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Project #: 13N15794
Order Number: 10045101
Date: August 23, 2013
Model: 001D7973

Electromagnetic Compatibility Test Report

For

Chamberlain Group Inc.

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Test Report Details

Tests Performed By: **UL LLC**
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 Northbrook, IL 60062

Tests Performed For: **Chamberlain Group Inc.**
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Test Report Date: **August 23, 2013**

Product Type: **Remote Control**

Product standards **FCC Part 15, Subpart C, 15.231 & RSS-210**

Model Number: **001D7973**

EUT Category: **Wireless Device**

Testing Start Date: **July 30, 2013**

Date Testing Complete: **August 13, 2013**

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.

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Client Name: Chamberlain Group Inc.

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Report Revision History

| Revision Date | Description | Revised By | Revision Reviewed By |
|---------------|-------------|------------|----------------------|
| none | | | |

1.0 GENERAL - Product Description

1.1 Equipment Description

The Equipment Under Test (EUT) is a Universal Keypad used to remotely control 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. | 001D7973 | - |

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 | 9 | - | - | dc | - | Standard 9V Battery |

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 below, in wall-mount configuration. |

1.5 Rational for EUT Configuration

| Mode # | Description | | | | | | | | | | | | |
|--|--|-----------------|-----------|----|---------------------------------|---|---------------------------------|---|-----------------|---|-----------------|---|-----------------|
| 1 | Below is a list of possible configurations. Configurations that were not tested (configuration 5) had same power amplifier setting, same frequency and same duty cycle number as the ones above. The EUT can only be mounted in one position, no X, Y, Z-Axis were explored. | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>Configuration #</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>4*</td> <td>310MHz, 315MHz, 390MHz (E-Code)</td> </tr> <tr> <td>5</td> <td>310MHz, 315MHz, 390MHz (F-Code)</td> </tr> <tr> <td>1</td> <td>315MHz (D-Code)</td> </tr> <tr> <td>2</td> <td>390MHz (D-Code)</td> </tr> <tr> <td>3</td> <td>390MHz (B-Code)</td> </tr> </tbody> </table> | Configuration # | Frequency | 4* | 310MHz, 315MHz, 390MHz (E-Code) | 5 | 310MHz, 315MHz, 390MHz (F-Code) | 1 | 315MHz (D-Code) | 2 | 390MHz (D-Code) | 3 | 390MHz (B-Code) |
| Configuration # | Frequency | | | | | | | | | | | | |
| 4* | 310MHz, 315MHz, 390MHz (E-Code) | | | | | | | | | | | | |
| 5 | 310MHz, 315MHz, 390MHz (F-Code) | | | | | | | | | | | | |
| 1 | 315MHz (D-Code) | | | | | | | | | | | | |
| 2 | 390MHz (D-Code) | | | | | | | | | | | | |
| 3 | 390MHz (B-Code) | | | | | | | | | | | | |
| * Configuration 4 has the same power setting and duty cycle as configuration 5. Only configuration 4 was tested. | | | | | | | | | | | | | |

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 |

* Peak limit and margin to peak limit is not shown in the data. In all cases the duty cycle correction factor is less than 20dB thus no emission will be more than 20dB above the average level.

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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:

$$\text{Field Strength (dBuV/m)} = \text{Meter Reading (dBuV)} + \text{AF (dB/m)} + (-\text{Gain (dB)}) + \text{Cable Loss (dB)}$$

$$\text{Conducted Voltage (dBuV)} = \text{Meter Reading (dBuV)} + \text{Cable Loss (dB)} + \text{LISN IL (dB)}$$

$$\text{Conducted Current (dBuA)} = \text{Meter Reading (dBuV)} + \text{Cable Loss (dB)} - \text{Transducer Factor (dBohms)}$$

Measurement Uncertainty

| Test | Range | Equipment | Uncertainty k=2 |
|--------------------|-------------|---------------|-----------------|
| Radiated Emissions | 30-200MHz | Bicon 3m Horz | 3.30dB |
| Radiated Emissions | 30-130MHz | Bicon 3m Vert | 4.84dB |
| Radiated Emissions | 130-200MHz | Bicon 3m Vert | 4.94dB |
| Radiated Emissions | 200-1000MHz | LogP 3m Horz | 3.46dB |
| Radiated Emissions | 200-1000MHz | LogP 3m Vert | 4.98dB |
| Radiated Emissions | 1-6GHz | Horn | 5.02dB |

4.1 Configuration 4 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 (310MHz: 775.00kHz) | |
| | 0.25% of Center Frequency (315MHz: 787.50kHz) | |
| | 0.25% of Center Frequency (390MHz: 975.00kHz) | |

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) |
|------------------|------------------------|-----------------------|
| 310MHz | 427.68 | 101.48 |
| 315MHz | 404.68 | 101.97 |
| 390MHz | 403.47 | 105.51 |

Figure 1 – Bandwidth Graph 310MHz

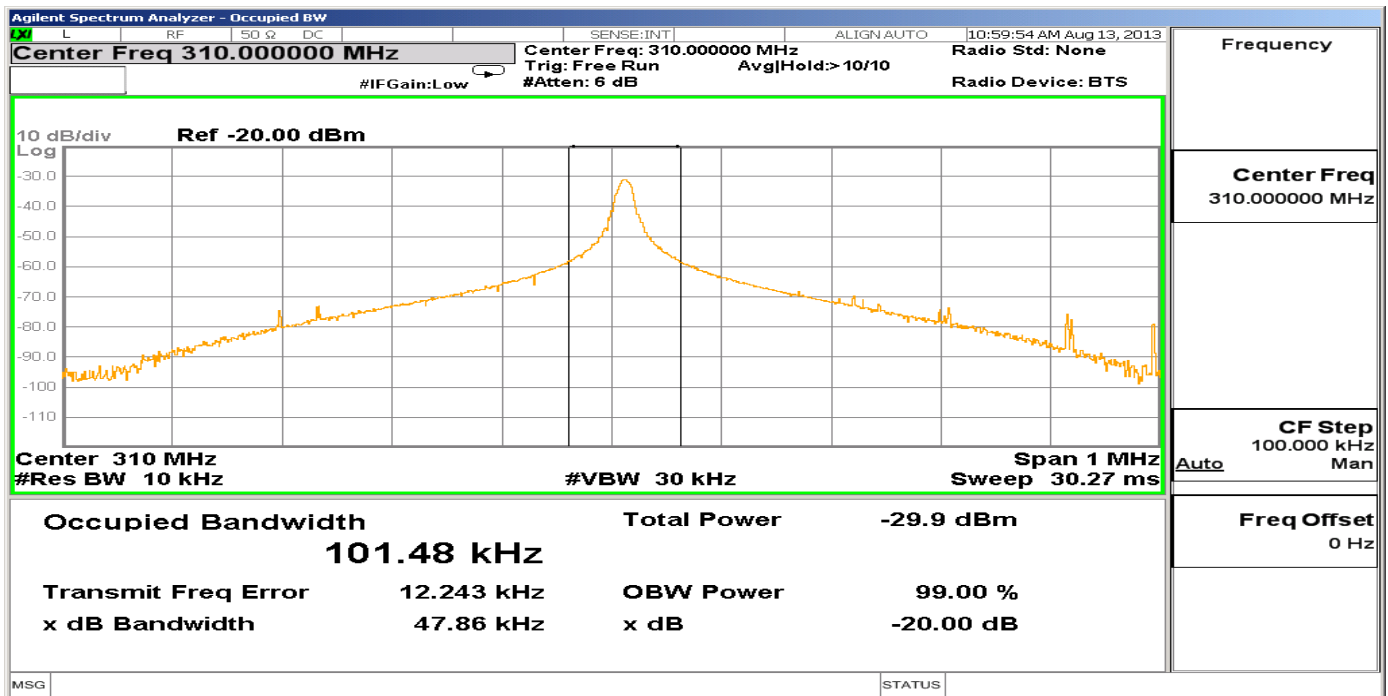
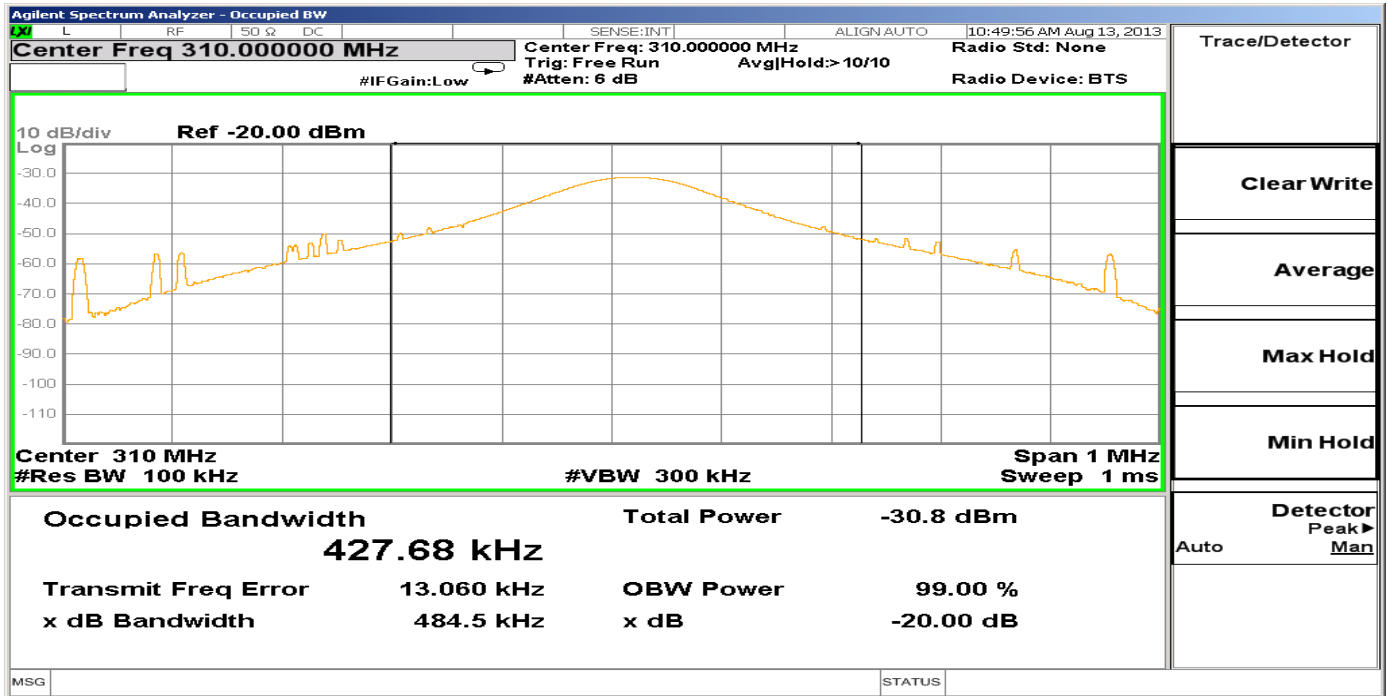


Figure 2 – Bandwidth Graph 315MHz

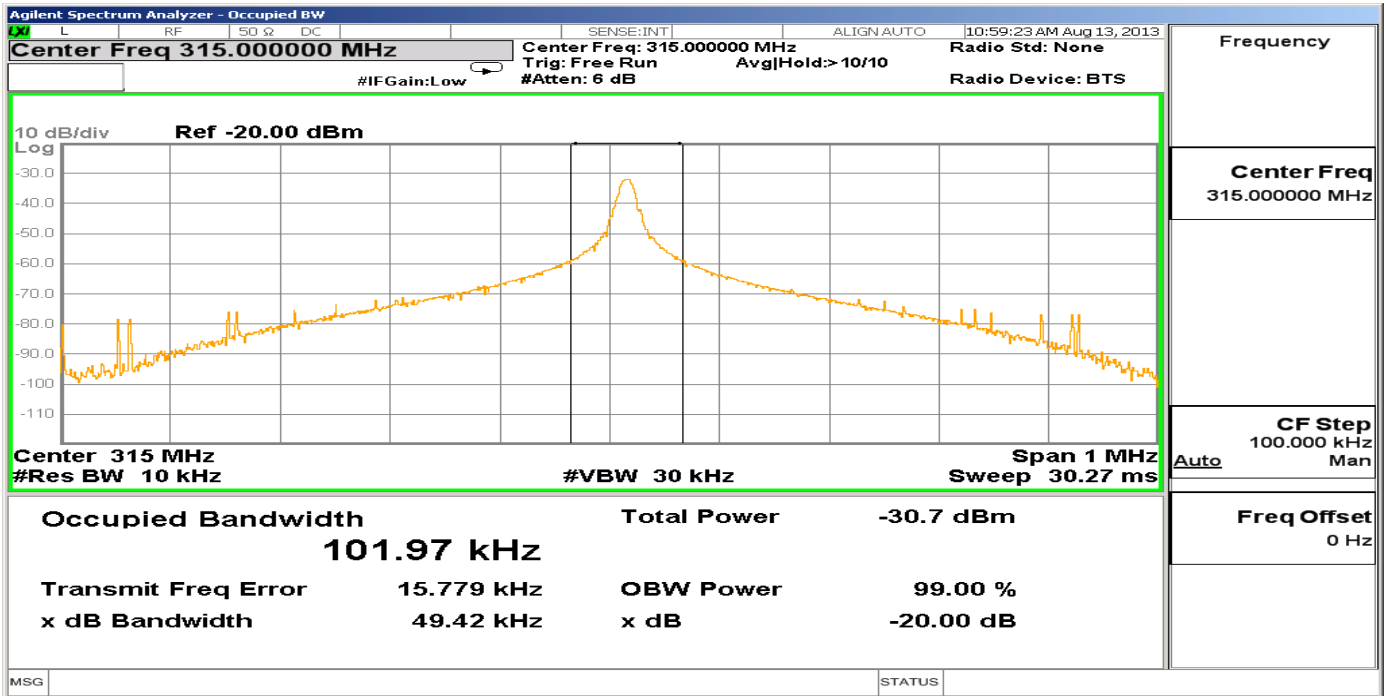
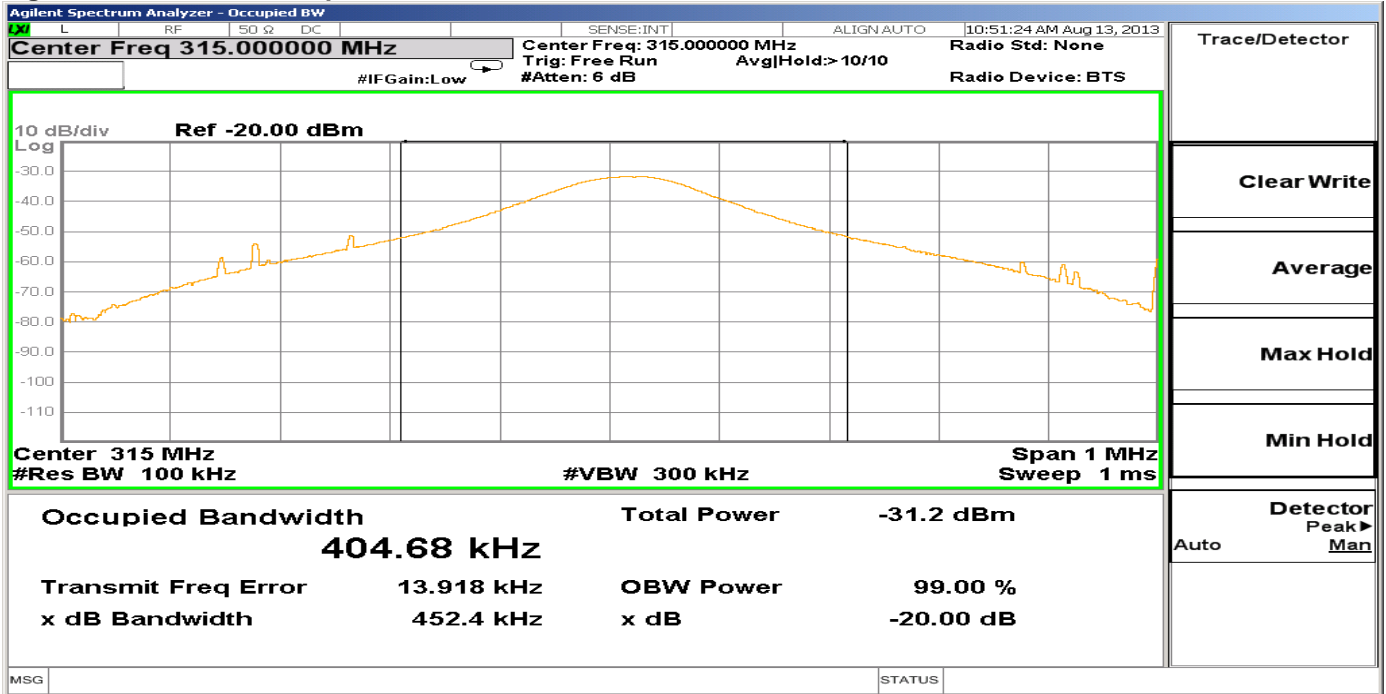
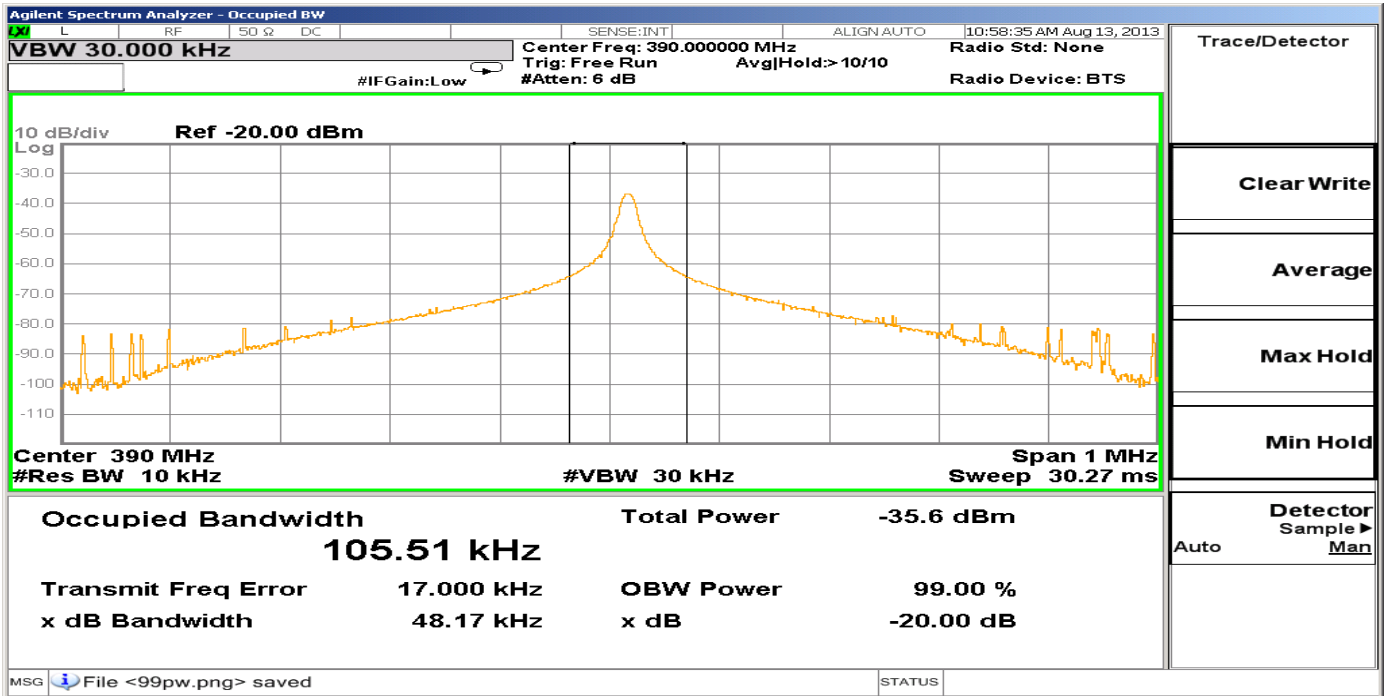
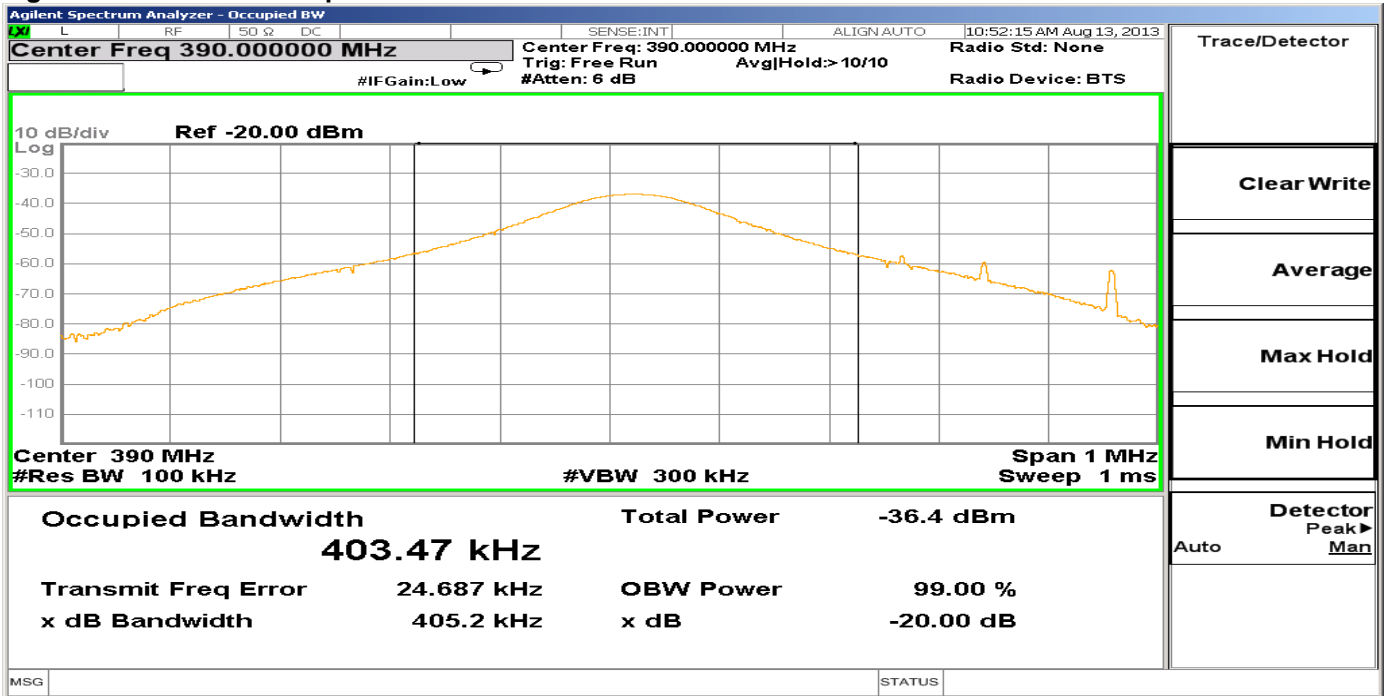


Figure 3 – Bandwidth Graph 390MHz



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 4 Cease Operation Graph 310MHz

