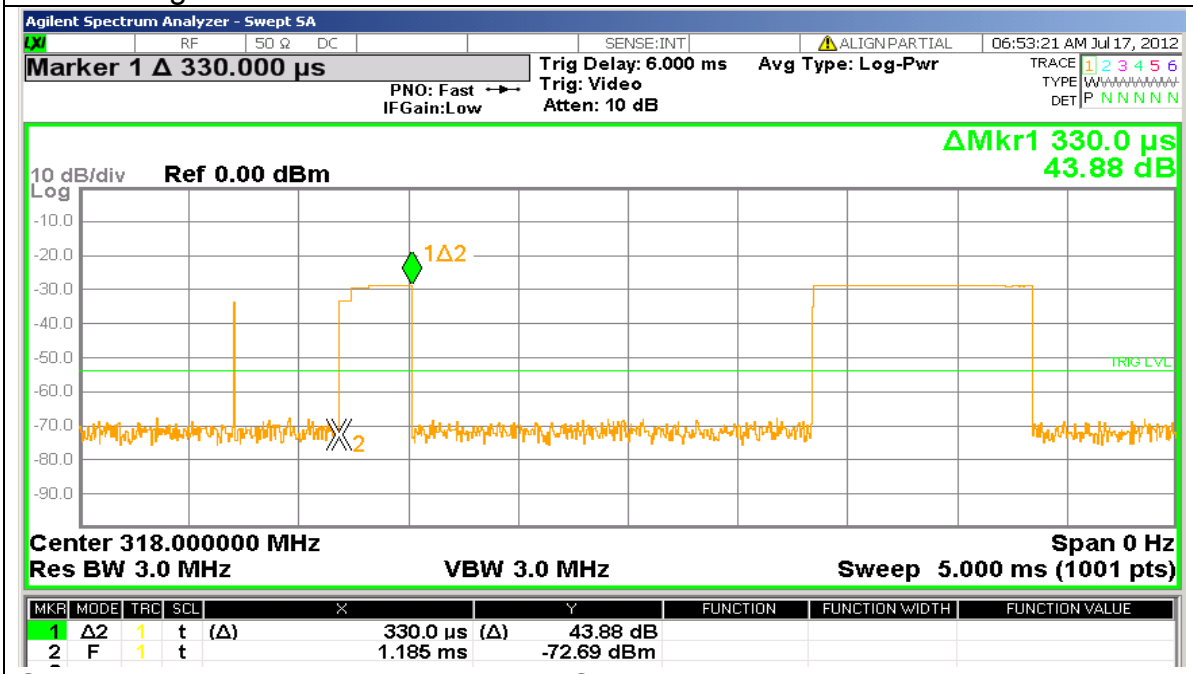
Table 64 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission Period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
318MHz	16mS	100ms	-15.9
Worst Case Duty Cycle: Measured worst case duty cycle was -15.9dB over message pulses, not including tuning pulses. Manufacturer declares the worst case duty cycle at -15.39dB. The declared duty cycle is used for all radiated emissions data.			

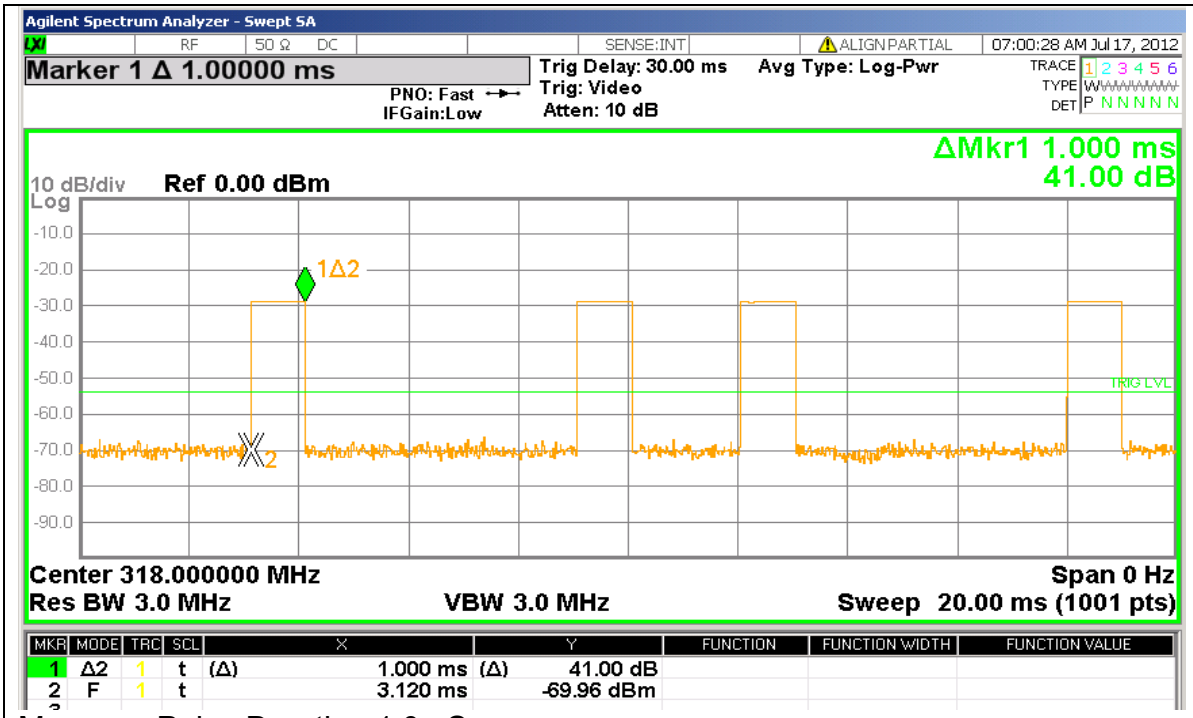
Figure 51 Pulse Train Graphs



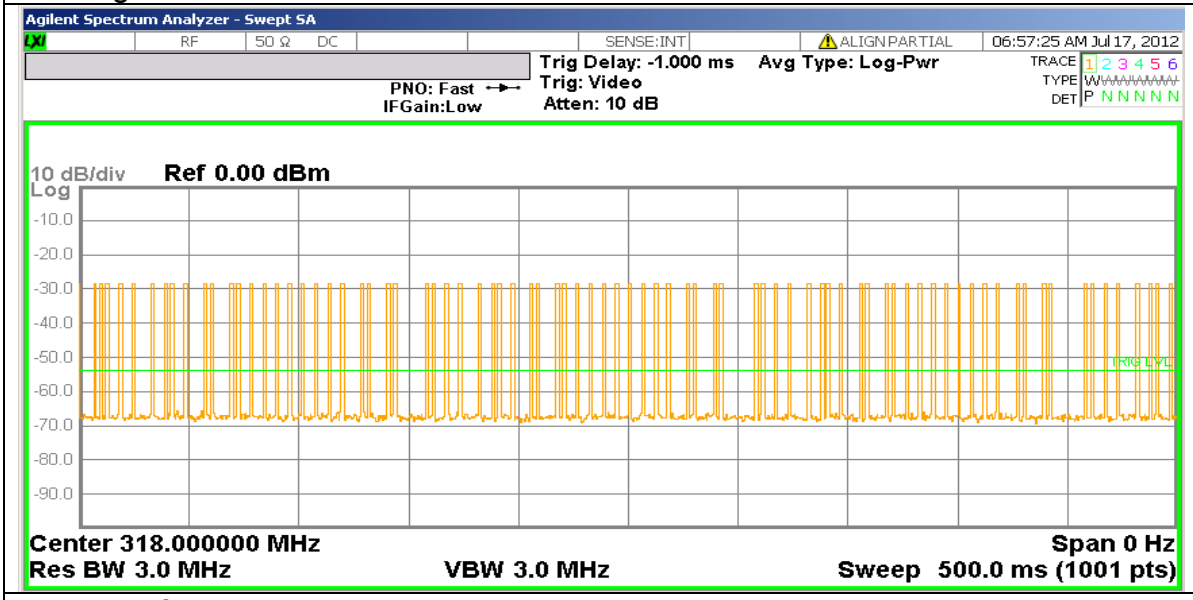
First Tuning Pulse duration: 0.159mS



Second Tuning Pulse duration: 0.330mS



Message Pulse Duration:1.0mS



Number of Pulses in 100ms (worst case): 16

4.9.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
318	75.80	95.80

Supplementary information: See section 4.9.3 for duty cycle information.

Figure 52 Radiated Emissions Graph (Below 1GHz)

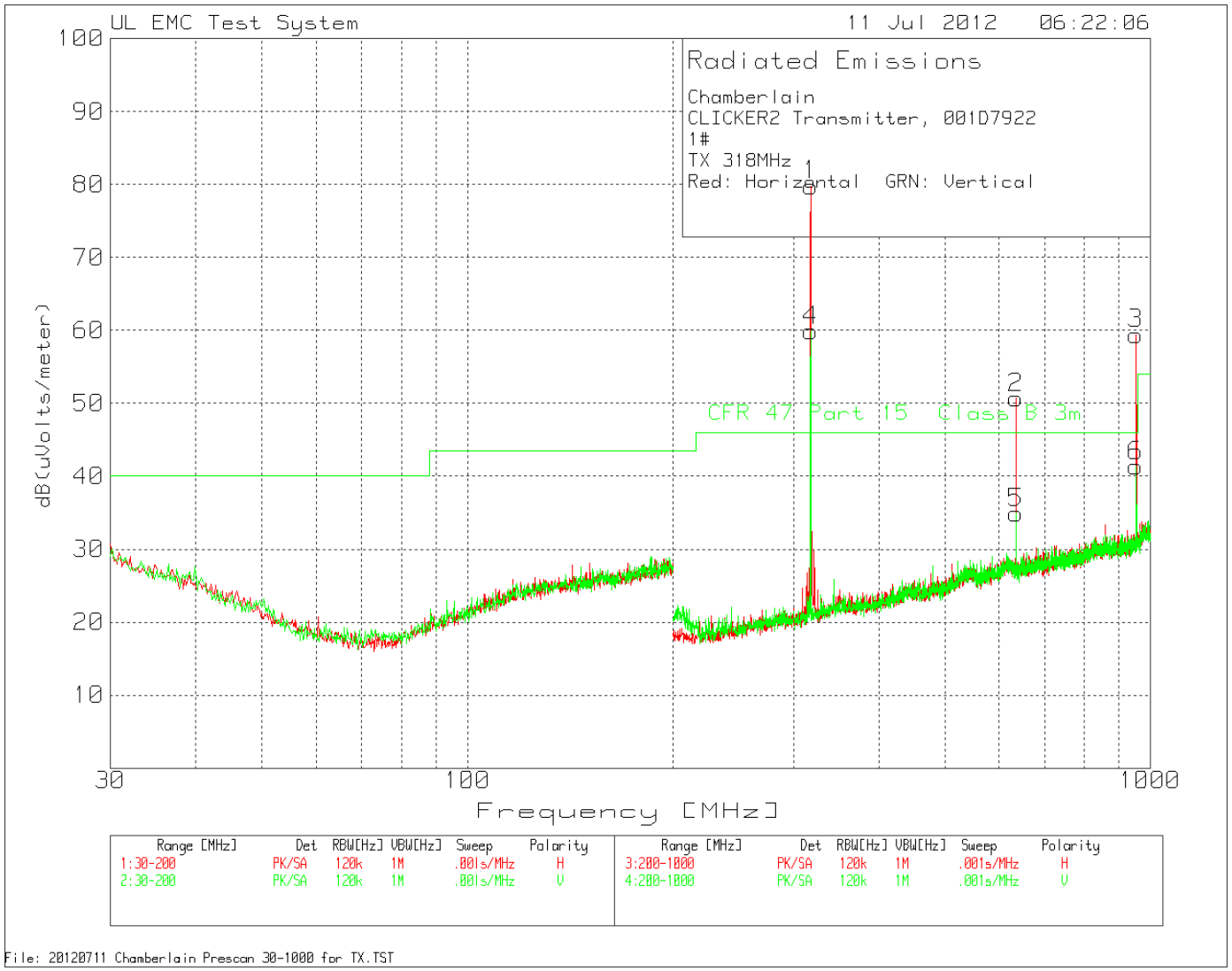


Figure 53 Radiated Emissions Graph (Above 1GHz)

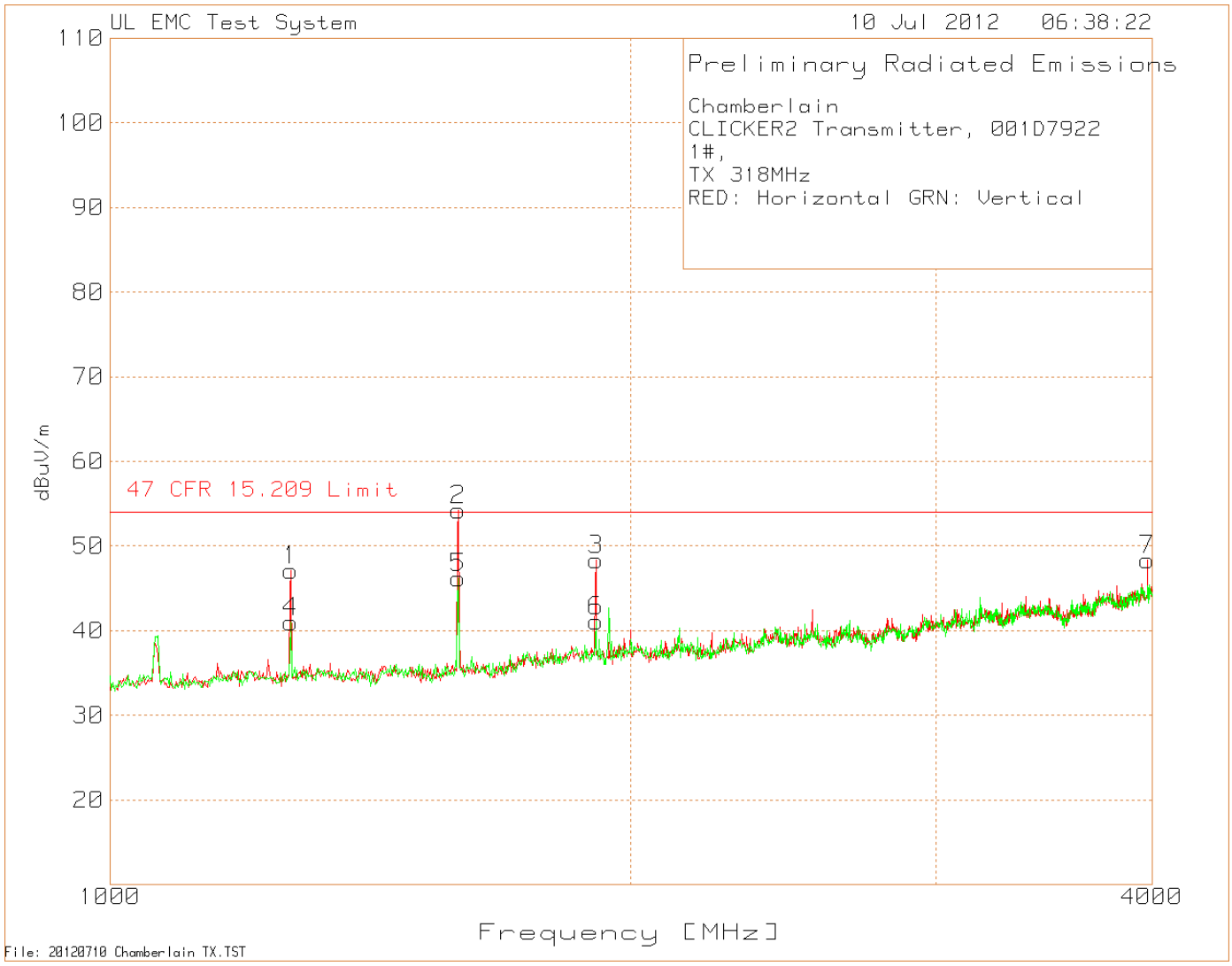


Table 65 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
318.011218	67.41	PK	14.4	2.1	83.91	-15.39	68.52	75.8	-7.28	121	102	Horz	X
318.011218	52.65	PK	14.4	2.1	69.15	-15.39	53.76	75.8	-22.04	207	121	Vert	X
318.011218	59.38	PK	14.4	2.1	75.88	-15.39	60.49	75.8	-15.31	18	214	Horz	Y
318.011218	65.18	PK	14.4	2.1	81.68	-15.39	66.29	75.8	-9.51	114	162	Vert	Y
318.011218	62.97	PK	14.4	2.1	79.47	-15.39	64.08	75.8	-11.72	207	102	Horz	Z
318.011218	65.15	PK	14.4	2.1	81.65	-15.39	66.26	75.8	-9.54	119	158	Vert	Z
636.020005	31.07	PK	20.6	3.1	54.77	-15.39	39.38	46	-6.62	163	130	Horz	X
636.020005	23.18	PK	20.6	3.1	46.88	-15.39	31.49	46	-14.51	262	262	Vert	X
954.0302	21.16	PK	24	3.9	49.06	-15.39	33.67	55.8	-22.13	269	167	Vert	X
954.0302	33.53	PK	24	3.9	61.43	-15.39	46.04	55.8	-9.76	360	152	Horz	X
1272.0291	82.03	PK	25.2	-56.79	50.44	-15.39	35.05	54	-18.95	360	124	Horz	X
1272.181	72.62	PK	25.2	-56.79	41.03	-15.39	25.64	54	-28.36	*	100	Vert	X
1589.9228	86.51	PK	25.3	-54.92	56.89	-15.39	41.5	54	-12.5	113	100	Horz	X
1590.394	75.85	PK	25.3	-54.9	46.25	-15.39	30.86	54	-23.14	*	125	Vert	X
1908.0361	79.21	PK	27.4	-54.46	52.15	-15.39	36.76	54	-17.24	360	118	Horz	X
1908.606	68.14	PK	27.4	-54.46	41.08	-15.39	25.69	54	-28.31	*	125	Vert	X
* Peak prescan data, not maximized													

4.10 Configuration 9# Test Data

4.10.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (372.5MHz: 931.256kHz)	

Table 66 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

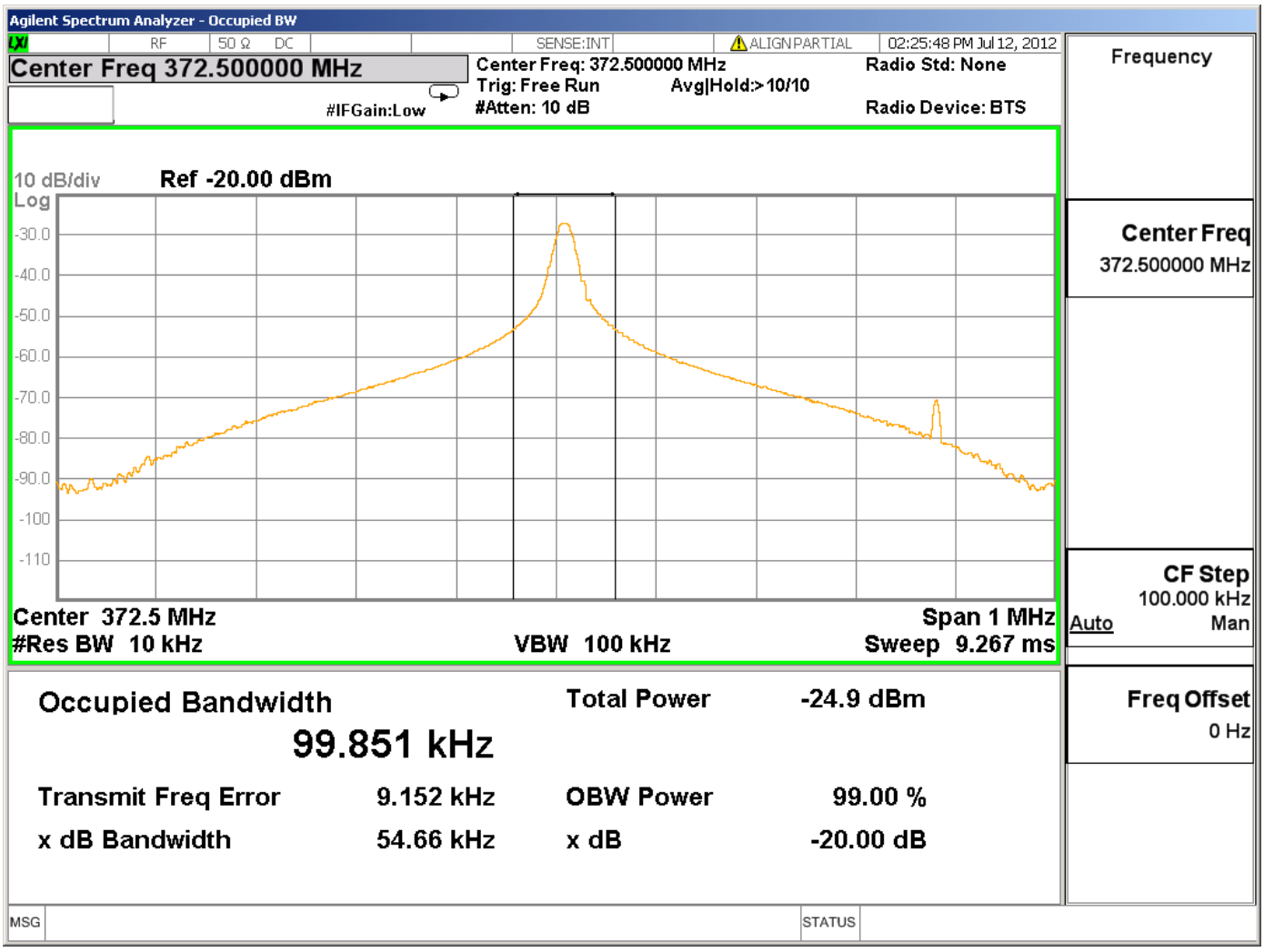
Table 67 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 68 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
372.5MHz	54.66	99.851

Figure 54 – Bandwidth Graph



4.10.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 69 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 55 Cease Operation Graph

4.10.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

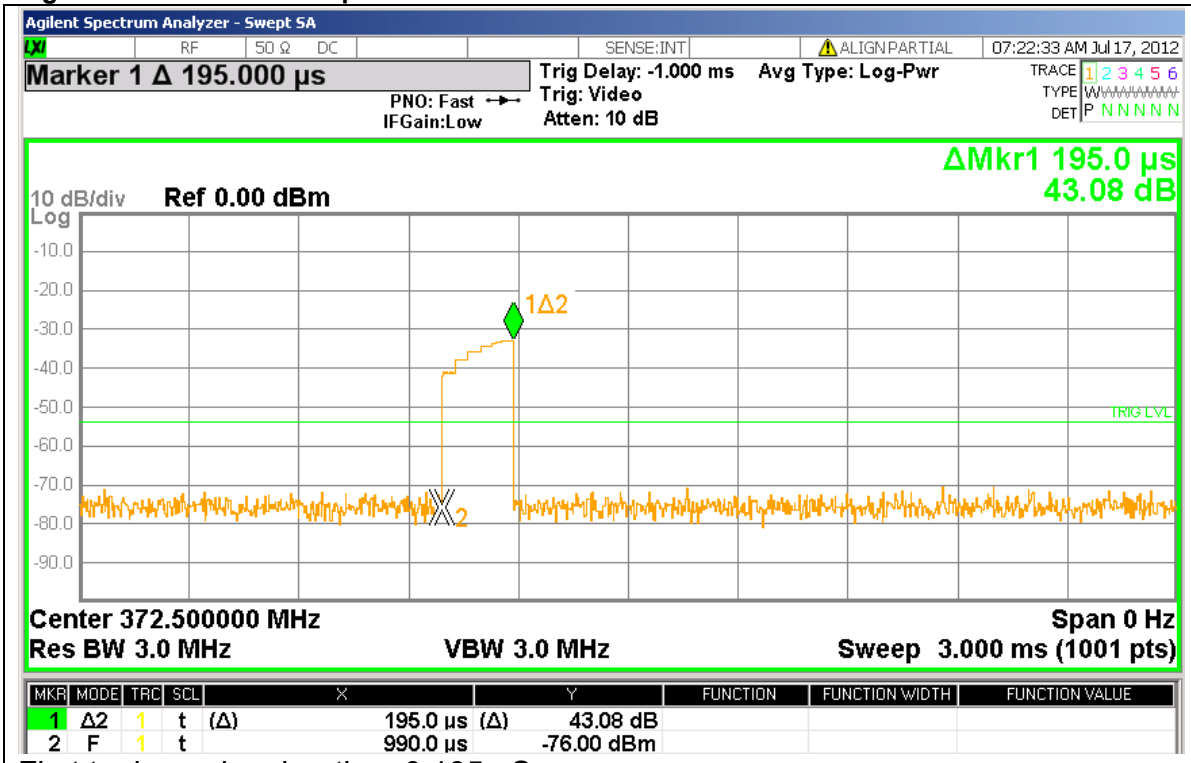
Table 70 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

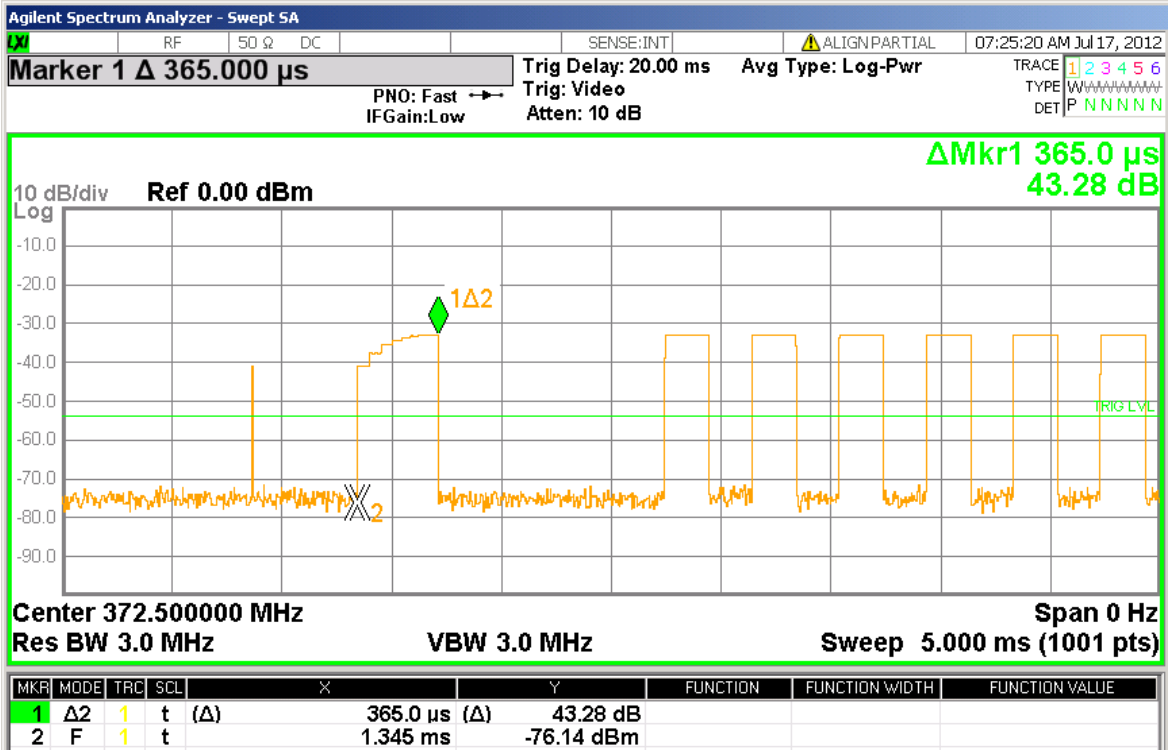
Table 71 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
372.5MHz	(47x0.204)+(31x0.402)+0.195+0.365	100ms	-12.91
Worst Case Duty Cycle: Worst case duty cycle was calculated over 100mS and it includes the two tuning pulses. Manufacturer declared worst case duty cycle is -12.36dB and it is used for radiated emissions data.			

