Broadband over Power Lines (BPL)
FCC Emissions Compliance Guidelines

Access-Underground Emissions testing to FCC Report & Order 04-245 (FCC Method)

Access-Underground BPL component being tested: Repeater

Applicable Standards for this test:	
STANDARD	**TITLE**
ANSI C63.4 - 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

EUT CONFIGURATION	
Product Type	BPL medium voltage (MV) Access Gateway
Serial Number	7353125931/6401625558/6938020727/6284826266
Model Number	CXP-MVA-GWY (T3B)
Marketing Designation	Corinex NR – MV Gateway
Chassis Revision Number	MV-Gateway V1
Firmware Revision Number	ac_CXP_GNR_GWY_A2_hv1_0_0_sv3_4_8_2_0_0
ECO Number (if applicable)	
ID #	QIU-CXP-MVA-GNR

EUT OPERATING PARAMETERS	
Modulation type	OFDM
Number of carriers	1536
Carrier spacing	Medium Voltage, mode 1, Spacing 6.51 kHz Medium Voltage, mode 2, Spacing 4.56 kHz Medium Voltage, mode 3, Spacing 6.51 kHz Low Voltage, Spacing 18.23 kHz
Channel bandwidth	Mode 1:10MHz; Mode 2 :7MHz; Mode 3 :10MHz
Lowest external frequency used	3MHz
Highest external frequency used	32MHz
Notching depth capability (dB)	30dB by default; 40dB maximum
Carrier On-Off remotely? (yes/no)	Yes
Power Setting mechanism	Default is power setting mask and notches active.
Maximum power setting	50mW/mode, 150mW total.
Range of duty factors (rep rates)	95%
Highest internal frequency	Crystal: 80MHz
Description of operation	The Corinex MV Access Gateway has 3 Powerline modules, an Ethernet switch between the modules, a power supply, and an industrial case that acts as a heat sink to the environment. The Gateway is attached to a utility pole via a bracket, typically located 20' or higher on the pole. Two of the 3 outputs of the device used for Medium Voltage communications with one being used for Low Voltage Communications. The MV outputs are connected to an MV Capacitive and Inductive Coupler and then attached to the MV line, the connector on the MV Gateway is an TNC type coaxial connector. The 2 MV outputs allow for connection to additional MV Gateway devices either "before" or "after" the device. The power cord for the device is also used for signal transmission on the Low Voltage lines and is internally coupled. The Ethernet switch within the device allows for inter-module communications. Finally, a grounding lug is

	provided on the device that is attached to the grounding wire on the pole. The MV Access Gateway uses orthogonal frequency-division multiplexing for modulation, which is a complex modulation technique for transmission based upon the idea of frequency-division multiplexing (FDM) where each frequency channel is modulated with a simpler modulation. We use 1536 carriers in our transmission. In each transmission, its normal operation mode will result in 20-25 pulse per second. Signaling type used is RF signals transmitted on MV powerlines with a frequency of 3-32 MHz. Unlike some MV Access devices, Corinex only uses Frequency Division Duplexing to communicate. The device is IP based and as such any IP packet can be transmitted over the network. Typical applications of the device include broadband internet access and the transmission of utility asset information.