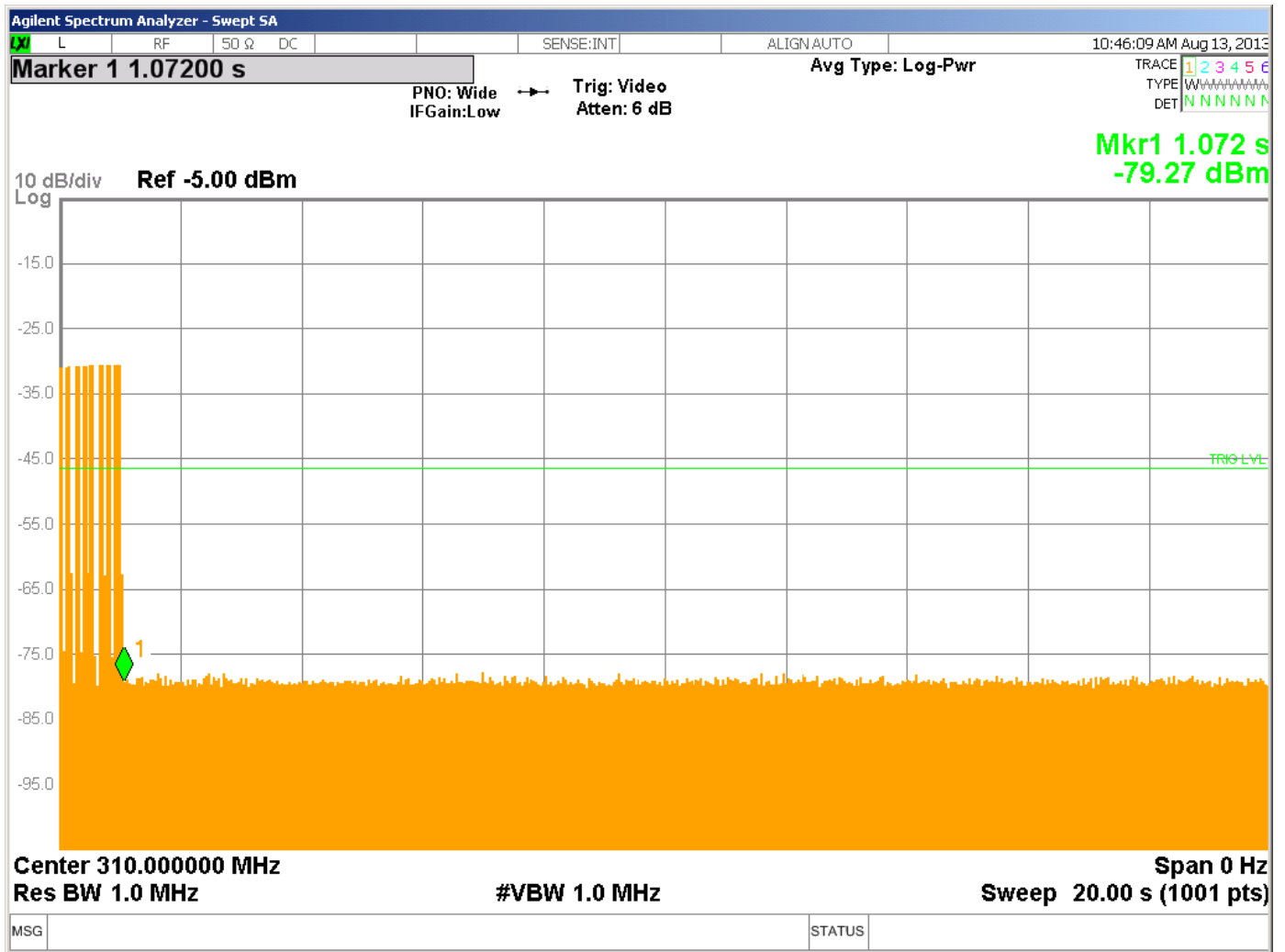


Figure 5 Cease Operation Graph 315MHz

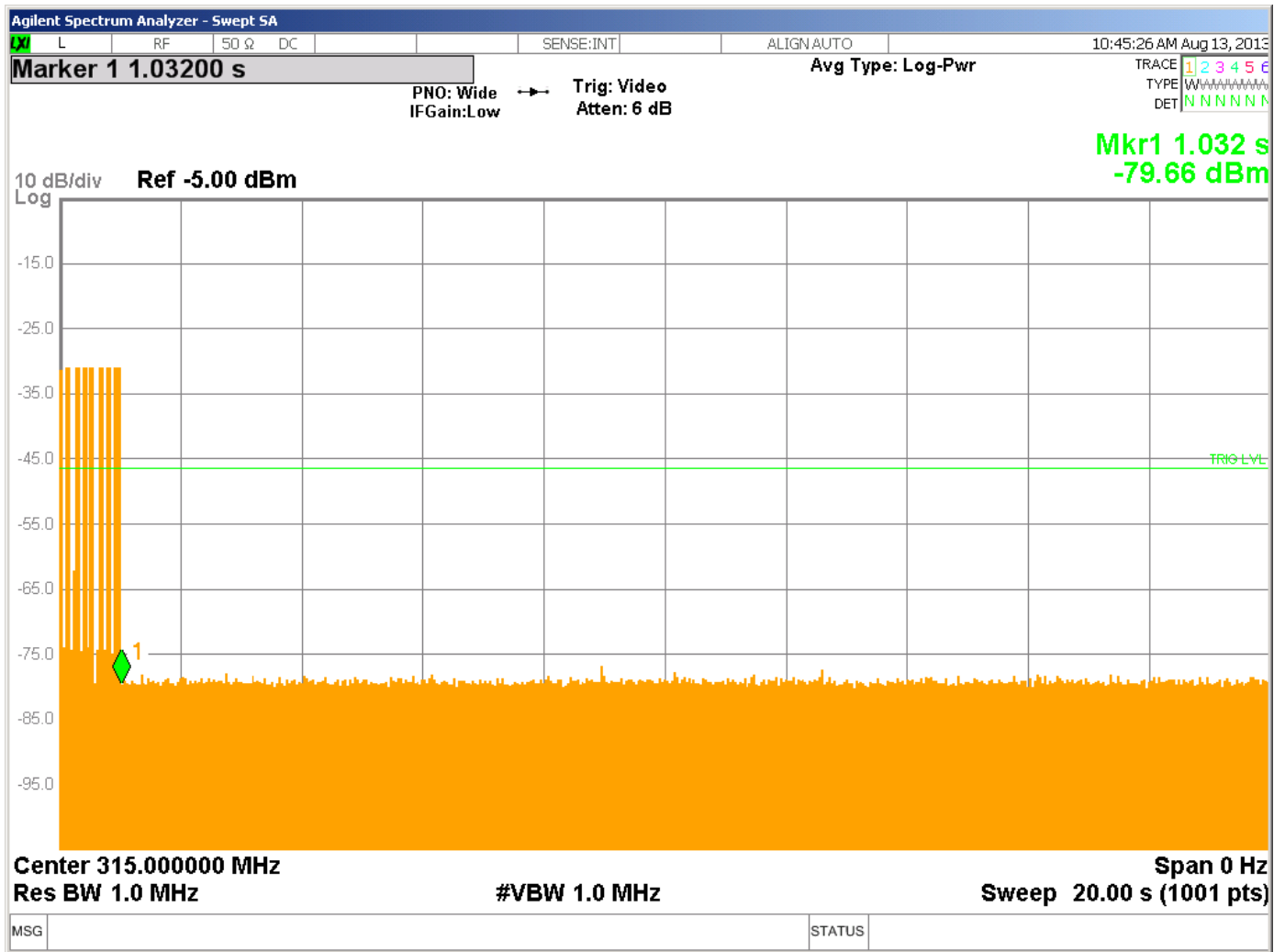
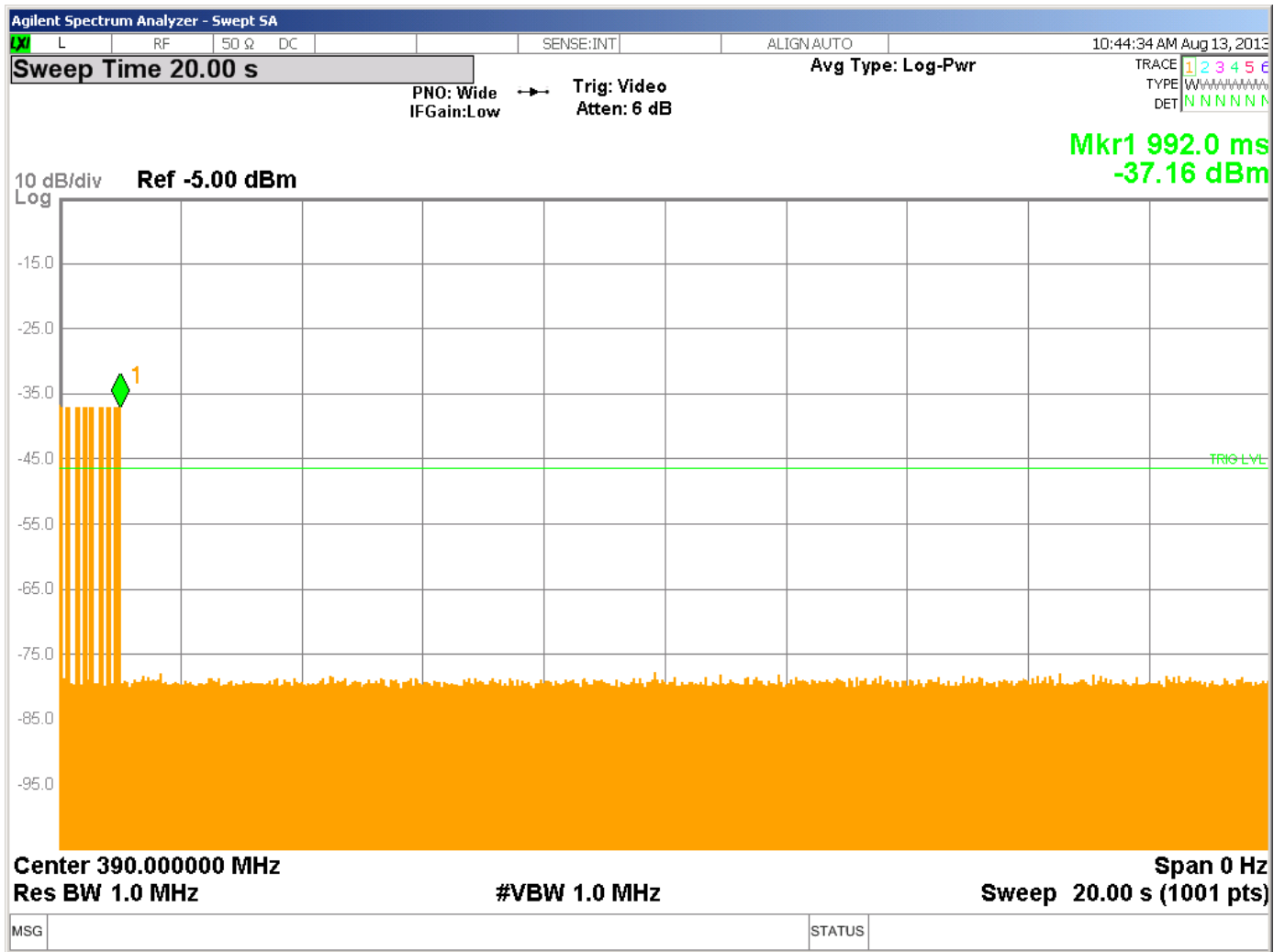


Figure 6 Cease Operation Graph 390MHz



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

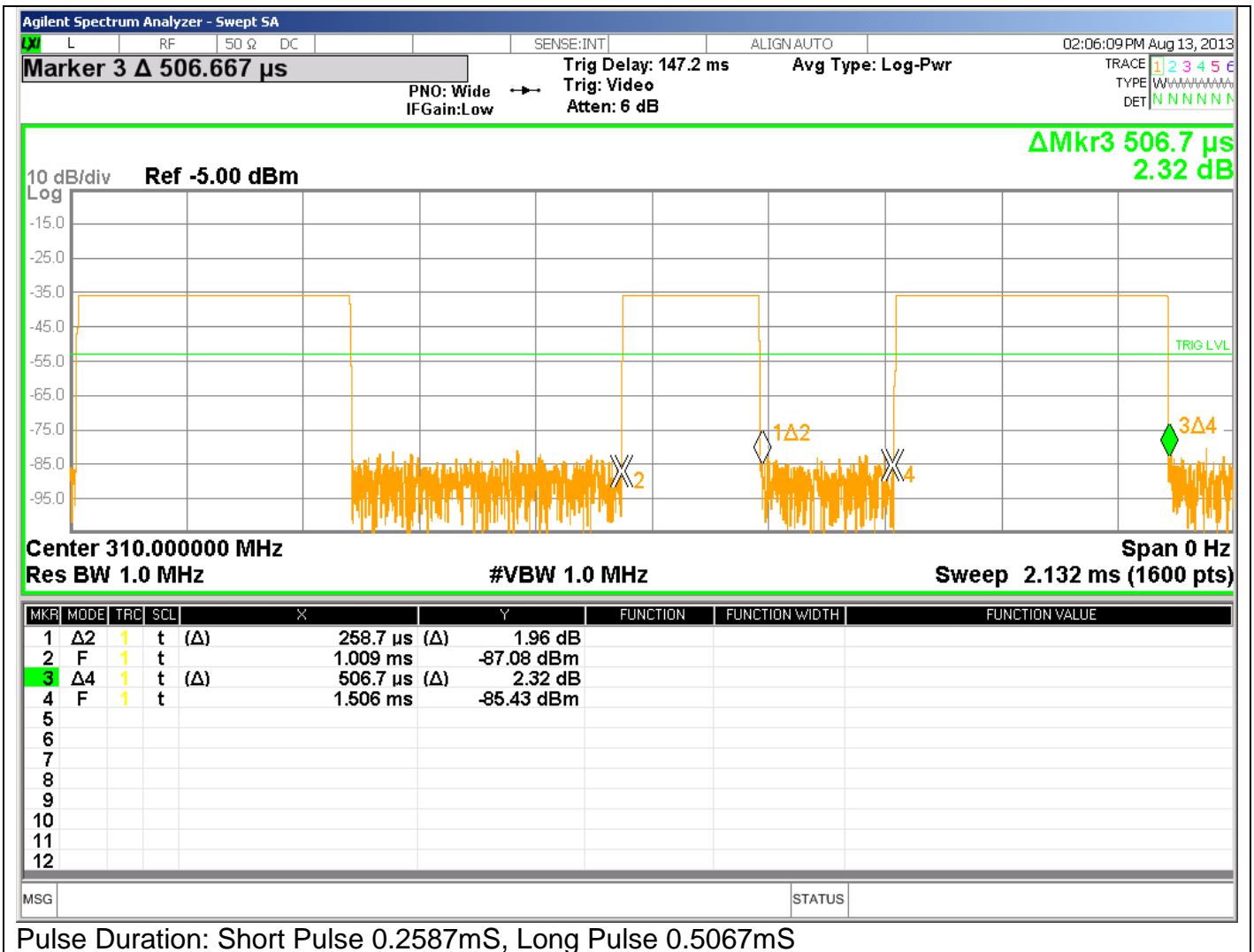
| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---------------------------------|---------------------------|----------------------|
| 1 | 1 | 1 |
| Supplementary information: None | | |

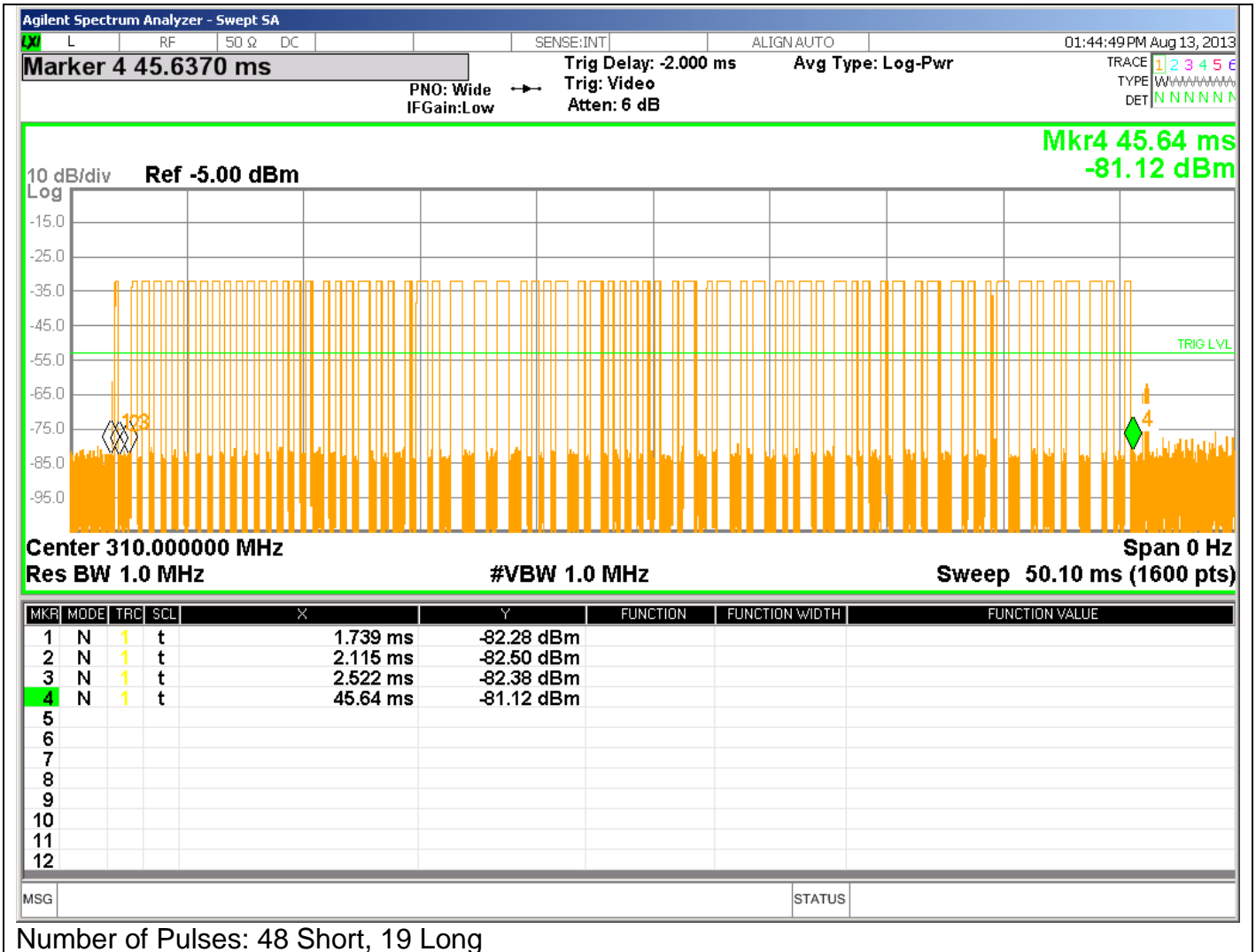
Table 6 Pulse Train Calculation

| TX Frequency | Total TX time | Total Transmission period or 100ms whichever is lesser | DC Correction Factor (dB) |
|--|--------------------------------|--|--|
| | | | $20\log\left(\frac{PulseWidth}{Period}\right)$ |
| 310MHz | 0.130+(48x0.2587)+(19x0.5067) | 100 | -13.08 |
| 315MHz | 0.1207+(42x0.264)+(22x0.5053) | 100 | -13.02 |
| 390MHz | 0.1365+(44x0.2587)+(21x0.5093) | 100 | -13.07 |
| Worst Case Duty Cycle: Measured Duty cycle is used for all data. | | | |

Figure 7 Pulse Train Graphs for 310MHz







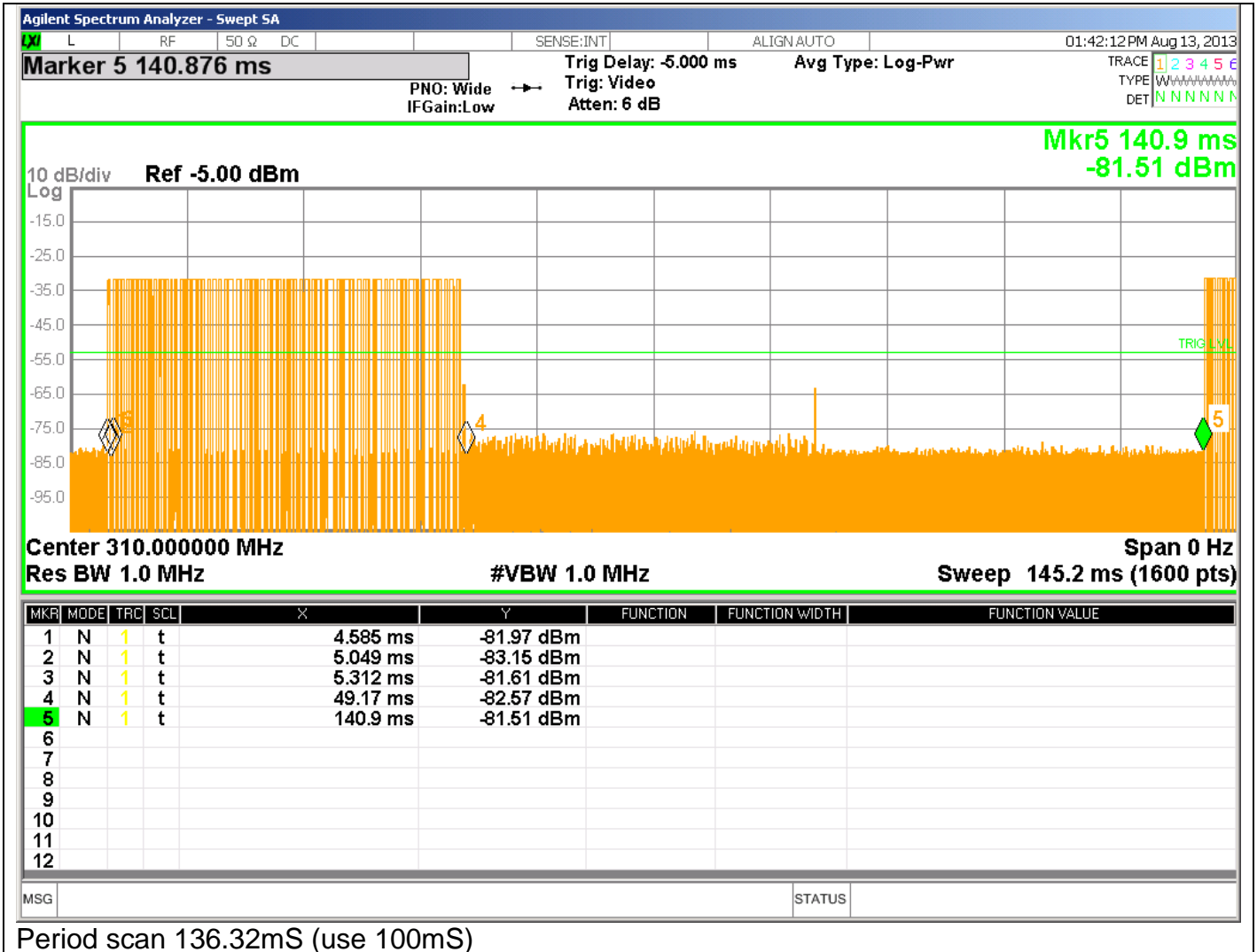
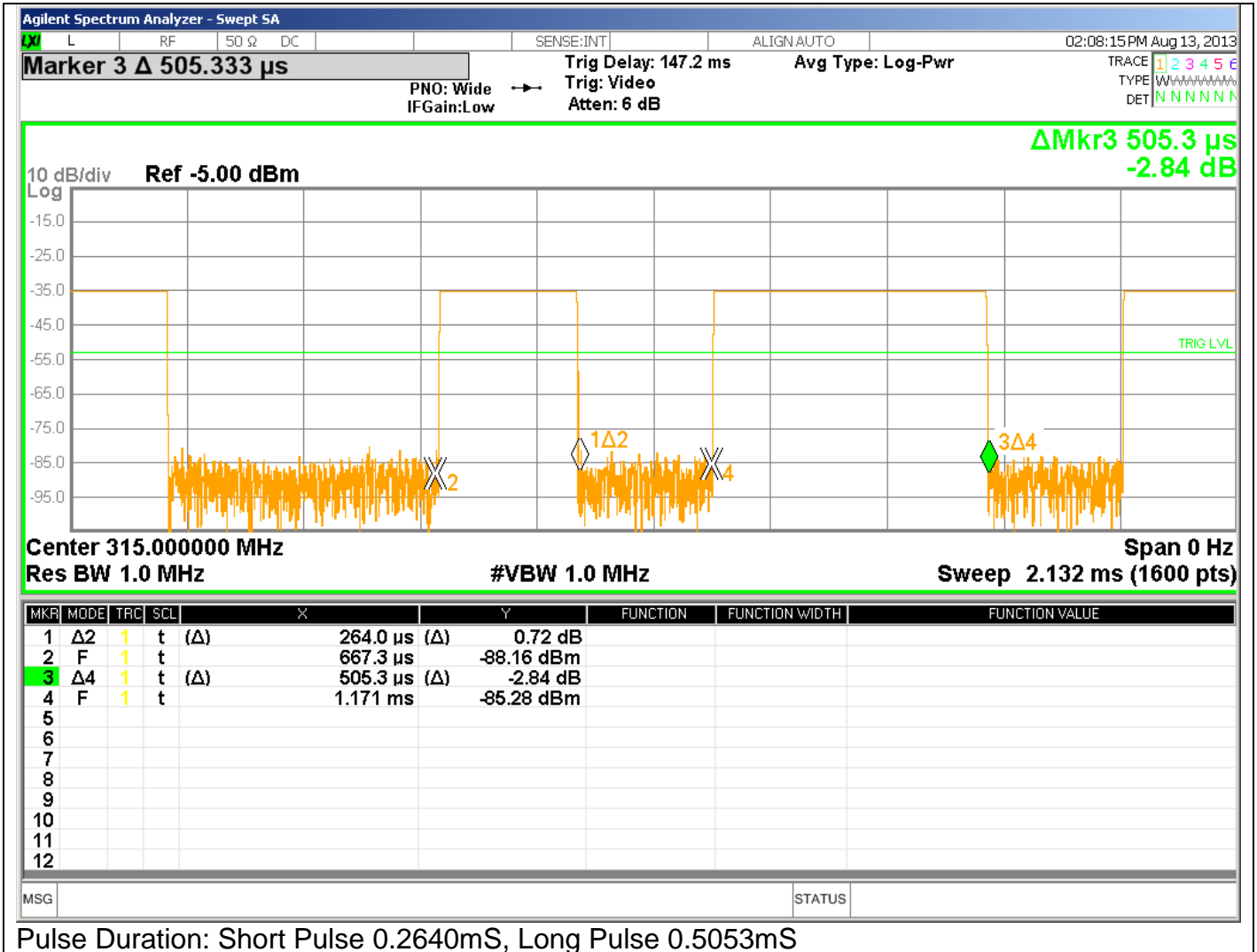