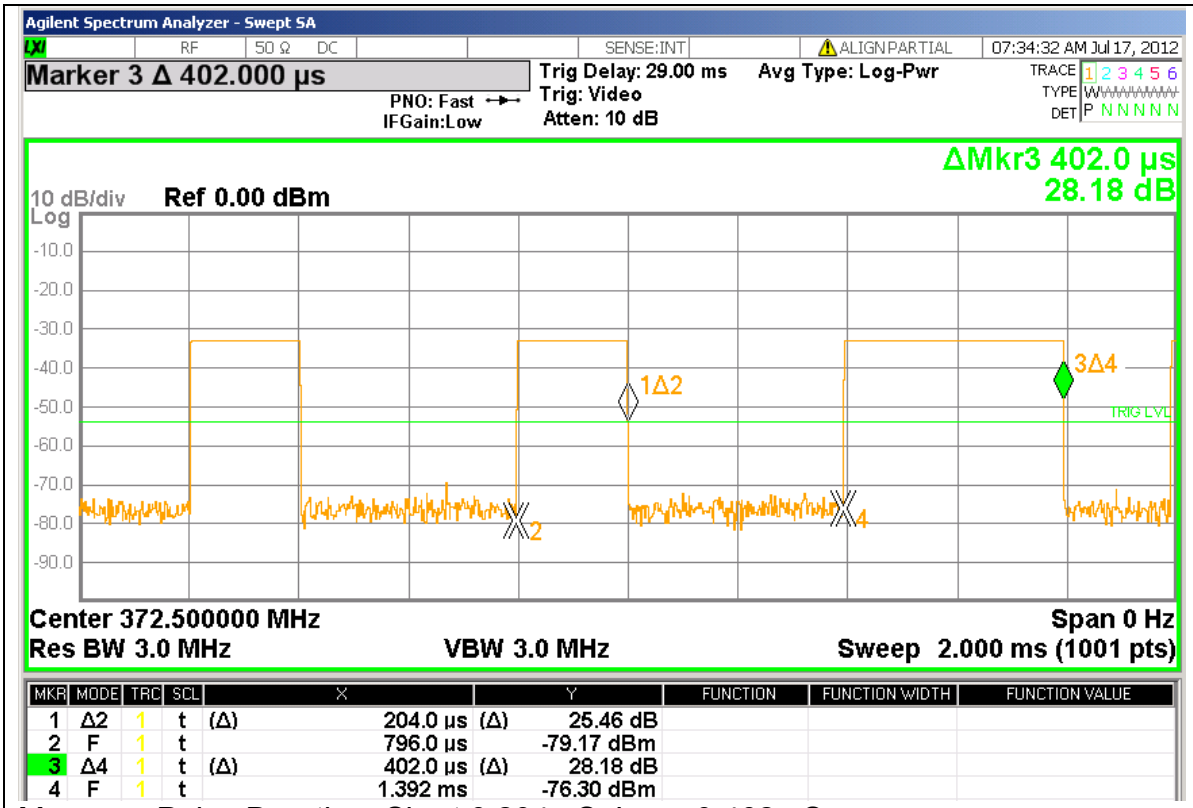
Figure 56 Pulse Train Graphs



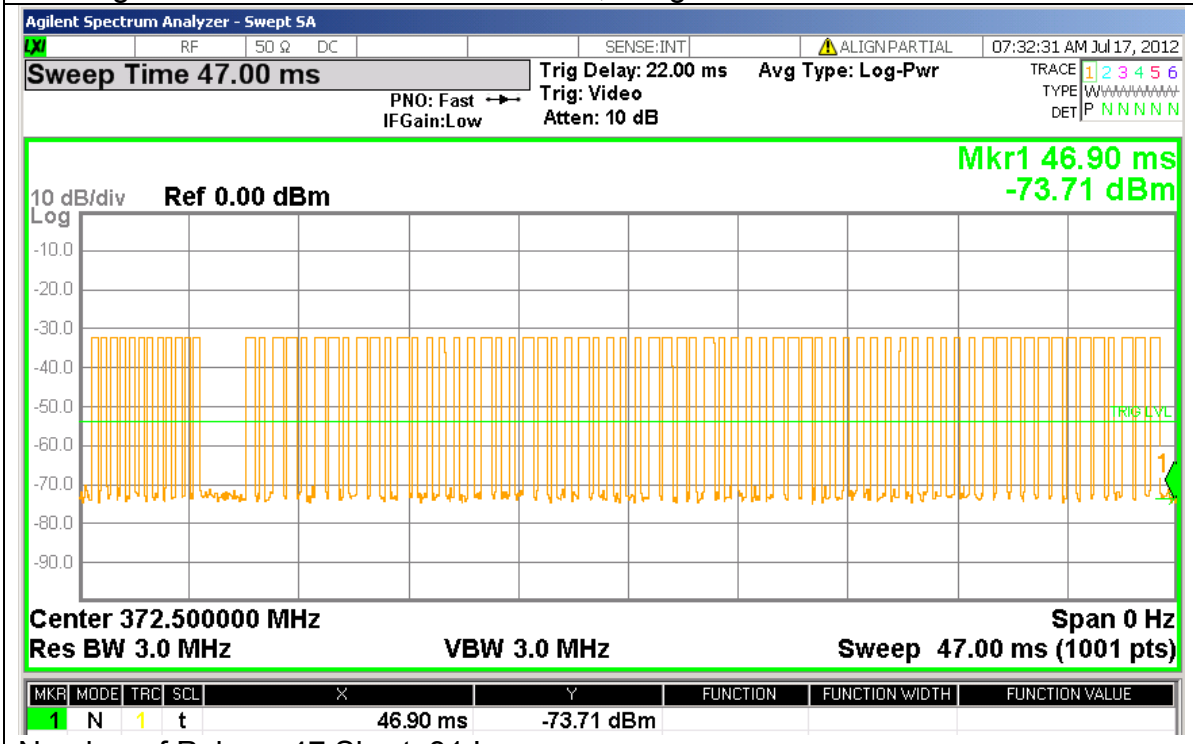
First tuning pulse duration: 0.195mS



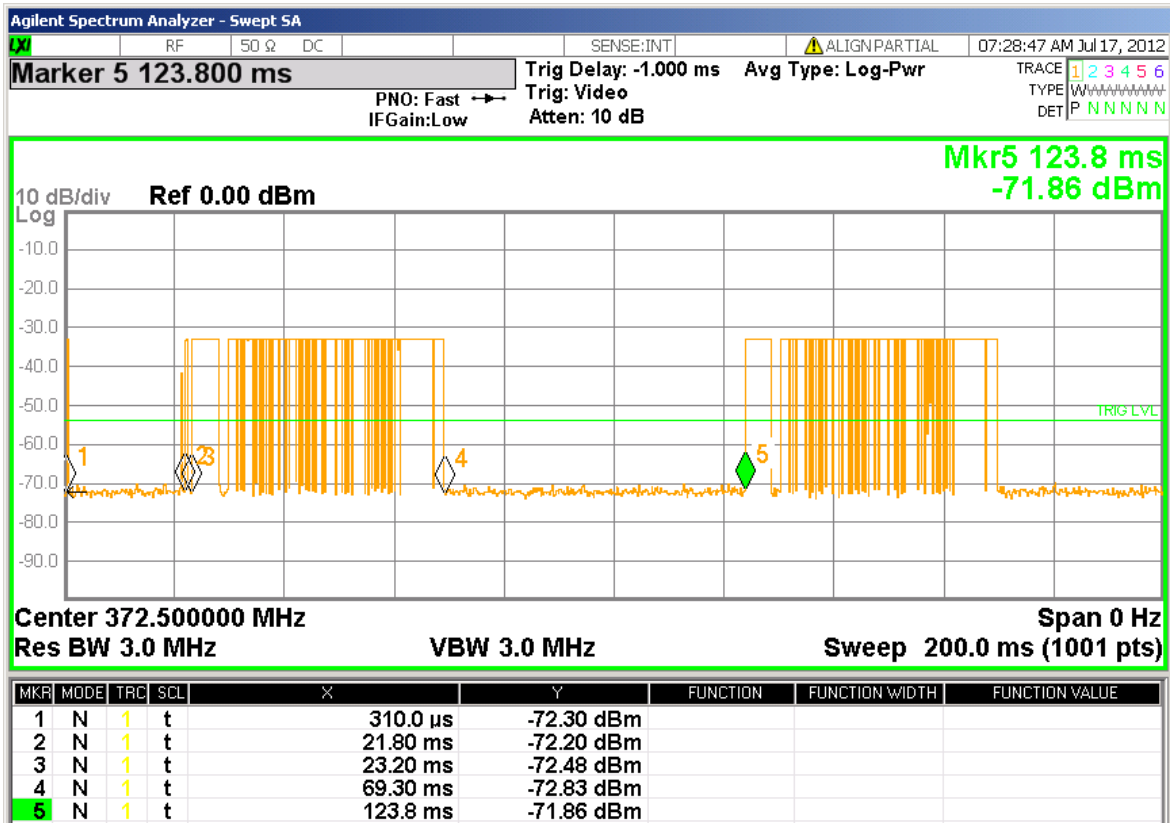
Second tuning pulse duration: 0.365mS



Message Pulse Duration: Short 0.204mS, Long 0.402mS



Number of Pulses: 47 Short, 31 Long


Agilent Spectrum Analyzer - Swept SA
RF
50 Ω DC
SENSE:INT
ALIGN PARTIAL
07:28:47 AM Jul 17, 2012
Marker 5 123.800 ms
PNO: Fast
IFGain:Low
Trig Delay: -1.000 ms
Trig: Video
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET P N N N N N
Mkr5 123.8 ms
-71.86 dBm
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
TRIG LVL
Center 372.500000 MHz
Res BW 3.0 MHz
VBW 3.0 MHz
Span 0 Hz
Sweep 200.0 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 t 310.0 µs -72.30 dBm
2 N 1 t 21.80 ms -72.20 dBm
3 N 1 t 23.20 ms -72.48 dBm
4 N 1 t 69.30 ms -72.83 dBm
5 N 1 t 123.8 ms -71.86 dBm

Period

4.10.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
372.5	78.52	98.52

Supplementary information: See section 4.10.3 for duty cycle information.

Figure 57 Radiated Emissions Graph (Below 1GHz)

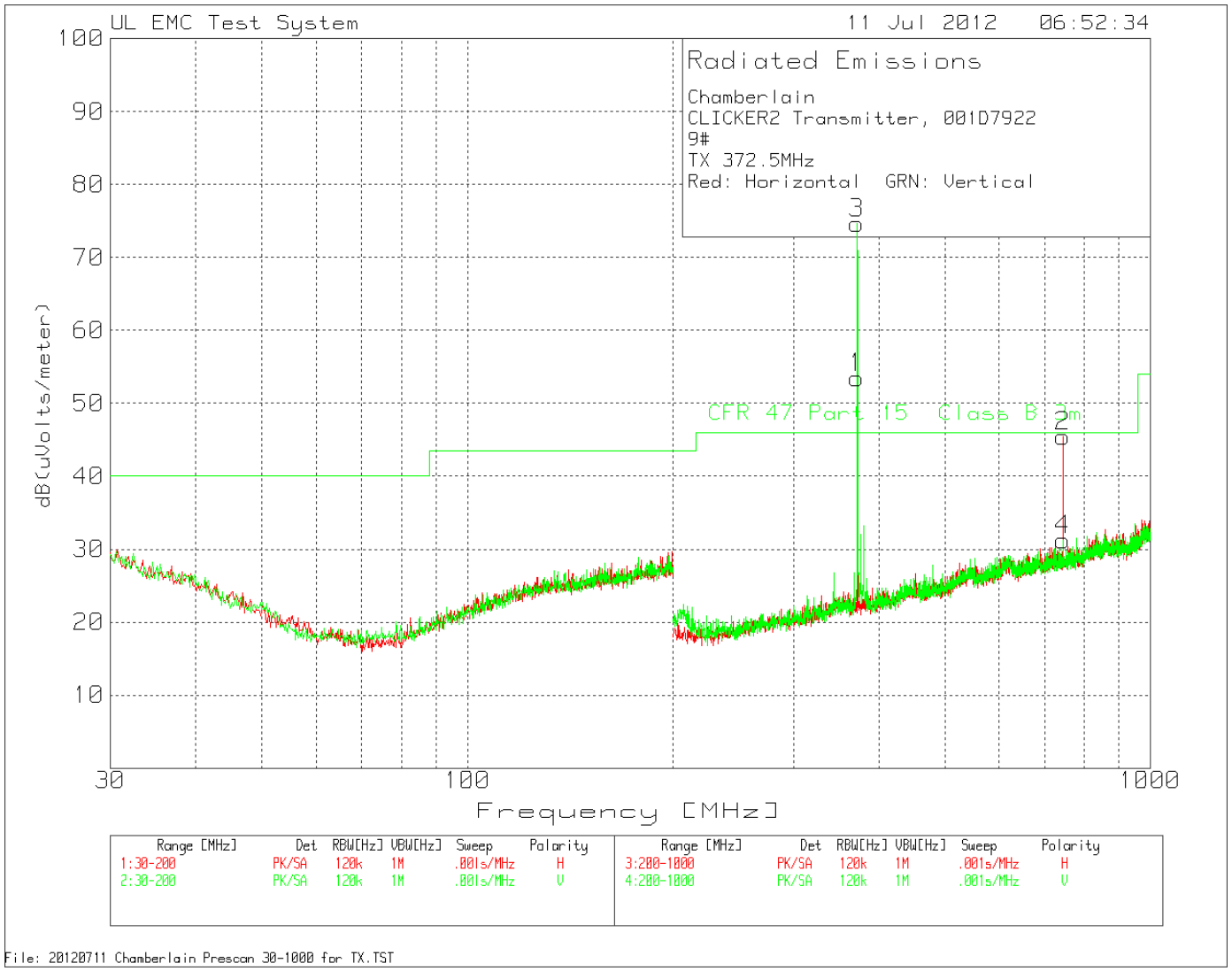


Figure 58 Radiated Emissions Graph (Above 1GHz)

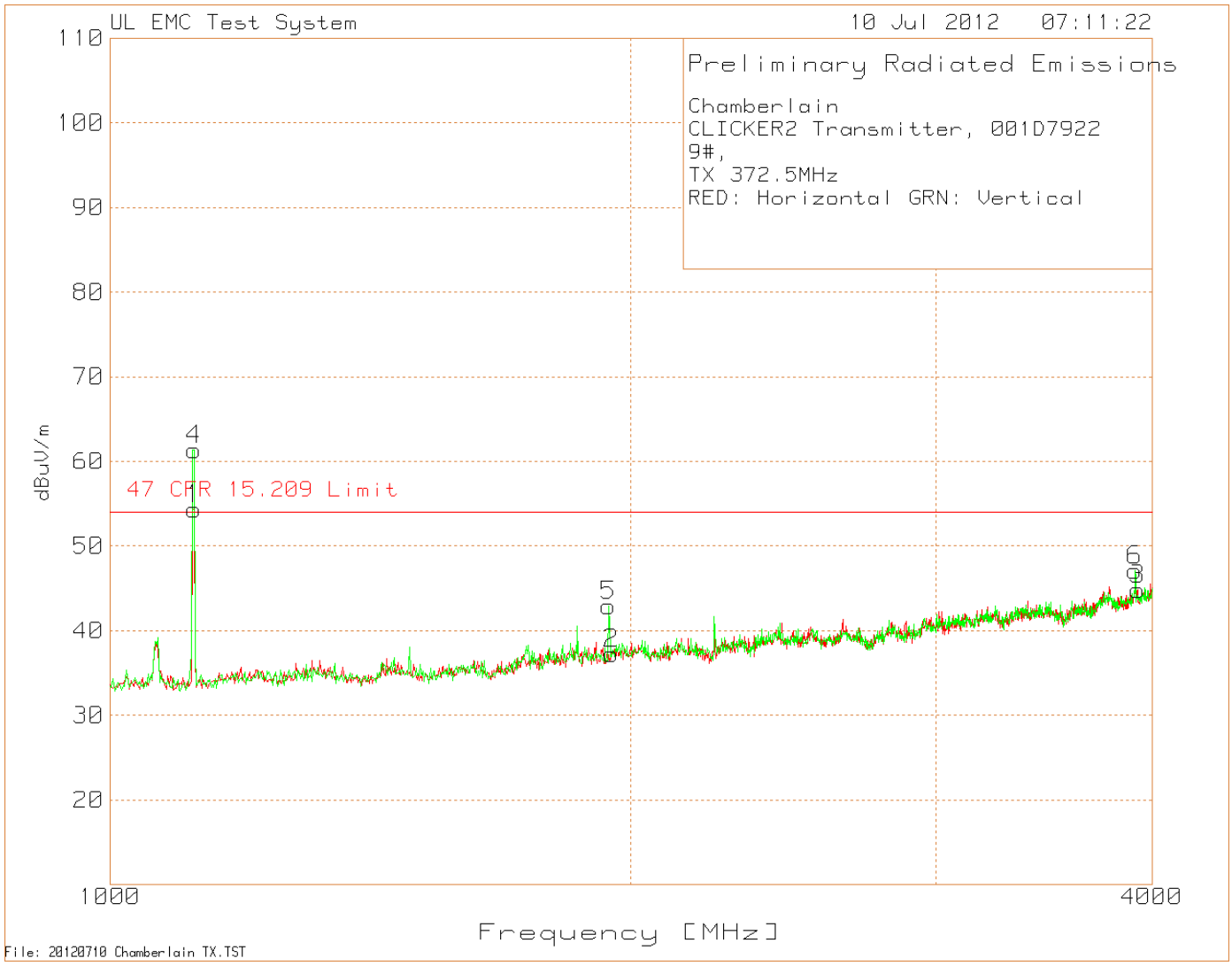


Table 72 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
372.514423	57.26	PK	15.6	2.3	75.16	-12.36	62.8	78.52	-15.72	103	102	Horz	X
372.514423	43.34	PK	15.6	2.3	61.24	-12.36	48.88	78.52	-29.64	36	106	Vert	X
372.514423	50.3	PK	15.6	2.3	68.2	-12.36	55.84	78.52	-22.68	31	187	Horz	Y
372.514423	57.49	PK	15.6	2.3	75.39	-12.36	63.03	78.52	-15.49	304	156	Vert	Y
372.514423	52.8	PK	15.6	2.3	70.7	-12.36	58.34	78.52	-20.18	27	102	Horz	Z
372.514423	57.1	PK	15.6	2.3	75	-12.36	62.64	78.52	-15.88	121	140	Vert	Z
745.011492	24.21	PK	21.4	3.4	49.01	-12.36	36.65	46	-9.35	181	114	Horz	Y
745.011492	15.87	PK	21.4	3.4	40.67	-12.36	28.31	46	-17.69	264	150	Vert	Y
1117.506	90.7	PK	24.5	-57.49	57.71	-12.36	45.35	54	-8.65	12	136	Horz	Y
1117.524	95.08	PK	24.5	-57.49	62.09	-12.36	49.73	54	-4.27	41	100	Vert	Y
1948.632	64.23	PK	27.4	-54.39	37.24	-12.36	24.88	54	-29.12	*	125	Horz	Y
3925.951	64.22	PK	32.7	-52.03	44.89	-12.36	32.53	54	-21.47	*	118	Horz	Y
1940.627	70.11	PK	27.4	-54.54	42.97	-12.36	30.61	54	-23.39	*	101	Vert	Y
3911.941	66.01	PK	32.7	-51.61	47.1	-12.36	34.74	54	-19.26	*	125	Vert	Y
* Prescan Data Used													

4.11 Configuration 2# Test Data

4.11.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 73 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

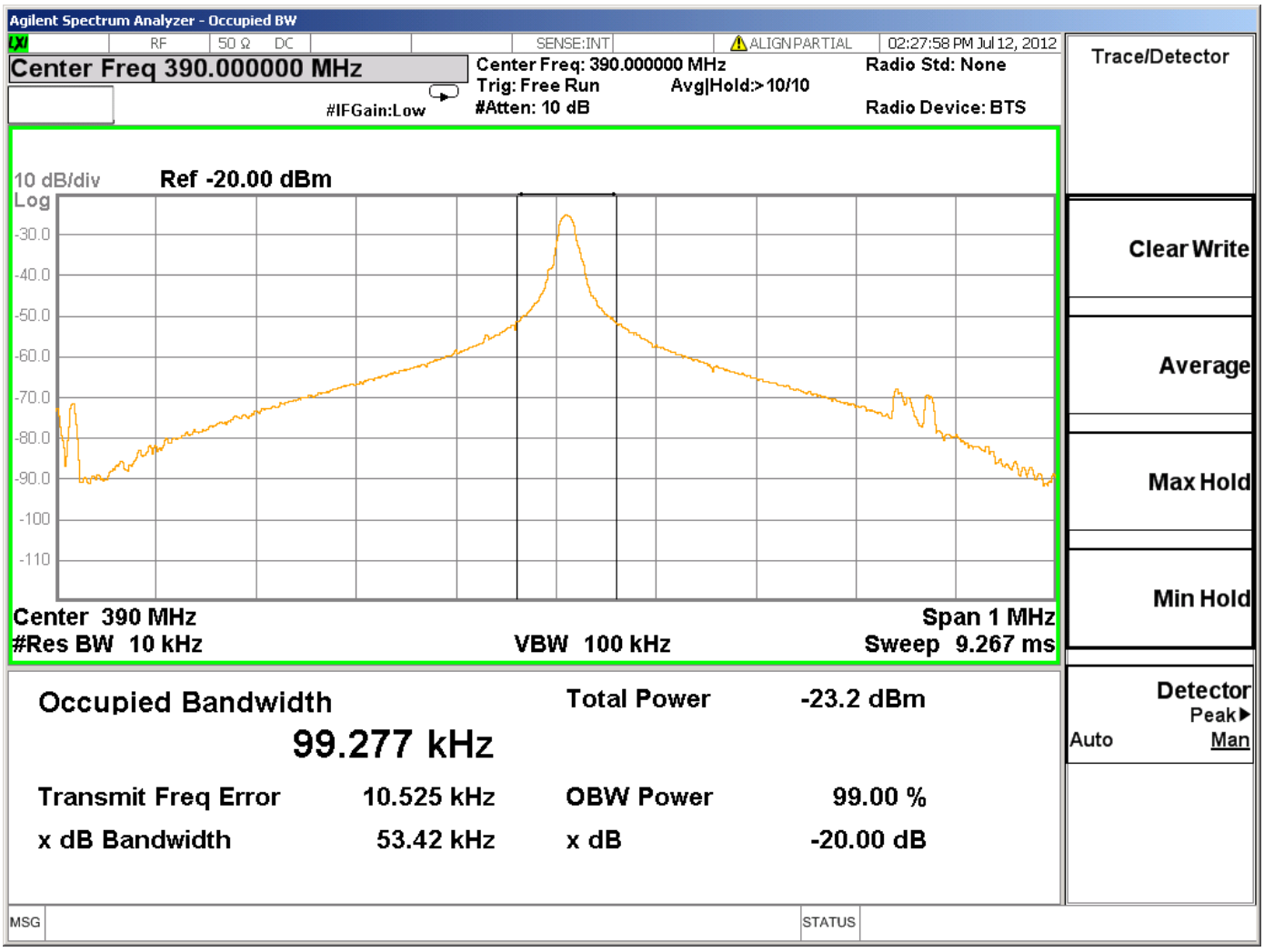
Table 74 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 75 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	53.32	99.277

Figure 59 – Bandwidth Graph



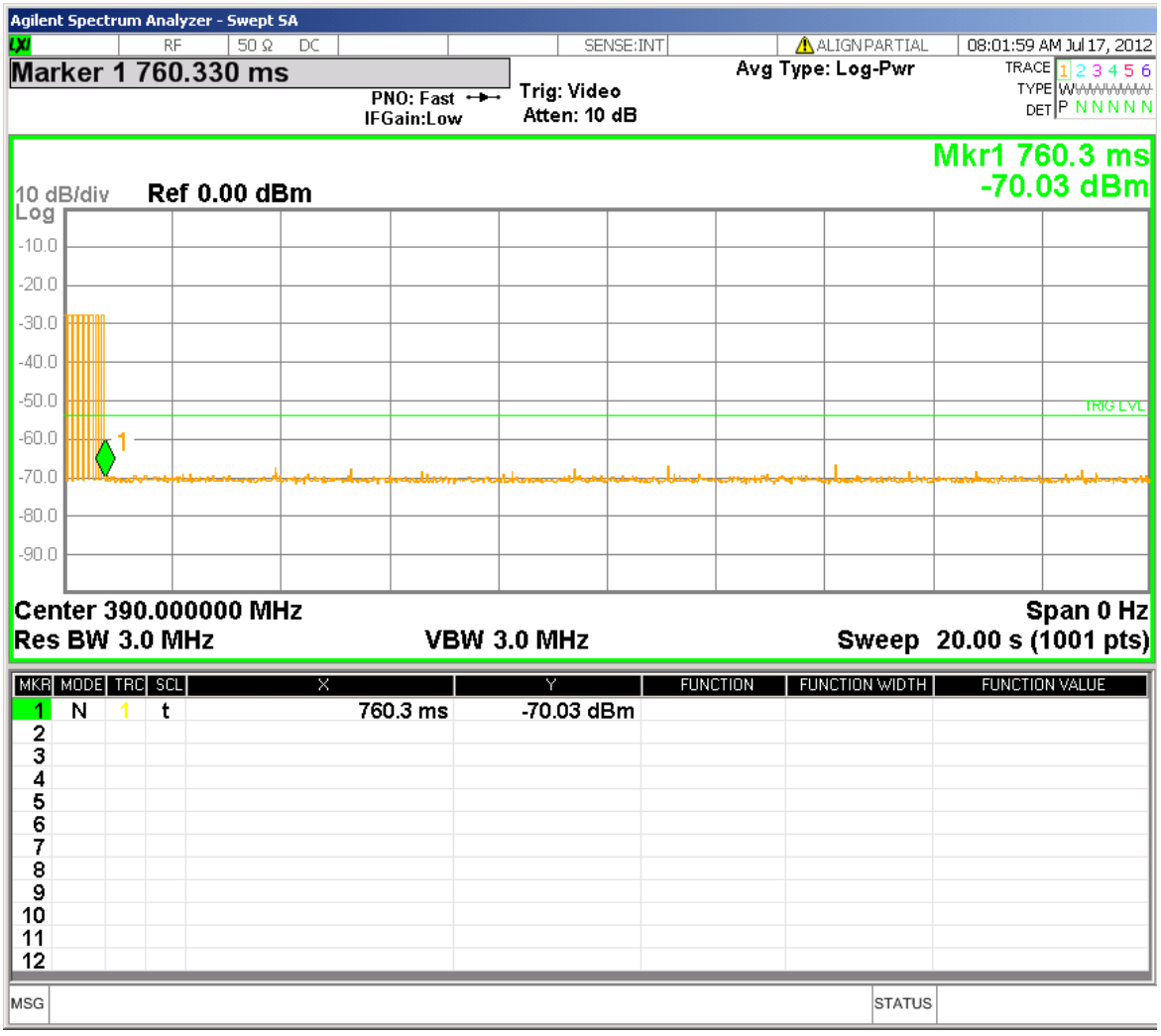
4.11.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 76 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 60 Cease Operation Graph



4.11.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

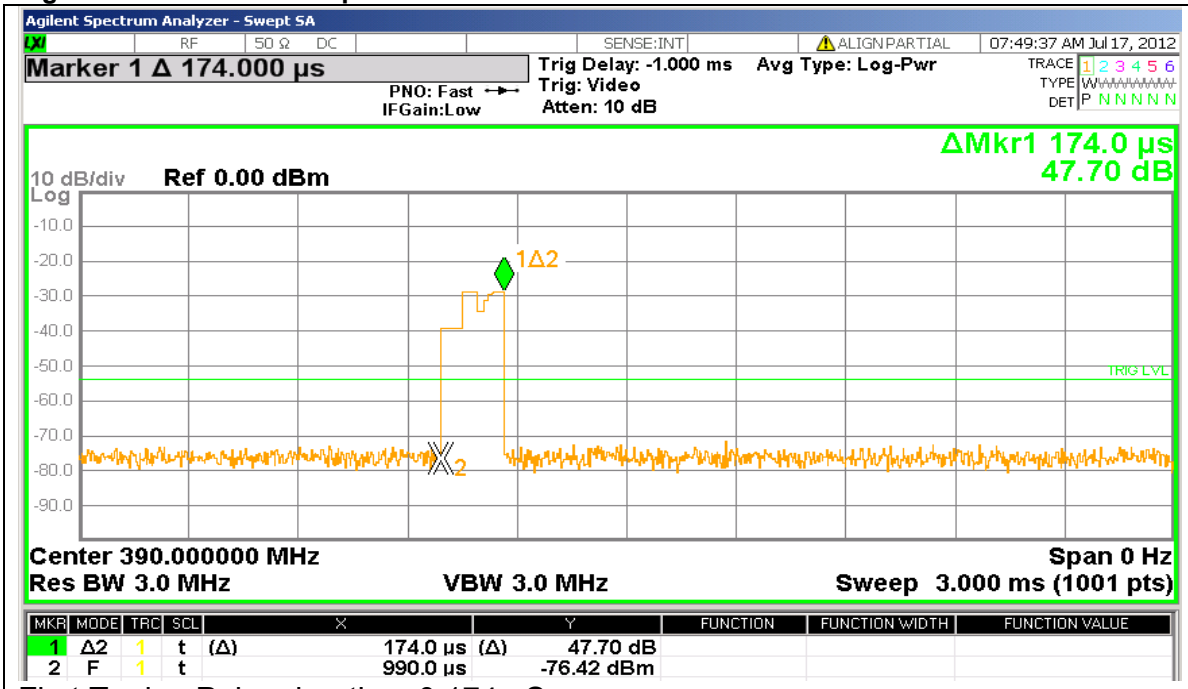
Table 77 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

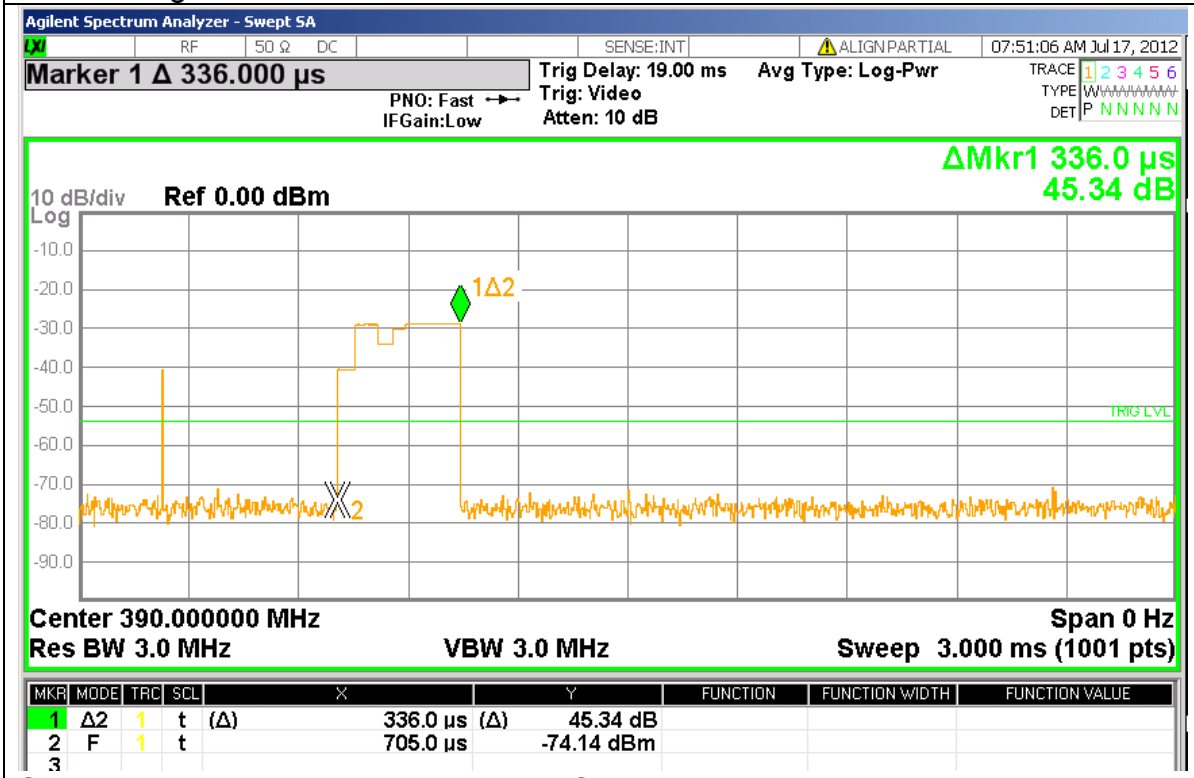
Table 78 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission Period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
390MHz	(9x0.505)+(6x1.0)+(6x1.495)	96.9ms	-13.9
Worst Case Duty Cycle: -13.9, Calculated over 96.9mS period that does not include the tuning pulses. Manufacturer declares worst case duty cycle as -13.55dB. Manufacturer declared duty cycle is used for all radiated emissions.			