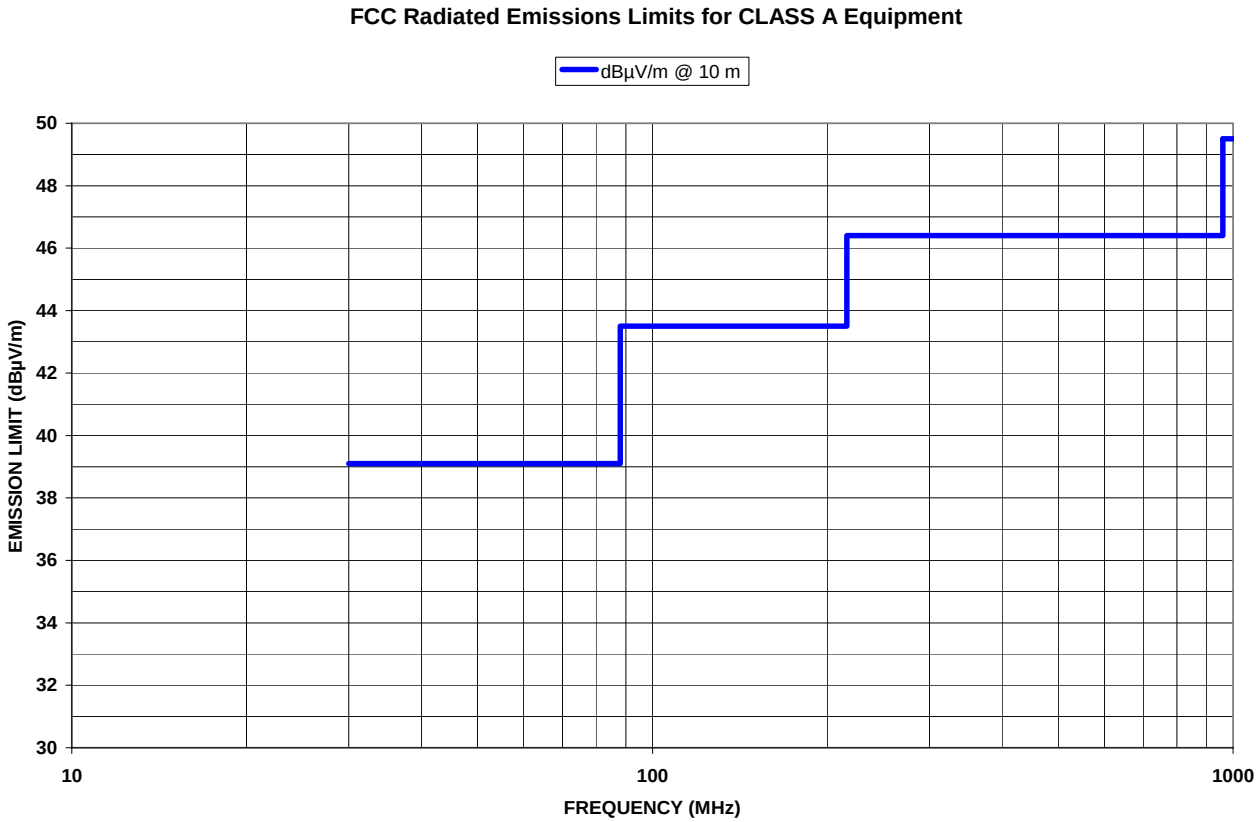
Rationale for selection of test site:
This site was chosen as one of three representative installations for this component because it is free of obstructions and has a low ambient.

OBJECT

This test procedure outlines the specific electromagnetic compatibility (EMC) emissions testing requirements applicable to Access BPL Underground installations. This procedure will be used for the testing and comparison of results from various locations and system architectures.

EUT PASS CRITERIA			
Location	**Test**	**Frequency Range**	**Limits**
"In situ"	**Radiated Emissions**	9 kHz – 30 MHz	29.5 dB(μV/m) measured at 30 meters[1]
		30 MHz - 88 MHz	39.1 dB(μV/m) measured at 10 meters[1]
		88 MHz – 216 MHz	43.5 dB(μV/m) measured at 10 meters[1]
		216 MHz – 960 MHz	56.4 dB(μV/m) measured at 10 meters[1]
		Above 960 MHz	49.5 dB(μV/m) measured at 10 meters[1]
Note 1: Installations will be measured at slant-range distances other than those listed above. The formulas to find the dB value to subtract from the measured values when data are taken at distances other than those indicated are: $40\log_{10} 30m/d_n$ for frequencies below 30MHz $20\log_{10} 10m/d_n$ for frequencies above 30MHz			

RADIATED EMISSIONS LIMITS (above 30 MHz)



Unintentional Radiator Upper Frequency Range of Measurement	
Highest frequency used in the device (MHz)	**Upper Frequency of Measurement (MHz)**
1.705-108MHz	1,000MHz
108-500MHz	2,000MHz
500-1,000MHz	5,000MHz
Above 1,000MHz	5th Harmonic <40GHz