Figure 8 Pulse Train Graphs for 315MHz





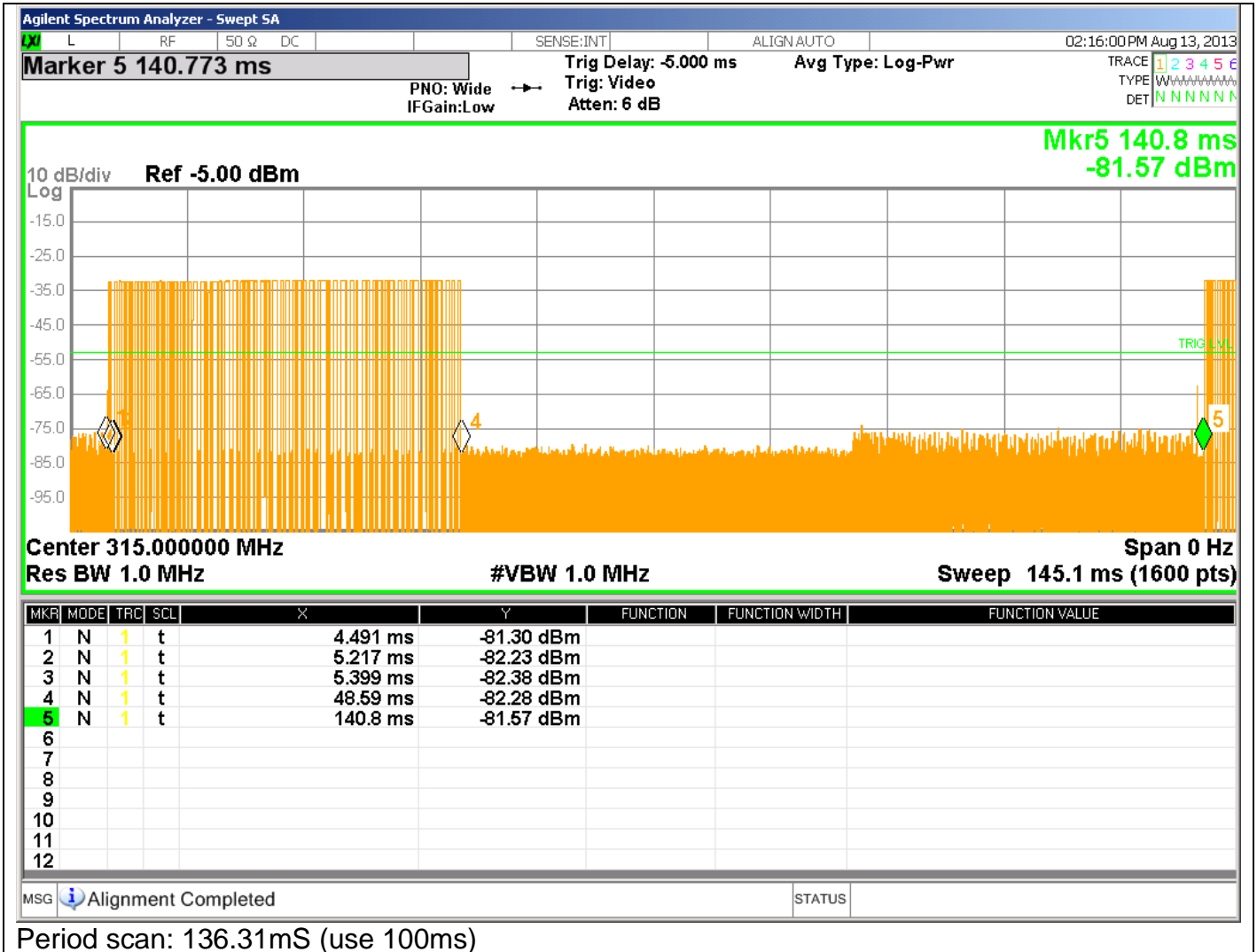
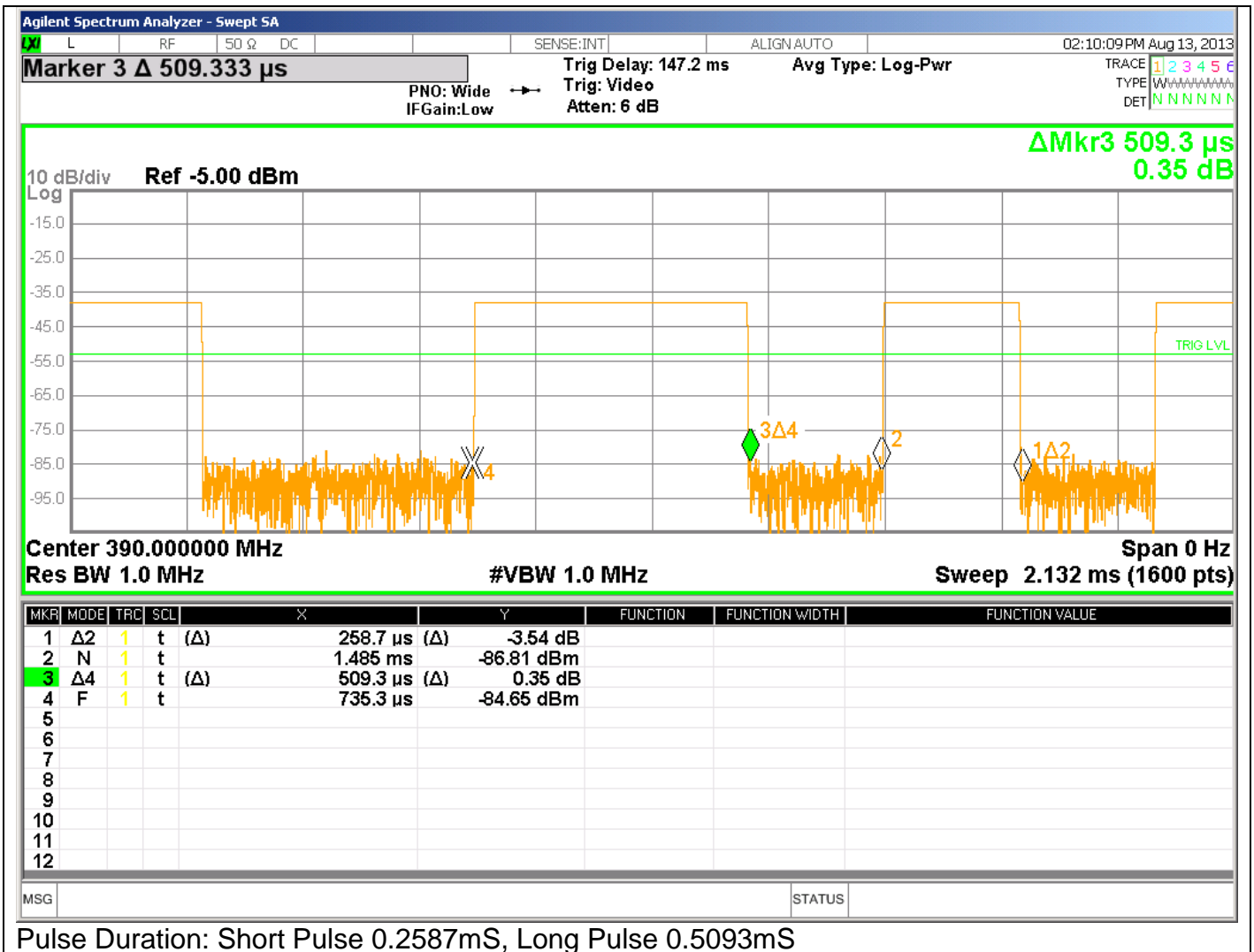
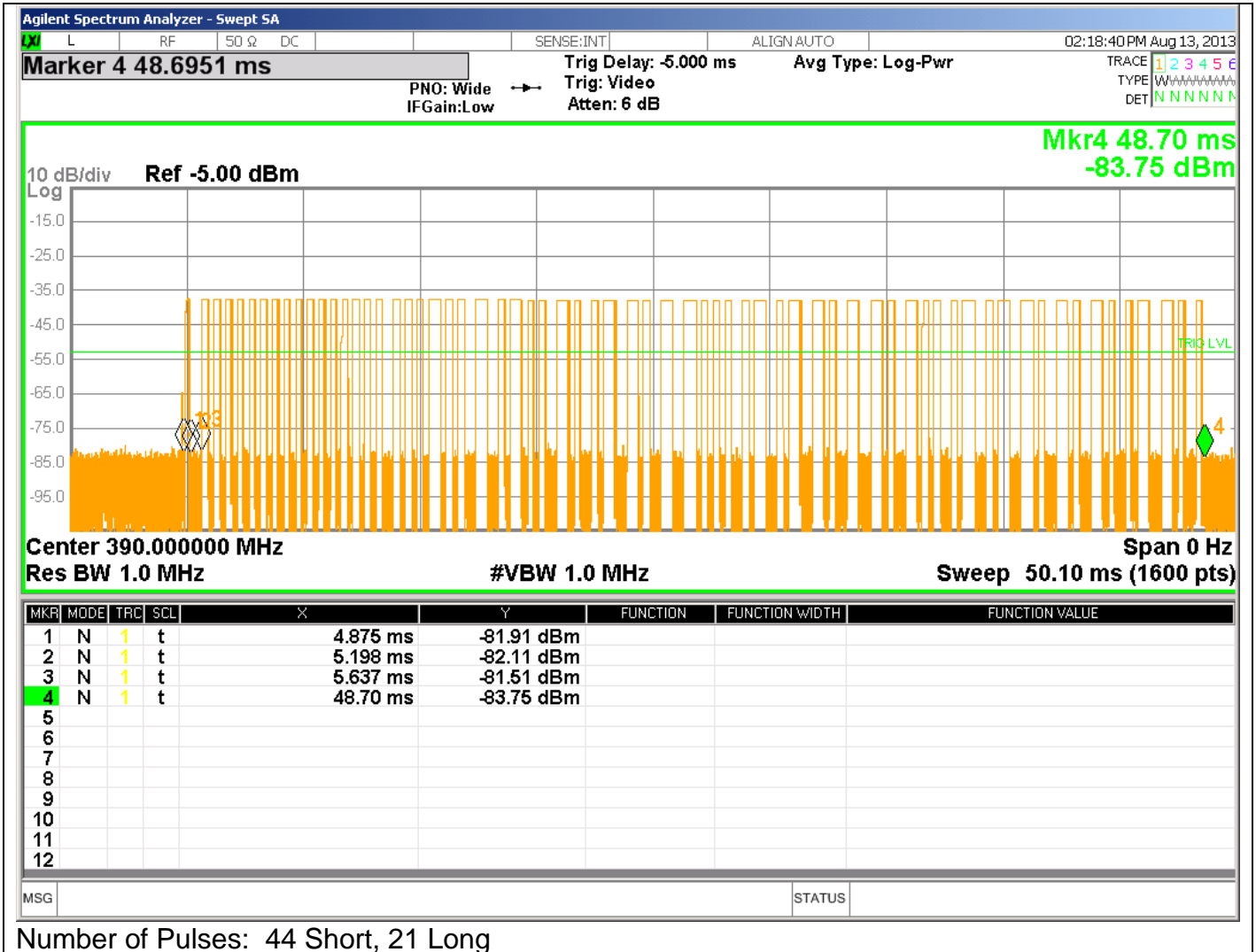
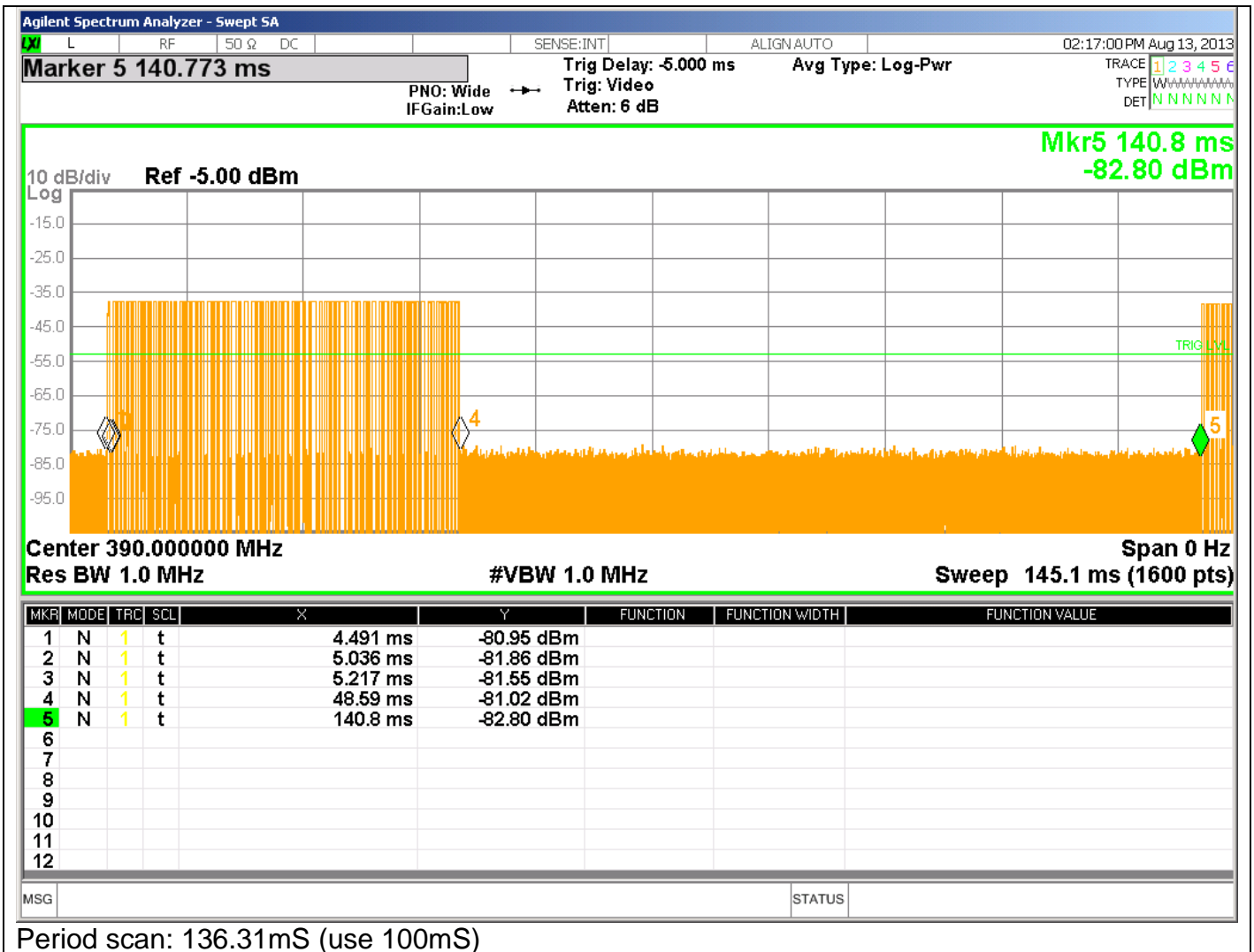


Figure 9 Pulse Train Graphs for 390MHz









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. Below 1GHz the combination of RBW/VBW was 120kHz/1MHz and above 1GHz the RBW/VBW was 1MHz/3MHz. | |
| 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 |
| Out of band spurious emissions limit | | |
| 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 4.1.3 for duty cycle information. Below 1GHz only emissions visible above the noise floor were the fundamental and the harmonics of the fundamental. | | |

Figure 10 Radiated Emissions Graph Above 1GHz

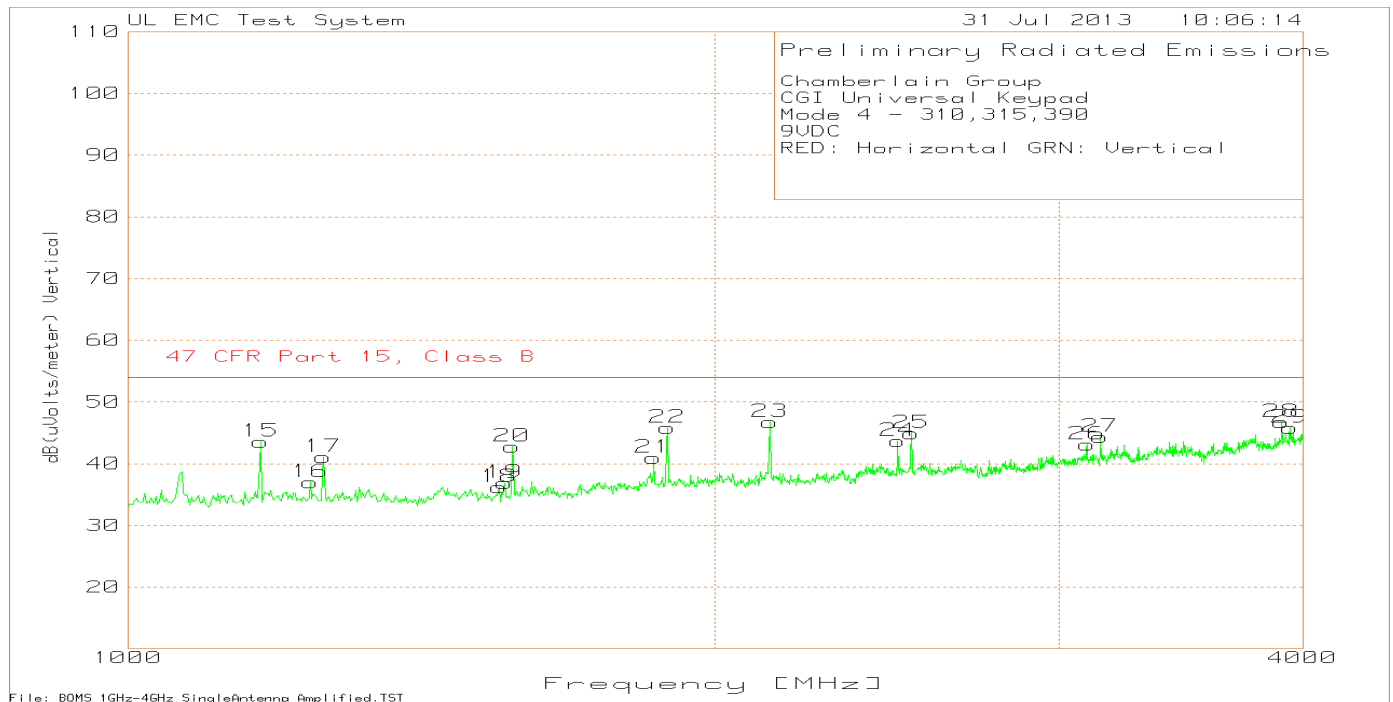
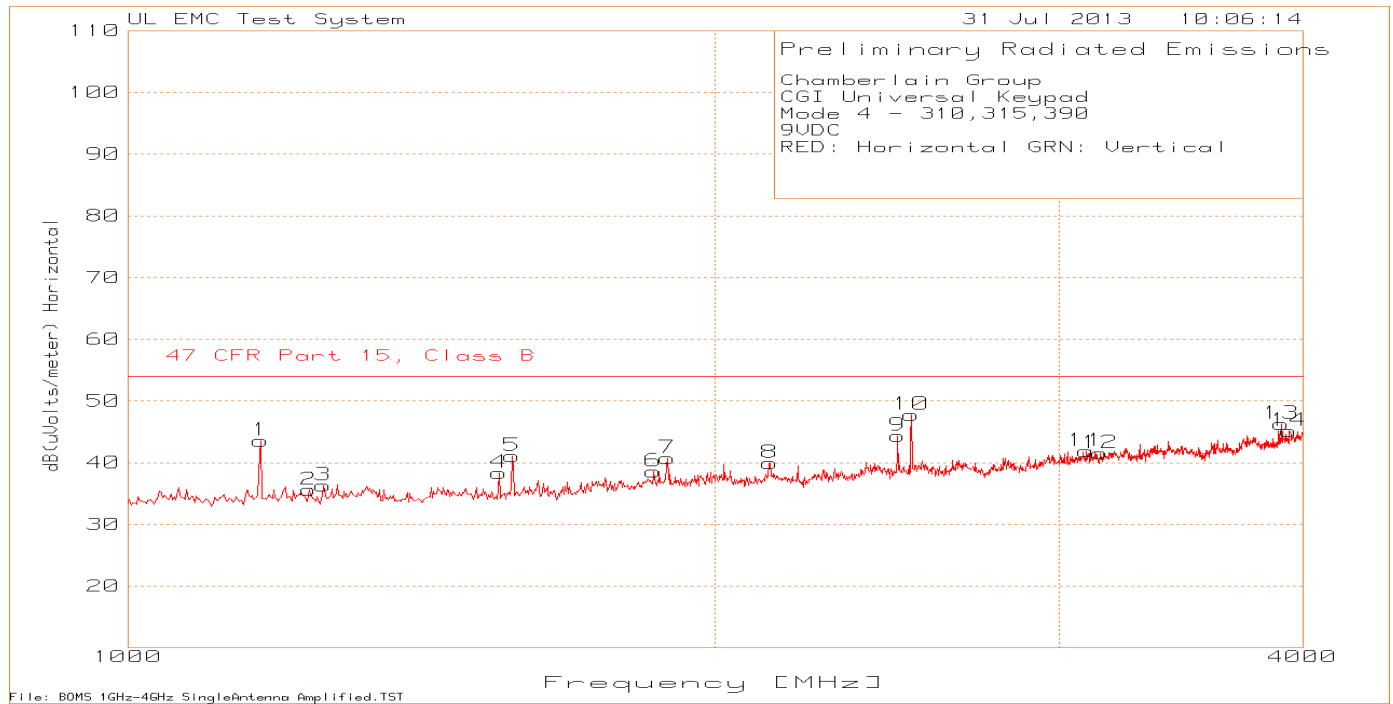