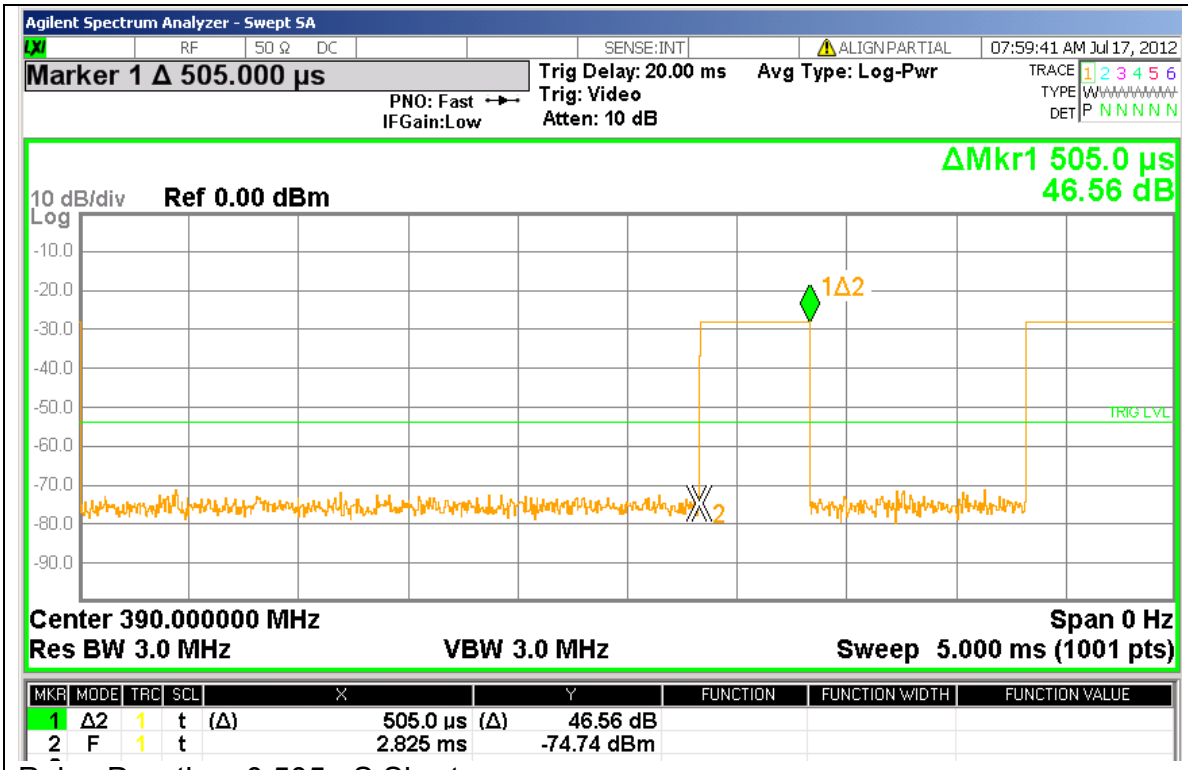
Figure 61 Pulse Train Graphs



First Tuning Pulse duration: 0.174mS

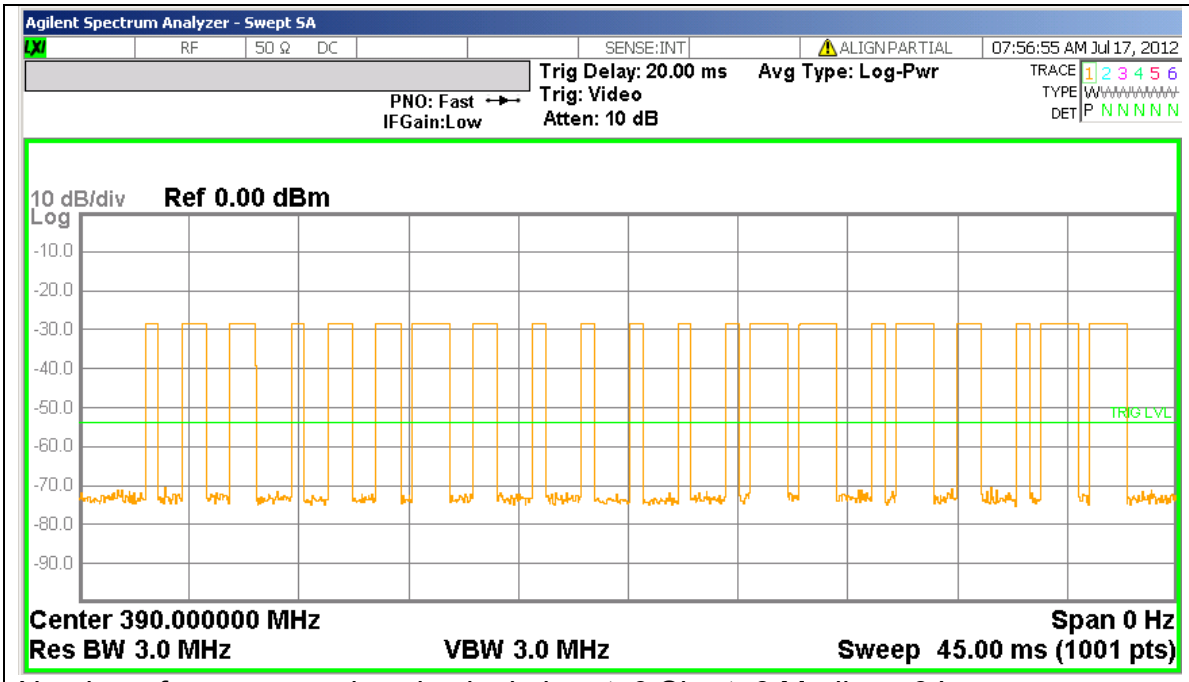


Second Tuning Pulse duration: 0.336mS

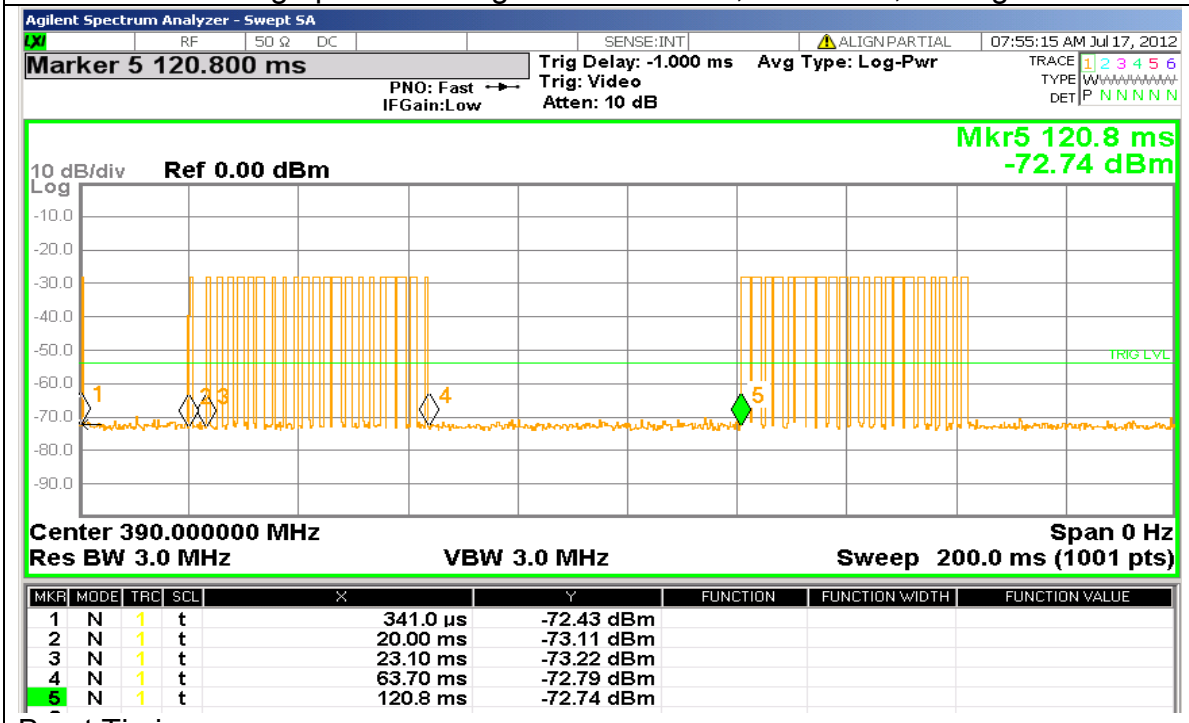


Pulse Duration: 0.505mS Short

Pulse Duration: 1.0mS Medium, 1.495mS Long



Number of message pulses in single burst: 9 Short, 6 Medium, 6 Long



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	341.0 µs	-72.43 dBm			
2	N	1	t	20.00 ms	-73.11 dBm			
3	N	1	t	23.10 ms	-73.22 dBm			
4	N	1	t	63.70 ms	-72.79 dBm			
5	N	1	t	120.8 ms	-72.74 dBm			

Burst Timing

4.11.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.11.3 for duty cycle information.

Figure 62 Radiated Emissions Graph (Below 1GHz)

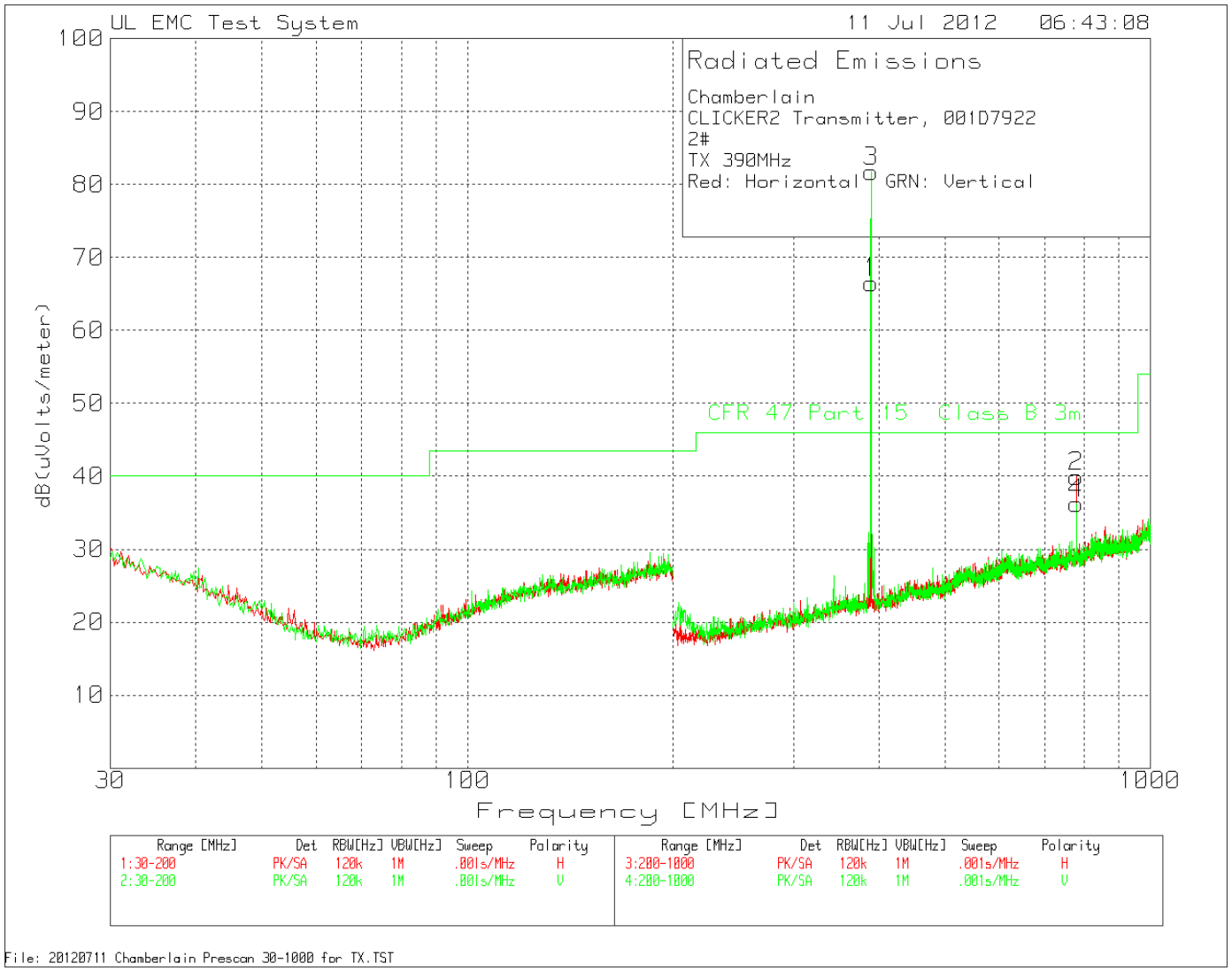


Figure 63 Radiated Emissions Graph (Above 1GHz)

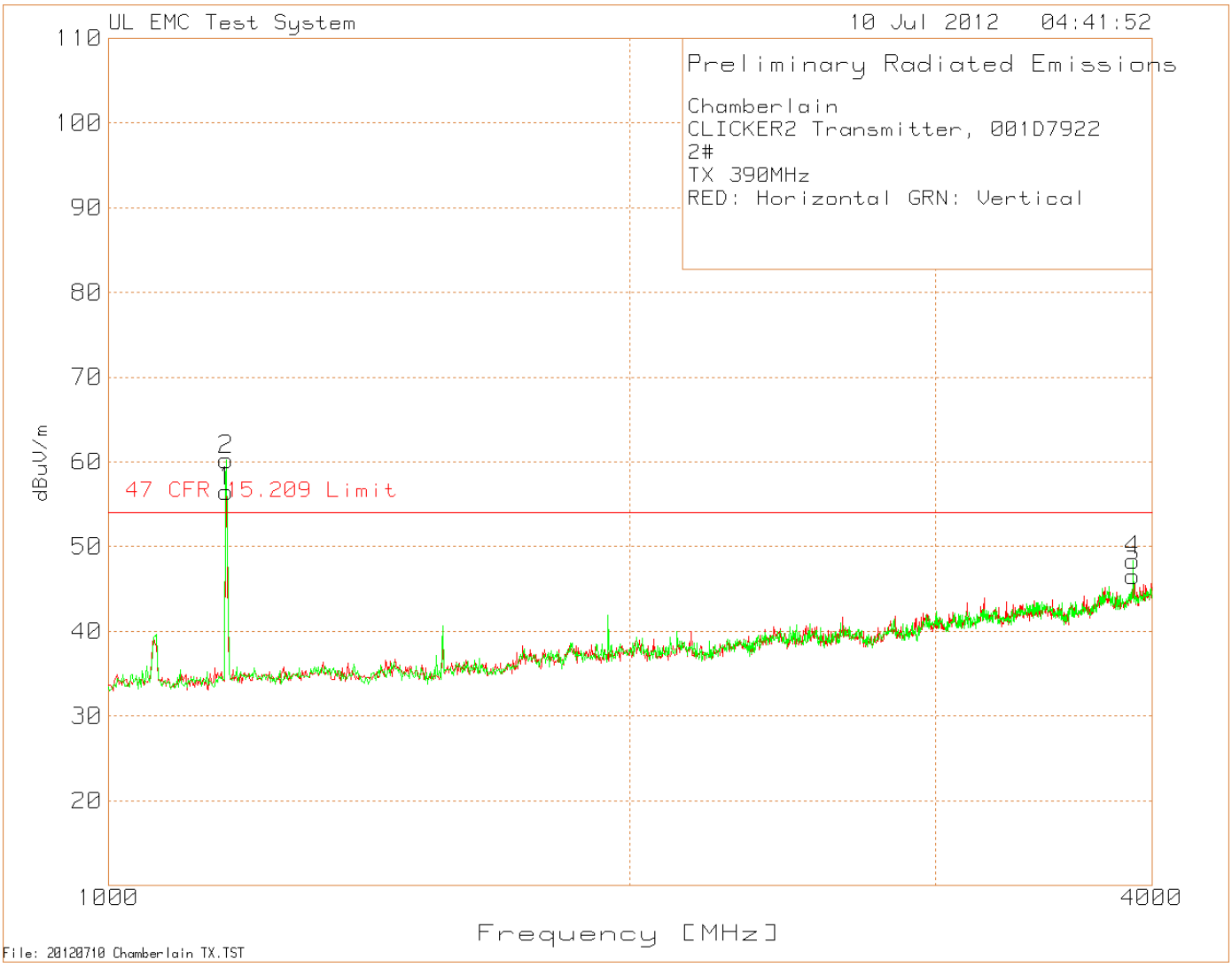


Table 79 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.011218	63.78	PK	16.1	2.3	82.18	-13.55	68.63	79.24	-10.61	107	143	Vert	Y
390.011218	58.01	PK	16.1	2.3	76.41	-13.55	62.86	79.24	-16.38	210	172	Horz	Y
780.022436	17.74	PK	21.8	3.4	42.94	-13.55	29.39	46	-16.61	15	106	Horz	Y
780.022436	15.03	PK	21.8	3.4	40.23	-13.55	26.68	46	-19.32	113	137	Vert	Y
1170.015	90.13	PK	24.8	-57.24	57.69	-13.55	44.14	54	-9.86	6	133	Horz	Y
3901.935	65.87	PK	32.7	-51.99	46.58	-13.55	33.03	54	-20.97	*	126	Horz	Y
1170.0451	93.8	PK	24.8	-57.24	61.36	-13.55	47.81	54	-6.19	27	140	Vert	Y
3901.935	67.68	PK	32.7	-51.99	48.39	-13.55	34.84	54	-19.16	*	125	Vert	Y
* Level from prescan, not maxized													

4.12 Configuration 6# Test Data

4.12.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 80 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

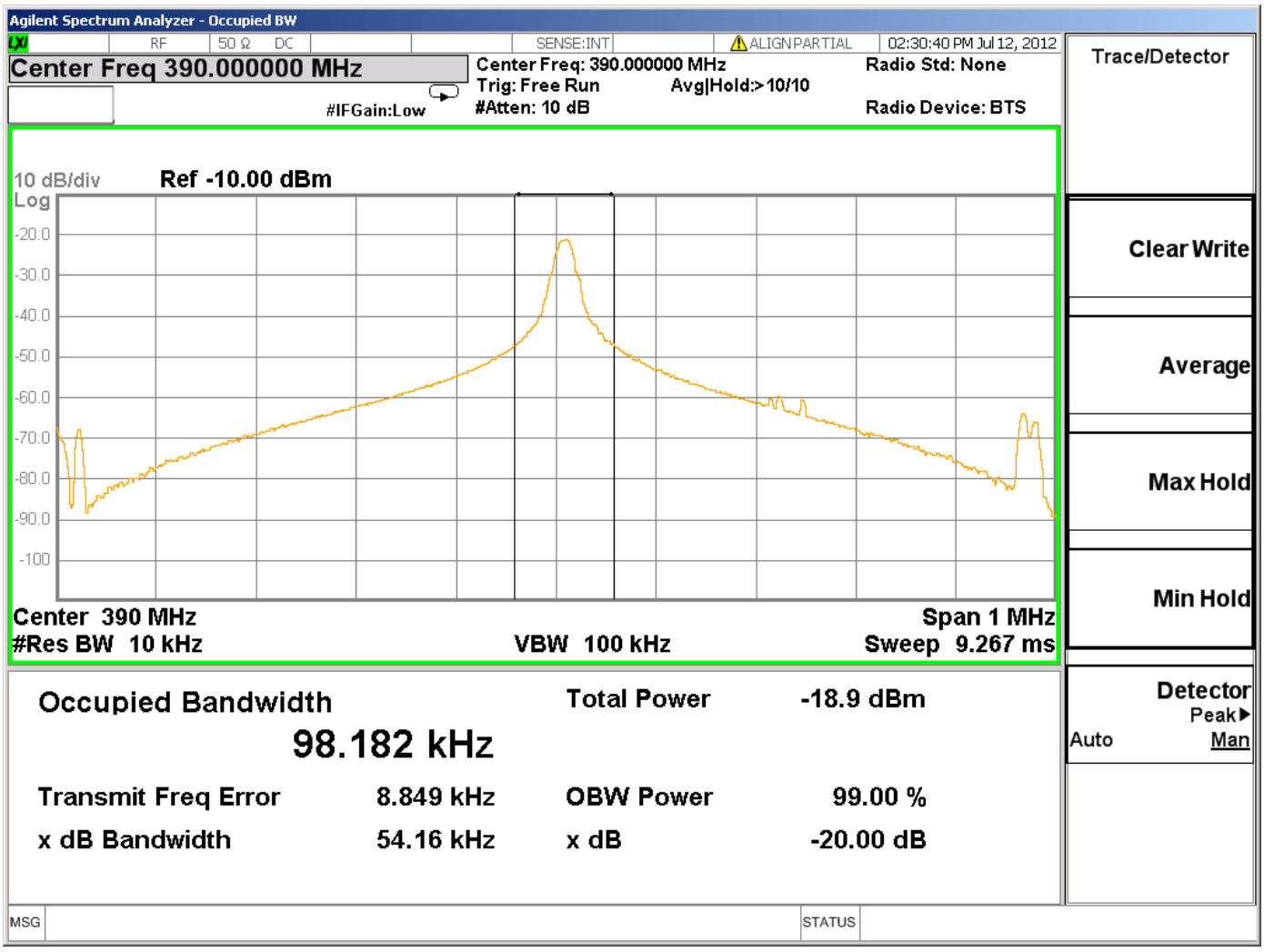
Table 81 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 82 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	54.16	98.182

Figure 64 – Bandwidth Graph



4.12.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 83 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 65 Cease Operation Graph

4.12.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

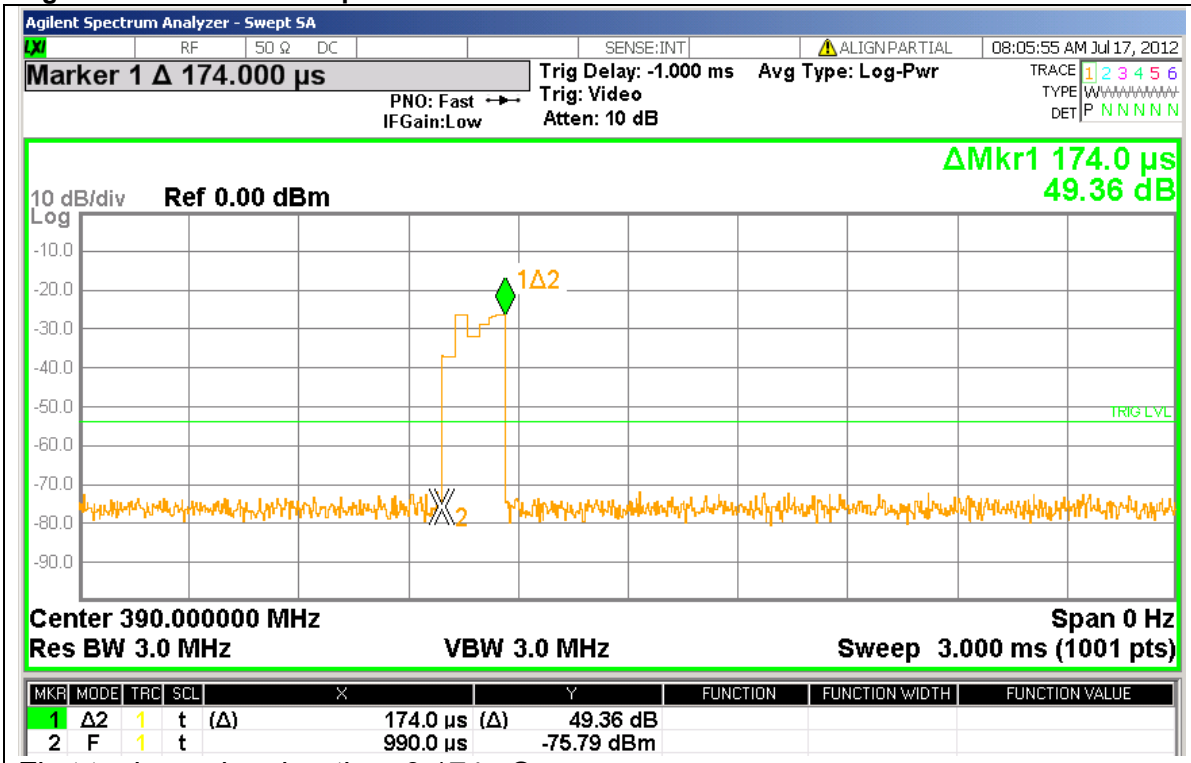
Table 84 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

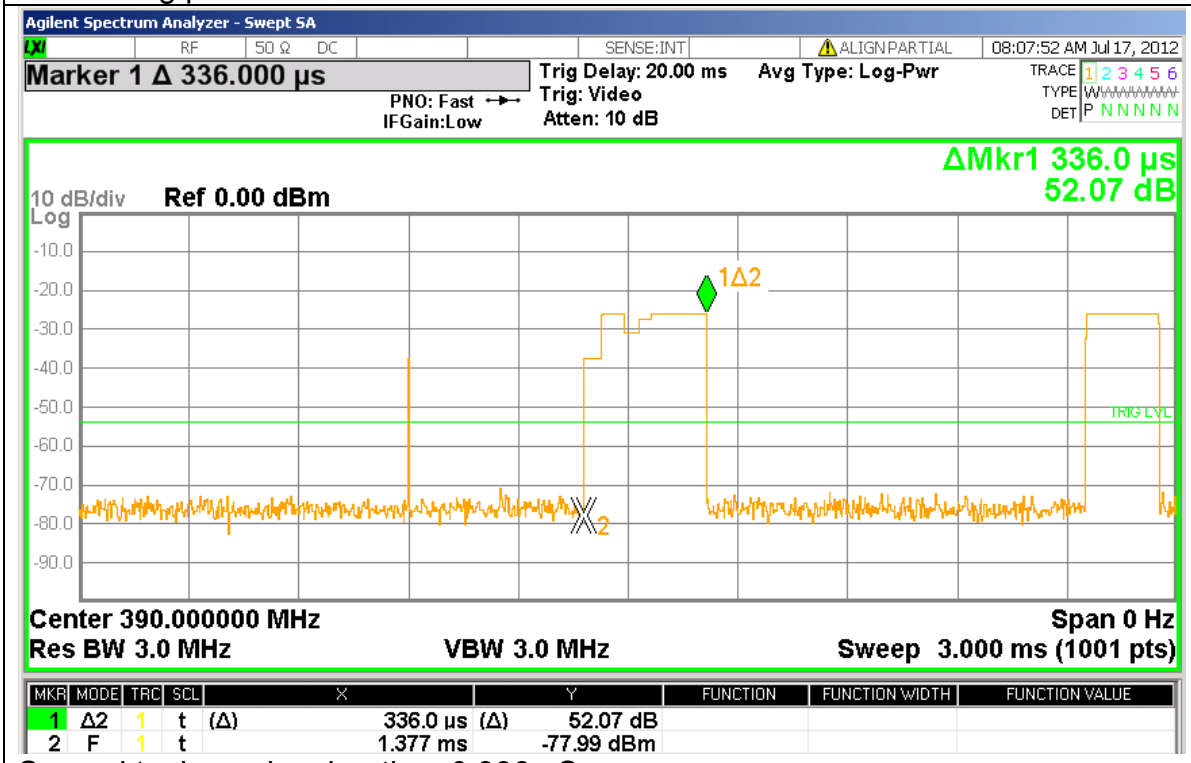
Table 85 Pulse Train Calculation

TX Frequency	Total TX time mS	Total Transmission time or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
390MHz	(48x0.204)+(29x0.402)+0.174+0.336	100ms	-13.16
Worst Case Duty Cycle: The worst case duty cycle is calculated as worst case over 100mS. Manufacturer declared worst case duty cycle is -12.36dB and its used for all emissions data.			

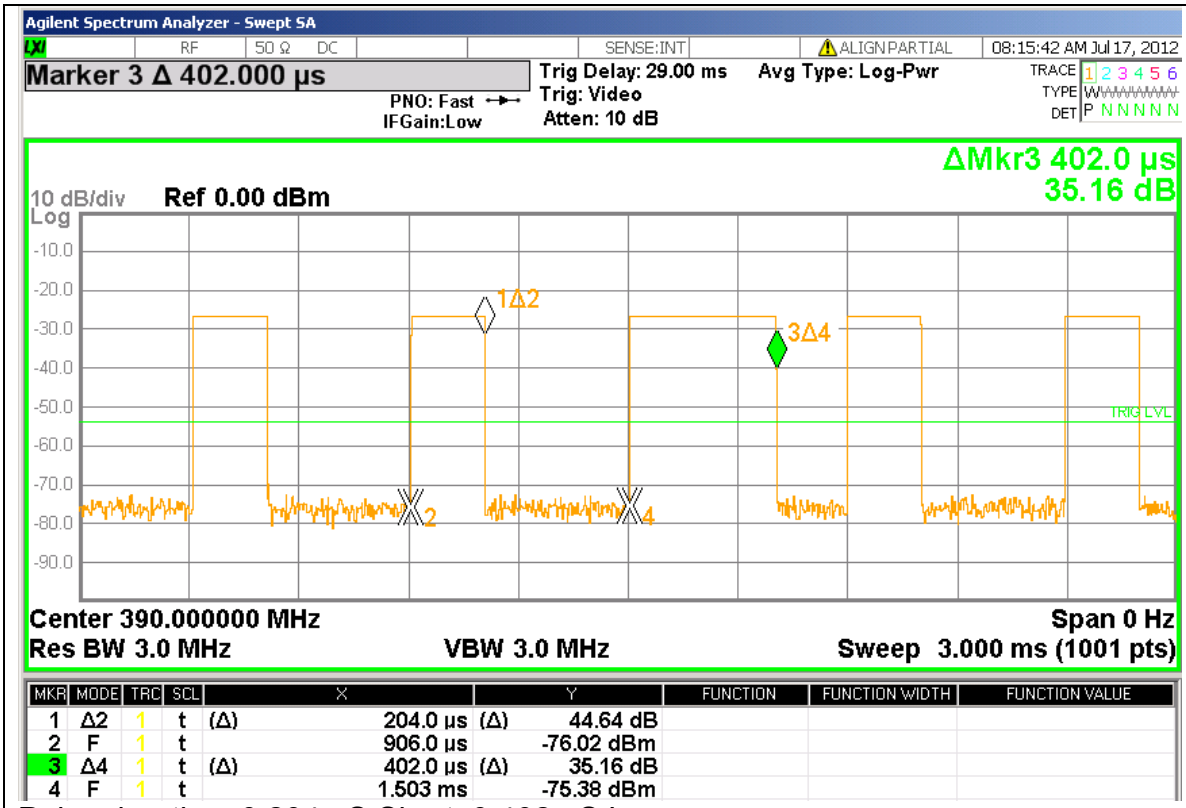
Figure 66 Pulse Train Graphs



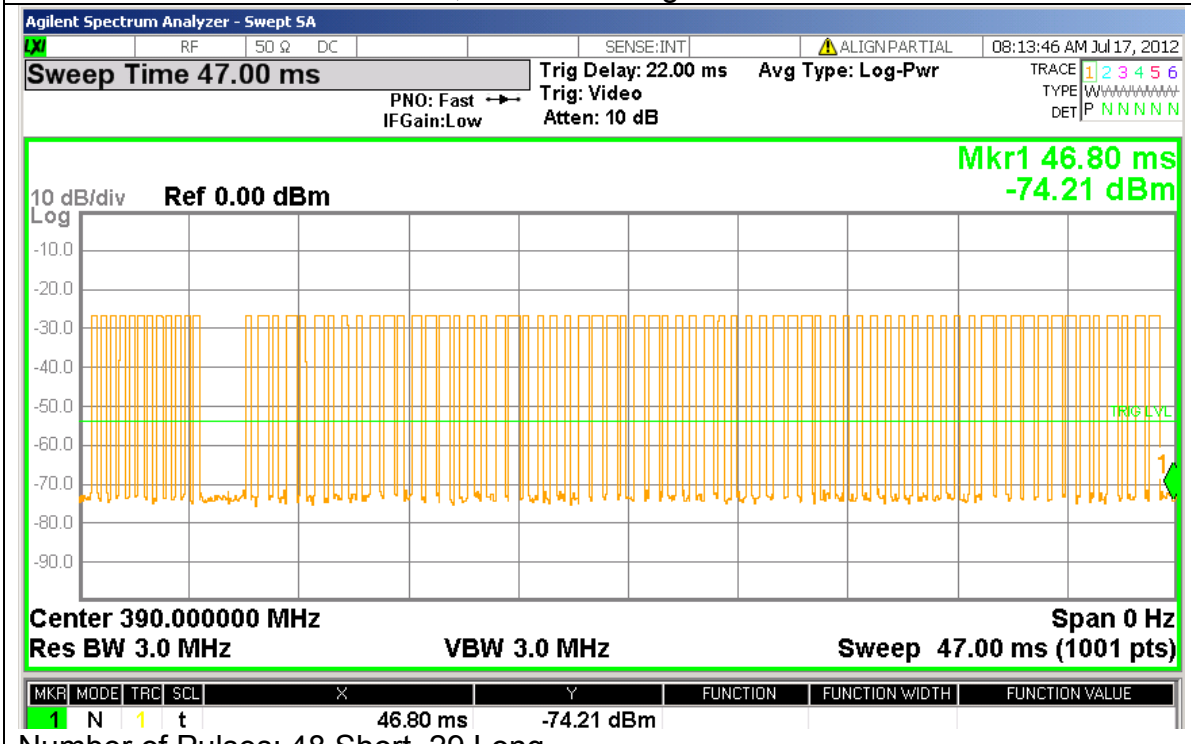
First tuning pulse duration: 0.174mS



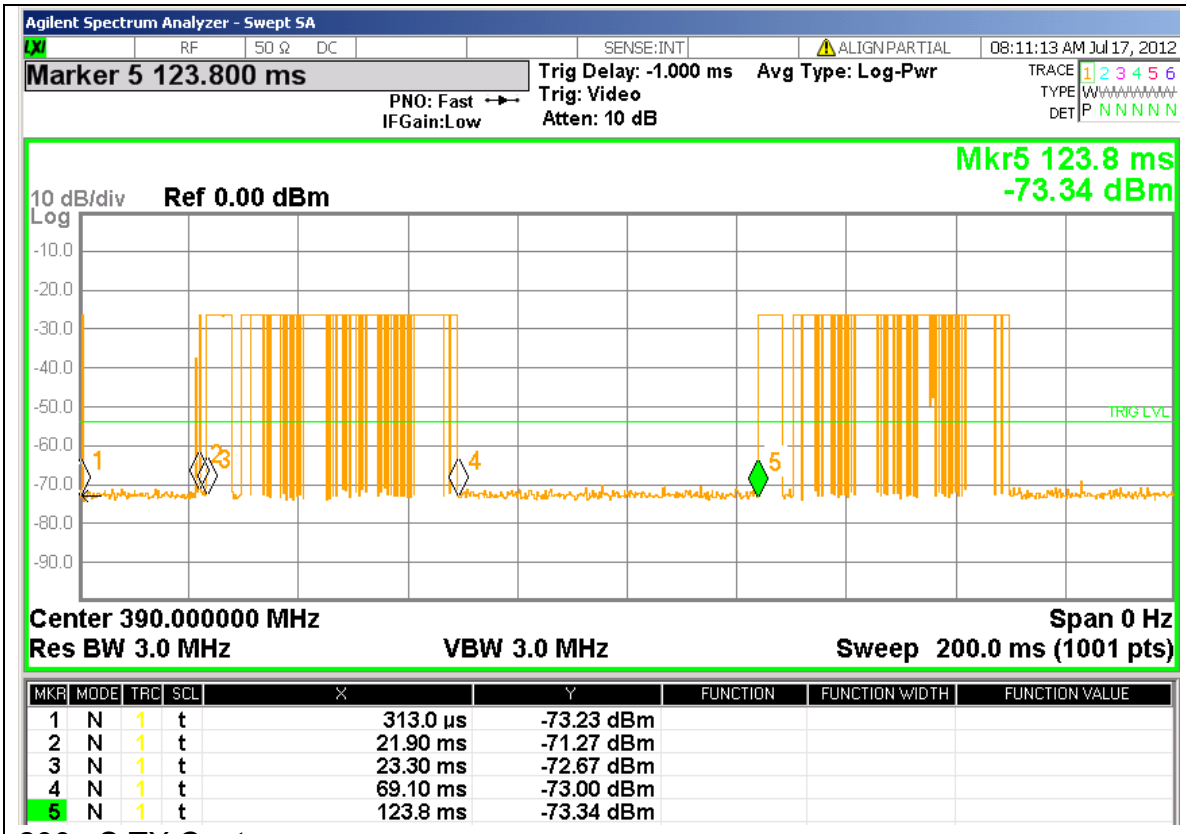
Second tuning pulse duration: 0.336mS



Pulse duration: 0.204mS Short, 0.402mS Long



Number of Pulses: 48 Short, 29 Long



200mS TX Capture

4.12.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.12.3 for duty cycle information.