Table 7 - Radiated Emissions Data Points – for 310MHz, 315MHz and 390MHz

| Test Frequency (MHz) | Meter Reading (dBuV) | Detector | AF dB/m | CF dB | 6dB pad dB | Corrected Peak Level dBuV/m | Peak Limit dBuV/m | Peak Margin dB | DC Factor dB | Average Level dBuV/m | Average Limit dBuV/m | Average Margin dB | Azimuth [Degs] | Height [cm] | Polarity |
|----------------------|----------------------|----------|---------|--------|------------|-----------------------------|-------------------|----------------|--------------|----------------------|----------------------|-------------------|----------------|-------------|----------|
| 310.0184 | 67.06 | PK | 14.1 | 8.2 | -5.96 | 83.40 | 95.32 | -11.92 | -13.08 | 70.32 | 75.32 | -5.00 | 359 | 236 | H |
| 310.0184 | 68.51 | PK | 14.1 | 8.2 | -5.96 | 84.85 | 95.32 | -10.47 | -13.08 | 71.77 | 75.32 | -3.55 | 87 | 184 | V |
| 315.0232 | 67.22 | PK | 14.3 | 8.1 | -5.96 | 83.66 | 95.62 | -11.96 | -13.02 | 70.64 | 75.62 | -4.98 | 360 | 231 | H |
| 315.0232 | 68.46 | PK | 14.3 | 8.1 | -5.96 | 84.90 | 95.62 | -10.72 | -13.02 | 71.88 | 75.62 | -3.74 | 92 | 189 | V |
| 390.0335 | 65.51 | PK | 16.1 | 8.5 | -5.99 | 84.12 | 99.24 | -15.12 | -13.07 | 71.05 | 79.24 | -8.19 | 90 | 134 | V |
| 390.0281 | 61.67 | PK | 16.1 | 8.5 | -5.99 | 80.28 | 99.24 | -18.96 | -13.07 | 67.21 | 79.24 | -12.03 | 360 | 179 | H |
| 620.0388 | 8.59 | PK | 20.4 | 9.2 | -6.00 | 32.19 | 66.02 | -33.83 | -13.08 | 19.11 | 46.02 | -26.91 | 0 | 230 | H |
| 630.0467 | 7.39 | PK | 20.7 | 9.2 | -6.00 | 31.29 | 66.02 | -34.73 | -13.02 | 18.27 | 46.02 | -27.75 | 0 | 230 | H |
| 780.0552 | 8.82 | PK | 22 | 9.7 | -6.01 | 34.51 | 66.02 | -31.51 | -13.07 | 21.44 | 46.02 | -24.58 | 360 | 231 | H |
| 930.0538 | 25.38 | PK | 23.8 | 10 | -6.03 | 53.16 | 66.02 | -12.87 | -13.08 | 40.08 | 46.02 | -5.95 | 0 | 142 | H |
| 945.0665 | 23.51 | PK | 23.9 | 10.1 | -6.02 | 51.49 | 66.02 | -14.53 | -13.02 | 38.47 | 46.02 | -7.55 | 360 | 141 | H |
| 620.0428 | 16.43 | PK | 20.4 | 9.2 | -6.00 | 40.03 | 66.02 | -25.99 | -13.08 | 26.95 | 46.02 | -19.07 | 89 | 184 | V |
| 630.0495 | 16.57 | PK | 20.7 | 9.2 | -6.00 | 40.47 | 66.02 | -25.55 | -13.02 | 27.45 | 46.02 | -18.57 | 89 | 184 | V |
| 780.0414 | 12.54 | PK | 22 | 9.7 | -6.01 | 38.23 | 66.02 | -27.79 | -13.07 | 25.16 | 46.02 | -20.86 | 90 | 233 | V |
| 930.0543 | 22.28 | PK | 23.8 | 10 | -6.03 | 50.06 | 66.02 | -15.97 | -13.08 | 36.98 | 46.02 | -9.05 | 90 | 165 | V |
| 945.0676 | 20.46 | PK | 23.9 | 10.1 | -6.02 | 48.44 | 66.02 | -17.58 | -13.02 | 35.42 | 46.02 | -10.60 | 90 | 164 | V |
| 1170.113 | 75.84 | PK | 25 | -57.24 | 0.00 | 43.60 | 74 | -30.40 | -13.02 | 30.58 | 54 | -23.42 | * | 200 | H |
| 1238.159 | 67.48 | PK | 25.1 | -56.99 | 0.00 | 35.59 | 74 | -38.41 | -13.02 | 22.57 | 54 | -31.43 | * | 150 | H |
| 1260.173 | 68.19 | PK | 25.1 | -56.92 | 0.00 | 36.37 | 74 | -37.63 | -13.02 | 23.35 | 54 | -30.65 | * | 100 | H |
| 1550.367 | 69.14 | PK | 25.2 | -56.02 | 0.00 | 38.32 | 74 | -35.68 | -13.02 | 25.30 | 54 | -28.70 | * | 100 | H |
| 1574.383 | 71.14 | PK | 25.2 | -55.3 | 0.00 | 41.04 | 74 | -32.96 | -13.02 | 28.02 | 54 | -25.98 | * | 100 | H |
| 1860.574 | 65.95 | PK | 27.1 | -54.44 | 0.00 | 38.61 | 74 | -35.39 | -13.02 | 25.59 | 54 | -28.41 | * | 150 | H |
| 1890.594 | 67.85 | PK | 27.2 | -54.32 | 0.00 | 40.73 | 74 | -33.27 | -13.02 | 27.71 | 54 | -26.29 | * | 150 | H |
| 2134.757 | 65.64 | PK | 27.5 | -53.14 | 0.00 | 40.00 | 74 | -34.00 | -13.02 | 26.98 | 54 | -27.02 | * | 150 | H |
| 2480.987 | 68.15 | PK | 28.8 | -52.57 | 0.00 | 44.38 | 74 | -29.62 | -13.02 | 31.36 | 54 | -22.64 | * | 150 | H |
| 2521.014 | 71.11 | PK | 28.9 | -52.19 | 0.00 | 47.82 | 74 | -26.18 | -13.02 | 34.80 | 54 | -19.20 | * | 150 | H |
| 3099.4 | 62.74 | PK | 30.5 | -51.33 | 0.00 | 41.91 | 74 | -32.09 | -13.02 | 28.89 | 54 | -25.11 | * | 100 | H |
| 3151.434 | 62.7 | PK | 30.6 | -51.71 | 0.00 | 41.59 | 74 | -32.41 | -13.02 | 28.57 | 54 | -25.43 | * | 150 | H |
| 3901.935 | 65.64 | PK | 32.6 | -51.99 | 0.00 | 46.25 | 74 | -27.75 | -13.02 | 33.23 | 54 | -20.77 | * | 100 | H |
| 3937.959 | 64.77 | PK | 32.6 | -52.17 | 0.00 | 45.20 | 74 | -28.80 | -13.02 | 32.18 | 54 | -21.82 | * | 150 | H |
| 1170.113 | 75.79 | PK | 25 | -57.24 | 0.00 | 43.55 | 74 | -30.45 | -13.02 | 30.53 | 54 | -23.47 | * | 150 | V |
| 1240.16 | 68.88 | PK | 25.1 | -56.96 | 0.00 | 37.02 | 74 | -36.98 | -13.02 | 24.00 | 54 | -30.00 | * | 150 | V |
| 1260.173 | 72.91 | PK | 25.1 | -56.92 | 0.00 | 41.09 | 74 | -32.91 | -13.02 | 28.07 | 54 | -25.93 | * | 150 | V |
| 1550.367 | 67.03 | PK | 25.2 | -56.02 | 0.00 | 36.21 | 74 | -37.79 | -13.02 | 23.19 | 54 | -30.81 | * | 100 | V |
| 1560.374 | 67.33 | PK | 25.2 | -55.65 | 0.00 | 36.88 | 74 | -37.12 | -13.02 | 23.86 | 54 | -30.14 | * | 200 | V |
| 1574.383 | 72.86 | PK | 25.2 | -55.3 | 0.00 | 42.76 | 74 | -31.24 | -13.02 | 29.74 | 54 | -24.26 | * | 100 | V |
| 1860.574 | 68.29 | PK | 27.1 | -54.44 | 0.00 | 40.95 | 74 | -33.05 | -13.02 | 27.93 | 54 | -26.07 | * | 100 | V |
| 1890.594 | 72.99 | PK | 27.2 | -54.32 | 0.00 | 45.87 | 74 | -28.13 | -13.02 | 32.85 | 54 | -21.15 | * | 100 | V |
| 2132.755 | 72.44 | PK | 27.5 | -53.18 | 0.00 | 46.76 | 74 | -27.24 | -13.02 | 33.74 | 54 | -20.26 | * | 100 | V |
| 2480.987 | 67.46 | PK | 28.8 | -52.57 | 0.00 | 43.69 | 74 | -30.31 | -13.02 | 30.67 | 54 | -23.33 | * | 200 | V |
| 2521.014 | 68.19 | PK | 28.9 | -52.19 | 0.00 | 44.90 | 74 | -29.10 | -13.02 | 31.88 | 54 | -22.12 | * | 200 | V |
| 3101.401 | 63.97 | PK | 30.5 | -51.31 | 0.00 | 43.16 | 74 | -30.84 | -13.02 | 30.14 | 54 | -23.86 | * | 100 | V |
| 3151.434 | 65.43 | PK | 30.6 | -51.71 | 0.00 | 44.32 | 74 | -29.68 | -13.02 | 31.30 | 54 | -22.70 | * | 100 | V |
| 3901.935 | 66.1 | PK | 32.6 | -51.99 | 0.00 | 46.71 | 74 | -27.29 | -13.02 | 33.69 | 54 | -20.31 | * | 100 | V |
| 3939.96 | 65.37 | PK | 32.6 | -52.13 | 0.00 | 45.84 | 74 | -28.16 | -13.02 | 32.82 | 54 | -21.18 | * | 150 | V |

PK - Peak Detector
 AF - Antenna Factor, CF - Cable Factor
 * - results based on peak pre-scan

4.2 Configuration 1 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 (315MHz: 787.5kHz) | | |

Table 8 Occupied Bandwidth Configuration Settings

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

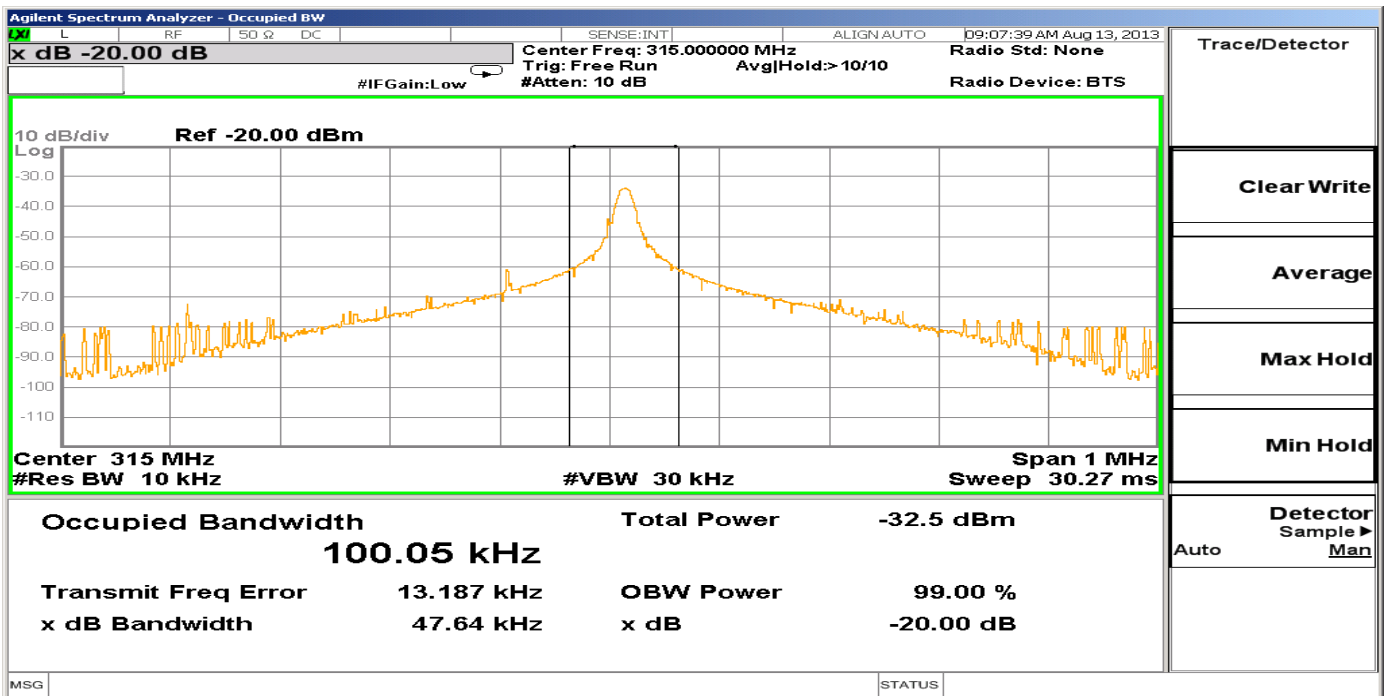
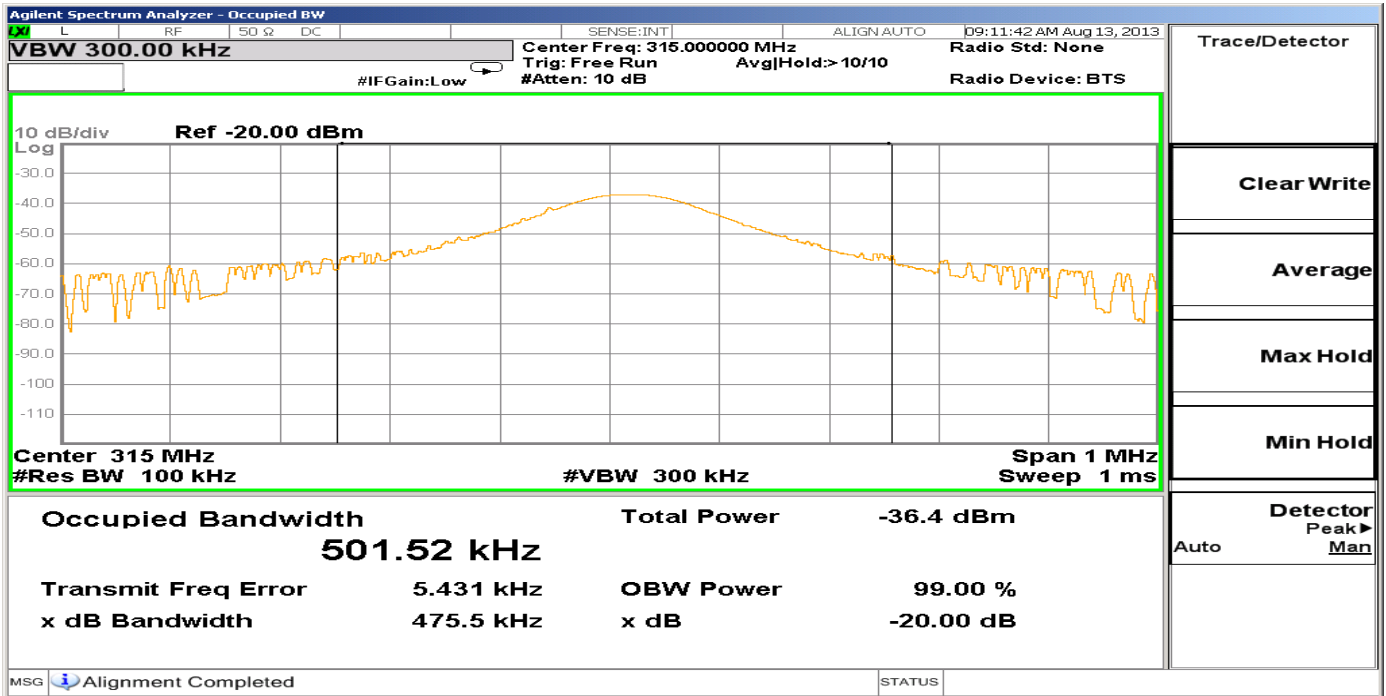
Table 9 Occupied Bandwidth Spectrum Analyzer Settings

| 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) |
|------------------|------------------------|-----------------------|
| 315MHz | 501.52 | 100.05 |

Figure 11 – Bandwidth Graph



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 | | |

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

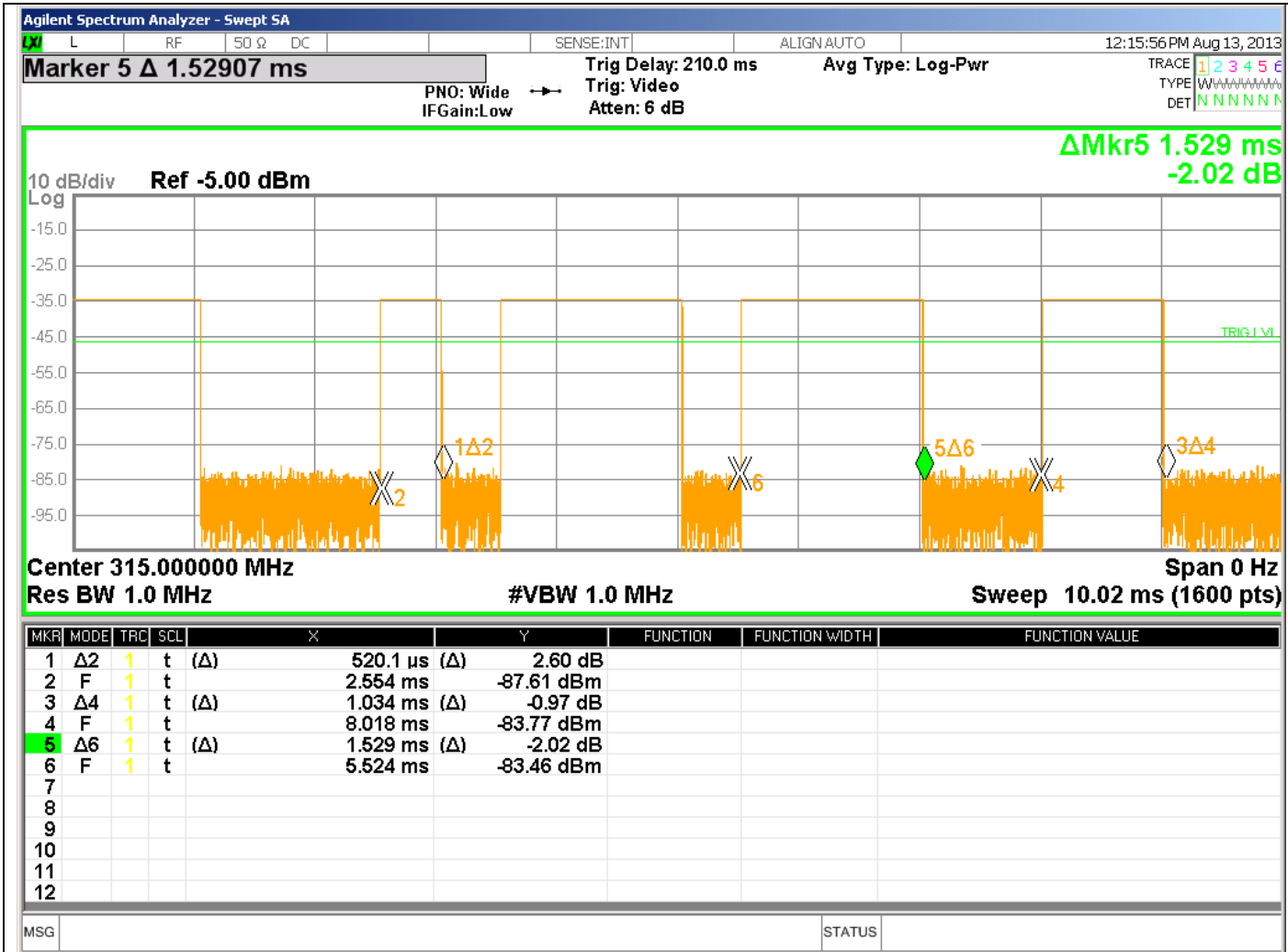
| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---------------------------------|---------------------------|----------------------|
| 1 | 1 | 1 |
| Supplementary information: None | | |