Figure 67 Radiated Emissions Graph (Below 1GHz)

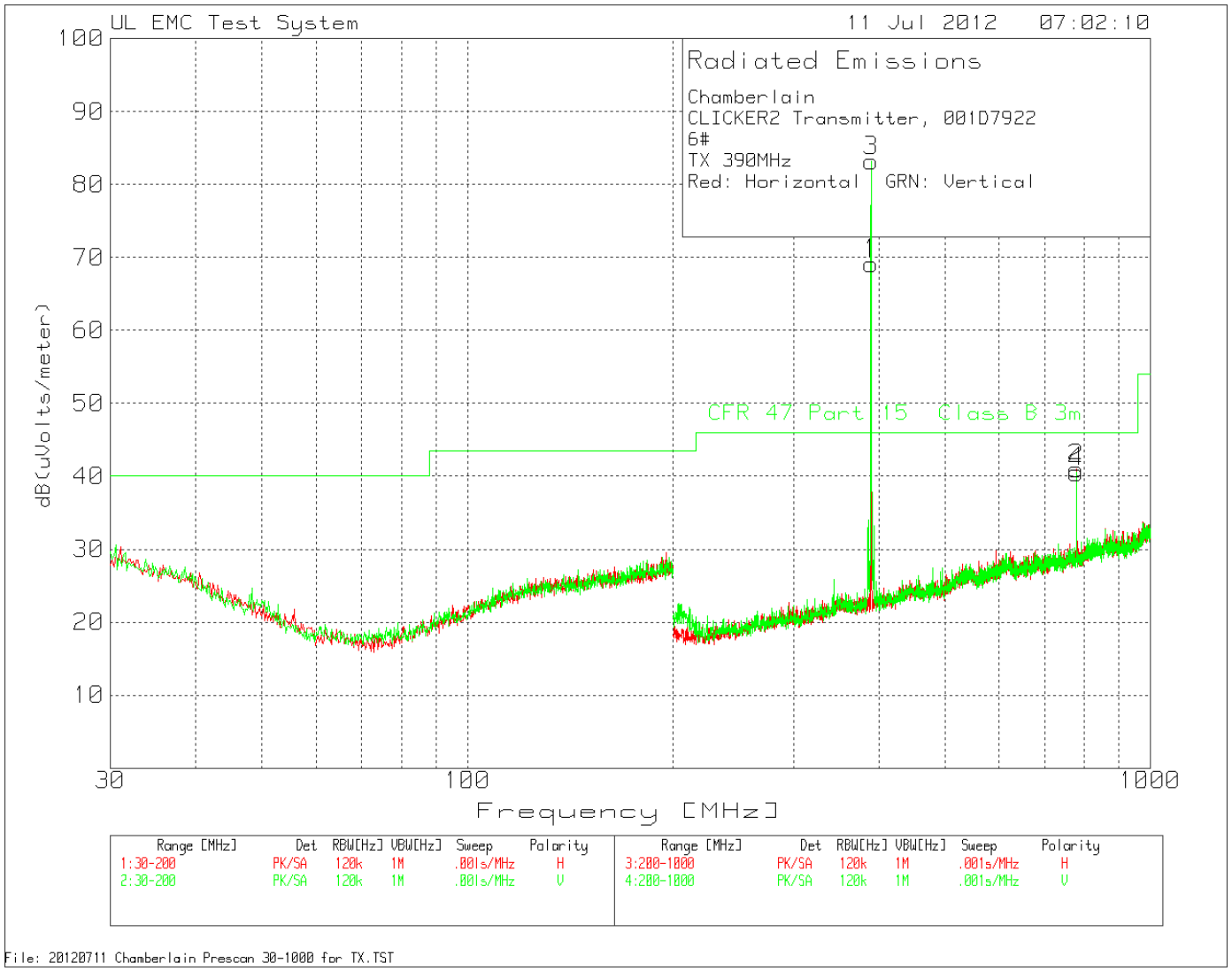


Figure 68 Radiated Emissions Graph (Above 1GHz)

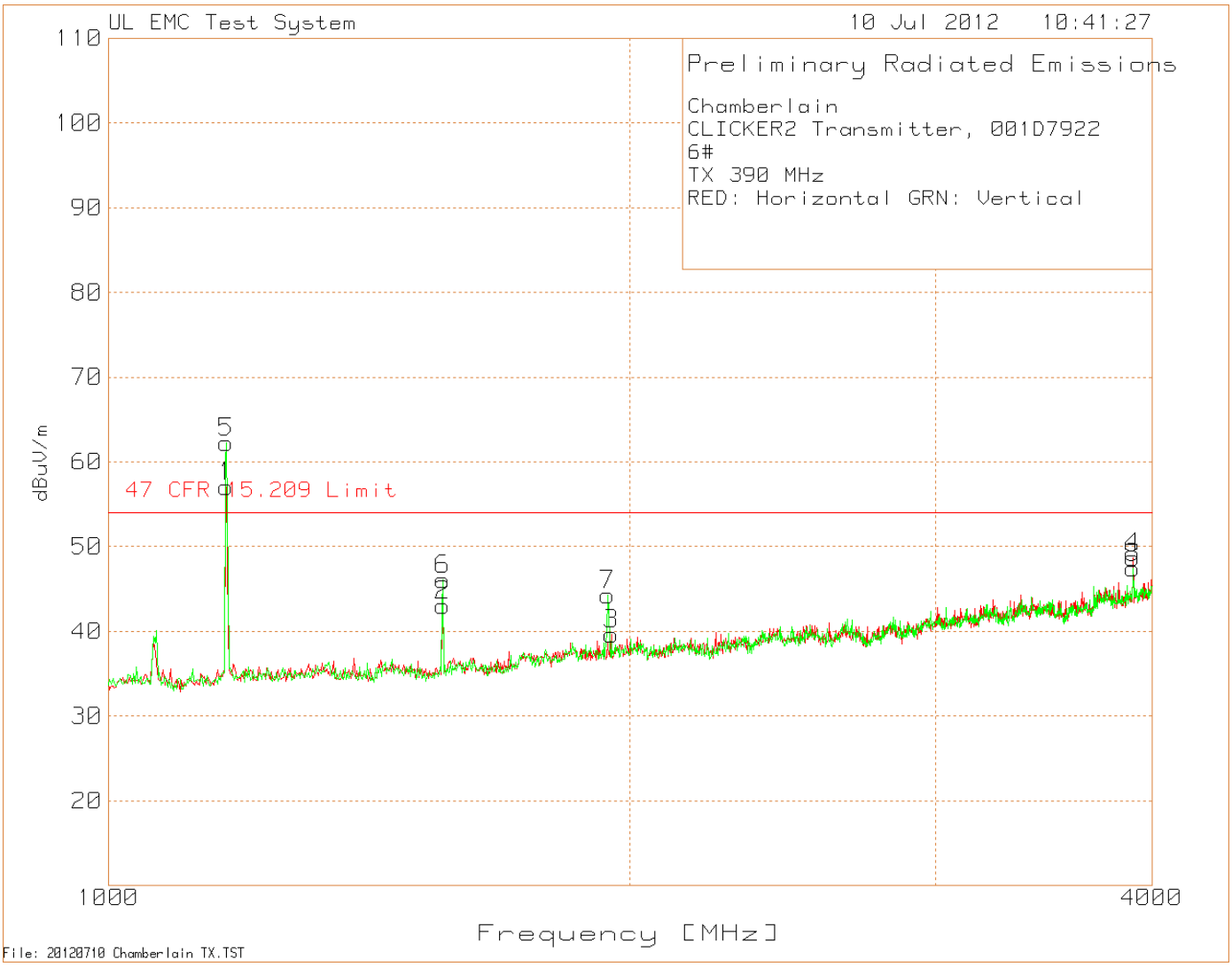


Table 86 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.007395	59.33	PK	16.1	2.3	77.73	-12.36	65.37	79.24	-13.87	186	174	Horz	Y
390.007395	66.76	PK	16.1	2.3	85.16	-12.36	72.8	79.24	-6.44	99	138	Vert	Y
780.015792	23.86	PK	21.8	3.4	49.06	-12.36	36.7	46	-9.3	356	112	Horz	Y
779.3471	8.22	PK	21.8	3.4	33.42	-12.36	21.06	46	-24.94	*	101	Vert	Y
1170.0631	90.7	PK	24.8	-57.24	58.26	-12.36	45.9	54	-8.1	357	132	Horz	Y
1170.1443	96.48	PK	24.8	-57.23	64.05	-12.36	51.69	54	-2.31	19	136	Vert	Y
1560.374	73.53	PK	25.2	-55.65	43.08	-12.36	30.72	54	-23.28	*	112	Horz	Y
1950.634	66.66	PK	27.4	-54.39	39.67	-12.36	27.31	54	-26.69	*	112	Horz	Y
3901.935	67.94	PK	32.7	-51.99	48.65	-12.36	36.29	54	-17.71	*	125	Horz	Y
1560.374	76.56	PK	25.2	-55.65	46.11	-12.36	33.75	54	-20.25	*	100	Vert	Y
1940.627	71.43	PK	27.4	-54.54	44.29	-12.36	31.93	54	-22.07	*	100	Vert	Y
3901.935	66.71	PK	32.7	-51.99	47.42	-12.36	35.06	54	-18.94	*	125	Vert	Y
* Prescan Data Used													

4.13 Configuration 19# Test Data

4.13.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 87 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

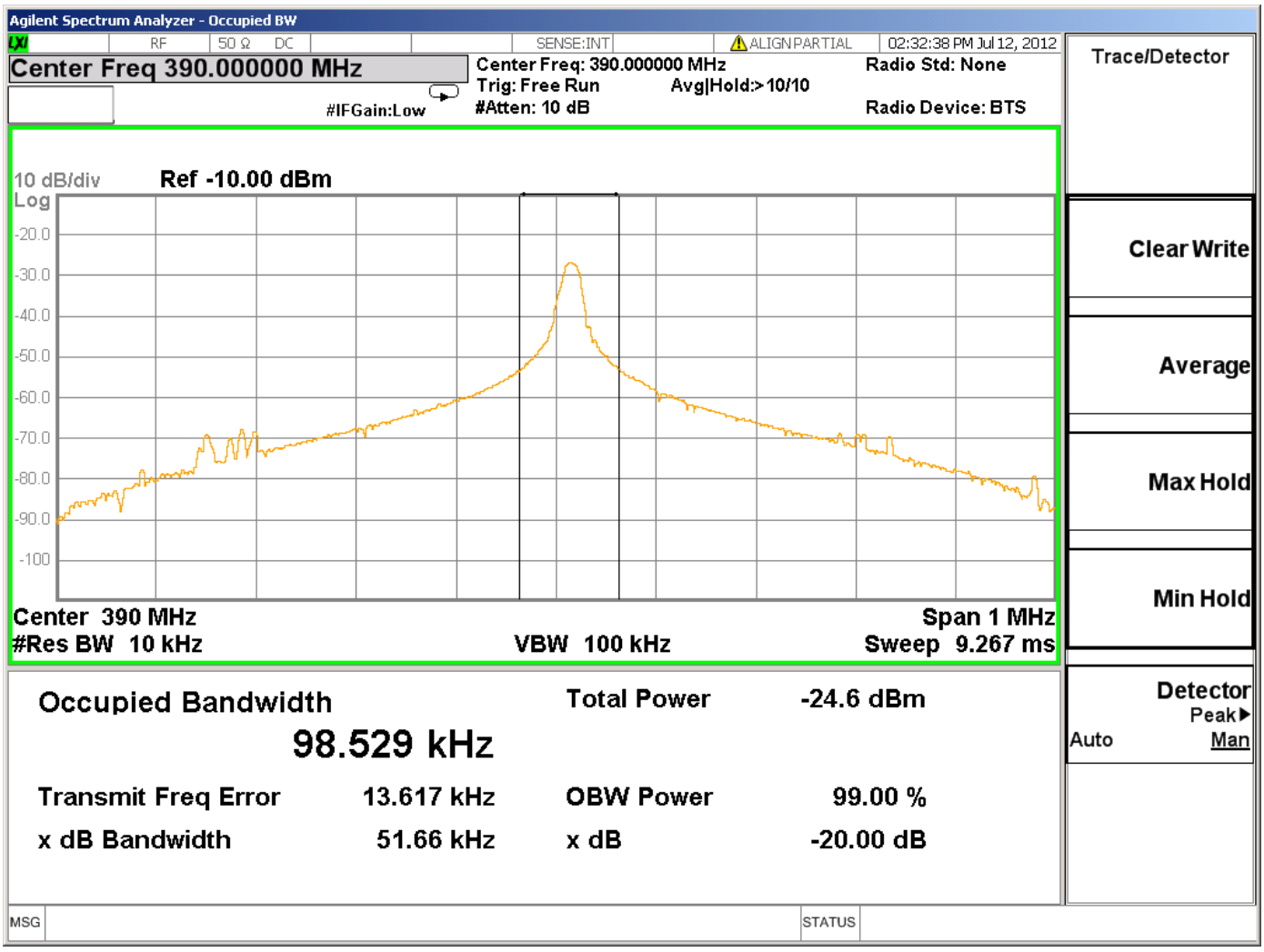
Table 88 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 89 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	51.66	98.529

Figure 69 – Bandwidth Graph



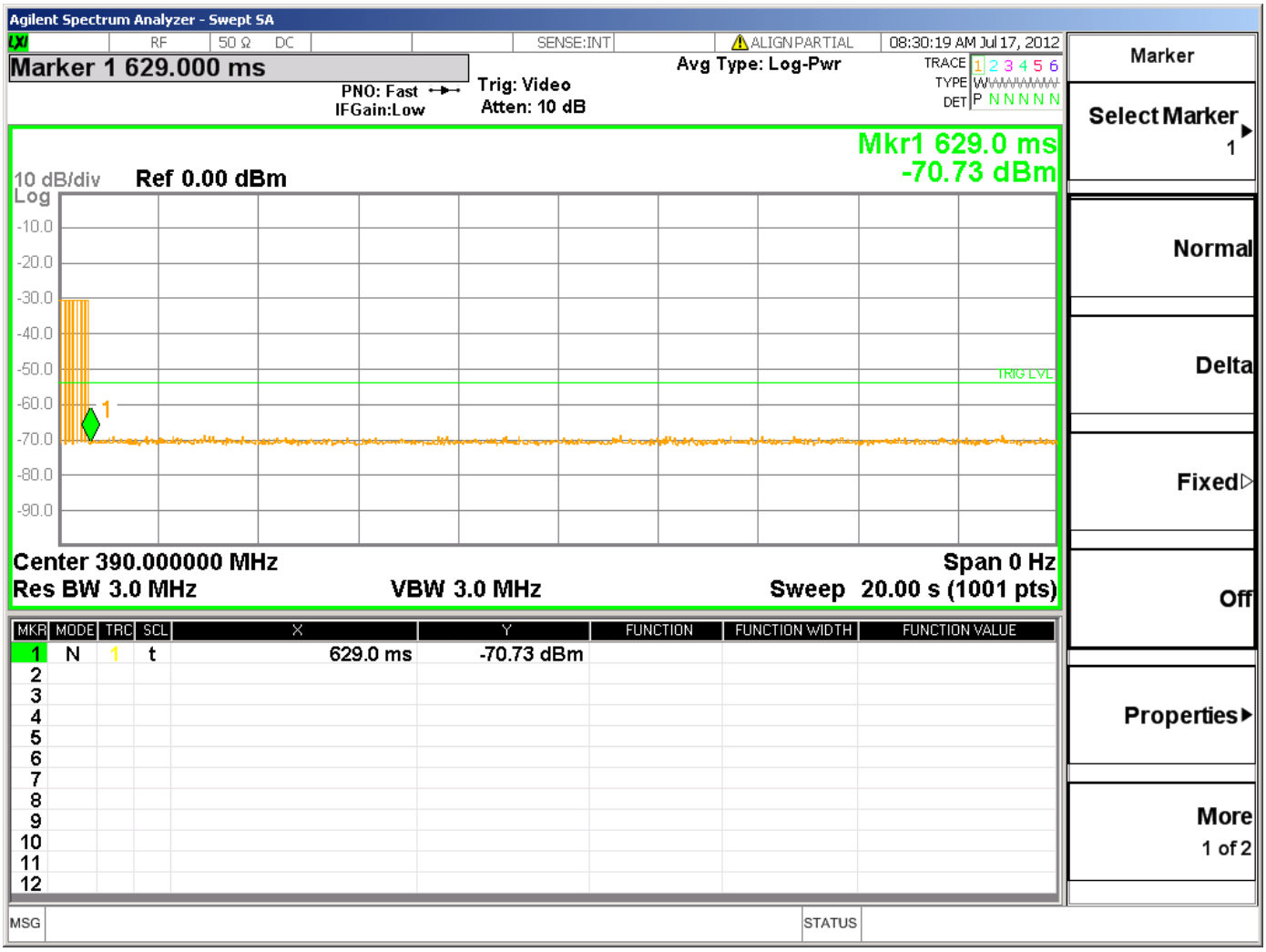
4.13.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 90 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 70 Cease Operation Graph



4.13.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

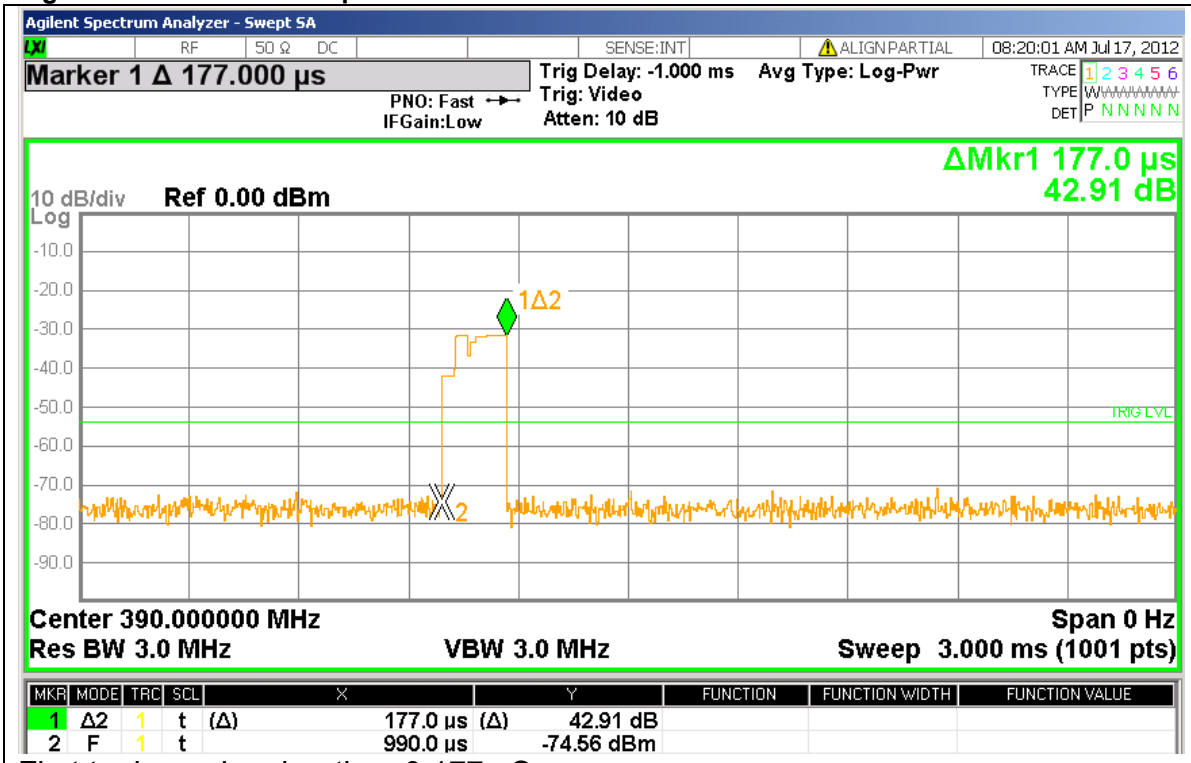
Table 91 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

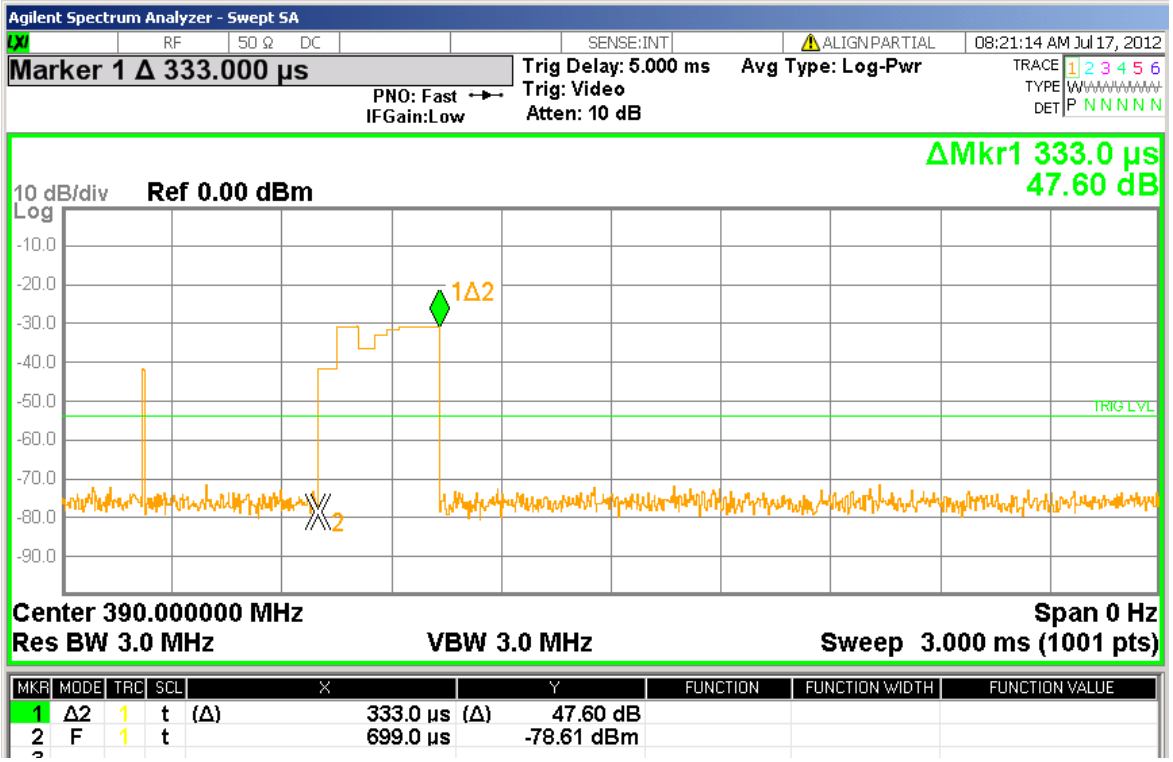
Table 92 Pulse Train Calculation

		Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
TX Frequency	Total TX time		
390MHz	(4x1.0)+(7x2.99)	78.5mS	-9.96
Worst Case Duty Cycle: Worst case duty cycle was calculated over one message period. Manufacturer declared worst case duty cycle is -10.4. Measured duty cycle is used for all radiated emissions data.			

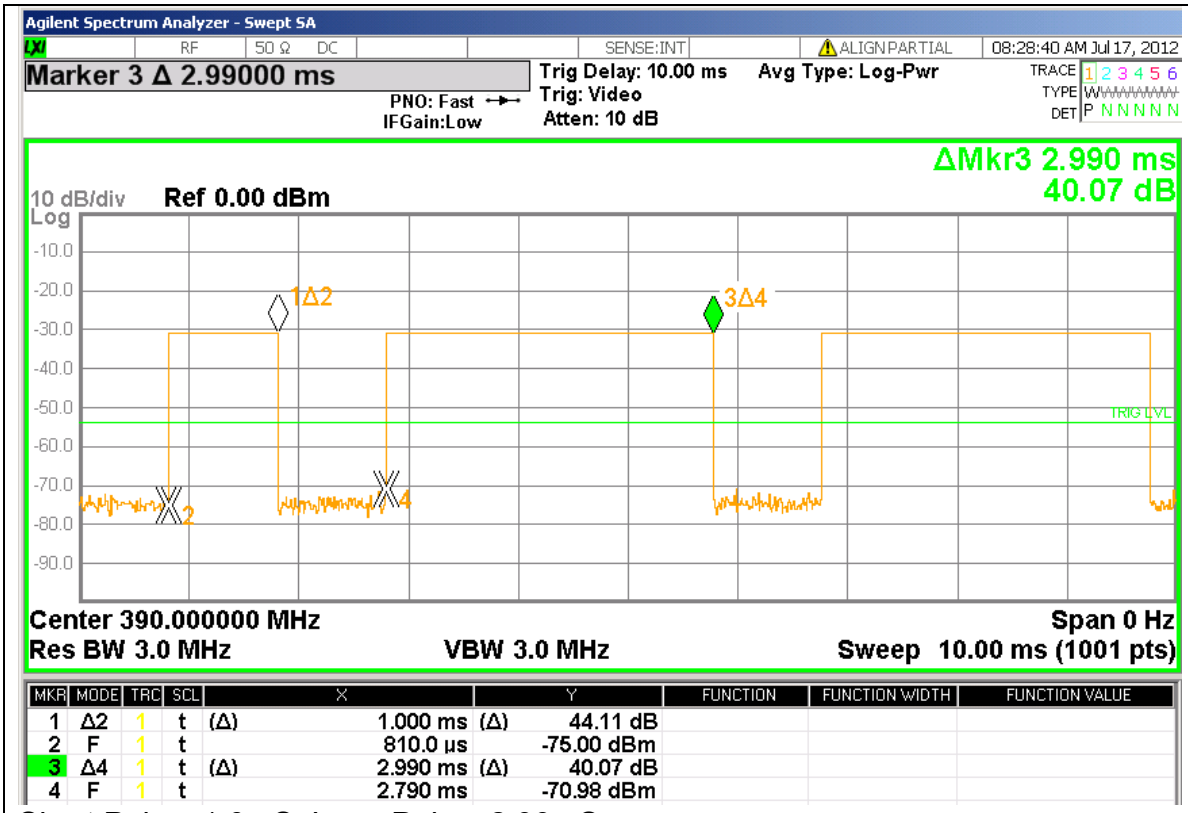
Figure 71 Pulse Train Graphs



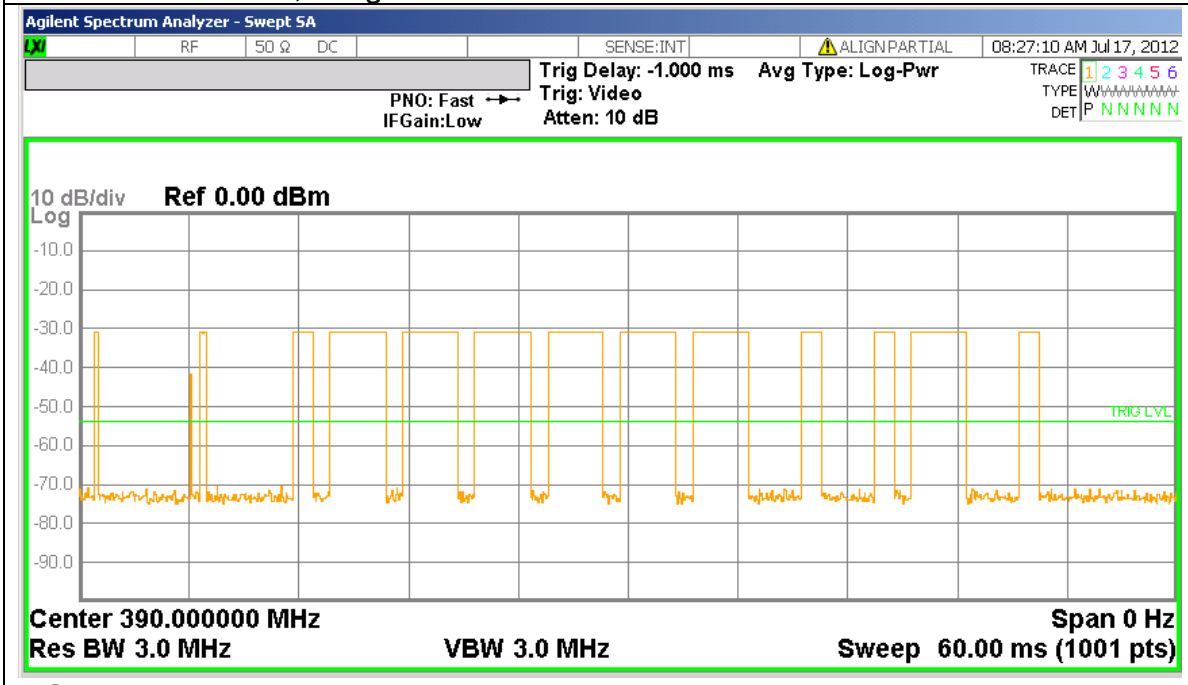
First tuning pulse duration: 0.177mS



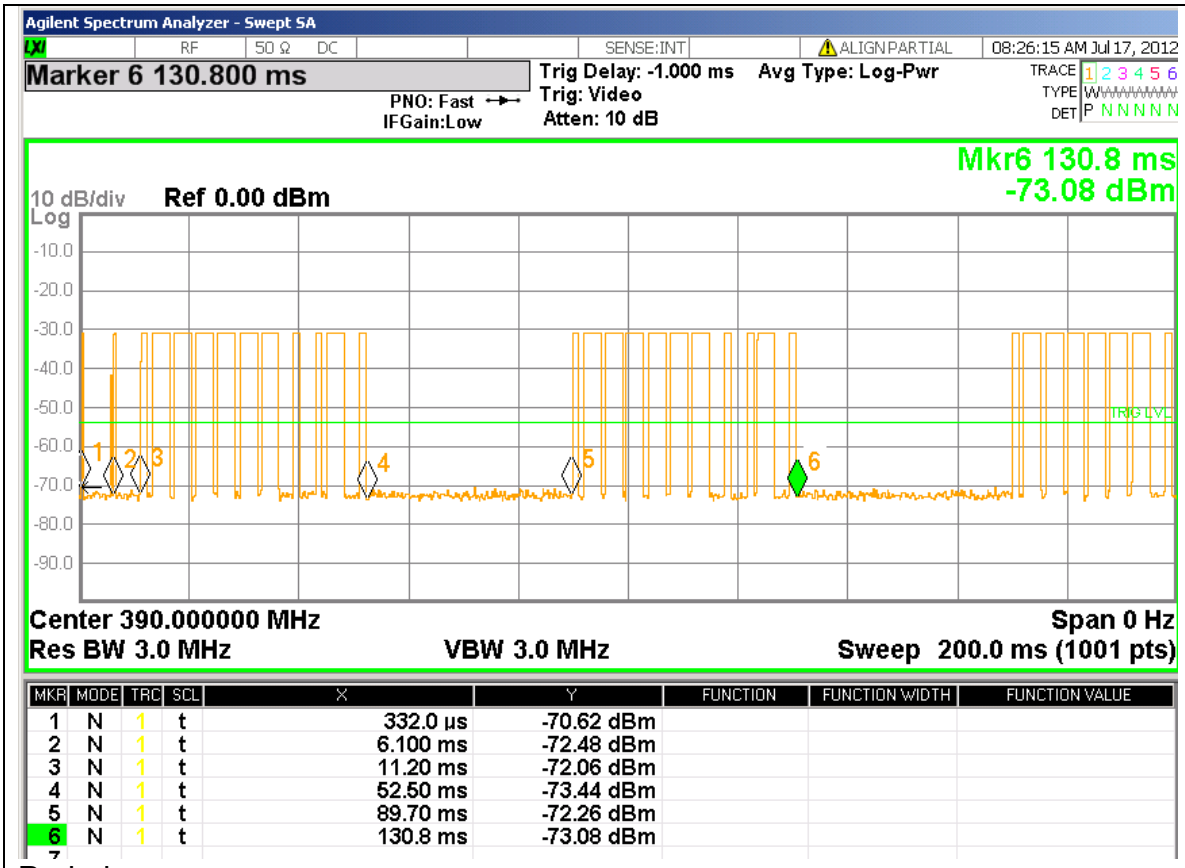
Second tuning pulse duration: 0.333mS



Short Pulse: 1.0mS, Long Pulse: 2.99mS



4 Short Pulses, 7 long pulses



Period sweep

4.13.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.13.3 for duty cycle information.

Figure 72 Radiated Emissions Graph (Below 1GHz)

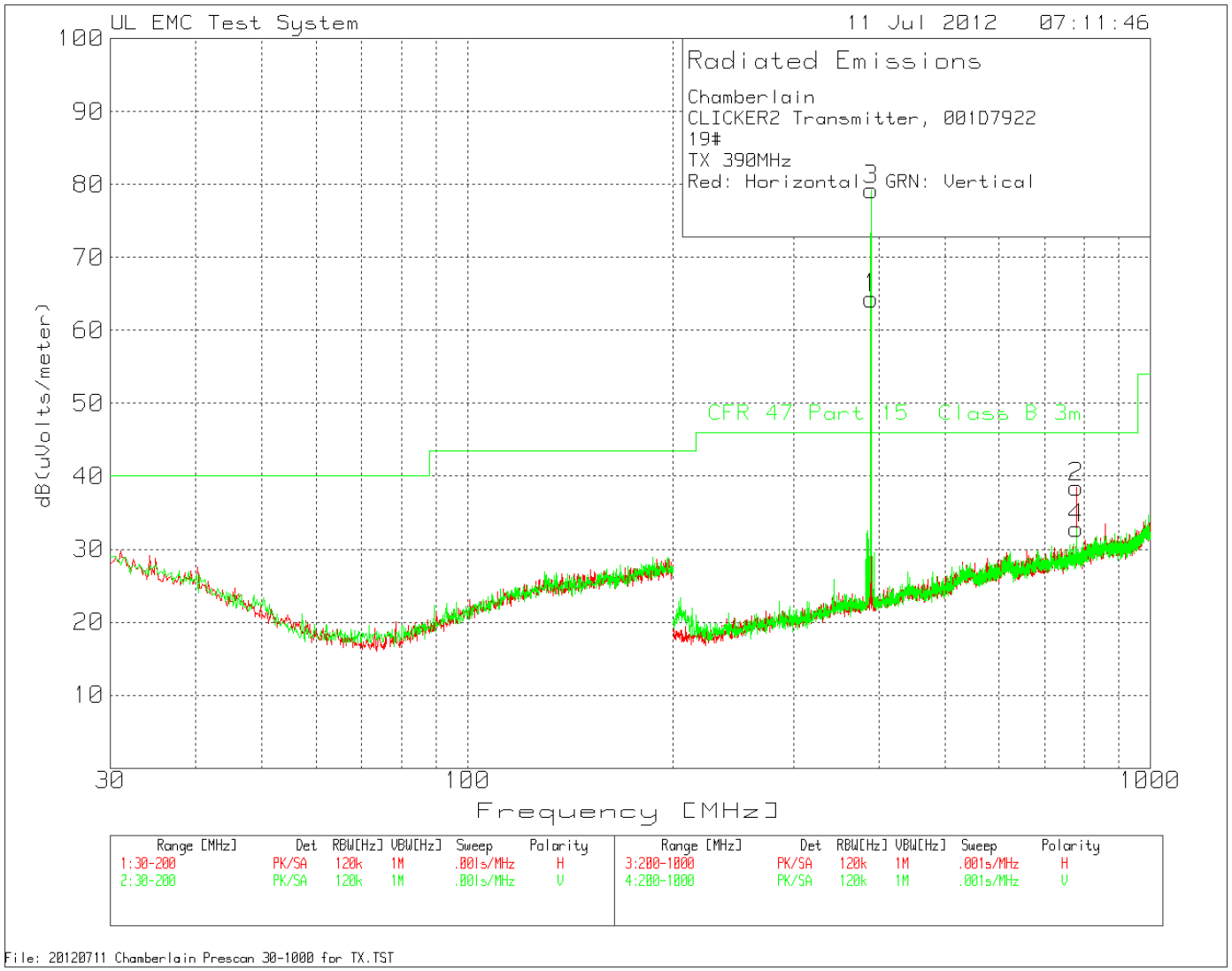


Figure 73 Radiated Emissions Graph (Above 1GHz)

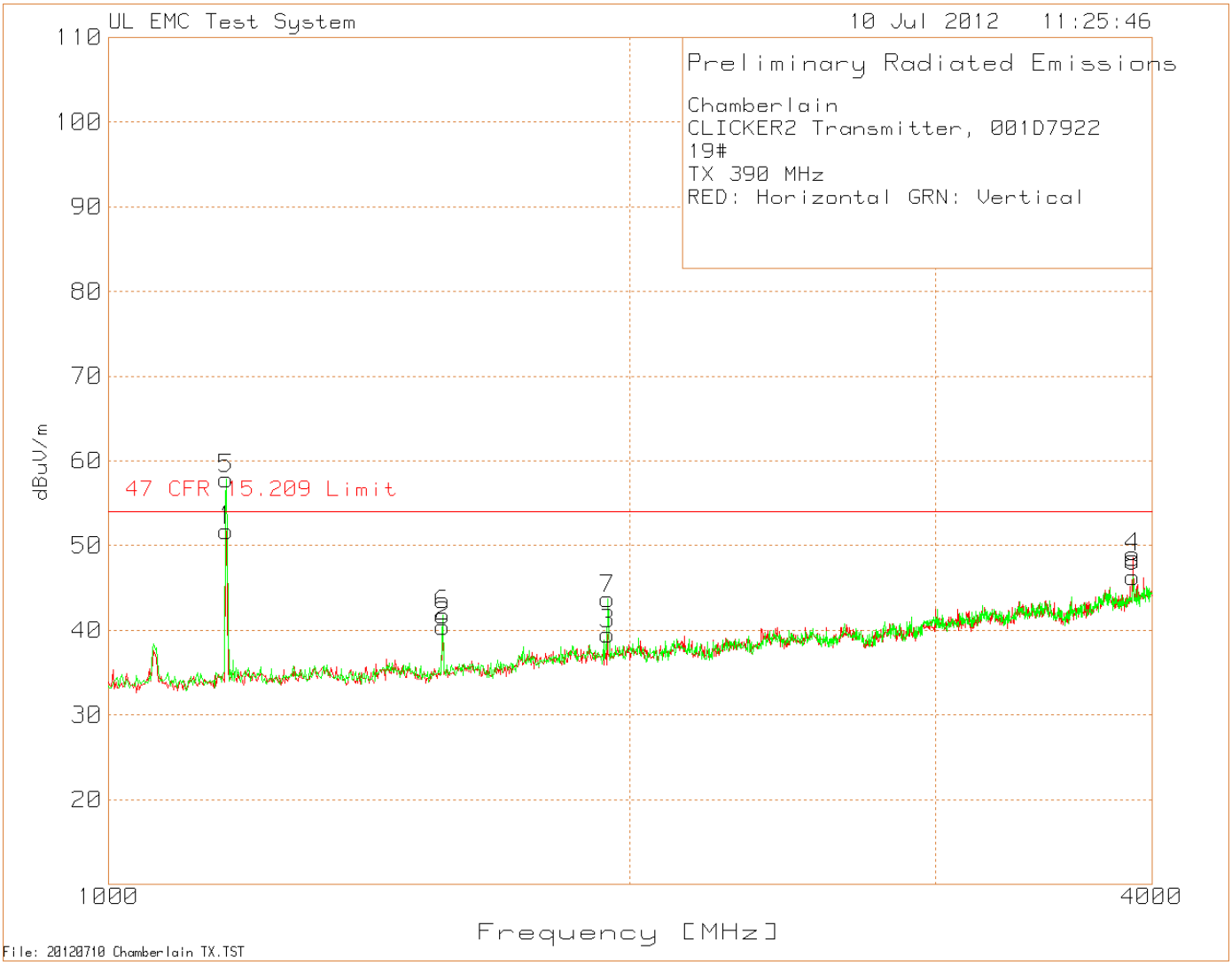


Table 93 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.0072	54.91	PK	16.1	2.3	73.31	-9.96	63.35	79.24	-15.89	184	175	Horz	Y
390.0072	62.37	PK	16.1	2.3	80.77	-9.96	70.81	79.24	-8.43	98	140	Vert	Y
780.014587	19.24	PK	21.8	3.4	44.44	-9.96	34.48	46	-11.52	1	112	Horz	Y
781.2125	8.34	PK	21.8	3.4	33.54	-9.96	23.58	46	-22.42	*	101	Vert	Y
1170.0872	86.27	PK	24.8	-57.24	53.83	-9.96	43.87	54	-10.13	355	133	Horz	Y
1170.0691	91.77	PK	24.8	-57.24	59.33	-9.96	49.37	54	-4.63	8	137	Vert	Y
1560.374	70.93	PK	25.2	-55.65	40.48	-9.96	30.52	54	-23.48	*	136	Horz	Y
1940.627	66.67	PK	27.4	-54.54	39.53	-9.96	29.57	54	-24.43	*	136	Horz	Y
3901.935	67.88	PK	32.7	-51.99	48.59	-9.96	38.63	54	-15.37	*	124	Horz	Y
1560.374	72.21	PK	25.2	-55.65	41.76	-9.96	31.8	54	-22.2	*	102	Vert	Y
1942.628	70.74	PK	27.4	-54.48	43.66	-9.96	33.7	54	-20.3	*	102	Vert	Y
3901.935	65.57	PK	32.7	-51.99	46.28	-9.96	36.32	54	-17.68	*	125	Vert	Y
* Prescan Data used													

4.14 Configuration 15# Test Data

4.14.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 94 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

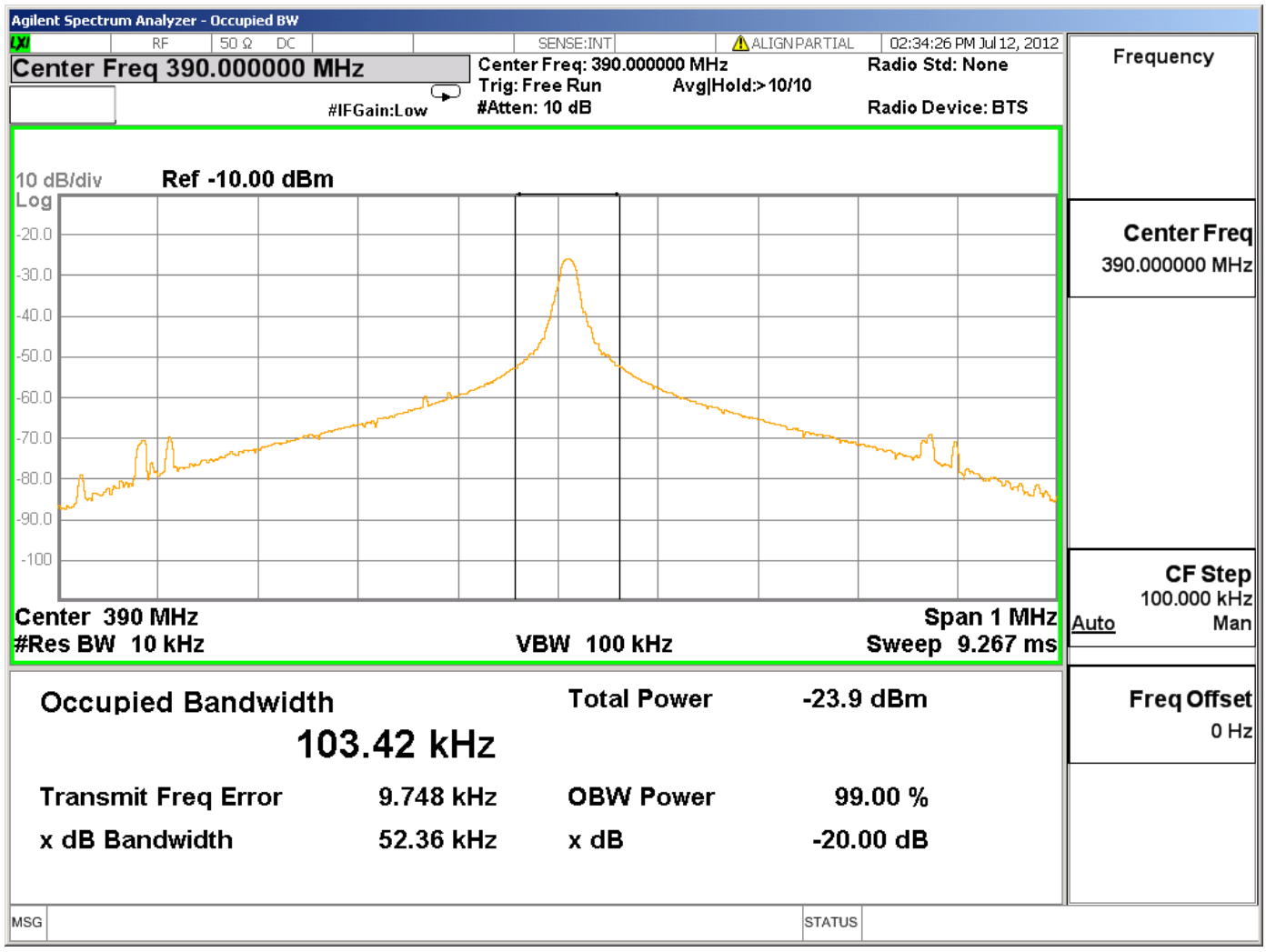
Table 95 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 96 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	52.36	103.42

Figure 74 – Bandwidth Graph



4.14.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 97 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 75 Cease Operation Graph

4.14.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

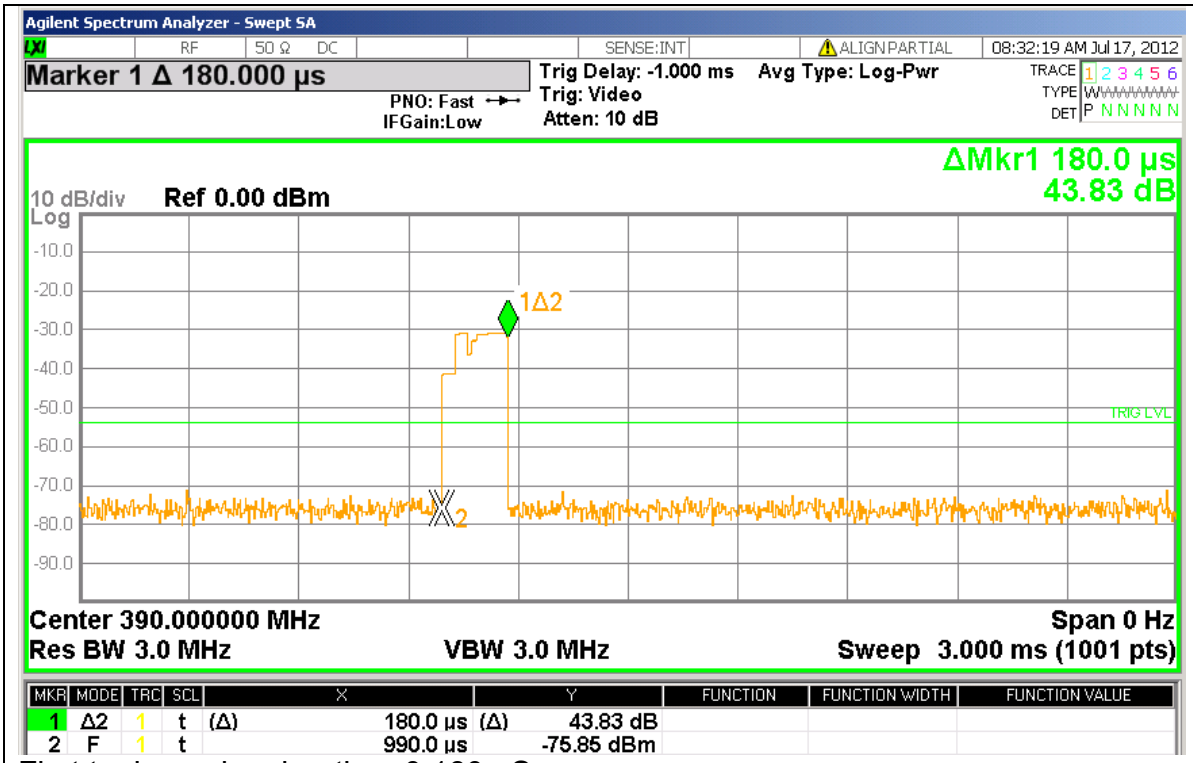
Table 98 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

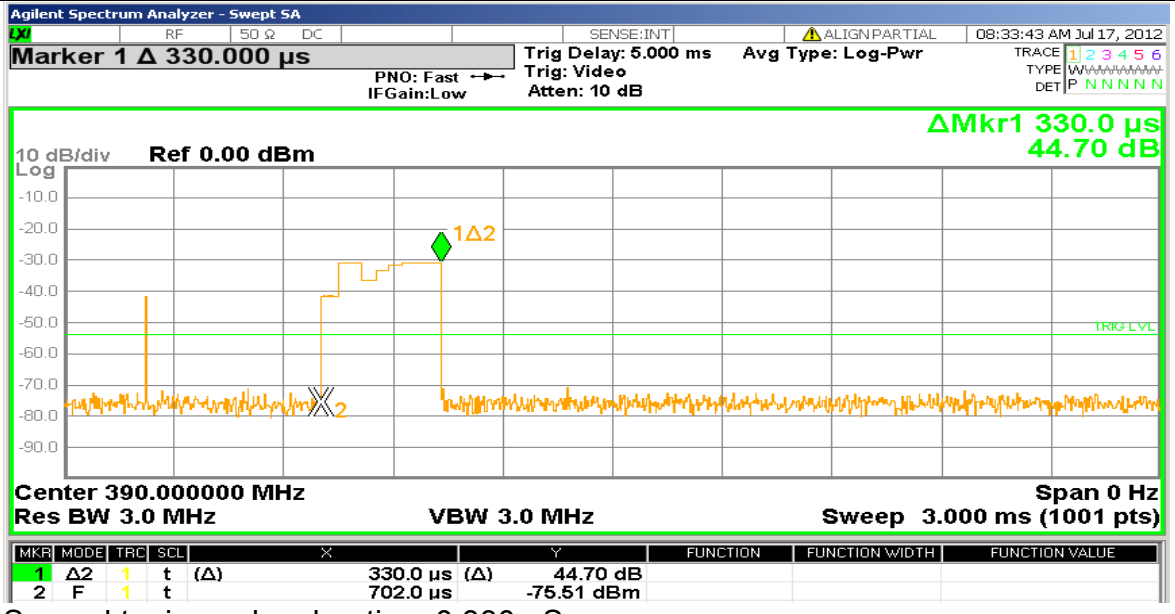
Table 99 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
390MHz	(2x1.010)+(8x2.980)	80.1	-10.52dB
Worst Case Duty Cycle: Worst case duty cycle was calculated over normal period of 80.1mS not including the tuning pulses. The manufacturer declared duty cycle as -9.75 and it is used for all radiated emissions data.			

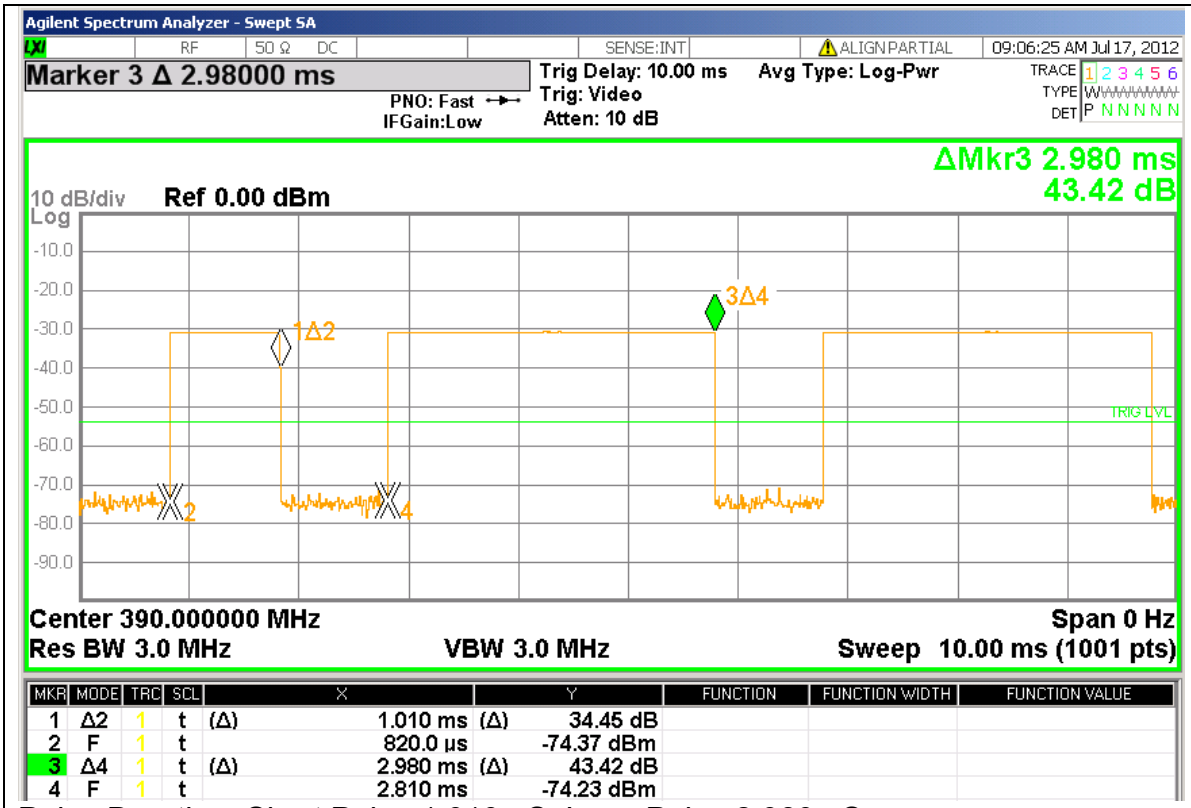
Figure 76 Pulse Train Graphs



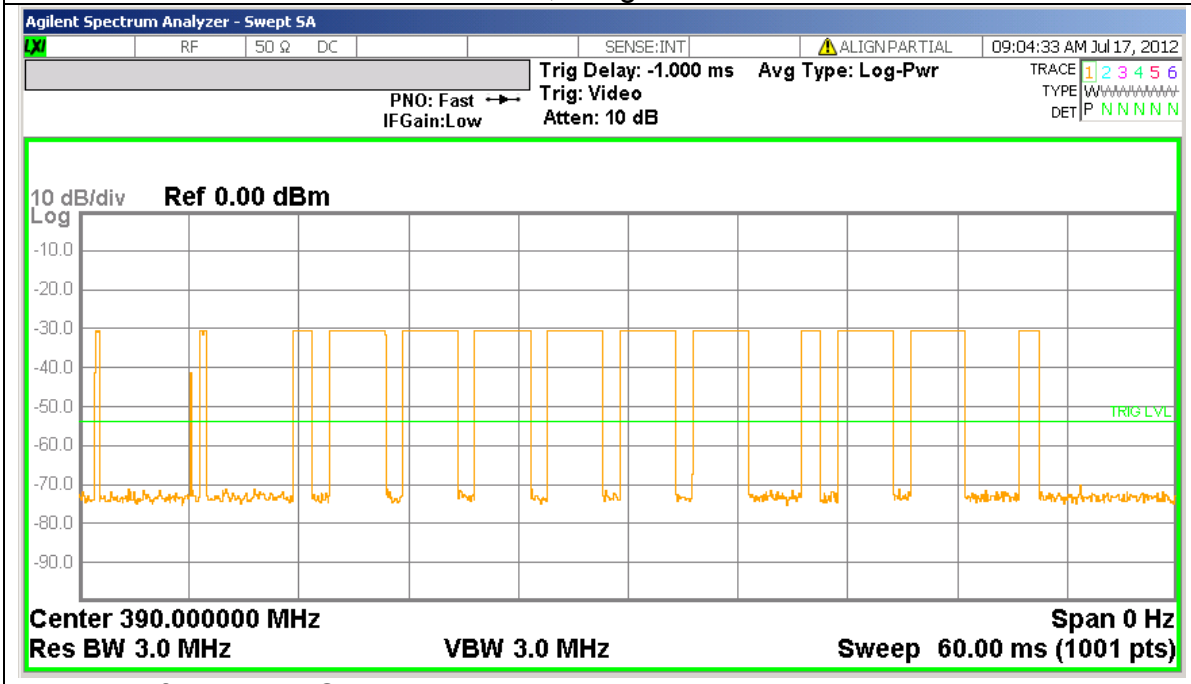
First tuning pulse duration: 0.180mS



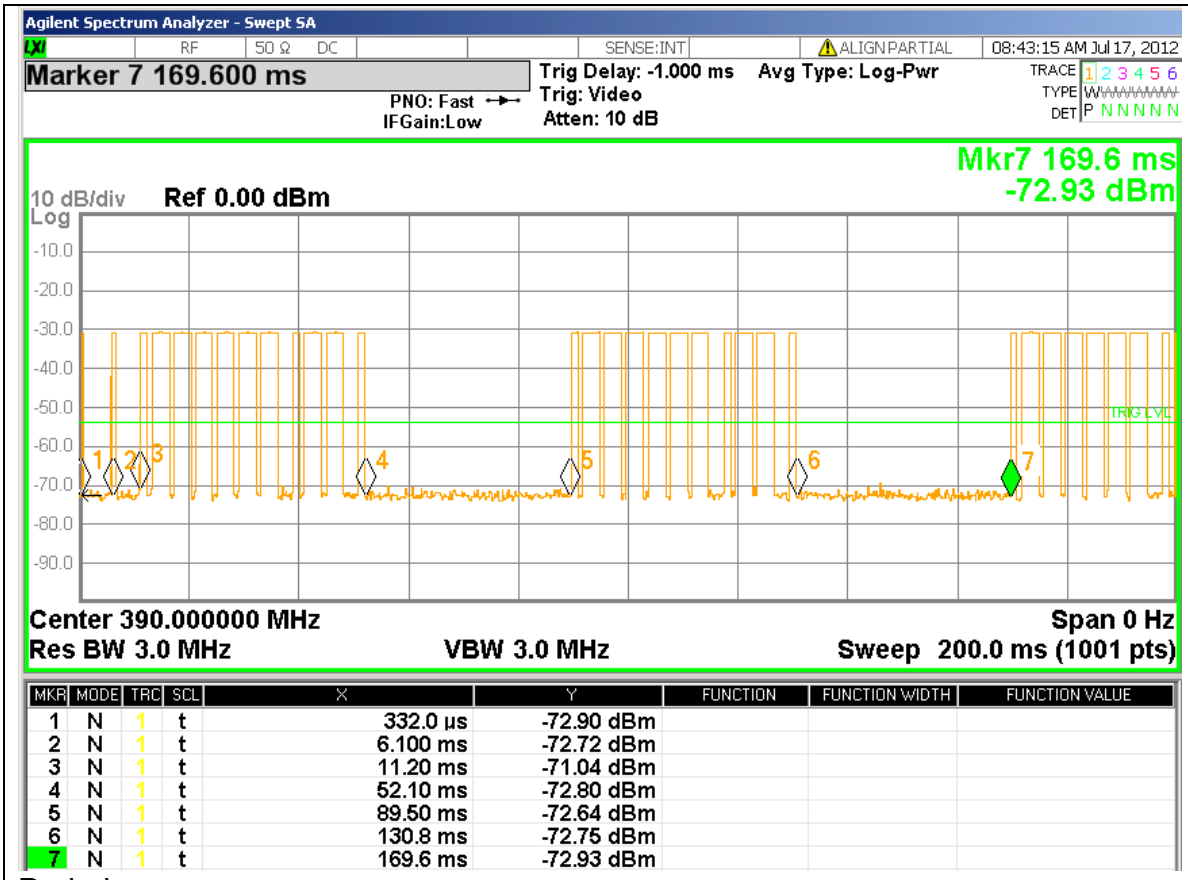
Second tuning pulse duration: 0.330mS



Pulse Duration: Short Pulse 1.010mS, Long Pulse 2.980mS



Number of Pulses: 3 Short, 8 Long



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	332.0 µs	-72.90 dBm			
2	N	1	t	6.100 ms	-72.72 dBm			
3	N	1	t	11.20 ms	-71.04 dBm			
4	N	1	t	52.10 ms	-72.80 dBm			
5	N	1	t	89.50 ms	-72.64 dBm			
6	N	1	t	130.8 ms	-72.75 dBm			
7	N	1	t	169.6 ms	-72.93 dBm			

Period scan

4.14.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.14.3 for duty cycle information.