Table 13 Pulse Train Calculation

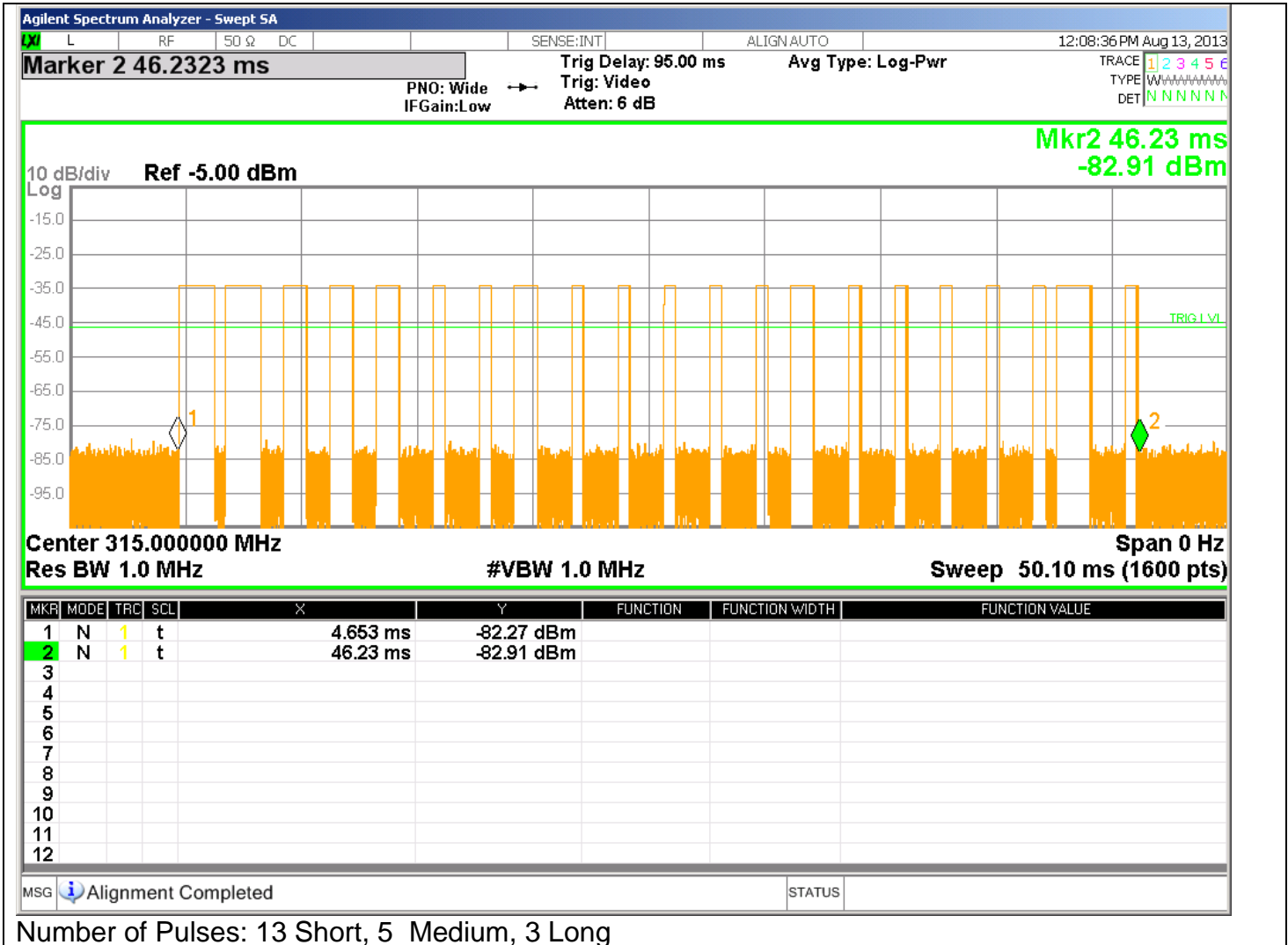
| TX Frequency | Total TX time | Total Transmission period or 100ms whichever is lesser | DC Correction Factor (dB) |
|---|---------------------------------|--|--|
| | | | $20\log\left(\frac{PulseWidth}{Period}\right)$ |
| 315MHz | (13x0.5201)+(5x1.034)+(3x1.529) | 97.41 | -15.41 |
| Worst Case Duty Cycle: Worst case duty cycle was calculated over 100mS including the tuning pulse. The manufacturer declared duty cycle as -10.17dB and it is used for all radiated emissions data. | | | |

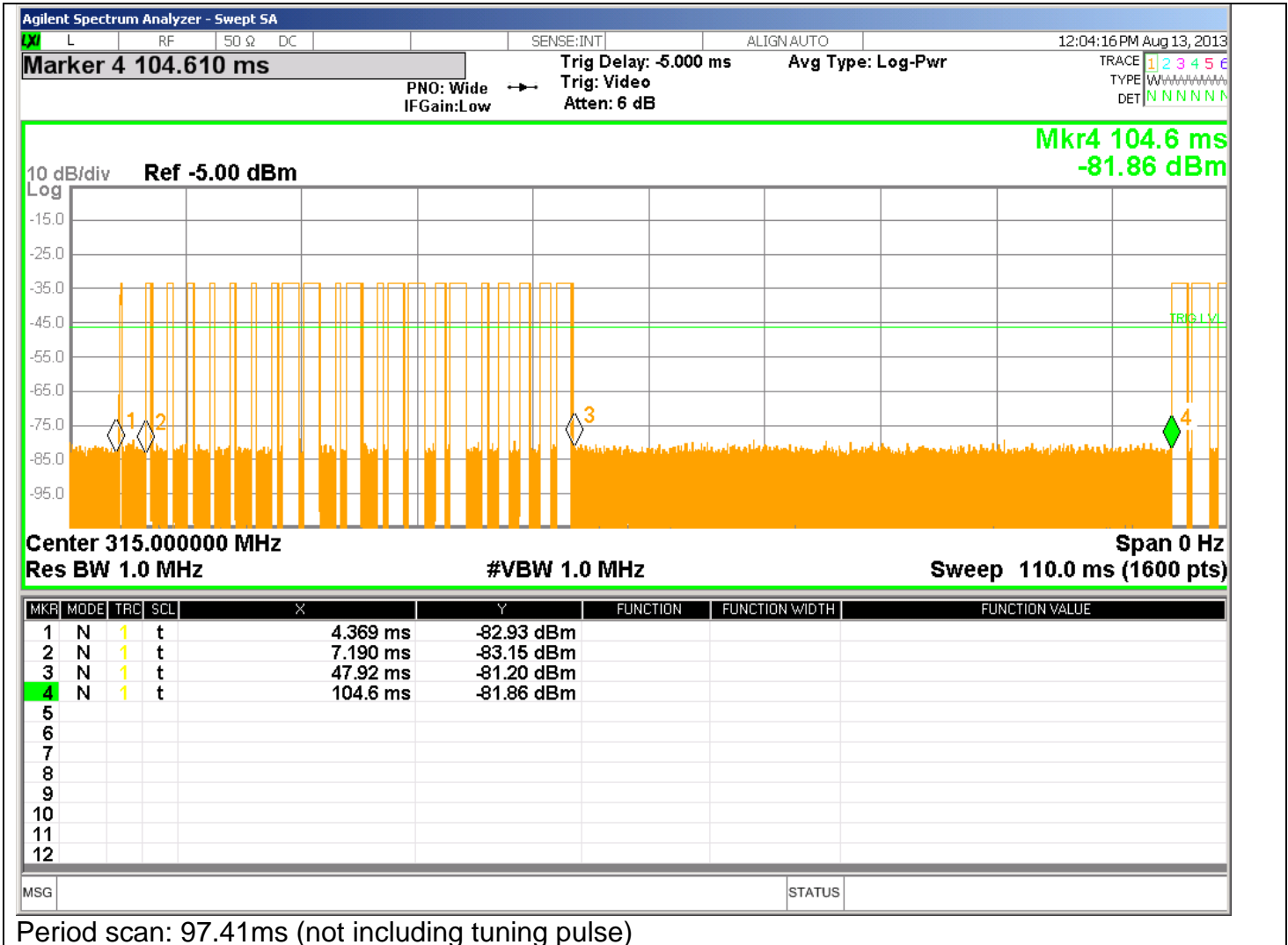
Figure 13 Pulse Train Graphs for 390MHz





Pulse Duration: Short Pulse 0.5201mS, Medium Pulse 1.034mS, Long Pulse 1.529mS





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. Below 1GHz the combination of RBW/VBW was 120kHz/1MHz and above 1GHz the RBW/VBW was 1MHz/3MHz. | |
| 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 |
| Out of band spurious emissions limits | | |
| Frequency (MHz) | Limit (dB μ V/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 (dB μ V/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 4.2.3 for duty cycle information. Below 1GHz only emissions visible above the noise floor were the fundamental and the harmonics of the fundamental. | | |

Figure 14 Radiated Emissions Graph (Above 1GHz)

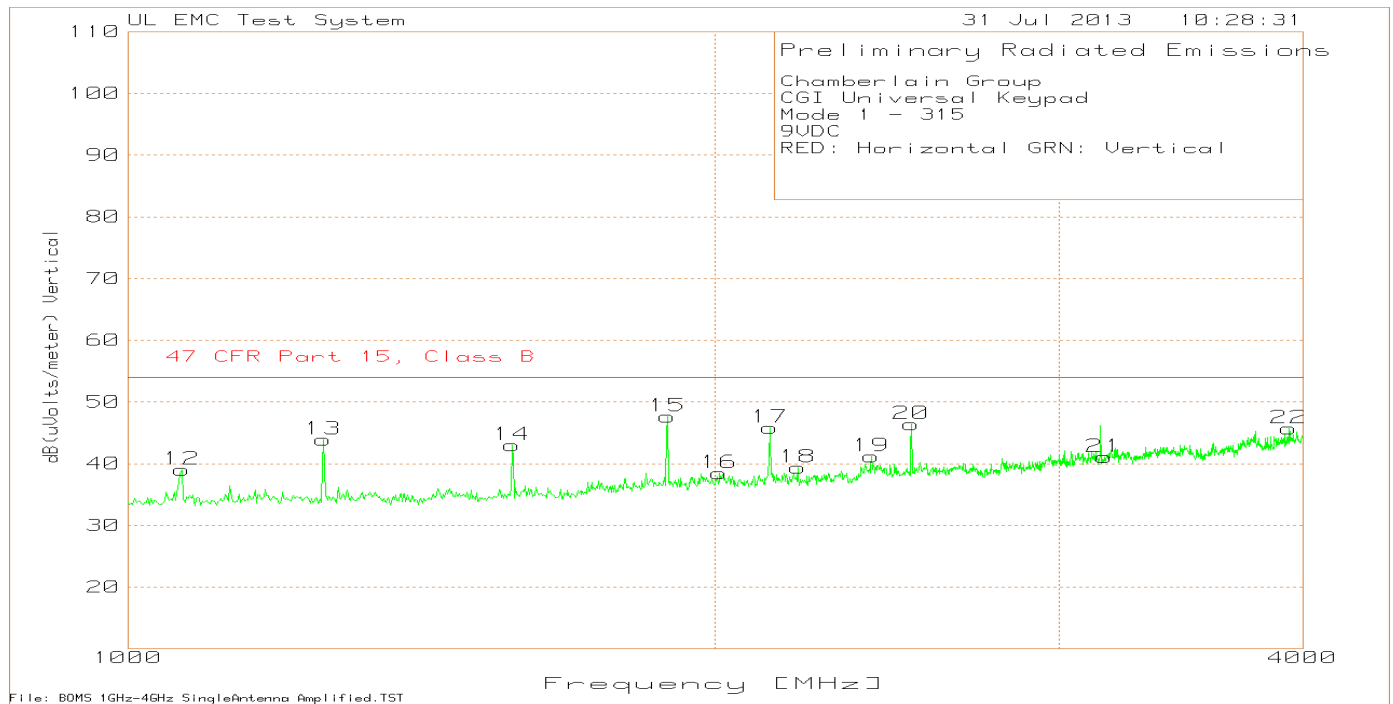
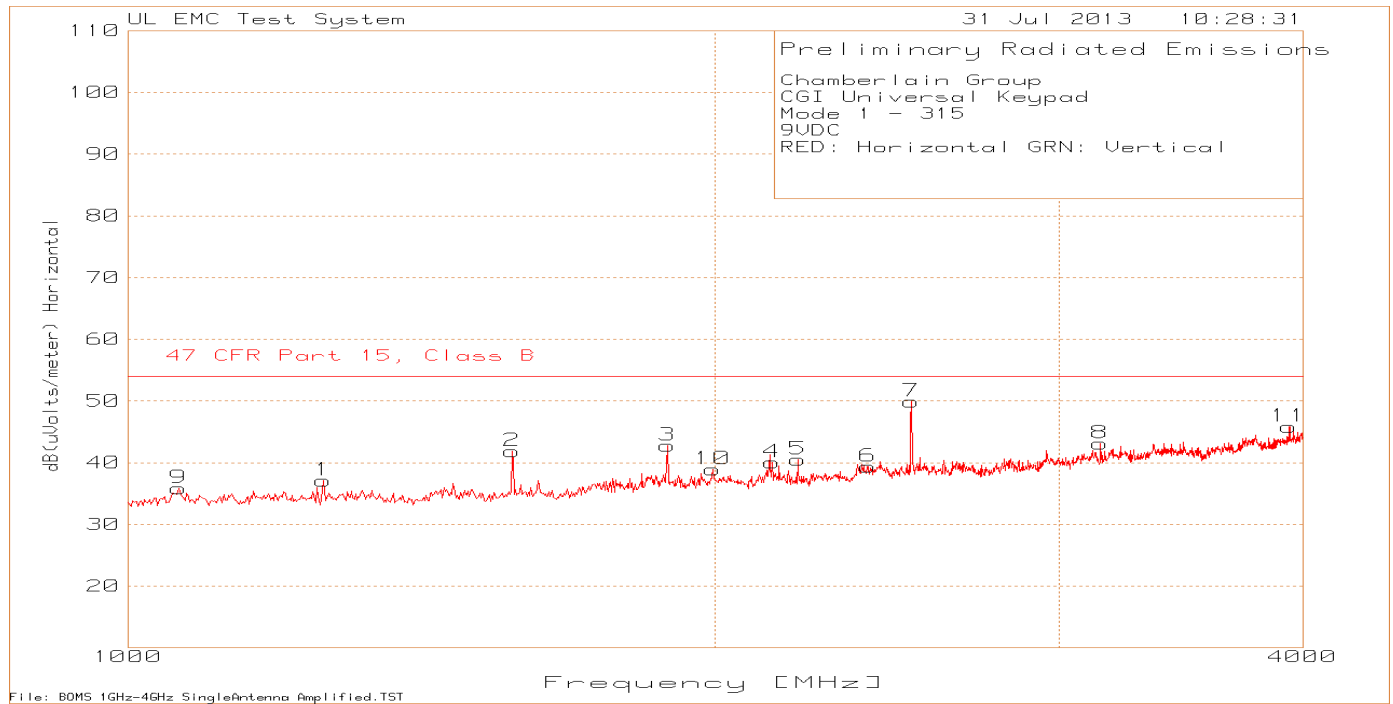


Table 14 - Radiated Emissions Data Points 315MHz

| Test Frequency (MHz) | Meter Reading (dBuV) | Detector | AF dB/m | CF dB | Corrected Peak Level dBuV/m | Peak Limit dBuV/m | Peak Margin dB | DC Factor dB | Average Level dBuV/m | Average Limit dBuV/m | Average Margin dB | Azimuth [Degs] | Height [cm] | Polarity |
|----------------------|----------------------|----------|---------|--------|-----------------------------|-------------------|----------------|--------------|----------------------|----------------------|-------------------|----------------|-------------|----------|
| 315.0189 | 61.18 | PK | 14.3 | 8.10 | 83.58 | 95.62 | -12.04 | -10.17 | 73.41 | 75.62 | -2.21 | 359 | 242 | H |
| 315.0148 | 62.57 | PK | 14.3 | 8.10 | 84.97 | 95.62 | -10.65 | -10.17 | 74.8 | 75.62 | -0.82 | 89 | 188 | V |
| 630.0416 | 11.67 | PK | 20.7 | 9.20 | 41.57 | 66.02 | -24.45 | -10.17 | 31.4 | 46.02 | -14.62 | 89 | 189 | V |
| 945.0411 | 17.01 | PK | 23.9 | 10.10 | 51.01 | 66.02 | -15.01 | -10.17 | 40.84 | 46.02 | -5.18 | 88 | 100 | V |
| 945.0566 | 18.53 | PK | 23.9 | 10.10 | 52.53 | 66.02 | -13.49 | -10.17 | 42.36 | 46.02 | -3.66 | 359 | 137 | H |
| 630.0251 | 11.05 | PK | 20.7 | 9.20 | 40.95 | 66.02 | -25.07 | -10.17 | 30.78 | 46.02 | -15.24 | 359 | 153 | H |
| 1260.173 | 68.98 | PK | 25.1 | -56.92 | 37.16 | 74.00 | -36.84 | -10.17 | 26.99 | 54 | -27.01 | 150 | * | H |
| 1574.383 | 72.01 | PK | 25.2 | -55.30 | 41.91 | 74.00 | -32.09 | -10.17 | 31.74 | 54 | -22.26 | 100 | * | H |
| 1890.594 | 69.94 | PK | 27.2 | -54.32 | 42.82 | 74.00 | -31.18 | -10.17 | 32.65 | 54 | -21.35 | 200 | * | H |
| 2138.759 | 65.64 | PK | 27.5 | -53.08 | 40.06 | 74.00 | -33.94 | -10.17 | 29.89 | 54 | -24.11 | 150 | * | H |
| 2204.803 | 66.31 | PK | 27.4 | -53.20 | 40.51 | 74.00 | -33.49 | -10.17 | 30.34 | 54 | -23.66 | 100 | * | H |
| 2396.931 | 62.54 | PK | 28.6 | -51.76 | 39.38 | 74.00 | -34.62 | -10.17 | 29.21 | 54 | -24.79 | 200 | * | H |
| 2521.014 | 73.26 | PK | 28.9 | -52.19 | 49.97 | 74.00 | -24.03 | -10.17 | 39.8 | 54 | -14.2 | 150 | * | H |
| 3151.434 | 64.19 | PK | 30.6 | -51.71 | 43.08 | 74.00 | -30.92 | -10.17 | 32.91 | 54 | -21.09 | 200 | * | H |
| 1062.041 | 67.96 | PK | 24.5 | -56.64 | 35.82 | 74.00 | -38.18 | -10.17 | 25.65 | 54 | -28.35 | 150 | * | H |
| 1994.663 | 65.44 | PK | 27.3 | -53.78 | 38.96 | 74.00 | -35.04 | -10.17 | 28.79 | 54 | -25.21 | 150 | * | H |
| 3937.959 | 65.46 | PK | 32.6 | -52.17 | 45.89 | 74.00 | -28.11 | -10.17 | 35.72 | 54 | -18.28 | 100 | * | H |
| 1066.044 | 71.21 | PK | 24.5 | -56.71 | 39 | 74.00 | -35 | -10.17 | 28.83 | 54 | -25.17 | 200 | * | V |
| 1260.173 | 75.69 | PK | 25.1 | -56.92 | 43.87 | 74.00 | -30.13 | -10.17 | 33.7 | 54 | -20.3 | 150 | * | V |
| 1574.383 | 73.06 | PK | 25.2 | -55.30 | 42.96 | 74.00 | -31.04 | -10.17 | 32.79 | 54 | -21.21 | 100 | * | V |
| 1890.594 | 74.74 | PK | 27.2 | -54.32 | 47.62 | 74.00 | -26.38 | -10.17 | 37.45 | 54 | -16.55 | 100 | * | V |
| 2010.674 | 64.71 | PK | 27.3 | -53.56 | 38.45 | 74.00 | -35.55 | -10.17 | 28.28 | 54 | -25.72 | 100 | * | V |
| 2132.755 | 71.55 | PK | 27.5 | -53.18 | 45.87 | 74.00 | -28.13 | -10.17 | 35.7 | 54 | -18.3 | 100 | * | V |
| 2204.803 | 65.16 | PK | 27.4 | -53.20 | 39.36 | 74.00 | -34.64 | -10.17 | 29.19 | 54 | -24.81 | 200 | * | V |
| 2404.937 | 64.34 | PK | 28.6 | -51.77 | 41.17 | 74.00 | -32.83 | -10.17 | 31 | 54 | -23 | 200 | * | V |
| 2521.014 | 69.69 | PK | 28.9 | -52.19 | 46.4 | 74.00 | -27.6 | -10.17 | 36.23 | 54 | -17.77 | 200 | * | V |
| 3167.445 | 61.83 | PK | 30.7 | -51.48 | 41.05 | 74.00 | -32.95 | -10.17 | 30.88 | 54 | -23.12 | 100 | * | V |
| 3937.959 | 65.29 | PK | 32.6 | -52.17 | 45.72 | 74.00 | -28.28 | -10.17 | 35.55 | 54 | -18.45 | 100 | * | V |

PK - Peak Detector
 AF - Antenna Factor, CF - Cable Factor
 * - results based on peak prescan

4.3 Configuration 2 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 (390MHz: 975.0kHz) | | |

Table 15 Occupied Bandwidth Configuration Settings

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

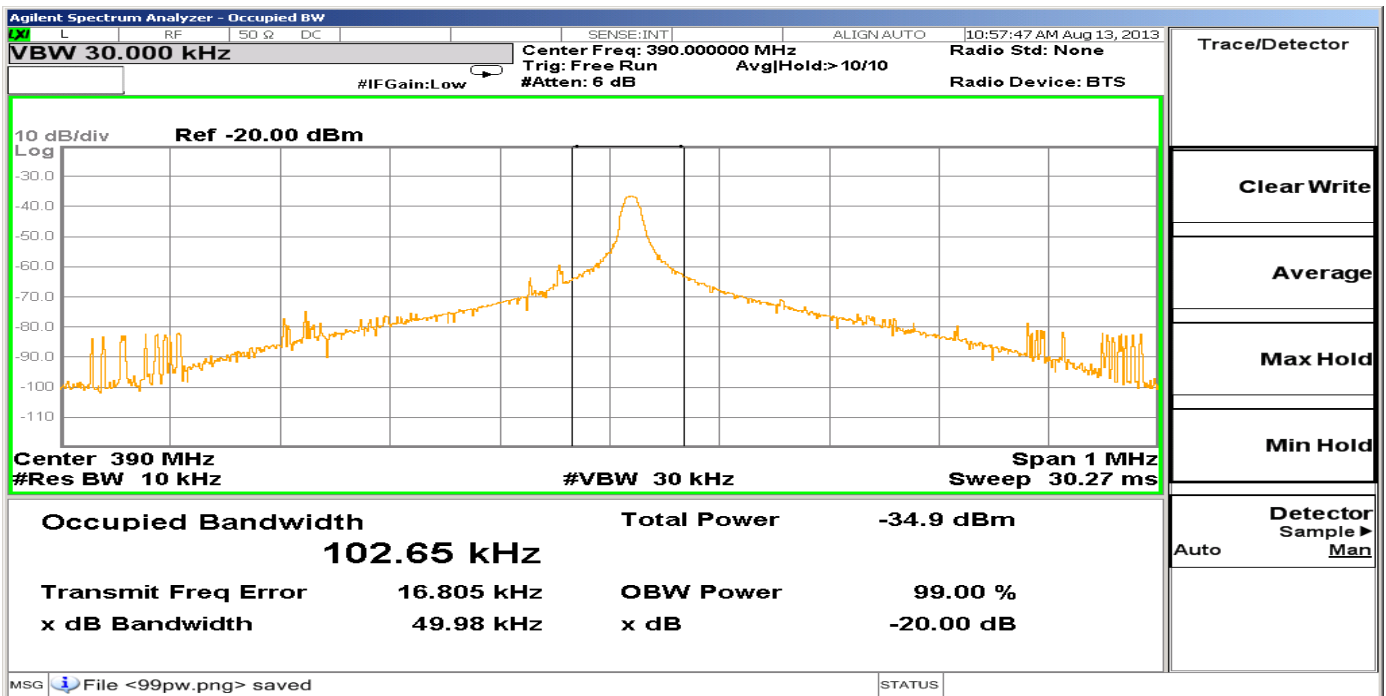
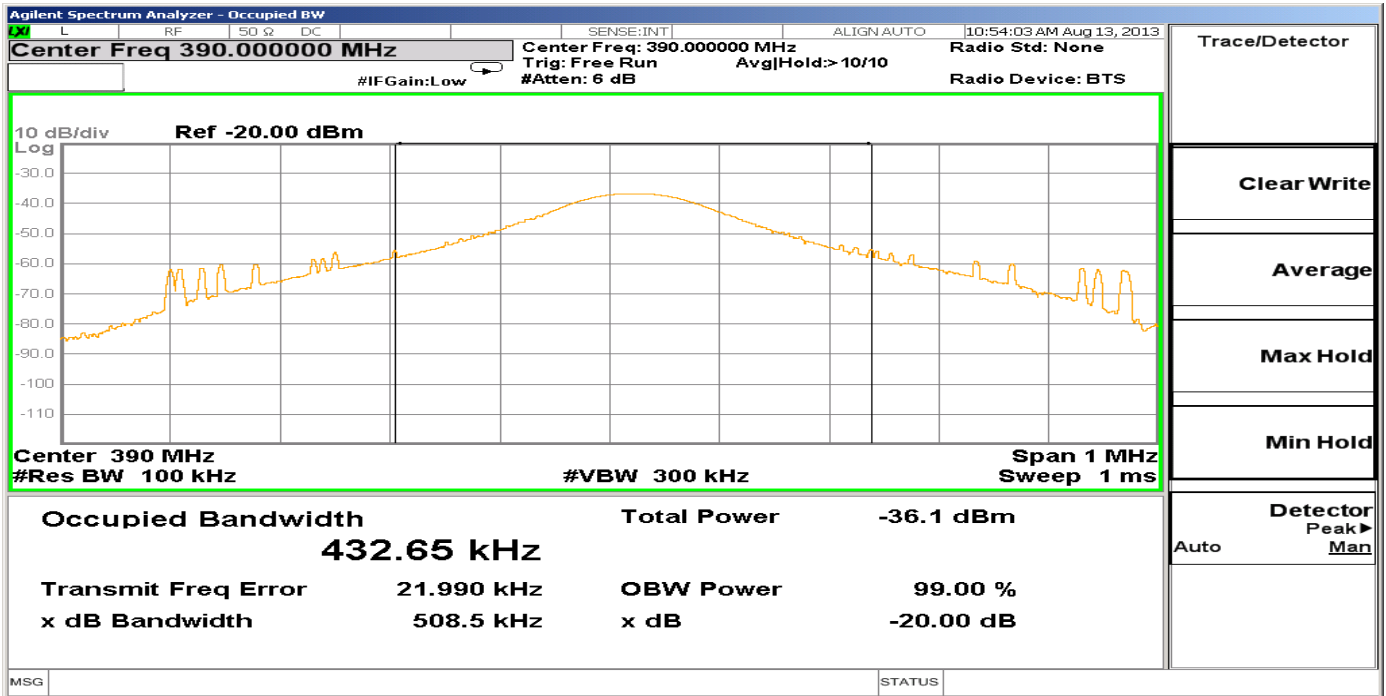
Table 16 Occupied Bandwidth Spectrum Analyzer Settings

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

Table 17 Occupied Bandwidth Test Result Summary

| Center Frequency | 20dB BW Measured (kHz) | 99% BW Measured (kHz) |
|------------------|------------------------|-----------------------|
| 390MHz | 432.65 | 102.65 |

Figure 15 – 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 18 Cease Operation Configuration Settings

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

Figure 16 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 19 Pulse Train Configuration Settings

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

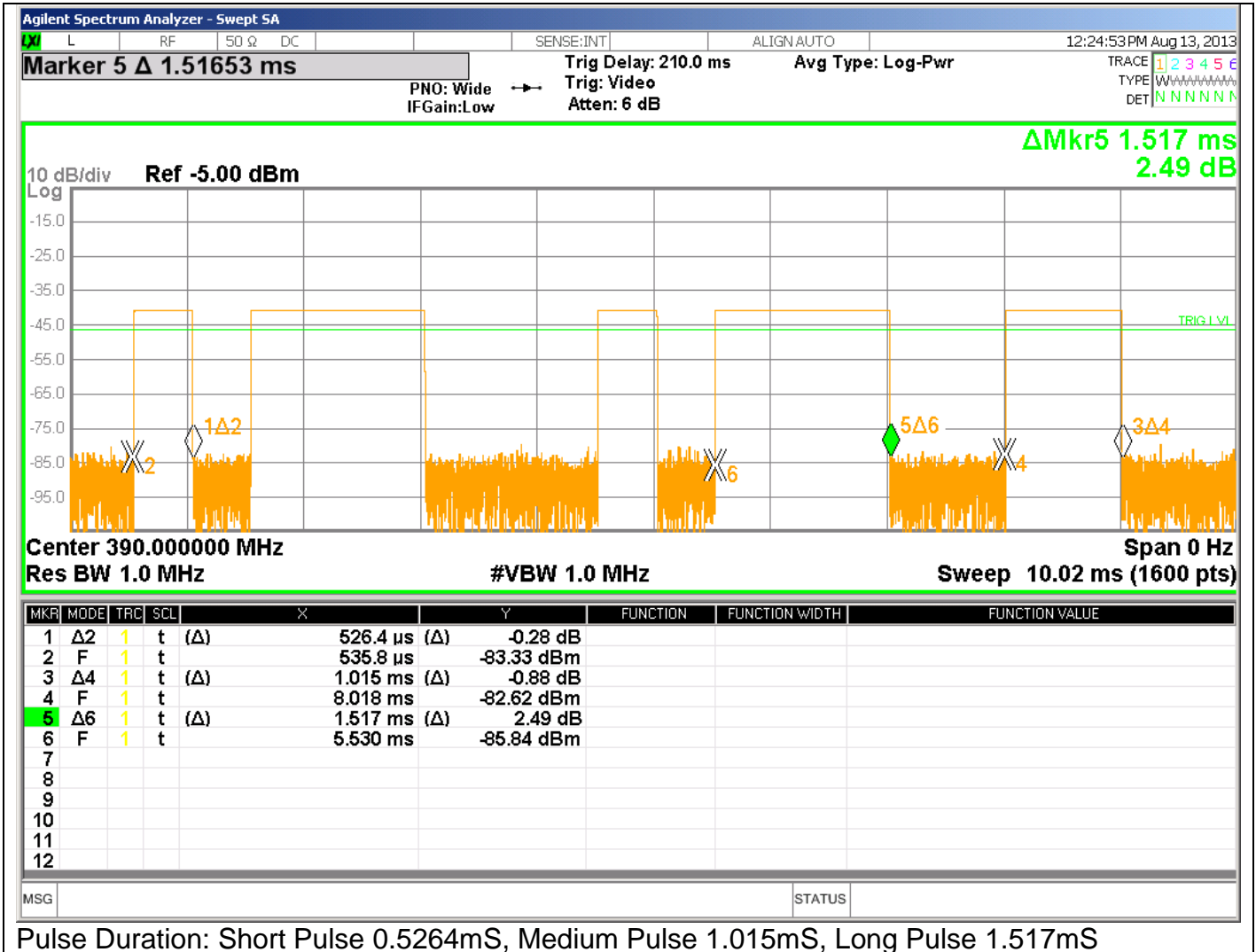
Table 20 Pulse Train Calculation

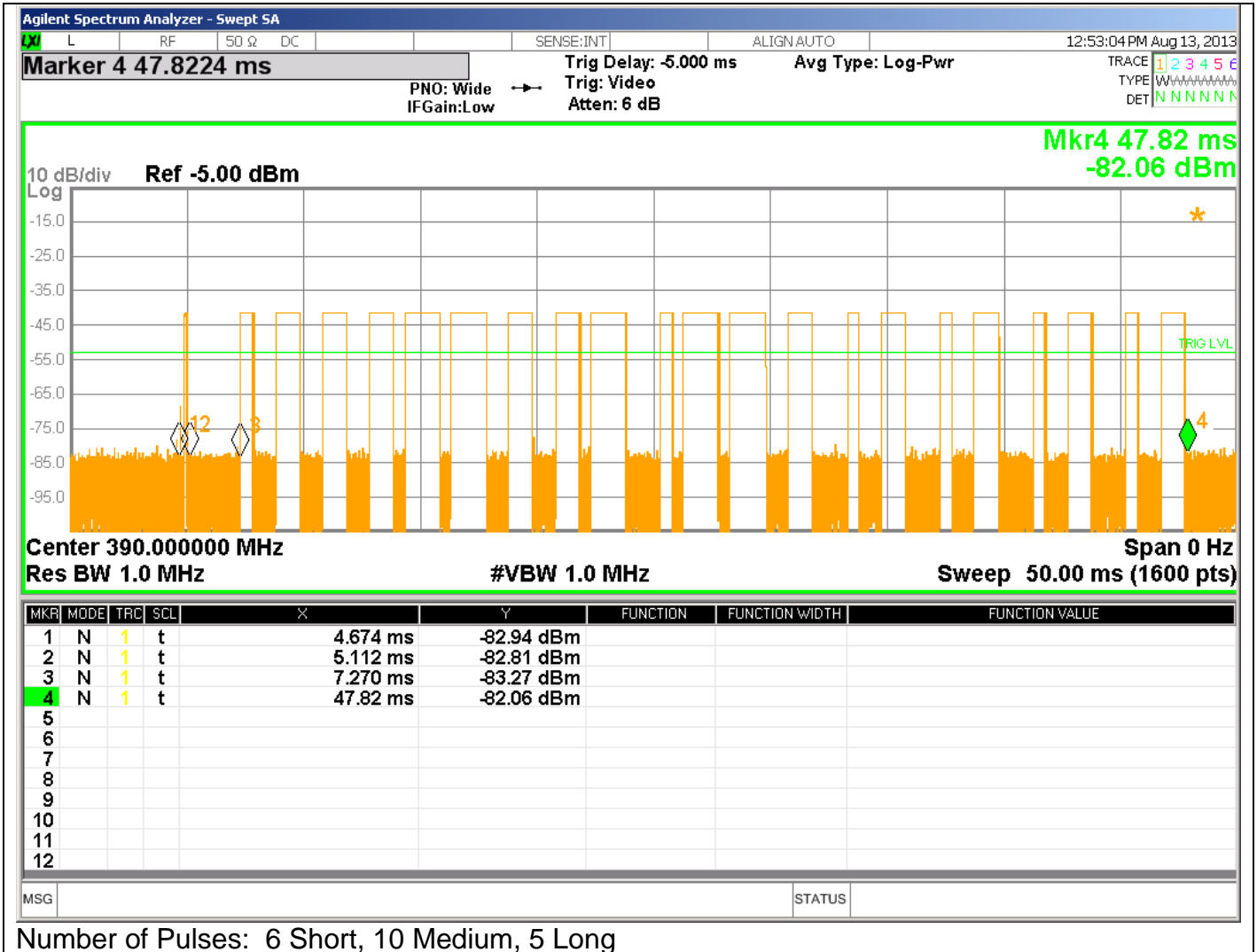
| TX Frequency | Total TX time | Total Transmission period or 100ms whichever is lesser | DC Correction Factor (dB) $20\log\left(\frac{PulseWidth}{Period}\right)$ |
|---|----------------------------------|--|---|
| 390MHz | (6x0.5264)+(10x1.015)+(5x1.5170) | 97.3 | -13.36 |
| Worst Case Duty Cycle: Worst case duty cycle was calculated over 97.3ms excluding the tuning pulses. The manufacturer declared duty cycle as -10.17dB and it is used for all radiated emissions data. | | | |

Figure 17 Pulse Train Graphs for 390MHz

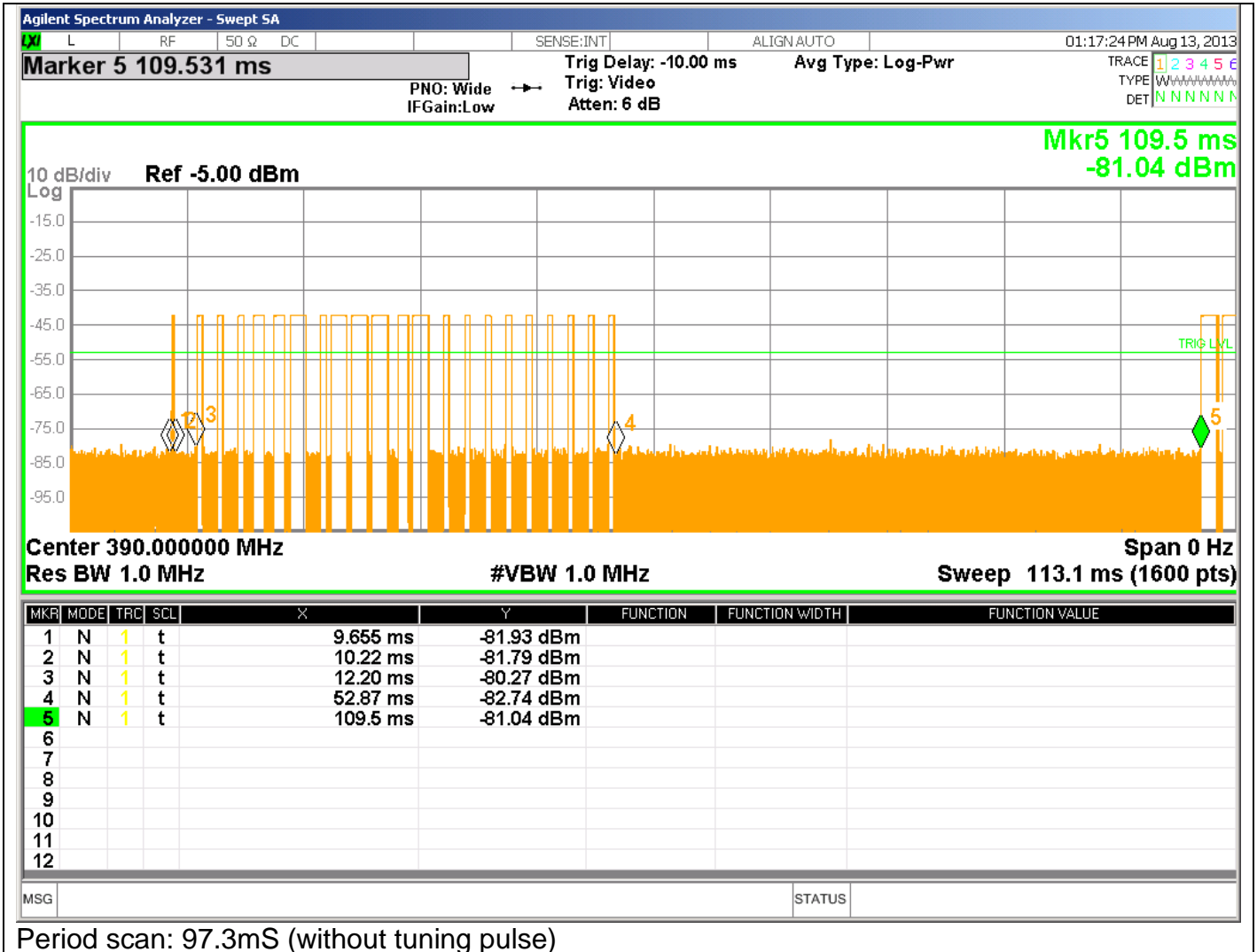


First tuning pulse duration: 0.1371mS





Number of Pulses: 6 Short, 10 Medium, 5 Long



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. Below 1GHz the combination of RBW/VBW was 120kHz/1MHz and above 1GHz the RBW/VBW was 1MHz/3MHz. | |
| 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 |
| Out of band spurious emissions | | |
| 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 4.3.3 for duty cycle information. Below 1GHz only emissions visible above the noise floor were the fundamental and the harmonics of the fundamental. | | |

Figure 18 Radiated Emissions Graph (Above 1GHz)

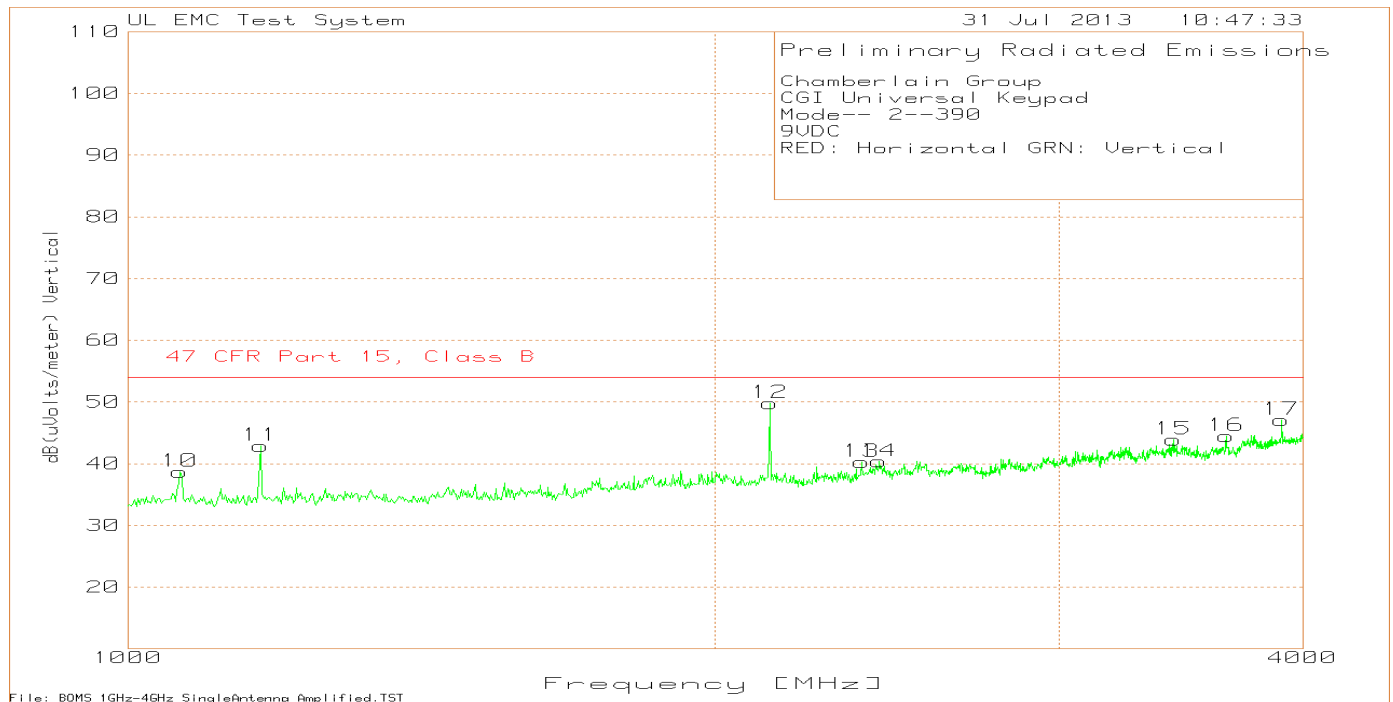
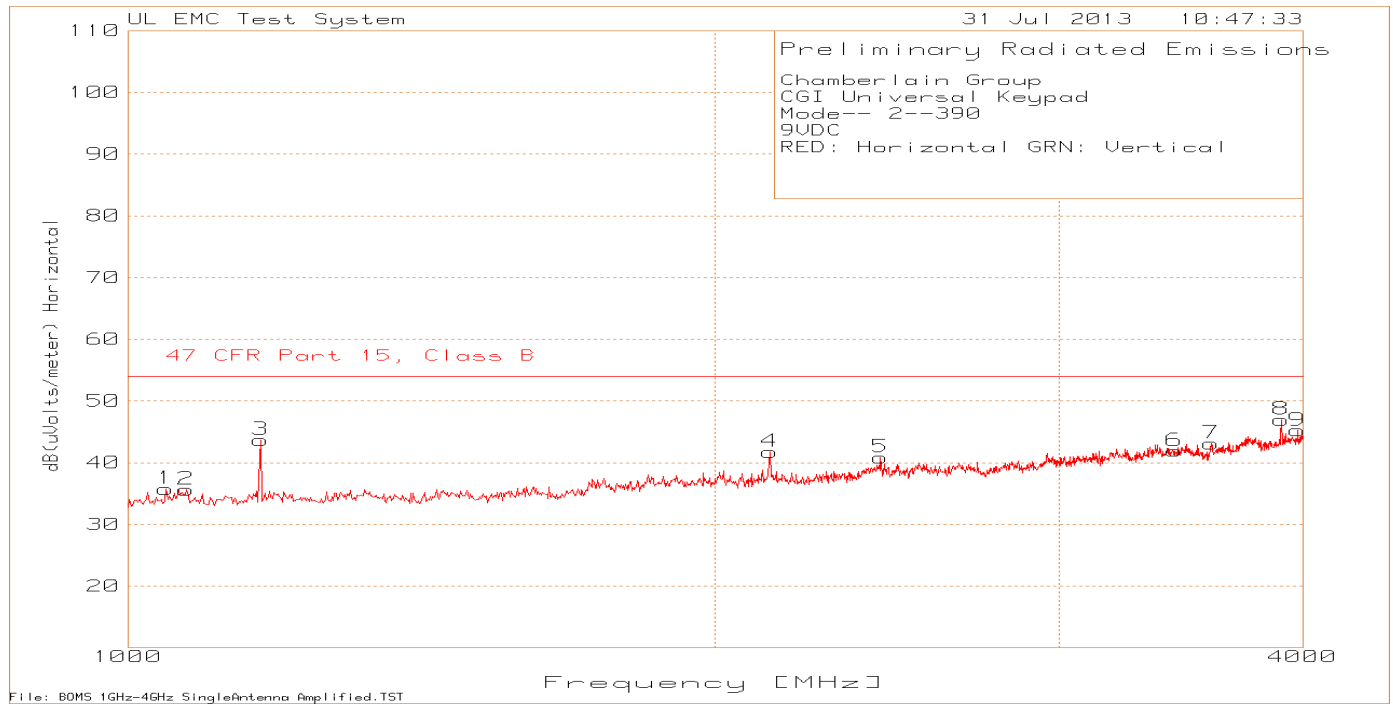