Figure 77 Radiated Emissions Graph (Below 1GHz)

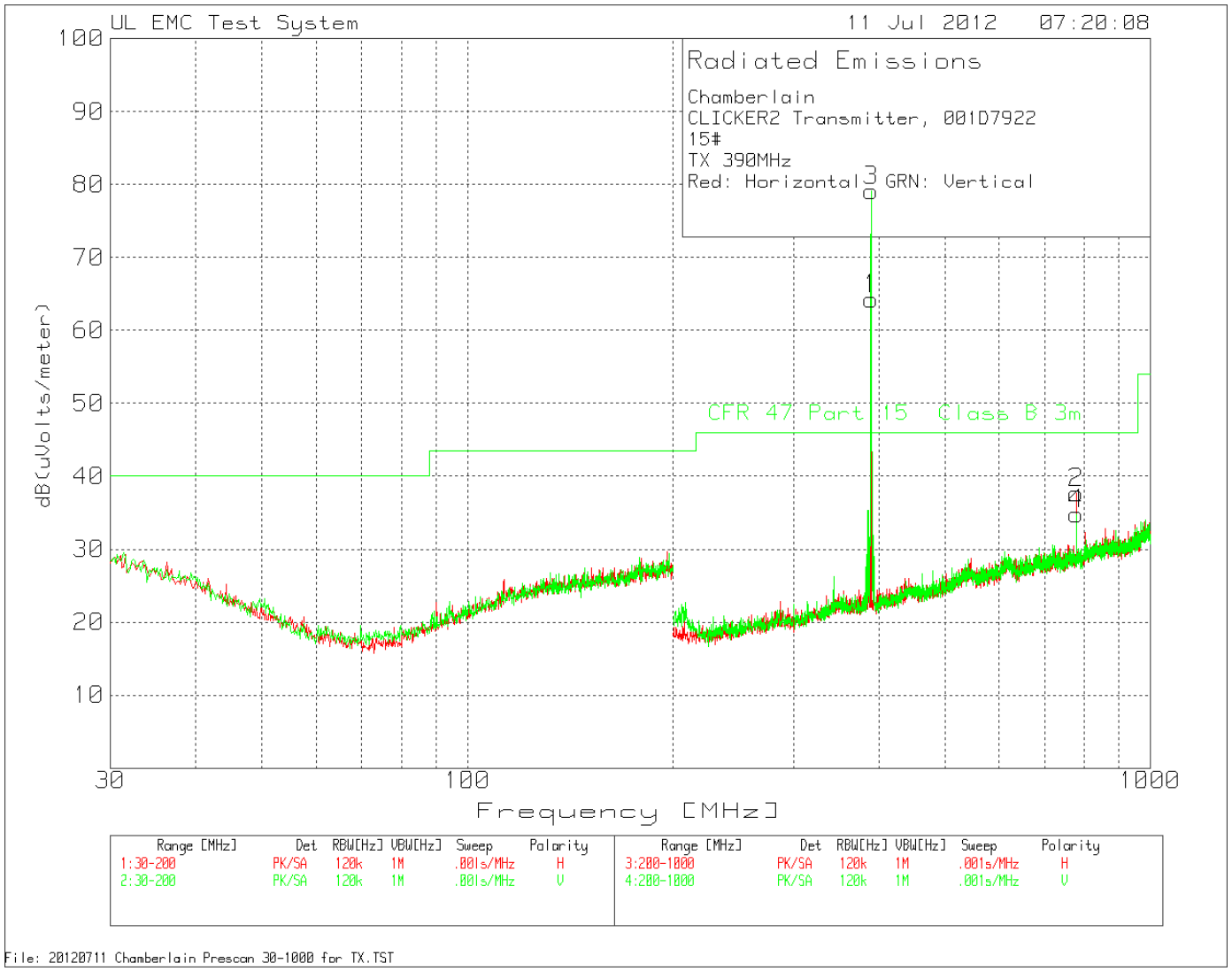


Figure 78 Radiated Emissions Graph (Above 1GHz)

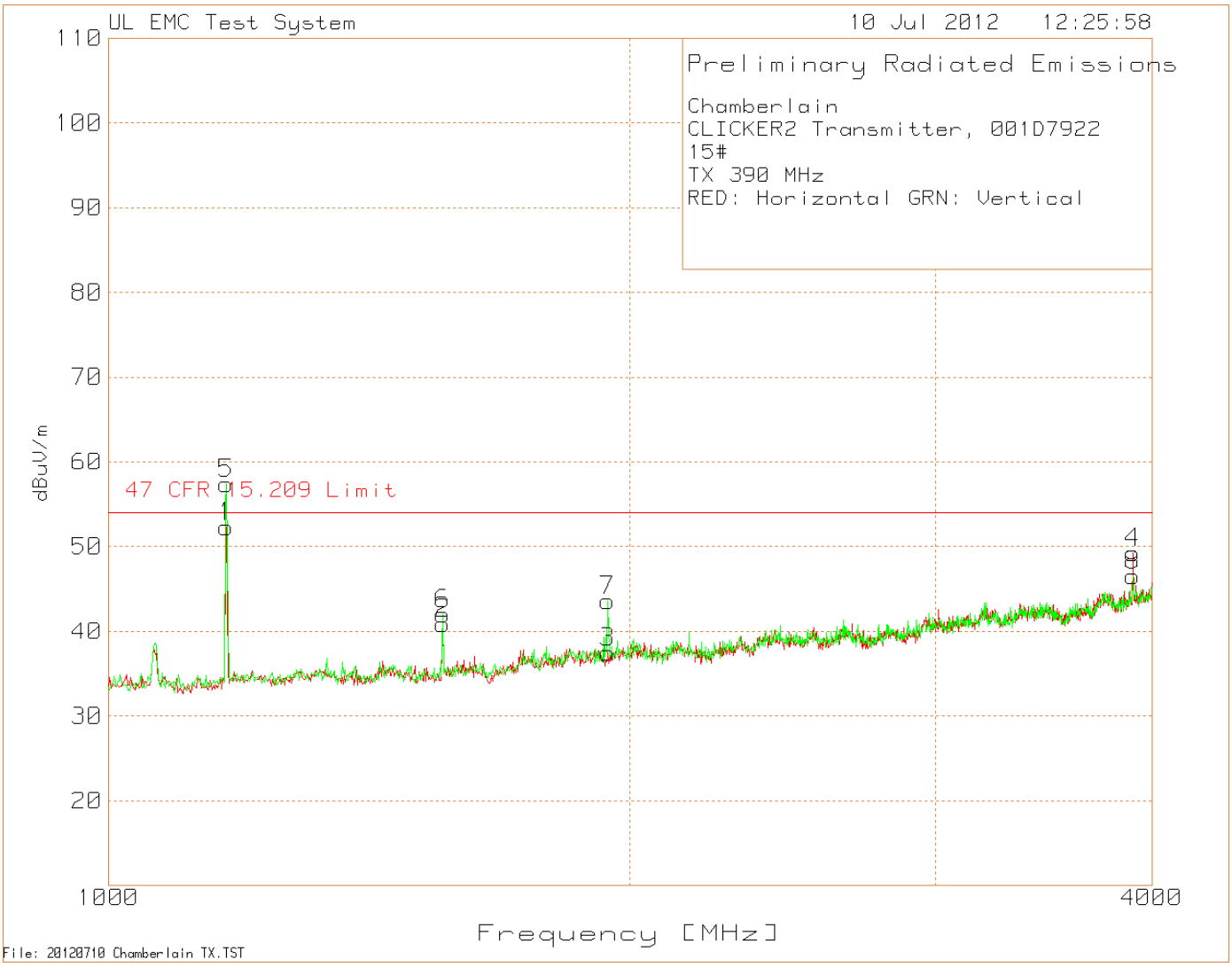


Table 100 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.0072	54.59	PK	16.1	2.3	72.99	-9.75	63.24	79.24	-16	187	174	Horz	Y
390.0072	61.98	PK	16.1	2.3	80.38	-9.75	70.63	79.24	-8.61	99	138	Vert	Y
780.012492	20.12	PK	21.8	3.4	45.32	-9.75	35.57	46	-10.43	348	112	Horz	Y
780.1466	8.61	PK	21.8	3.4	33.81	-9.75	24.06	46	-21.94	*	101	Vert	Y
1169.997	85.78	PK	24.8	-57.24	53.34	-9.75	43.59	54	-10.41	353	131	Horz	Y
1170.021	92.01	PK	24.8	-57.24	59.57	-9.75	49.82	54	-4.18	39	138	Vert	Y
1560.374	71.32	PK	25.2	-55.65	40.87	-9.75	31.12	54	-22.88	*	138	Horz	Y
1942.628	64.6	PK	27.4	-54.48	37.52	-9.75	27.77	54	-26.23	*	138	Horz	Y
3901.935	68.51	PK	32.7	-51.99	49.22	-9.75	39.47	54	-14.53	*	138	Horz	Y
1560.374	72.47	PK	25.2	-55.65	42.02	-9.75	32.27	54	-21.73	*	101	Vert	Y
1940.627	70.77	PK	27.4	-54.54	43.63	-9.75	33.88	54	-20.12	*	101	Vert	Y
3901.935	65.81	PK	32.7	-51.99	46.52	-9.75	36.77	54	-17.23	*	125	Vert	Y
* Prescan Data used													

4.15 Configuration 11# Test Data

4.15.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 101 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

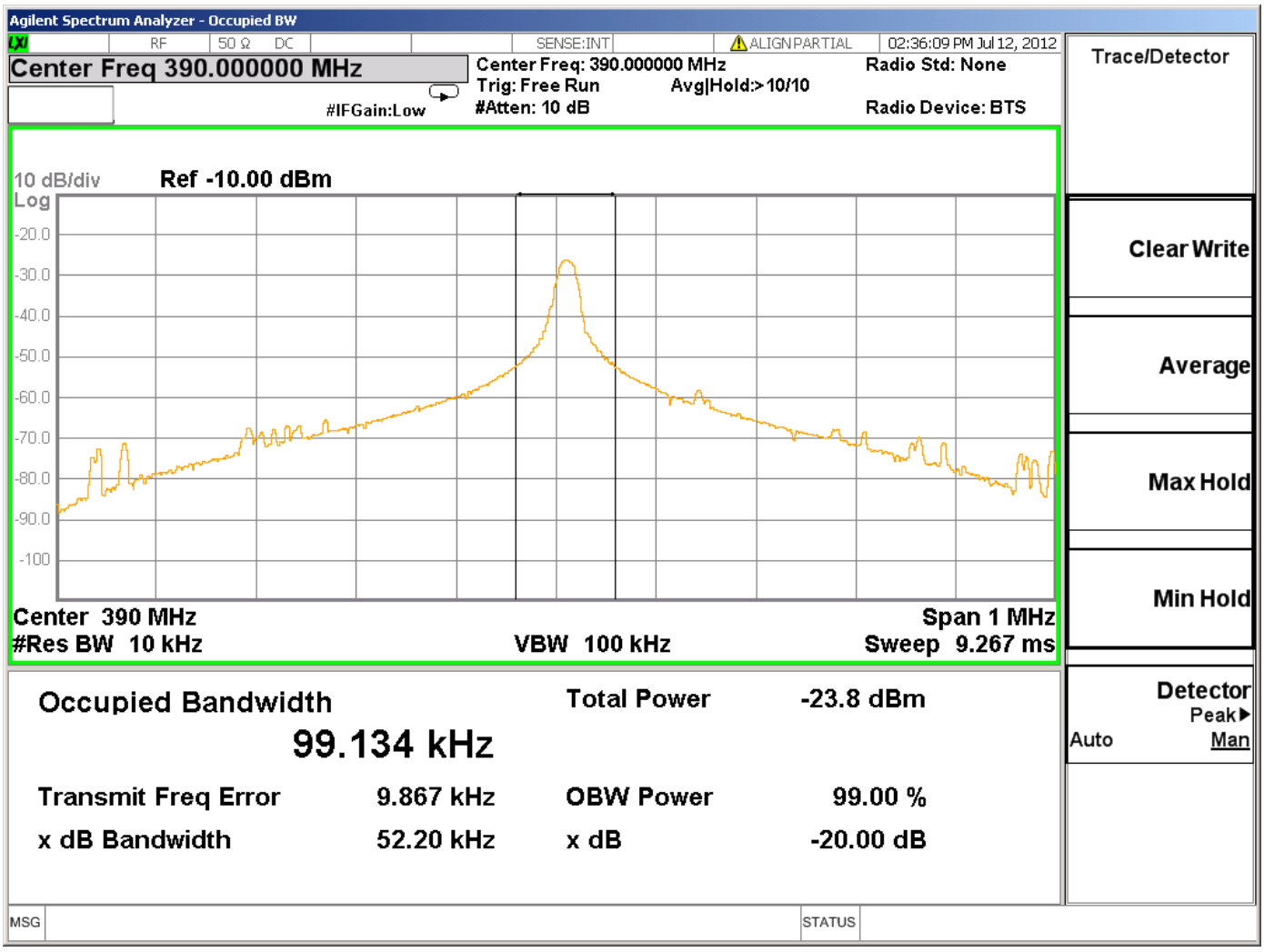
Table 102 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 103 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	52.2	99.134

Figure 79 – Bandwidth Graph



4.15.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 104 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 80 Cease Operation Graph

4.15.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

Table 105 Pulse Train Configuration Settings

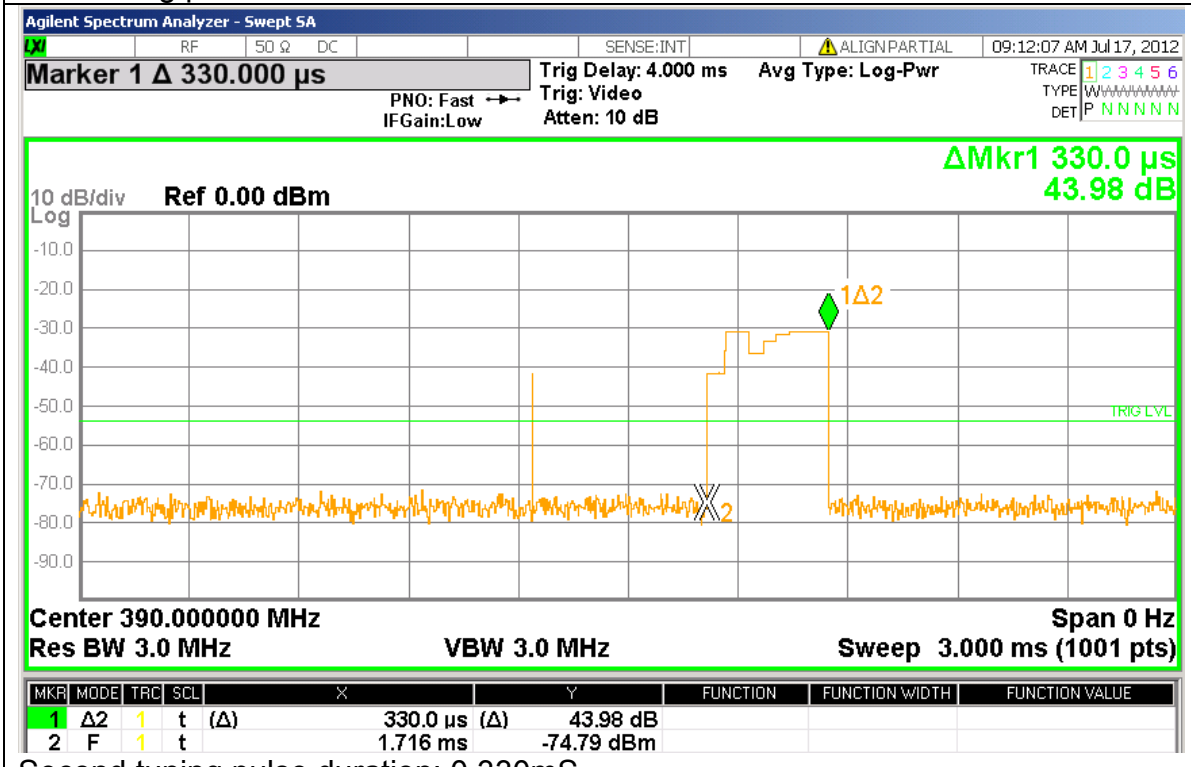
Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Table 106 Pulse Train Calculation

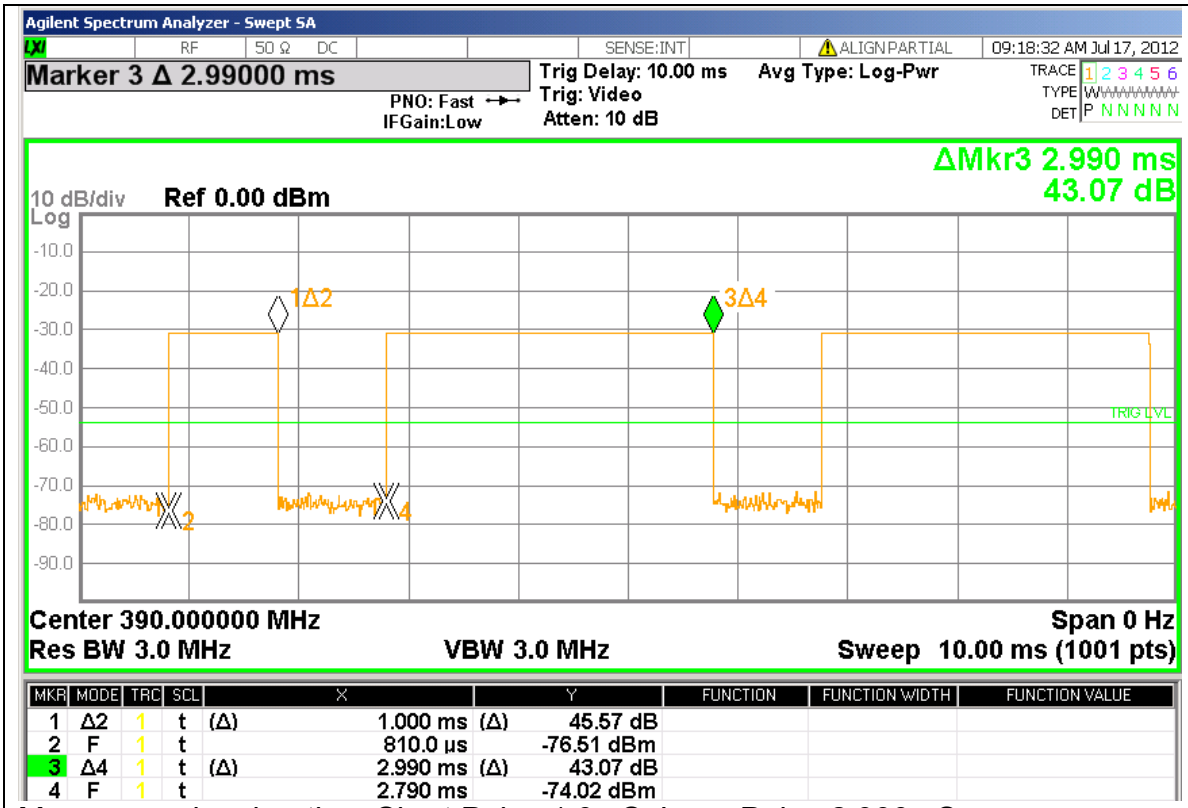
TX Frequency	Total TX time	Total Transmission period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
390MHz	(2x1.0)+(9x2.990)	80.3ms	-8.87
Worst Case Duty Cycle: Worst case duty cycle was calculated over one period of 80.3mS and it did not include the tuning pulses. Manufacturer declared duty cycle was -9.13dB. The measured duty cycle is used for all radiated emissions data.			

Figure 81 Pulse Train Graphs

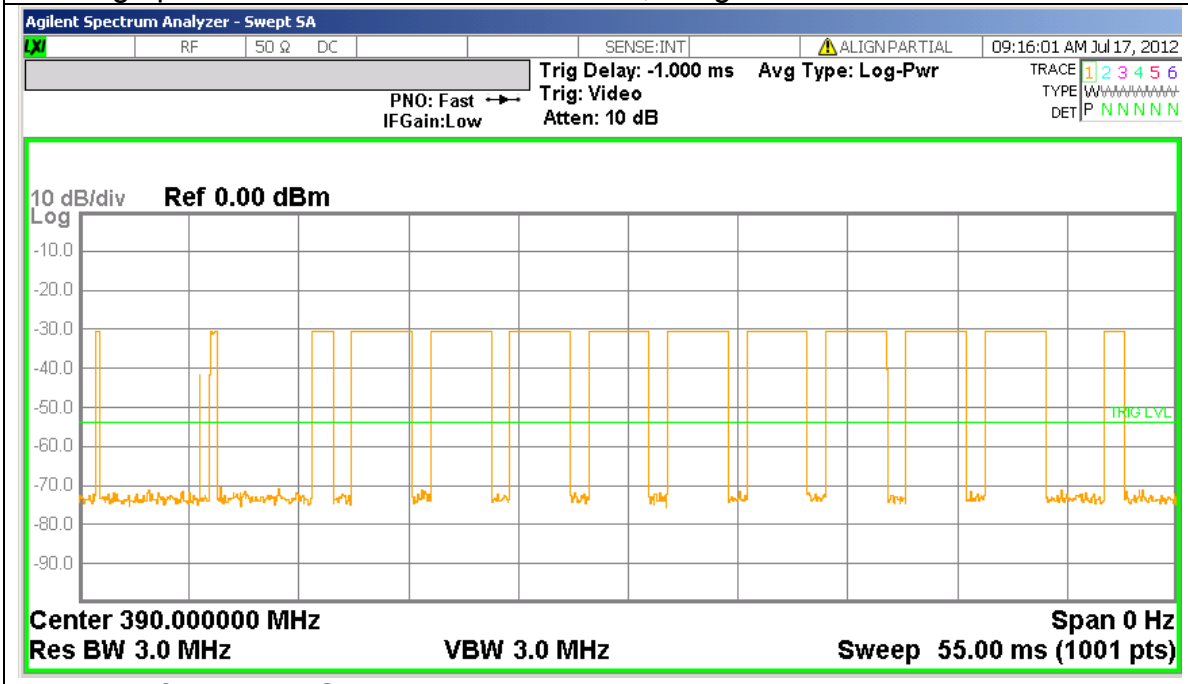
First tuning pulse duration: 0.177mS



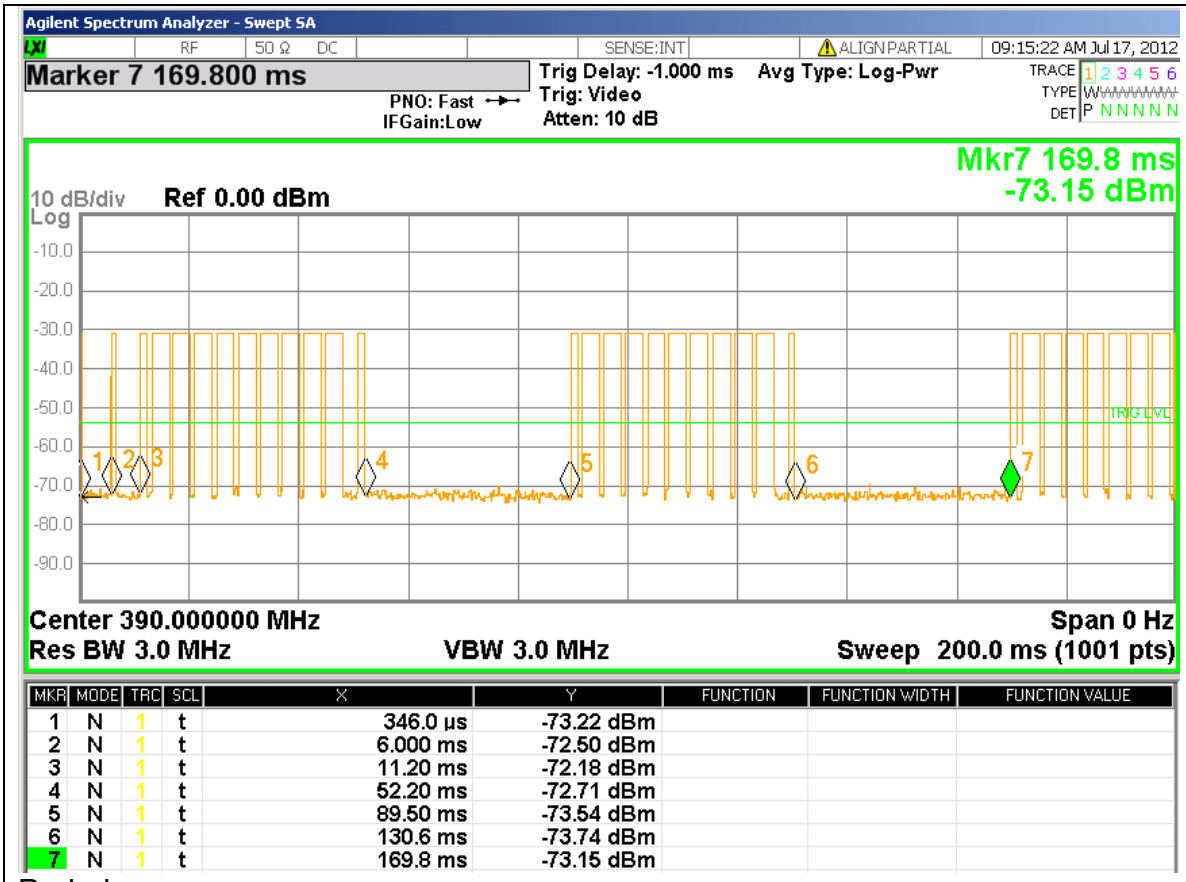
Second tuning pulse duration: 0.330mS



Message pulse duration: Short Pulse 1.0mS, Long Pulse 2.990mS



Number of Pulses: 2 Short, 9 Long



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	346.0 µs	-73.22 dBm			
2	N	1	t	6.000 ms	-72.50 dBm			
3	N	1	t	11.20 ms	-72.18 dBm			
4	N	1	t	52.20 ms	-72.71 dBm			
5	N	1	t	89.50 ms	-73.54 dBm			
6	N	1	t	130.6 ms	-73.74 dBm			
7	N	1	t	169.8 ms	-73.15 dBm			

Period scan

4.15.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.15.3 for duty cycle information.

Figure 82 Radiated Emissions Graph (Below 1GHz)

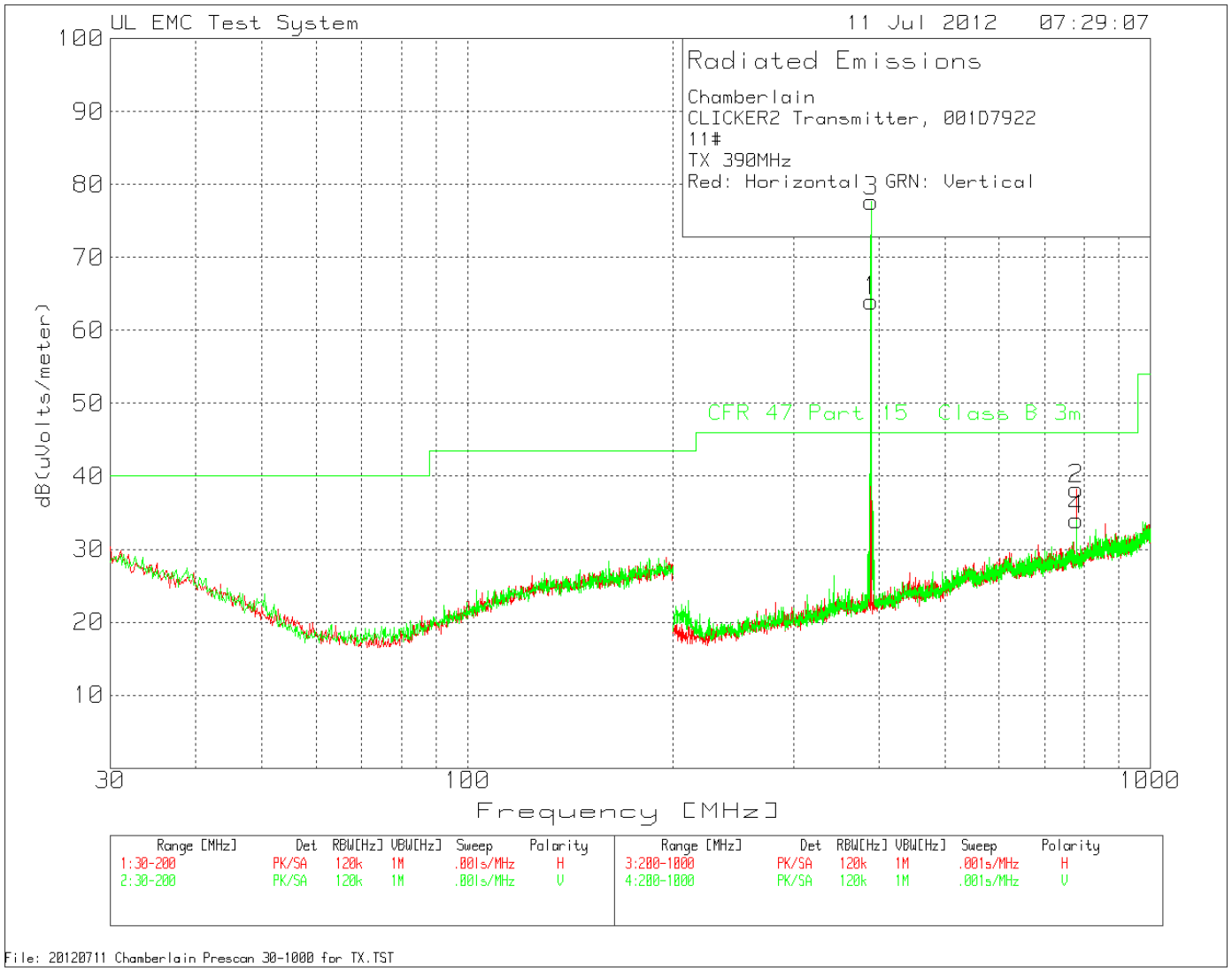


Figure 83 Radiated Emissions Graph (Above 1GHz)

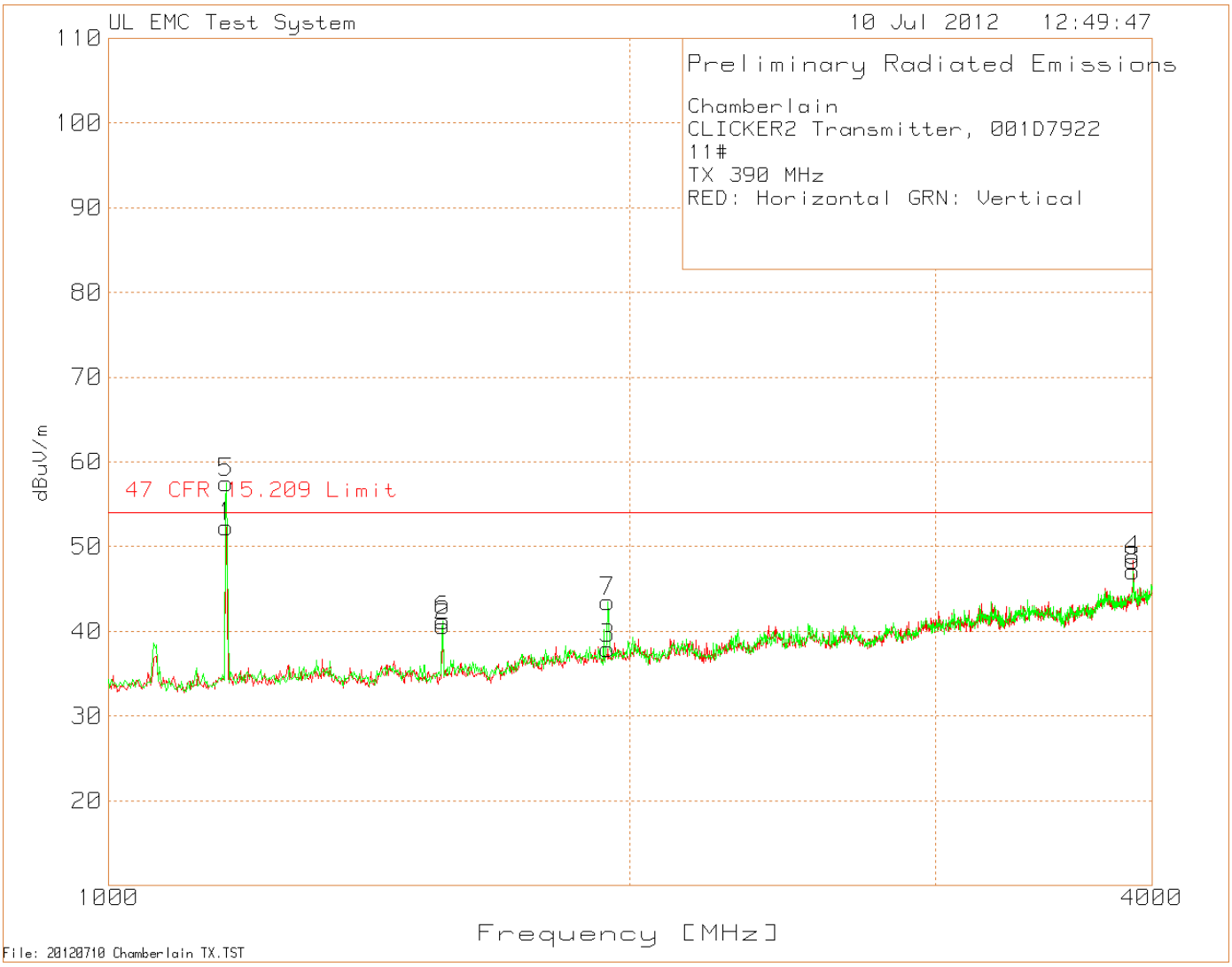


Table 107 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.0144	54.57	PK	16.1	2.3	72.97	-8.87	64.1	79.24	-15.14	184	175	Horz	Y
390.0144	61.9	PK	16.1	2.3	80.3	-8.87	71.43	79.24	-7.81	98	140	Vert	Y
780.0278	18.02	PK	21.8	3.4	43.22	-8.87	34.35	46	-11.65	0	111	Horz	Y
779.3471	8.3	PK	21.8	3.4	33.5	-8.87	24.63	46	-21.37	*	101	Vert	Y
1170.0631	85.87	PK	24.8	-57.24	53.43	-8.87	44.56	54	-9.44	354	131	Horz	Y
1170.0812	91.62	PK	24.8	-57.24	59.18	-8.87	50.31	54	-3.69	47	135	Vert	Y
1560.374	71.14	PK	25.2	-55.65	40.69	-8.87	31.82	54	-22.18	*	138	Horz	Y
1942.628	65.01	PK	27.4	-54.48	37.93	-8.87	29.06	54	-24.94	*	125	Horz	Y
3901.935	67.69	PK	32.7	-51.99	48.4	-8.87	39.53	54	-14.47	*	138	Horz	Y
1560.374	71.73	PK	25.2	-55.65	41.28	-8.87	32.41	54	-21.59	*	101	Vert	Y
1942.628	70.57	PK	27.4	-54.48	43.49	-8.87	34.62	54	-19.38	*	125	Vert	Y
3901.935	66.42	PK	32.7	-51.99	47.13	-8.87	38.26	54	-15.74	*	125	Vert	Y
* Prescan Data Used													

4.16 Configuration 4# Test Data

4.16.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 108 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