Table 21 - Radiated Emissions Data Points

| Test Frequency (MHz) | Meter Reading (dBuV) | Detector | AF dB/m | CF dB | Pad dB | Corrected Peak Level dBuV/m | Peak Limit dBuV/m | Peak Margin dB | DC Factor dB | Average Level dBuV/m | Average Limit dBuV/m | Average Margin dB | Azimuth [Degs] | Height [cm] | Polarity |
|----------------------|----------------------|----------|---------|--------|--------|-----------------------------|-------------------|----------------|--------------|----------------------|----------------------|-------------------|----------------|-------------|----------|
| 390.032 | 65.47 | PK | 16.10 | 8.50 | -5.99 | 84.08 | 99.24 | -15.16 | -10.17 | 73.91 | 79.24 | -5.33 | 90 | 153 | V |
| 390.0212 | 61.41 | PK | 16.10 | 8.50 | -5.99 | 80.02 | 99.24 | -19.22 | -10.17 | 69.85 | 79.24 | -9.39 | 0 | 172 | H |
| 780.0461 | 12.17 | PK | 22.00 | 9.70 | -6.01 | 37.86 | 66.02 | -28.16 | -10.17 | 27.69 | 46.02 | -18.33 | 1 | 199 | H |
| 780.0536 | 16.93 | PK | 22.00 | 9.70 | -6.01 | 42.62 | 66.02 | -23.40 | -10.17 | 32.45 | 46.02 | -13.57 | 90 | 137 | V |
| 1046.031 | 68.26 | PK | 24.30 | -56.81 | 0.00 | 35.75 | 74.00 | -38.25 | -10.17 | 25.58 | 54.00 | -18.25 | * | 200 | Horz |
| 1072.048 | 67.97 | PK | 24.60 | -56.95 | 0.00 | 35.62 | 74.00 | -38.38 | -10.17 | 25.45 | 54.00 | -18.38 | * | 150 | Horz |
| 1170.113 | 75.91 | PK | 25.00 | -57.24 | 0.00 | 43.67 | 74.00 | -30.33 | -10.17 | 33.50 | 54.00 | -10.33 | * | 200 | Horz |
| 2134.757 | 67.38 | PK | 27.50 | -53.14 | 0.00 | 41.74 | 74.00 | -32.26 | -10.17 | 31.57 | 54.00 | -12.26 | * | 150 | Horz |
| 2430.954 | 64.17 | PK | 28.70 | -51.98 | 0.00 | 40.89 | 74.00 | -33.11 | -10.17 | 30.72 | 54.00 | -13.11 | * | 200 | Horz |
| 3437.625 | 61.35 | PK | 31.10 | -50.52 | 0.00 | 41.93 | 74.00 | -32.07 | -10.17 | 31.76 | 54.00 | -12.07 | * | 200 | Horz |
| 3591.728 | 62.76 | PK | 31.50 | -51.17 | 0.00 | 43.09 | 74.00 | -30.91 | -10.17 | 32.92 | 54.00 | -10.91 | * | 100 | Horz |
| 3901.935 | 66.34 | PK | 32.60 | -51.99 | 0.00 | 46.95 | 74.00 | -27.05 | -10.17 | 36.78 | 54.00 | -7.05 | * | 100 | Horz |
| 3975.984 | 63.95 | PK | 32.50 | -51.23 | 0.00 | 45.22 | 74.00 | -28.78 | -10.17 | 35.05 | 54.00 | -8.78 | * | 200 | Horz |
| 1064.043 | 70.83 | PK | 24.50 | -56.63 | 0.00 | 38.70 | 74.00 | -35.30 | -10.17 | 28.53 | 54.00 | -15.30 | * | 200 | Vert |
| 1170.113 | 75.09 | PK | 25.00 | -57.24 | 0.00 | 42.85 | 74.00 | -31.15 | -10.17 | 32.68 | 54.00 | -11.15 | * | 150 | Vert |
| 2132.755 | 75.49 | PK | 27.50 | -53.18 | 0.00 | 49.81 | 74.00 | -24.19 | -10.17 | 39.64 | 54.00 | -4.19 | * | 100 | Vert |
| 2376.918 | 64.35 | PK | 28.40 | -52.44 | 0.00 | 40.31 | 74.00 | -33.69 | -10.17 | 30.14 | 54.00 | -13.69 | * | 100 | Vert |
| 2426.951 | 63.52 | PK | 28.70 | -51.87 | 0.00 | 40.35 | 74.00 | -33.65 | -10.17 | 30.18 | 54.00 | -13.65 | * | 150 | Vert |
| 3435.624 | 63.33 | PK | 31.10 | -50.54 | 0.00 | 43.89 | 74.00 | -30.11 | -10.17 | 33.72 | 54.00 | -10.11 | * | 200 | Vert |
| 3653.769 | 64.27 | PK | 31.70 | -51.52 | 0.00 | 44.45 | 74.00 | -29.55 | -10.17 | 34.28 | 54.00 | -9.55 | * | 200 | Vert |
| 3901.935 | 66.47 | PK | 32.60 | -51.99 | 0.00 | 47.08 | 74.00 | -26.92 | -10.17 | 36.91 | 54.00 | -6.92 | * | 100 | Vert |

PK - Peak Detector
 AF - Antenna Factor, CF - Cable Factor
 * - results based on peak prescan

4.4 Configuration 3 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 (390MHz: 975.0kHz) | | |

Table 22 Occupied Bandwidth Configuration Settings

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

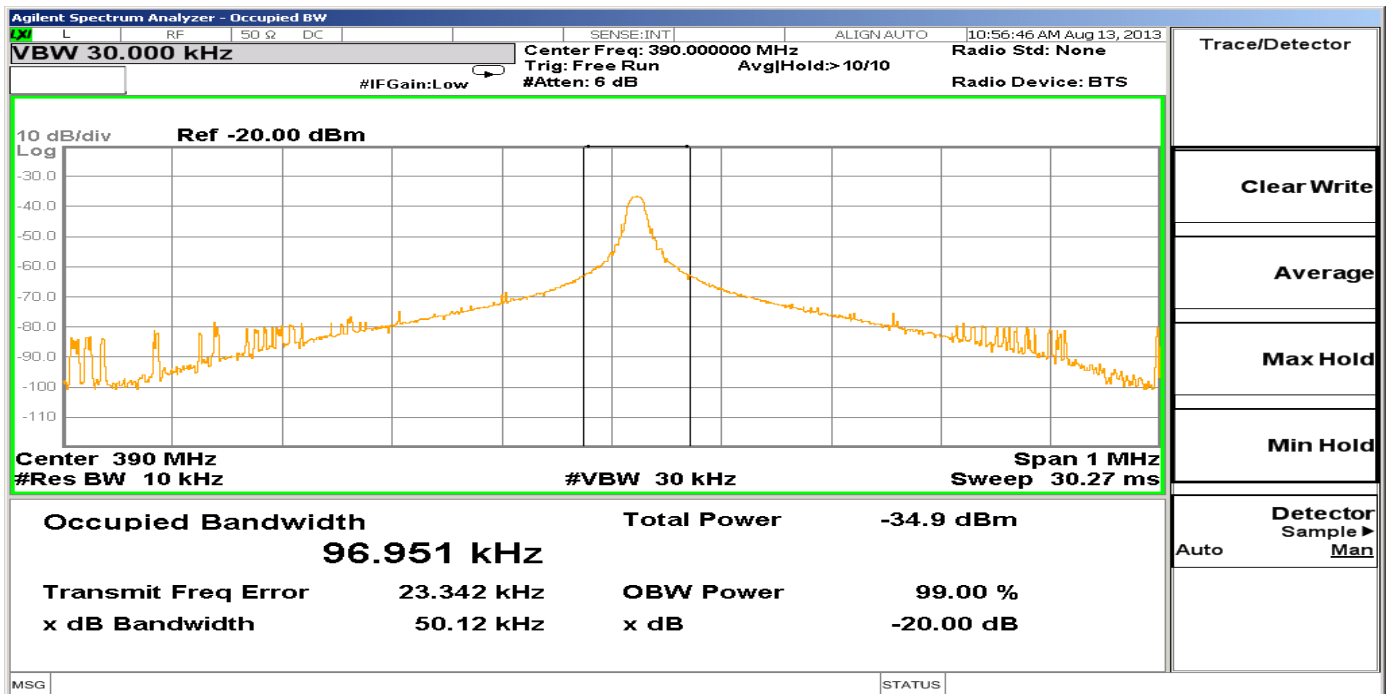
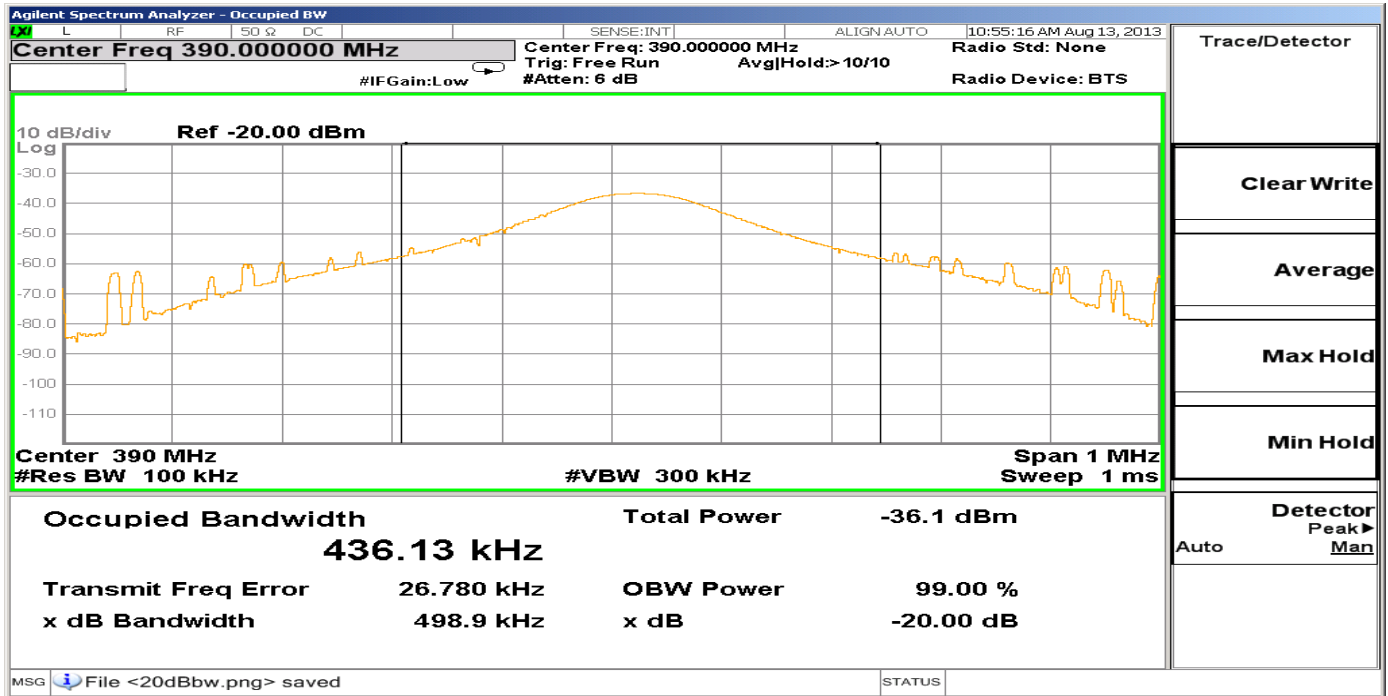
Table 23 Occupied Bandwidth Spectrum Analyzer Settings

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

Table 24 Occupied Bandwidth Test Result Summary

| Center Frequency | 20dB BW Measured (kHz) | 99% BW Measured (kHz) |
|------------------|------------------------|-----------------------|
| 390MHz | 436.13 | 96.951 |

Figure 19 – 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 25 Cease Operation Configuration Settings

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

Figure 20 Cease Operation Graph



4.4.3 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. | | |

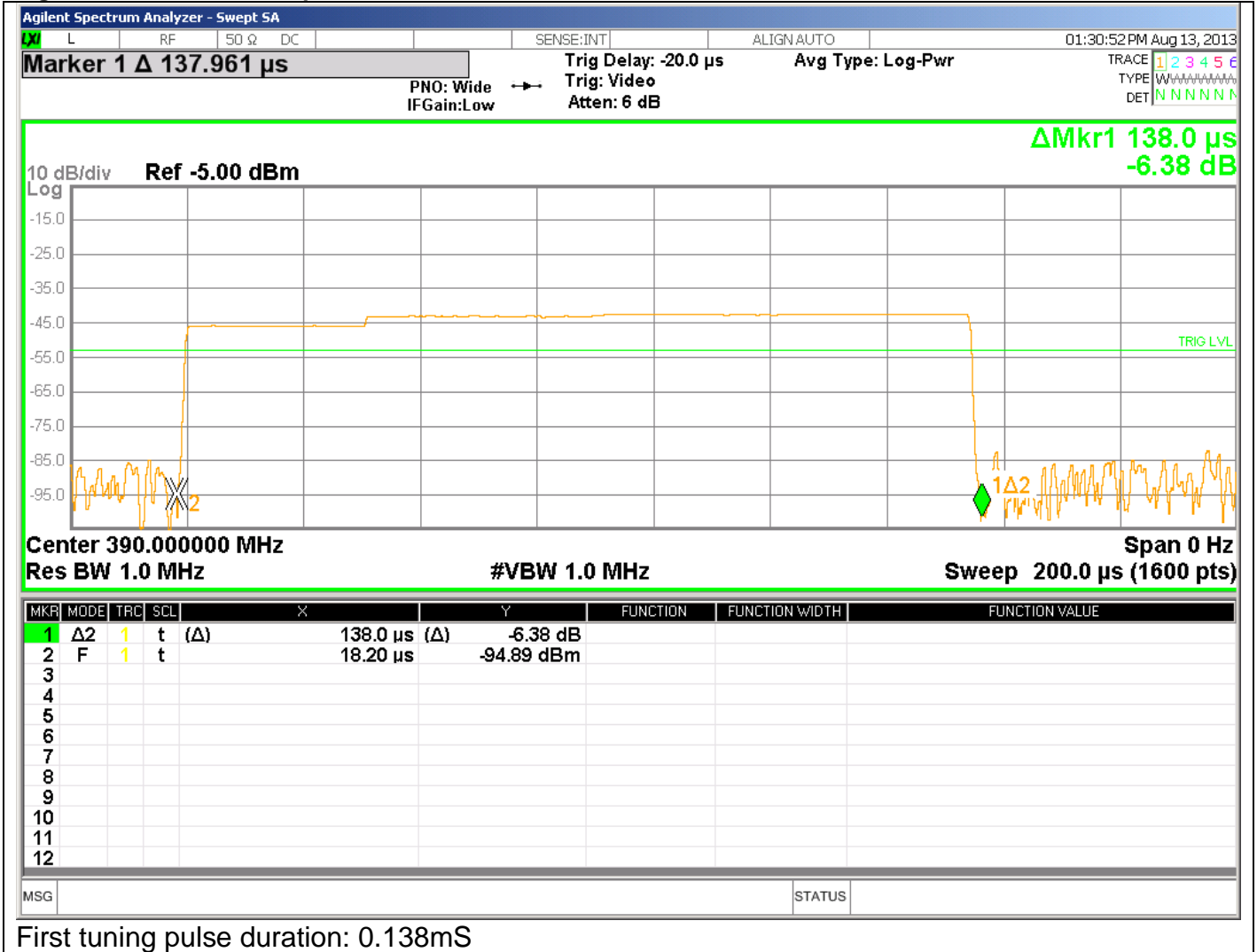
Table 26 Pulse Train Configuration Settings

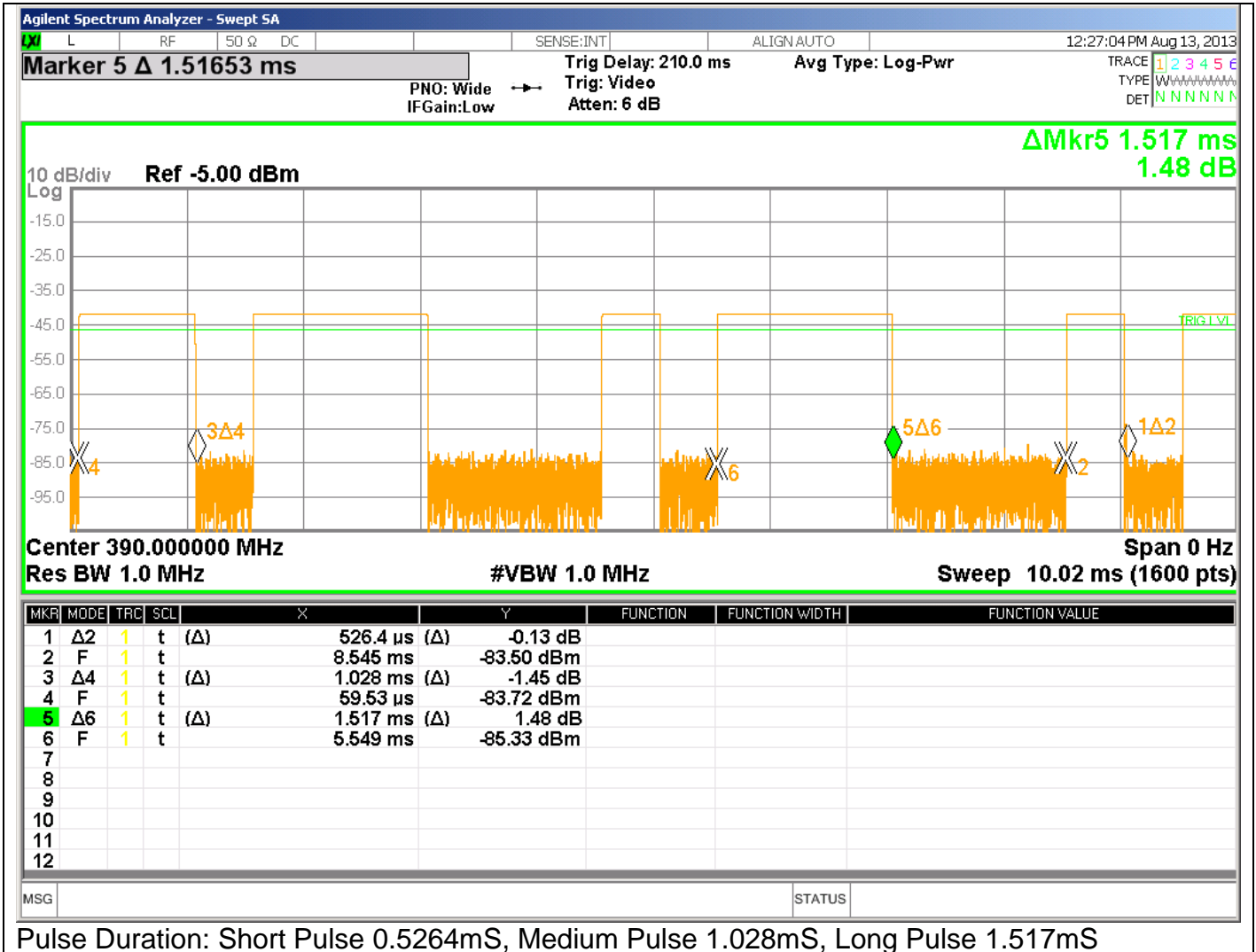
| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---------------------------------|---------------------------|----------------------|
| 1 | 1 | 1 |
| Supplementary information: None | | |

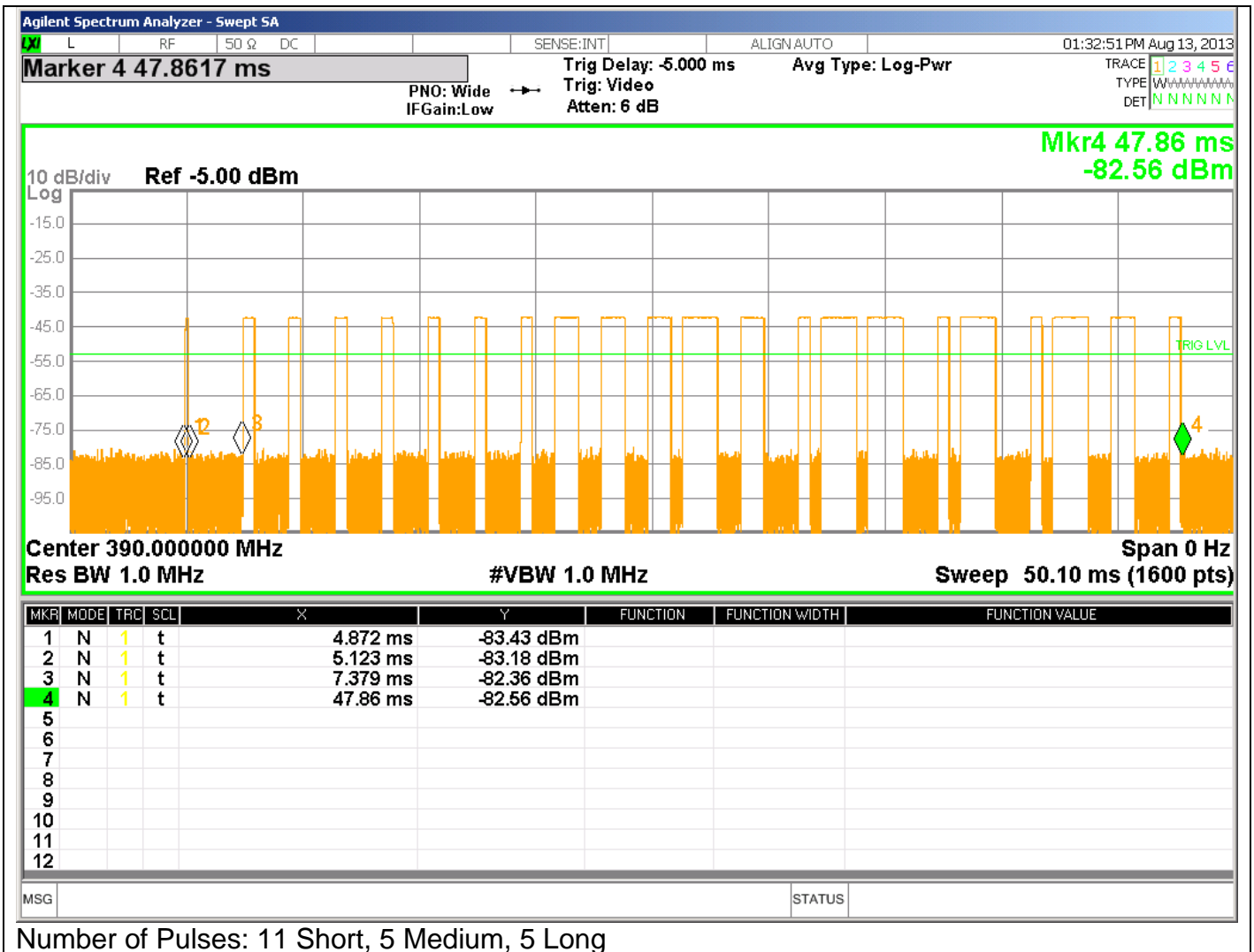
Table 27 Pulse Train Calculation

| 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 | (3x1.007)+(5x2.003)+(3x3.006) | 76.37 | -10.79 |
| Worst Case Duty Cycle: Worst case duty cycle was calculated over normal period of 76.4mS not including the tuning pulses. The manufacturer declared duty cycle as -8.52dB and it is used for all radiated emissions data. | | | |

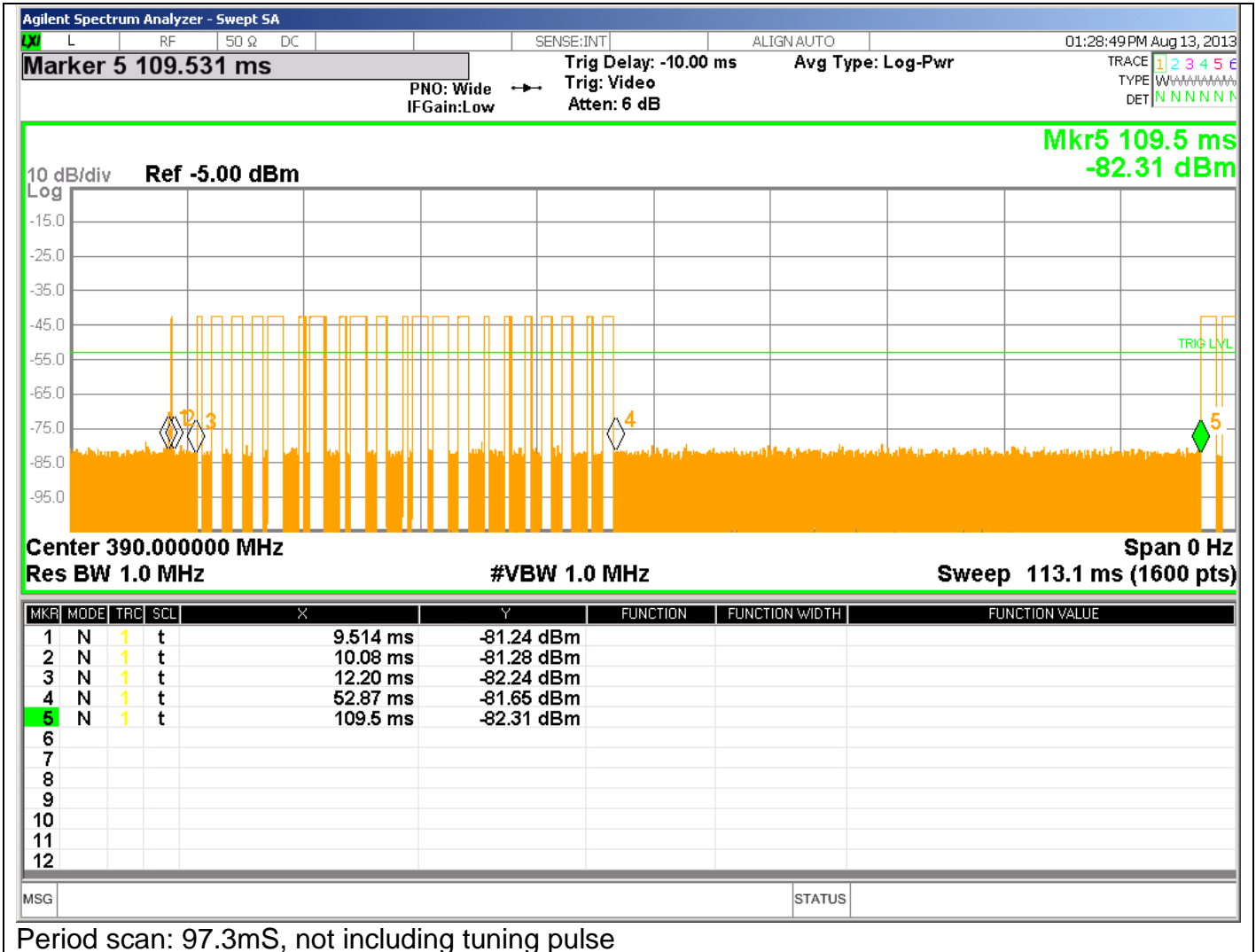
Figure 21 Pulse Train Graphs for 390MHz







Number of Pulses: 11 Short, 5 Medium, 5 Long



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. Below 1GHz the combination of RBW/VBW was 120kHz/1MHz and above 1GHz the RBW/VBW was 1MHz/3MHz. | |
| 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 4.4.3 for duty cycle information. Below 1GHz only emissions visible above the noise floor were the fundamental and the harmonics of the fundamental. | | |

Figure 22 Radiated Emissions Graph (Above 1GHz)

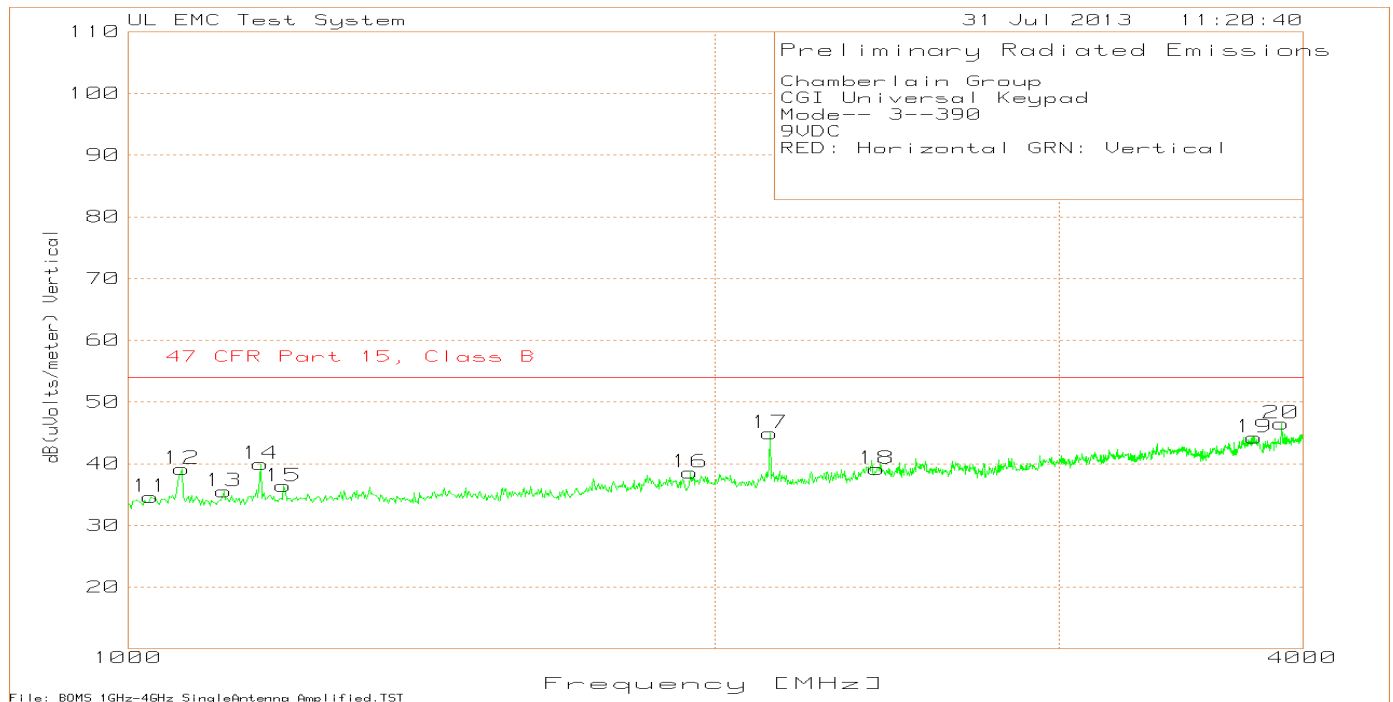
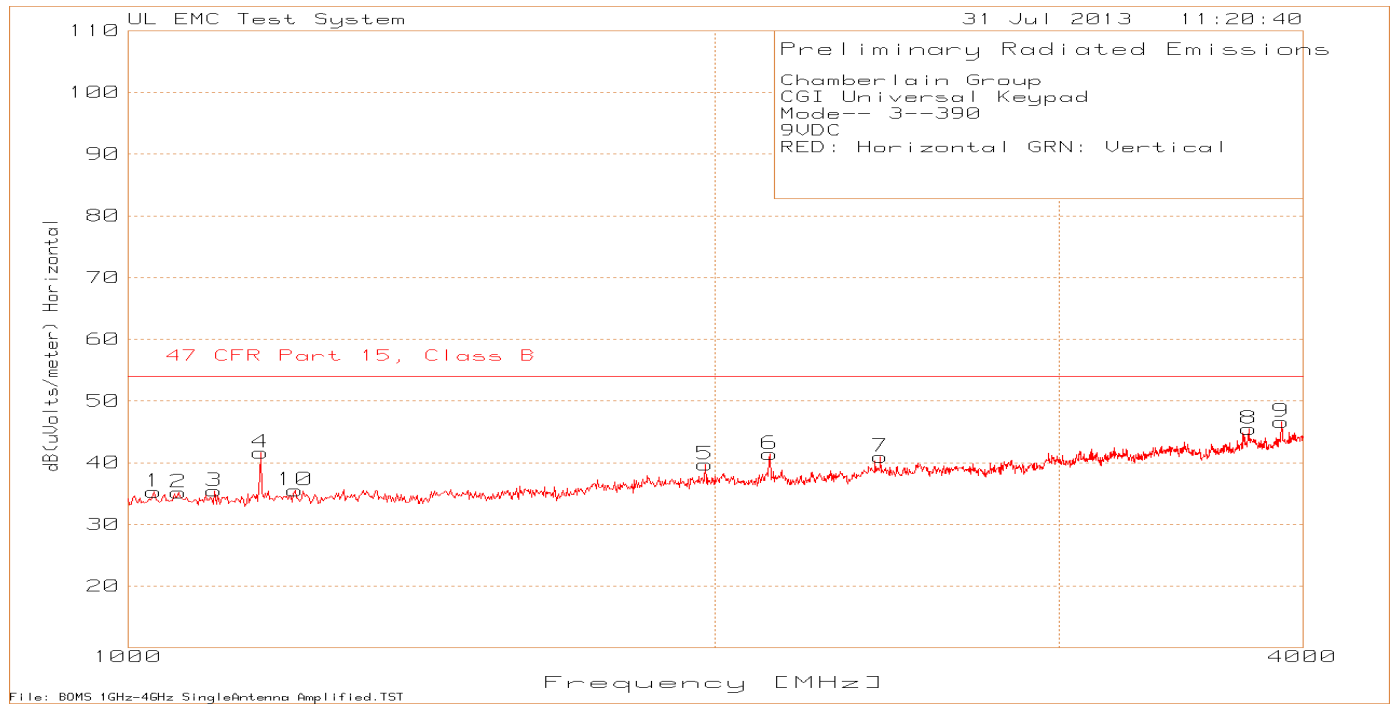


Table 28 - Radiated Emissions Data Points

| Test Frequency (MHz) | Meter Reading (dBuV) | Detector | AF dB/m | CF dB | Pad dB | Corrected Peak Level dBuV/m | Peak Limit dBuV/m | Peak Margin dB | DC Factor dB | Average Level dBuV/m | Average Limit dBuV/m | Average Margin dB | Azimuth [Degs] | Height [cm] | Polarity |
|----------------------|----------------------|----------|---------|--------|--------|-----------------------------|-------------------|----------------|--------------|----------------------|----------------------|-------------------|----------------|-------------|----------|
| 390.0307 | 57.31 | PK | 16.1 | 8.5 | -5.99 | 75.92 | 99.24 | -23.32 | -8.52 | 67.40 | 79.24 | -11.84 | 0 | 181 | H |
| 390.0372 | 61.05 | PK | 16.1 | 8.5 | -5.99 | 79.66 | 99.24 | -19.58 | -8.52 | 71.14 | 79.24 | -8.10 | 90 | 149 | V |
| 780.0515 | 10.41 | PK | 22 | 9.7 | -6.01 | 36.10 | 66.02 | -29.92 | -8.52 | 27.58 | 46.02 | -18.44 | 0 | 182 | H |
| 780.0776 | 13.13 | PK | 22 | 9.7 | -6.01 | 38.82 | 66.02 | -27.20 | -8.52 | 30.30 | 46.02 | -15.72 | 90 | 141 | V |
| 1032.021 | 68.01 | PK | 24.2 | -56.87 | 0 | 35.34 | 74 | -38.66 | -8.52 | 26.82 | 54 | -27.18 | * | 150 | H |
| 1062.041 | 67.28 | PK | 24.5 | -56.64 | 0 | 35.14 | 74 | -38.86 | -8.52 | 26.62 | 54 | -27.38 | * | 200 | H |
| 1108.072 | 68.19 | PK | 24.9 | -57.62 | 0 | 35.47 | 74 | -38.53 | -8.52 | 26.95 | 54 | -27.05 | * | 200 | H |
| 1170.113 | 73.86 | PK | 25 | -57.24 | 0 | 41.62 | 74 | -32.38 | -8.52 | 33.10 | 54 | -20.90 | * | 200 | H |
| 1976.651 | 66.25 | PK | 27.3 | -53.85 | 0 | 39.70 | 74 | -34.30 | -8.52 | 31.18 | 54 | -22.82 | * | 200 | H |
| 2132.755 | 67.13 | PK | 27.5 | -53.18 | 0 | 41.45 | 74 | -32.55 | -8.52 | 32.93 | 54 | -21.07 | * | 100 | H |
| 2430.954 | 64.27 | PK | 28.7 | -51.98 | 0 | 40.99 | 74 | -33.01 | -8.52 | 32.47 | 54 | -21.53 | * | 150 | H |
| 3753.836 | 64.34 | PK | 32.2 | -51.03 | 0 | 45.51 | 74 | -28.49 | -8.52 | 36.99 | 54 | -17.01 | * | 200 | H |
| 3901.935 | 66.06 | PK | 32.6 | -51.99 | 0 | 46.67 | 74 | -27.33 | -8.52 | 38.15 | 54 | -15.85 | * | 100 | H |
| 1218.145 | 67.36 | PK | 25.1 | -56.93 | 0 | 35.53 | 74 | -38.47 | -8.52 | 27.01 | 54 | -26.99 | * | 200 | H |
| 1028.019 | 67.56 | PK | 24.1 | -56.99 | 0 | 34.67 | 74 | -39.33 | -8.52 | 26.15 | 54 | -27.85 | * | 99 | V |
| 1066.044 | 71.41 | PK | 24.5 | -56.71 | 0 | 39.20 | 74 | -34.80 | -8.52 | 30.68 | 54 | -23.32 | * | 200 | V |
| 1120.08 | 68.07 | PK | 24.9 | -57.49 | 0 | 35.48 | 74 | -38.52 | -8.52 | 26.96 | 54 | -27.04 | * | 150 | V |
| 1170.113 | 72.15 | PK | 25 | -57.24 | 0 | 39.91 | 74 | -34.09 | -8.52 | 31.39 | 54 | -22.61 | * | 150 | V |
| 1202.135 | 67.96 | PK | 25.1 | -56.68 | 0 | 36.38 | 74 | -37.62 | -8.52 | 27.86 | 54 | -26.14 | * | 200 | V |
| 1942.628 | 65.75 | PK | 27.3 | -54.48 | 0 | 38.57 | 74 | -35.43 | -8.52 | 30.05 | 54 | -23.95 | * | 200 | V |
| 2132.755 | 70.61 | PK | 27.5 | -53.18 | 0 | 44.93 | 74 | -29.07 | -8.52 | 36.41 | 54 | -17.59 | * | 99 | V |
| 2420.947 | 62.45 | PK | 28.6 | -51.85 | 0 | 39.20 | 74 | -34.80 | -8.52 | 30.68 | 54 | -23.32 | * | 200 | V |
| 3777.852 | 63.42 | PK | 32.4 | -51.61 | 0 | 44.21 | 74 | -29.79 | -8.52 | 35.69 | 54 | -18.31 | * | 200 | V |
| 3901.935 | 65.92 | PK | 32.6 | -51.99 | 0 | 46.53 | 74 | -27.47 | -8.52 | 38.01 | 54 | -15.99 | * | 99 | V |

PK - Peak Detector
 AF - Antenna Factor, CF - Cable Factor
 * - results based on peak prescan

Appendix A

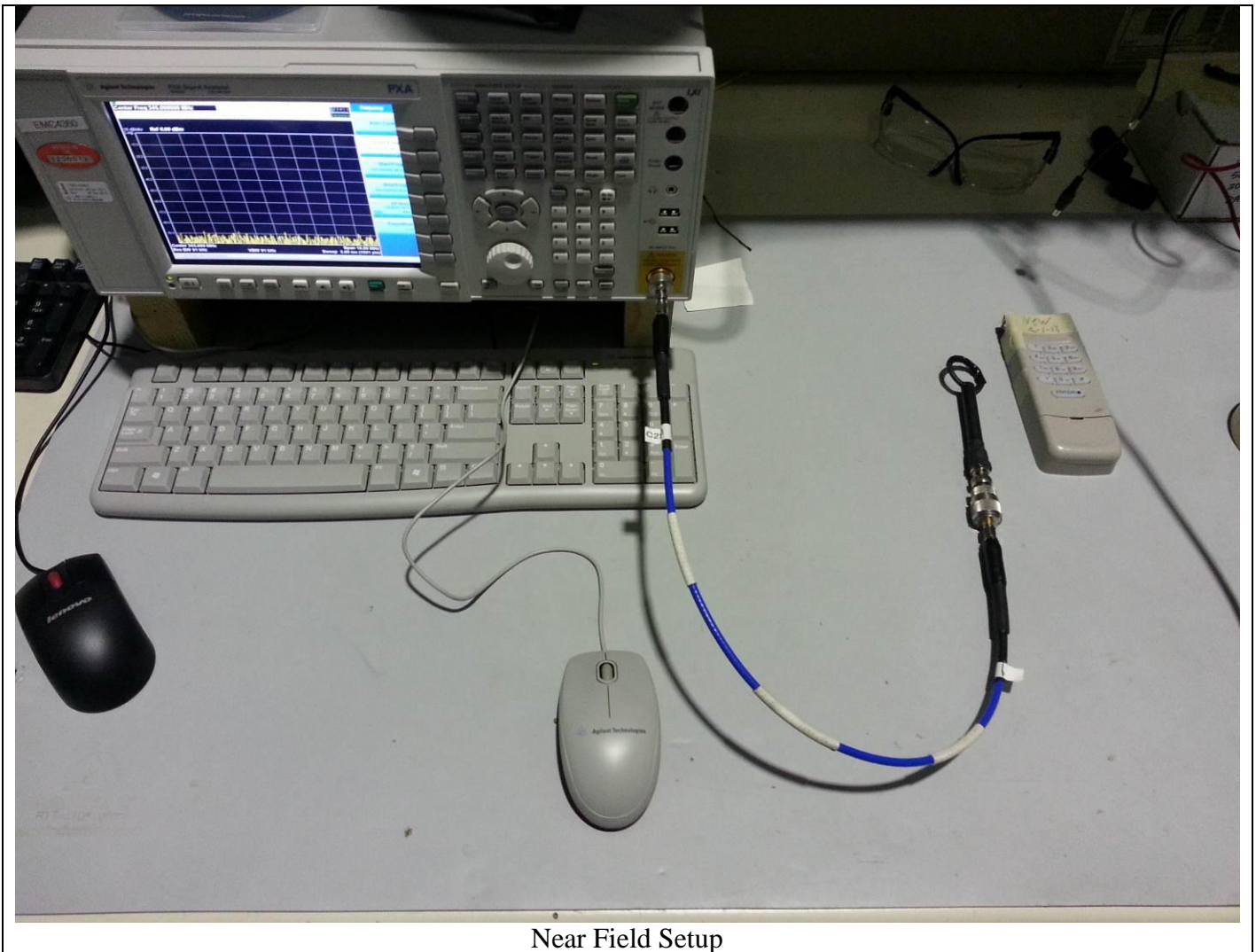
Test Equipment Used

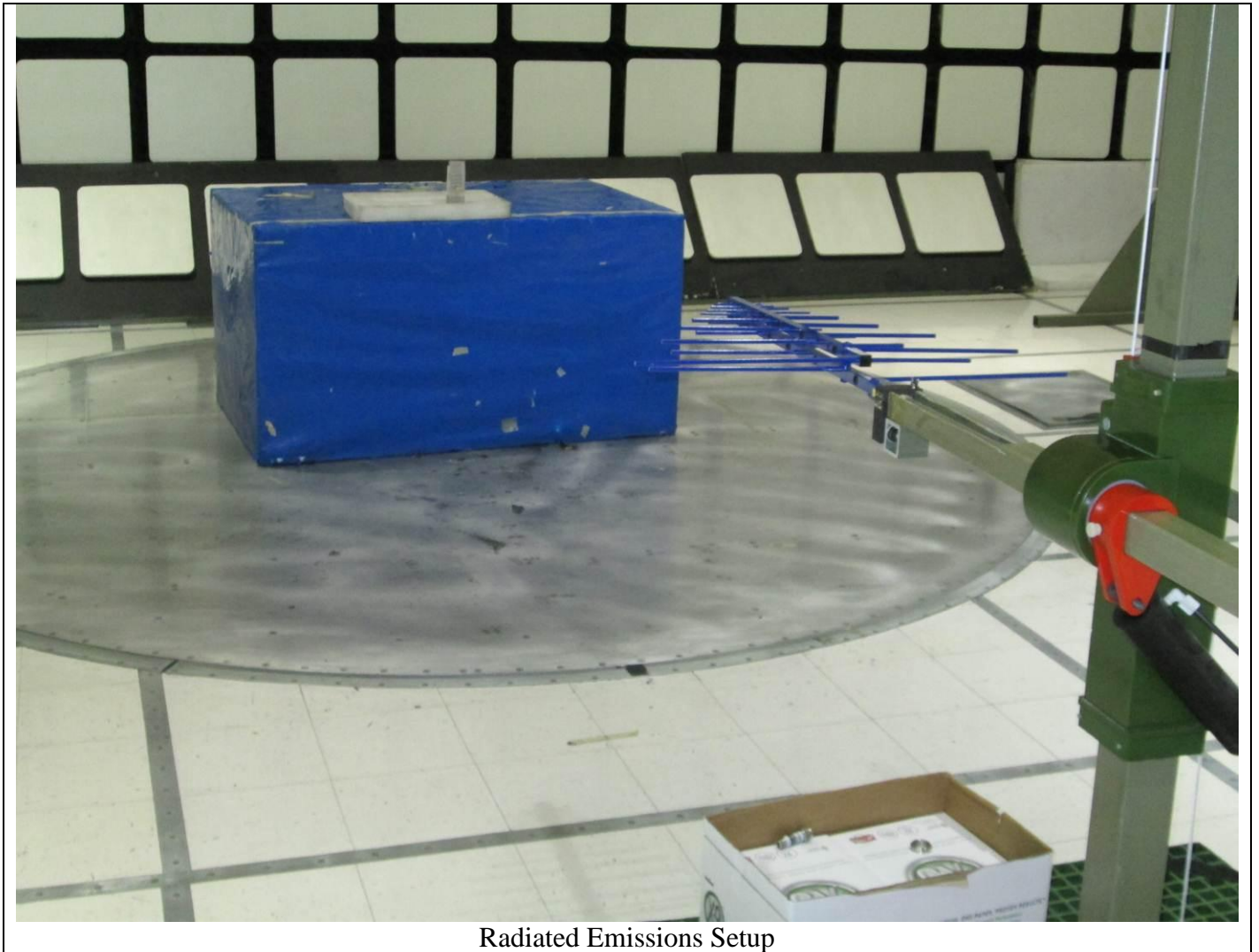
| Test Equipment Used for Near Field Measurements | | | | | |
|---|--------------|-------|------------|----------|--------------|
| Description | Manufacturer | Model | Identifier | Cal Date | Cal Due Date |
| Spectrum analyzer | Agilent | PXA | EMC4360 | 20121226 | 20131226 |
| Generic Loop Antenna | - | - | - | - | - |

| Test Equipment Used for Radiated Emissions | | | | | |
|--|-----------------|----------|------------|-----------|---------------|
| Description | Manufacturer | Model | Identifier | Cal. Date | Cal. Due Date |
| EMI Test Receiver | Rohde & Schwarz | ESU | EMC4323 | 20121227 | 20131231 |
| Bicon Antenna | Chase | VBA6106A | EMC4078 | 20130213 | 20140228 |
| Log-P Antenna | Chase | UPA6109 | EMC4313 | 20120807 | 20130831 |
| Spectrum Analyzer | Rhode & Schwarz | FSEK | EMC4182 | 20121226 | 20131231 |
| Antenna Array (1GHz-40GHz) | UL | BOMS | EMC4276 | 20111227 | 20131231 |

Appendix B

Test Setup Photos





Radiated Emissions Setup

Order #:10045101 Project#: 13N15794
Model Number: 001D7973
Client Name: Chamberlain Group Inc.

File #: MC15343 Page 72 of 74



Radiated Emissions Setup

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

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