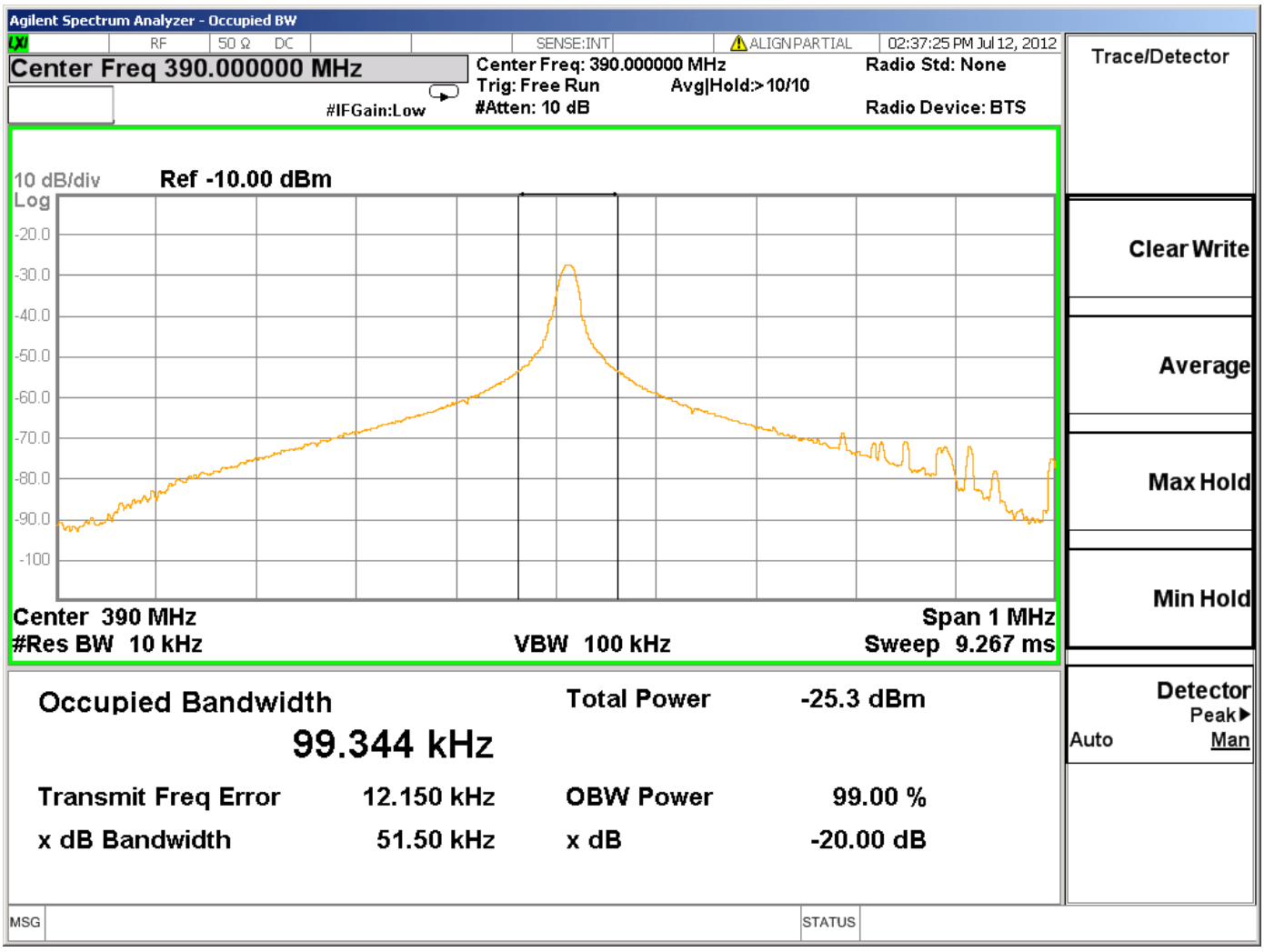
Table 109 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 110 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	51.50	99.344

Figure 84 – Bandwidth Graph



4.16.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 111 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 85 Cease Operation Graph

4.16.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

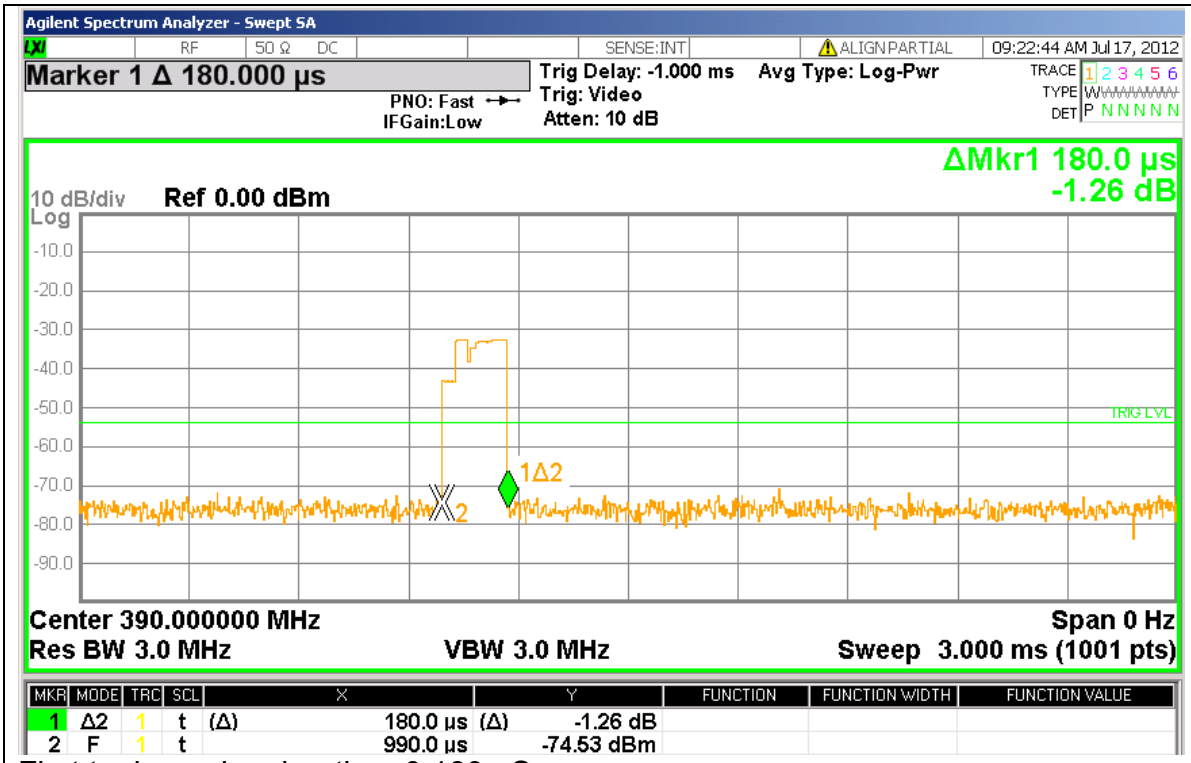
Table 112 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

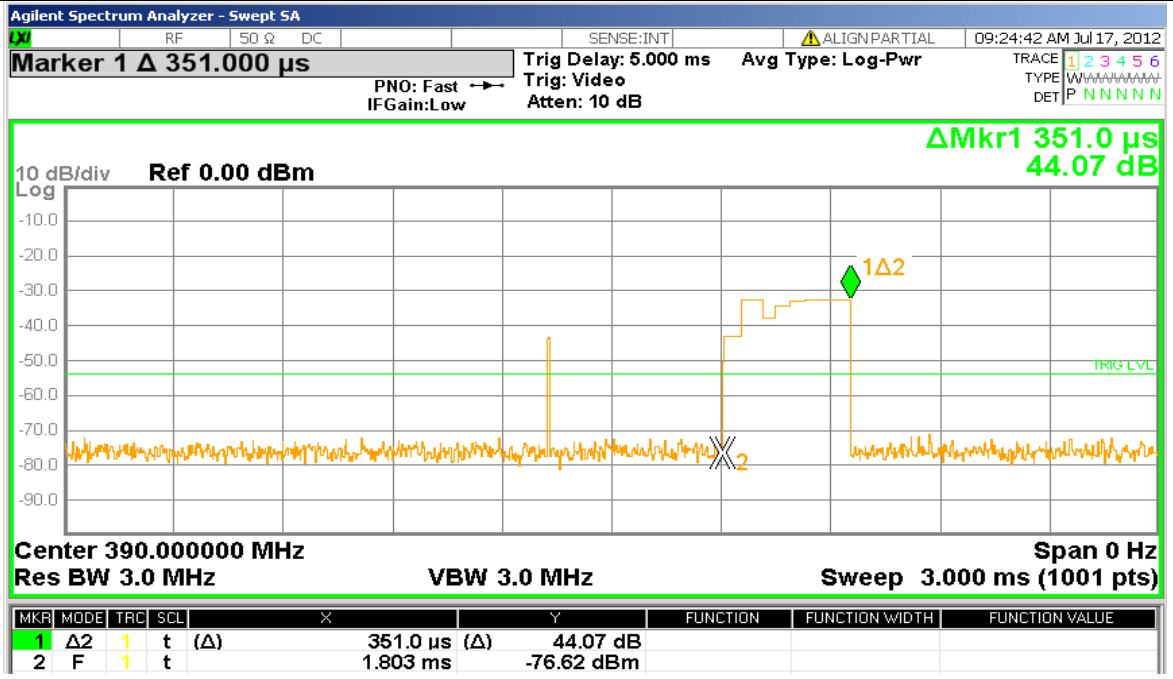
Table 113 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission Period or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
390MHz	(5x1.0mS)+(4x2.0mS)+(2x2.98mS)+6mS	100ms	-12.0
Worst Case Duty Cycle: -12dB, Worst case was calculated using transmit time over 100mS not including tuning pulses. The second message burst total transmit time was 18.96mS and six impulses from first burst were 6mS. Manufacturer declares worst case duty cycle as -6.74dB and this will be used for emission level calculation.			

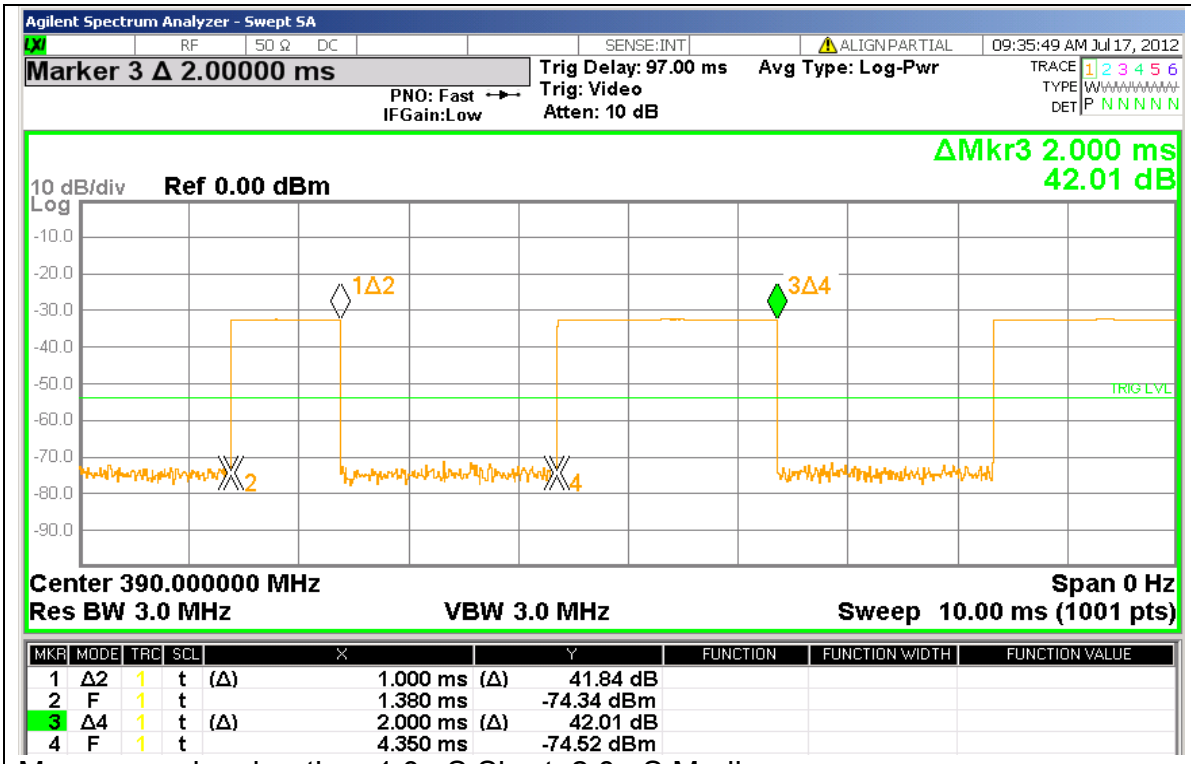
Figure 86 Pulse Train Graphs



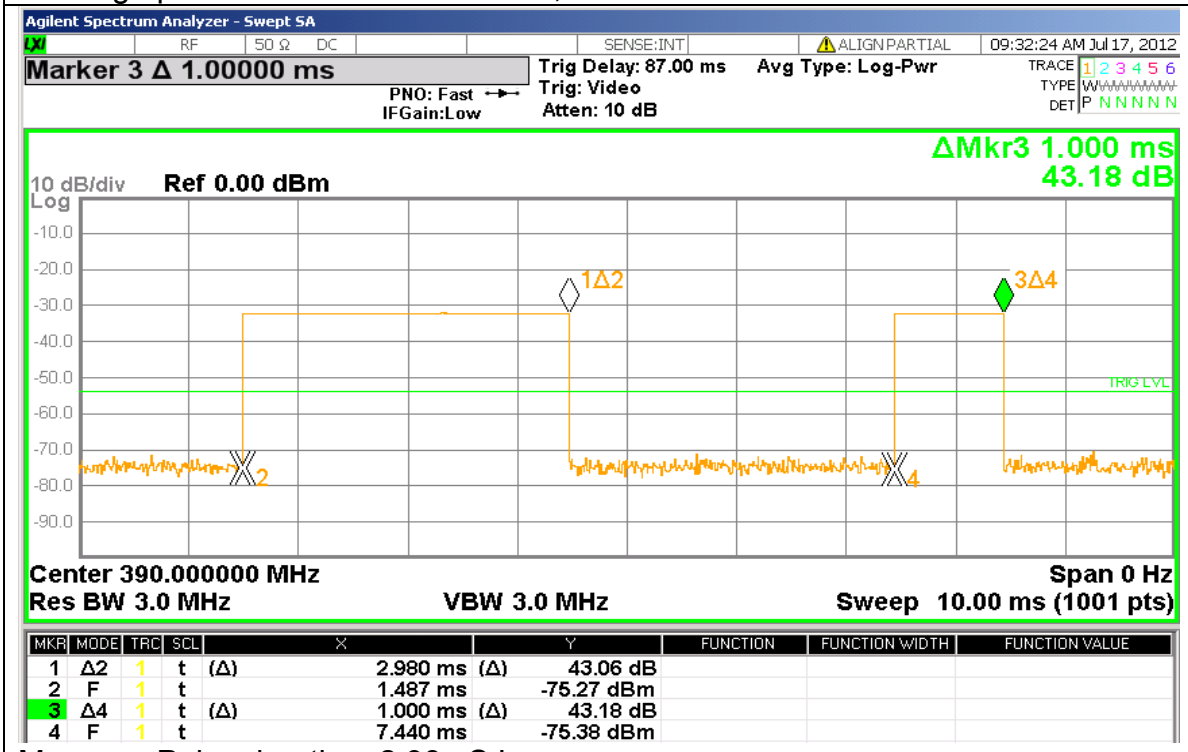
First tuning pulse duration: 0.180mS



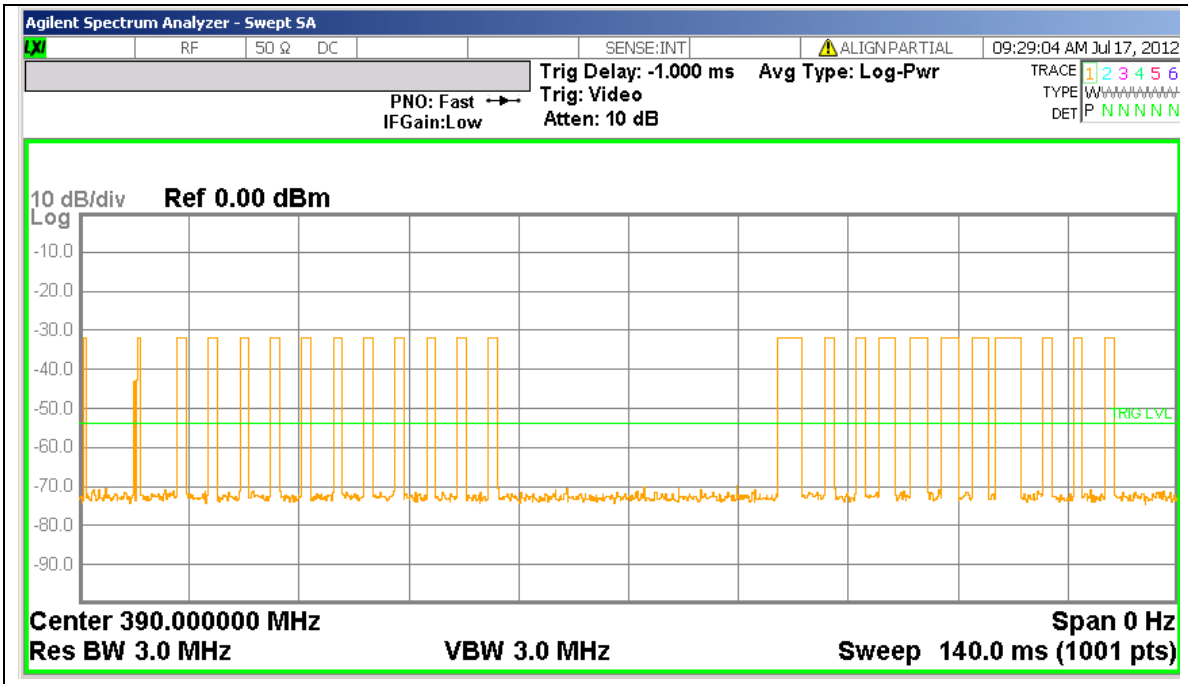
Second tuning pulse duration: 0.351mS



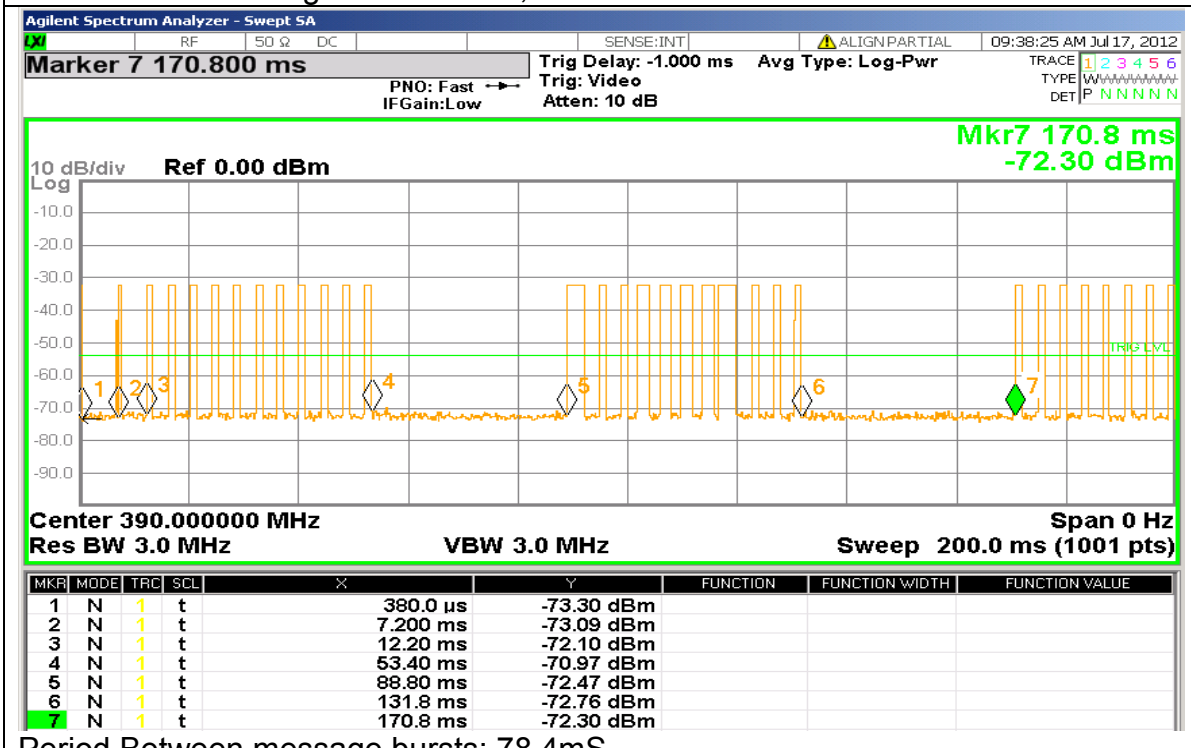
Message pulse duration: 1.0mS Short, 2.0mS Medium



Message Pulse duration: 2.98mS Long



Number of Pulses: First Burst – 11 short, Second Burst – 5 short, 4 medium, 2 long
Total TX first message burst: 11mS,



MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	t	380.0 µs	-73.30 dBm			
2	N	1	t	7.200 ms	-73.09 dBm			
3	N	1	t	12.20 ms	-72.10 dBm			
4	N	1	t	53.40 ms	-70.97 dBm			
5	N	1	t	88.80 ms	-72.47 dBm			
6	N	1	t	131.8 ms	-72.76 dBm			
7	N	1	t	170.8 ms	-72.30 dBm			

Period Between message bursts: 78.4mS

4.16.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.16.3 for duty cycle information.

Figure 87 Radiated Emissions Graph (Below 1GHz)

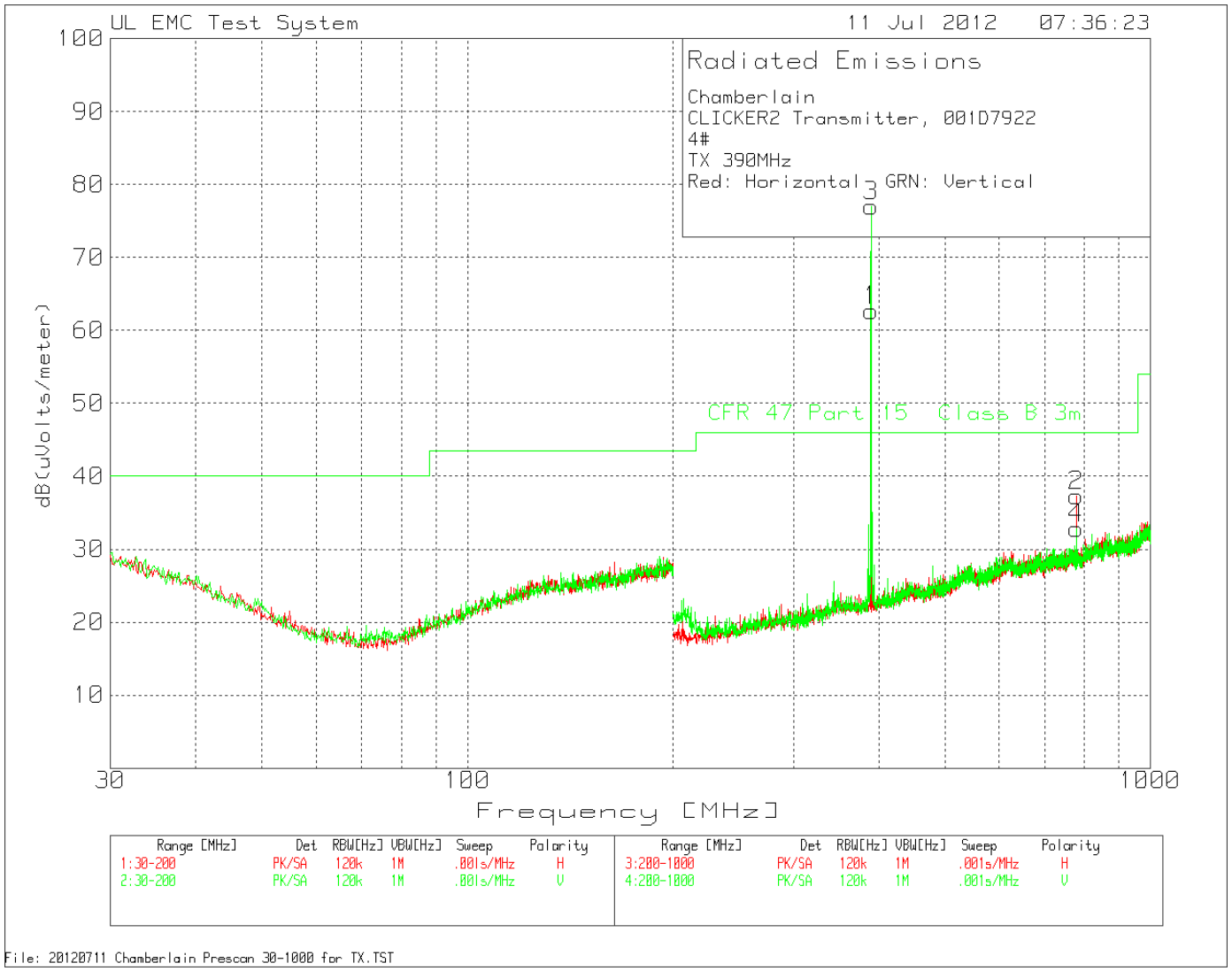


Figure 88 Radiated Emissions Graph (Above 1GHz)

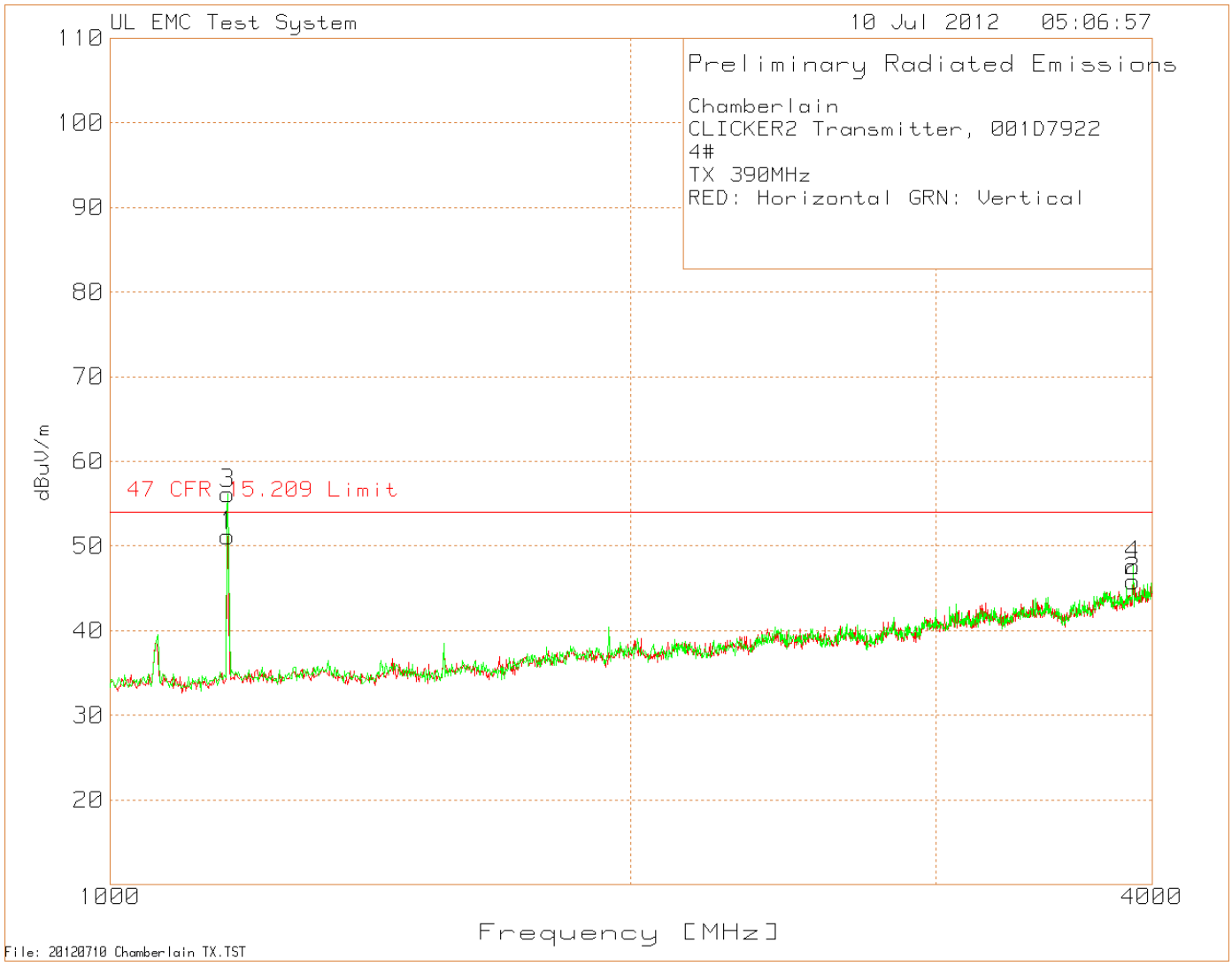


Table 114 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin dB	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.009615	52.4	PK	16.1	2.3	70.8	-6.74	64.06	79.24	-15.18	26	175	Horz	Y
390.009615	59.84	PK	16.1	2.3	78.24	-6.74	71.5	79.24	-7.74	119	141	Vert	Y
780.019231	15.75	PK	21.8	3.4	40.95	-6.74	34.21	46	-11.79	26	103	Horz	Y
780.019231	13.32	PK	21.8	3.4	38.52	-6.74	31.78	46	-14.22	89	133	Vert	Y
1170.1894	86.05	PK	24.8	-57.23	53.62	-6.74	46.88	54	-7.12	360	136	Horz	Y
1170.0331	89.77	PK	24.8	-57.24	57.33	-6.74	50.59	54	-3.41	71	136	Vert	Y
3901.935	65.1	PK	32.7	-51.99	45.81	-6.74	39.07	54	-14.93	*	140	Horz	Y
3901.935	66.96	PK	32.7	-51.99	47.67	-6.74	40.93	54	-13.07	*	125	Vert	Y
* Prescan Data used													

4.17 Configuration 13# Test Data

4.17.1 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the spectrum analyzer resolution bandwidth set per the appropriate standard.
Basic Standard	47 CFR Part 15.231(c)
Occupied Bandwidth Limits	
0.25% of Center Frequency (390MHz: 975.0kHz)	

Table 115 Occupied Bandwidth Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

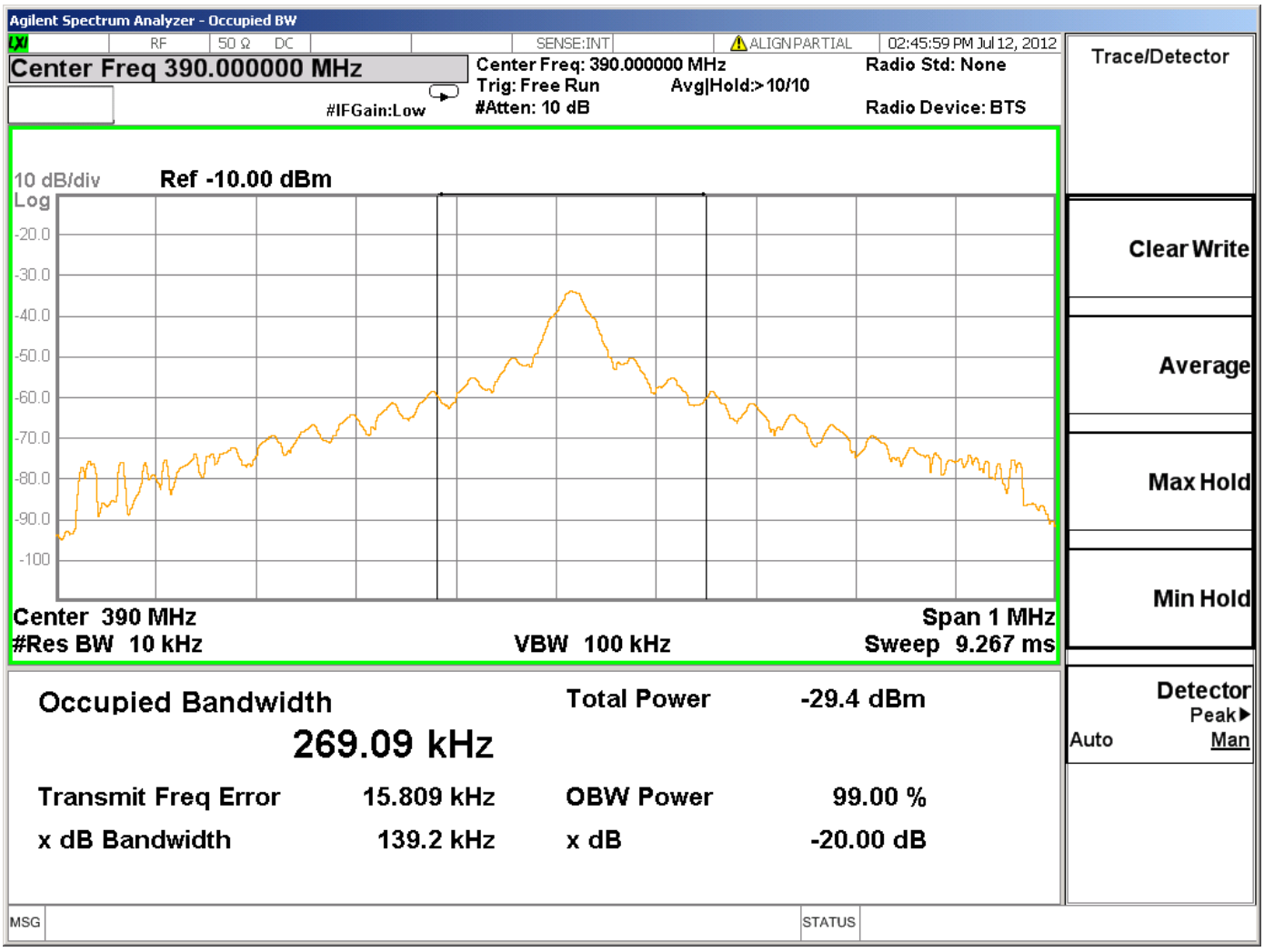
Table 116 Occupied Bandwidth Spectrum Analyzer Settings

Resolution Bandwidth	Occupied Bandwidth Requirements	
	dBc	% PWR
10kHz	-20	99
Supplementary information: None		

Table 117 Occupied Bandwidth Test Result Summary

Center Frequency	20dB BW Measured (kHz)	99% BW Measured (kHz)
390MHz	139.2	269.09

Figure 89 – Bandwidth Graph



4.17.2 Test Conditions and Results – Cease Operation

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The device was operated and the transmission time measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	47 CFR Part 15.231(a)
Cease Operation Limits	
The transmissions shall stop within 5 seconds of either a button being released or if automatically controlled transmissions shall be stopped 5 seconds after transmissions begin.	

Table 118 Cease Operation Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

Figure 90 Cease Operation Graph

4.17.3 Test Conditions and Results – Pulse Train

Test Description	Measurements were made in the laboratory environment. A Dipole (or equivalent) antenna tuned to the transmit frequency was attached to the input of a spectrum analyzer. The pulse train was measured with the spectrum analyzer set to zero span at the fundamental frequency.
Basic Standard	FCC Part 15 Subpart A, 15.35
Pulse Train Limits	
There are no limits for this test. This data is used to calculate the averaging correction factor that is applied to the measured peak radiated emissions results.	

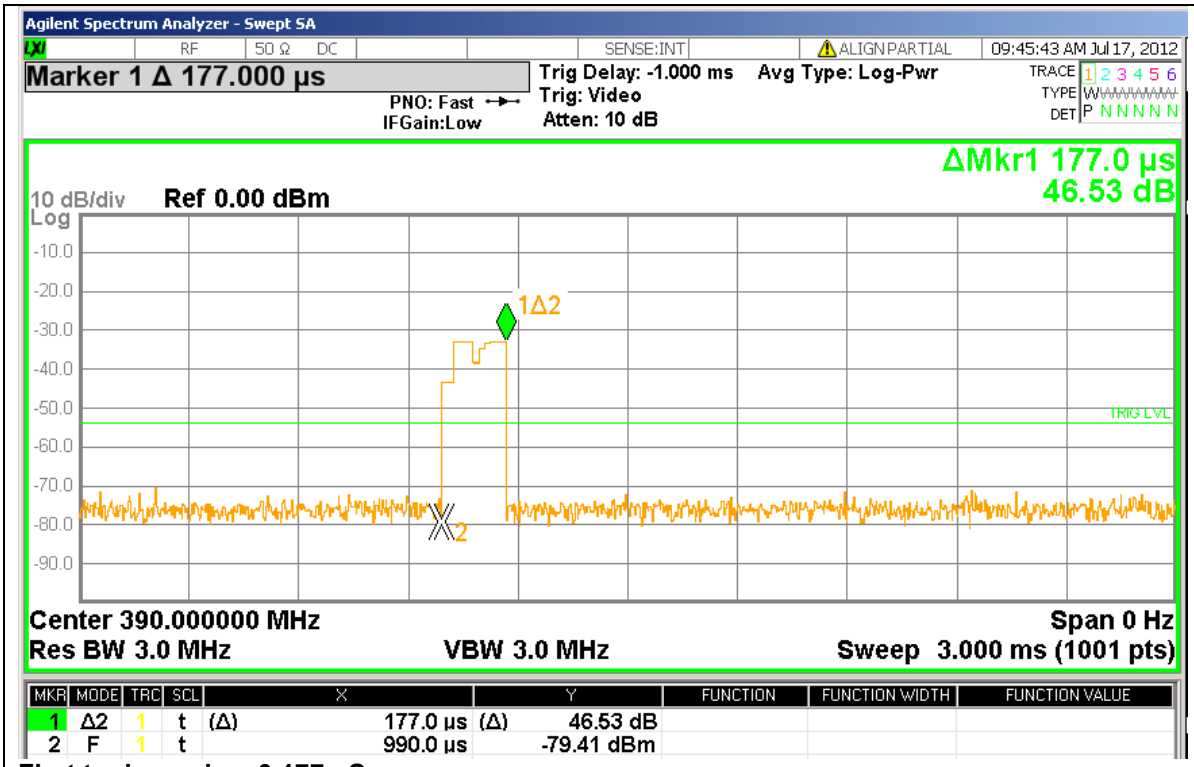
Table 119 Pulse Train Configuration Settings

Power Interface Mode #	EUT Configurations Mode #	EUT Operation Mode #
1	1	1
Supplementary information: None		

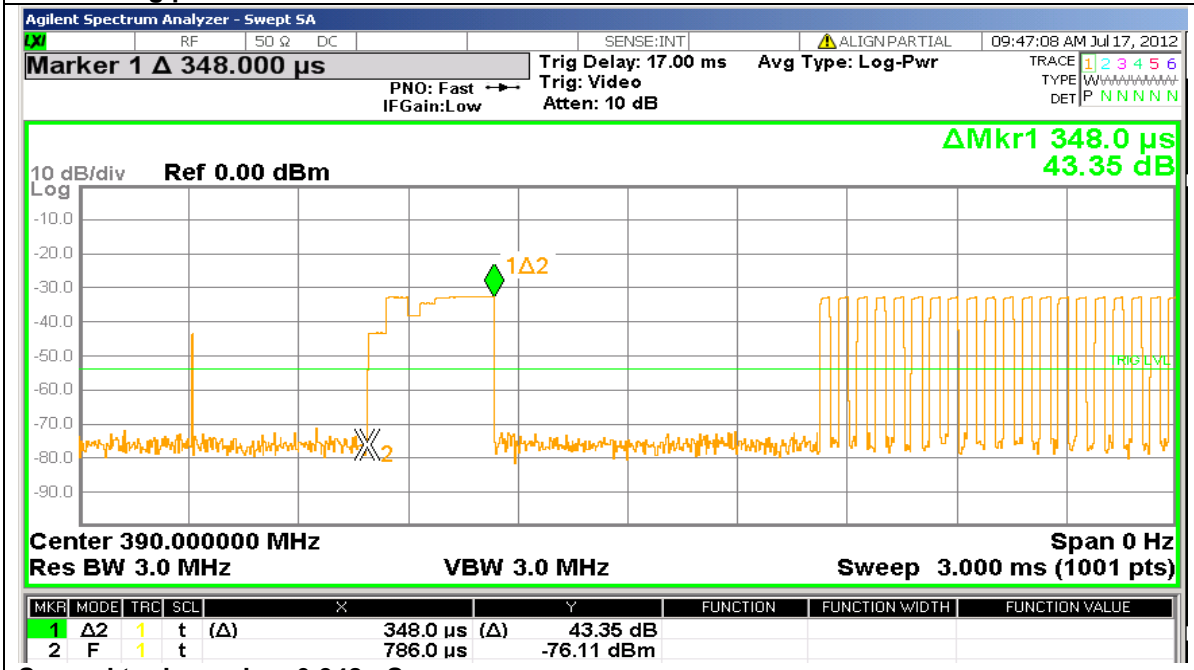
Table 120 Pulse Train Calculation

TX Frequency	Total TX time	Total Transmission time or 100ms whichever is lesser	DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$
390MHz	See below	100ms	-5.4dB
Worst Case Duty Cycle: Because of design the transmitter transmits very short on and off pulses where its not possible to capture a plot showing number of pulses over 100mS. The measured individual pulses show short pulse on time of 0.0276mS and long pulse on time of 0.0528mS. Respectively the off time between the short pulses is 0.0228mS and long pulses 0.0474mS. The number of short pulses is 32 where in the same amount of time the number of long pulses is 16. The on time of short pulses in first section is 0.8832mS and on time of long pulses in first section is 0.8448mS. In the same time the off time between short pulses is 0.7296mS and off time between long pulses is 0.7584mS. The total on time of short and long pulses is 1.728mS and off time in the same section is 1.486mS. This makes the estimated on time of 53.7% and it does not include the very short dip between series of bursts. Worst case duty cycle is calculated using the 53.7% on time over 100mS and its considered worst case and its used for all radiated emissions data. Manufacturer declared duty cycle is 6dB.			

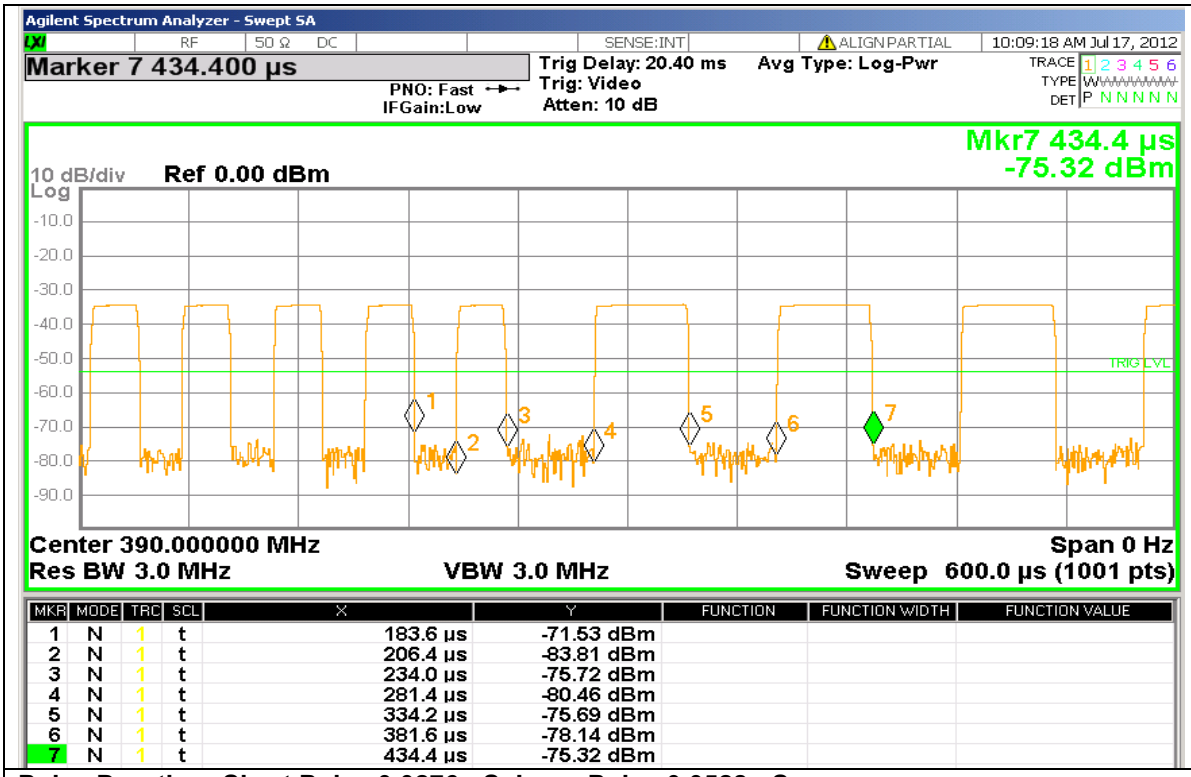
Figure 91 Pulse Train Graphs



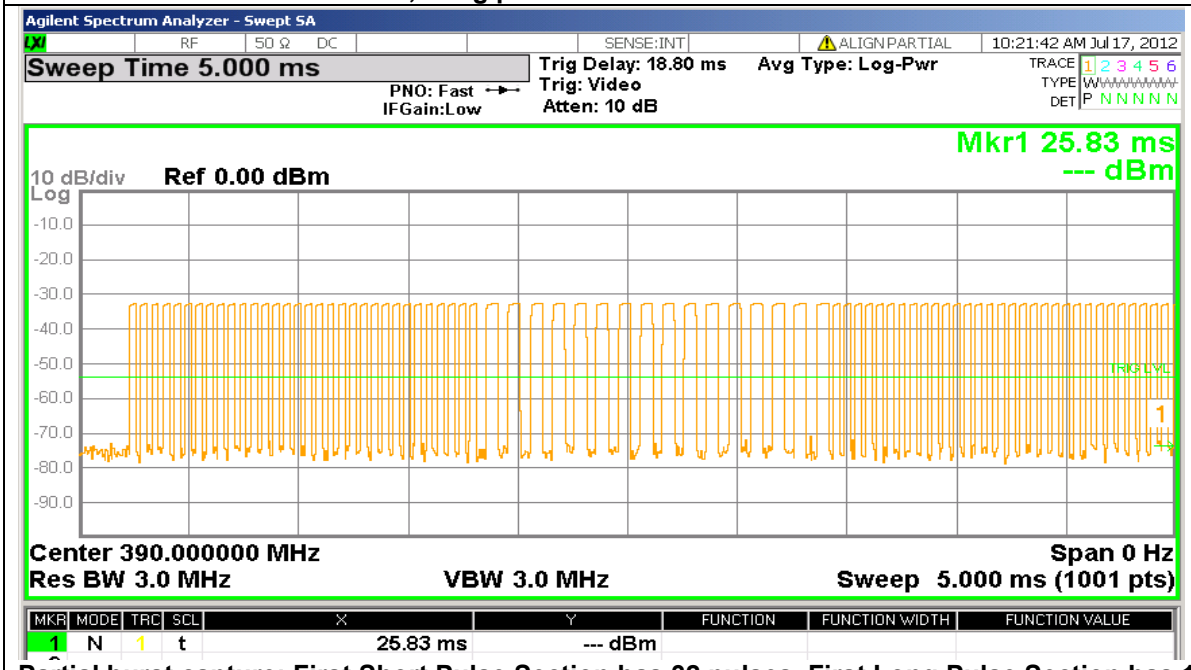
First tuning pulse: 0.177mS



Second tuning pulse: 0.348mS



Pulse Duration: Short Pulse 0.0276mS, Long Pulse 0.0528mS
Short Pulse off time: 0.0228mS, Long pulse off time: 0.0474mS



Partial burst capture: First Short Pulse Section has 32 pulses, First Long Pulse Section has 16 pulses.

4.17.4 Test Conditions and Results – RADIATED EMISSIONS Fundamental and Spurious

Test Description	Measurements were made in a 10-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4:2003. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3-meter as noted. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.		
Basic Standard	47 CFR Part 15 subpart C, and RSS-210		
UL LPG	80-EM-S0029		
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	30MHz – 1GHz	3 meter distance	
	1GHz – 4GHz	3 meter distance	

Restricted Band Limits

Frequency (MHz)	Limit (dBµV/m)	
	Quasi-Peak	Peak
30 - 88	40.00	NA
88 - 216	43.52	NA
216 - 960	46.02	NA
960 - 1000	54	NA
Above 1000 (FCC)	NA	54 (at 3-meter)

Fundamental Frequency Limits and Non-restricted band Harmonic Limits

Frequency (MHz)	Limit (dBµV/m) @ 3m distance All harmonics except those in restricted bands must be attenuated by 20dB or more	
	Average - Fundamental	Peak - Fundamental
390	79.24	99.24

Supplementary information: See section 4.17.3 for duty cycle information.

Figure 92 Radiated Emissions Graph (Below 1GHz)

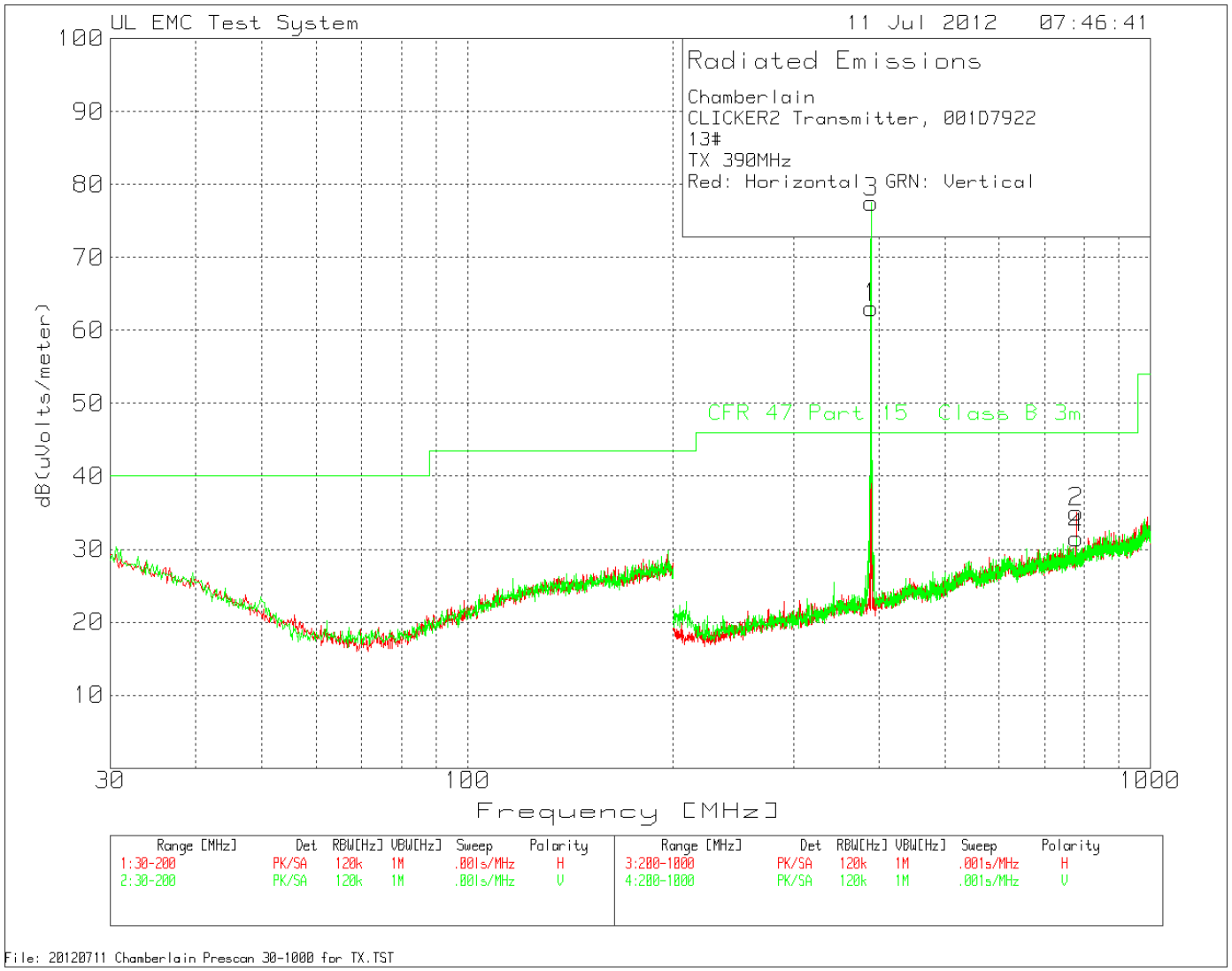


Figure 93 Radiated Emissions Graph (Above 1GHz)

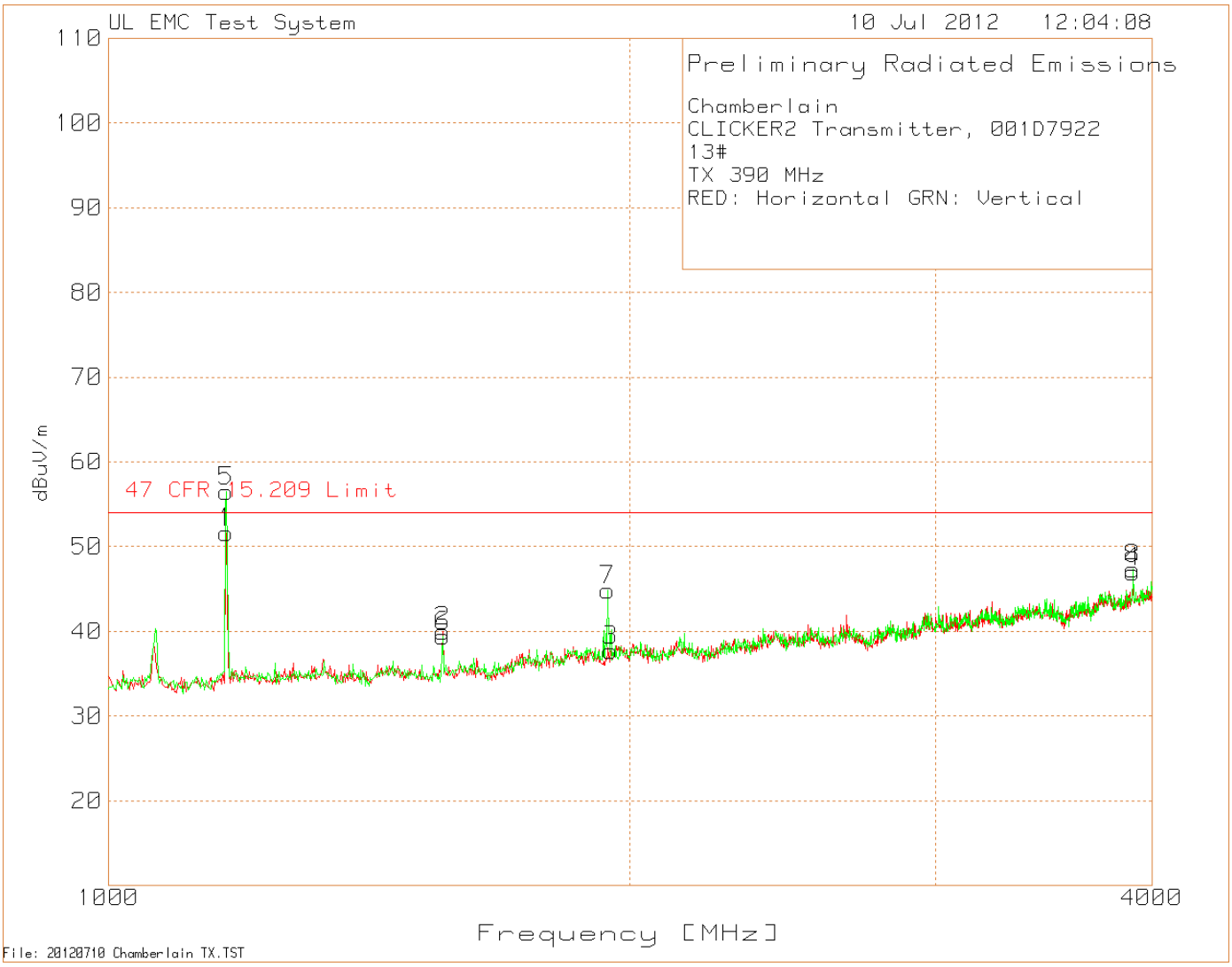


Table 121 - Radiated Emissions Data Points

Test Frequency	Meter Reading dBuV	Detector	Antenna Factor dB	Path Loss/Gain dB	Level dBuV/m	Duty Cycle Factor dB	Level with DC Factor dBuV/m	Limit @ 3m dBuV/m	Margin	Azimuth [Degs]	Height [cm]	Polarity	Axis
390.008803	53.29	PK	16.1	2.3	71.69	-5.4	66.29	79.24	-12.95	188	175	Horz	Y
390.008803	60.62	PK	16.1	2.3	79.02	-5.4	73.62	79.24	-5.62	88	141	Vert	Y
780.1466	11.38	PK	21.8	3.4	36.58	-5.4	31.18	46	-14.82	*	101	Horz	Y
780.946	8.22	PK	21.8	3.4	33.42	-5.4	28.02	46	-17.98	*	101	Vert	Y
1170.0872	86.26	PK	24.8	-57.24	53.82	-5.4	48.42	54	-5.58	360	131	Horz	Y
1169.8948	90.02	PK	24.8	-57.24	57.58	-5.4	52.18	54	-1.82	8	138	Vert	Y
1560.374	70.43	PK	25.2	-55.65	39.98	-5.4	34.58	54	-19.42	*	100	Horz	Y
1948.632	64.75	PK	27.4	-54.39	37.76	-5.4	32.36	54	-21.64	*	125	Horz	Y
3901.935	66.34	PK	32.7	-51.99	47.05	-5.4	41.65	54	-12.35	*	125	Horz	Y
1560.374	69.88	PK	25.2	-55.65	39.43	-5.4	34.03	54	-19.97	*	100	Vert	Y
1940.627	71.96	PK	27.4	-54.54	44.82	-5.4	39.42	54	-14.58	*	100	Vert	Y
3901.935	66.63	PK	32.7	-51.99	47.34	-5.4	41.94	54	-12.06	*	125	Vert	Y
* Prescan Data Used													

Appendix A

Test Equipment Used

Test Equipment Used for Near Field Measurements					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due Date
Spectrum analyzer	Agilent	PXA	EMC4360	20120515	20130515
Generic Loop Antenna	-	-	-	-	-

Test Equipment Used for Radiated Emissions					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due Date
EMI Test Receiver	Rohde & Schwarz	ESU	EMC4323	20111228	20121231
Bicon Antenna	Chase	VBA6106A	EMC4078	20120117	20130131
Log-P Antenna	Chase	UPA6109	EMC4258	20110927	20120928
Spectrum Analyzer	Rhode & Schwarz	FSEK	EMC4182	20111227	20121231
Antenna Array	UL	BOMS	EMC4276	20111227	20121231

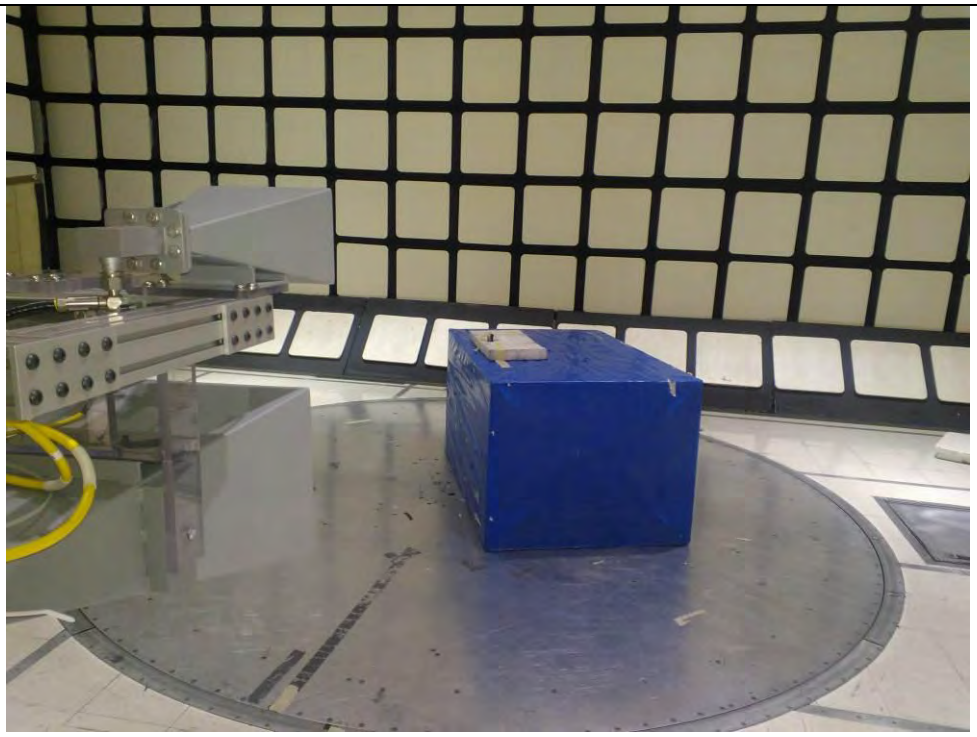
Appendix B

Test Setup Photos

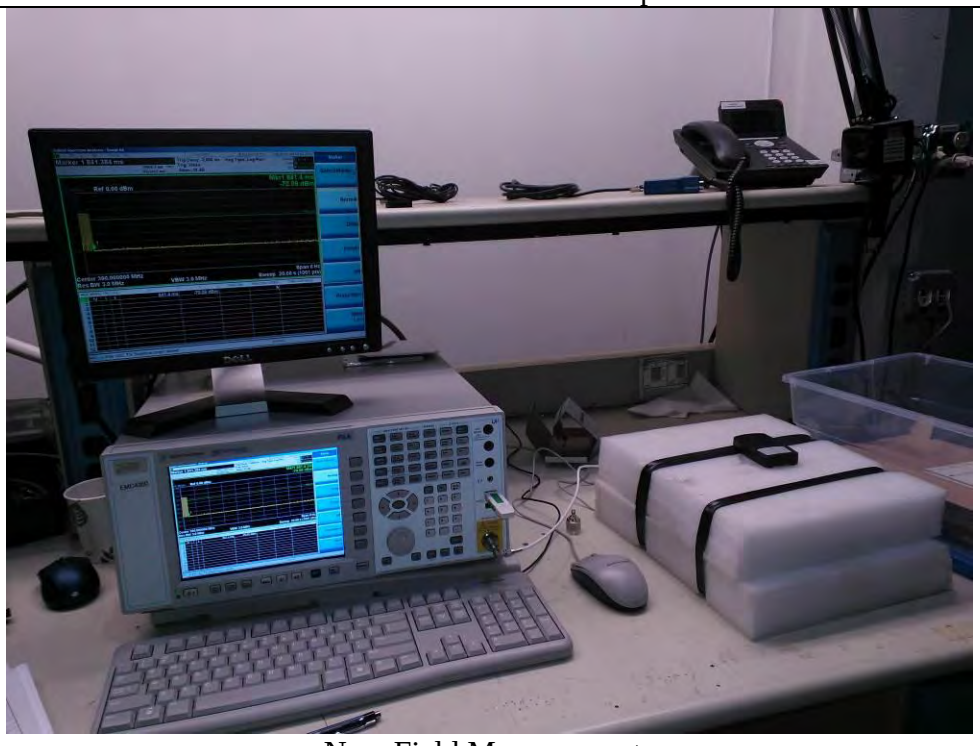
X-Axis Configuration

Y-Axis Configuration

Z-Axis Configuration



Radiated Emissions Setup



Near Field Measurements

Appendix C

Accreditations and Authorizations

NVLAP Lab code: 100414-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see http://ts.nist.gov/standards/scopes/1004140.htm

FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91044).

Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180

VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: Radiated Emissions R-621, Conducted Emissions C-642.

ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).

NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III (2-3). Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.
NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).
NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22), IEC 61000-4-2, -4-3, -4-4, -4-5, and -4-6