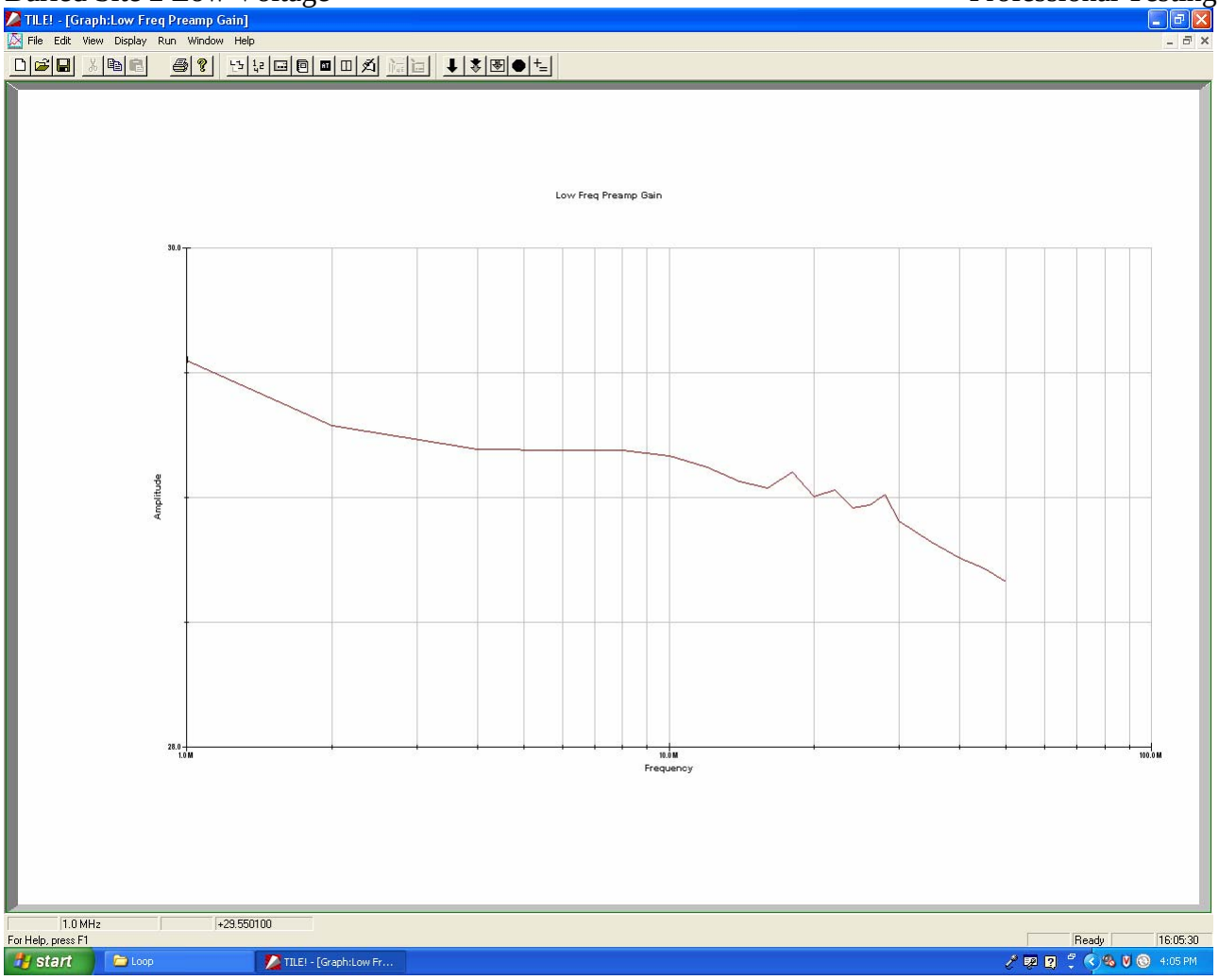
The upper frequency of measurement for this test is 1000 MHz.

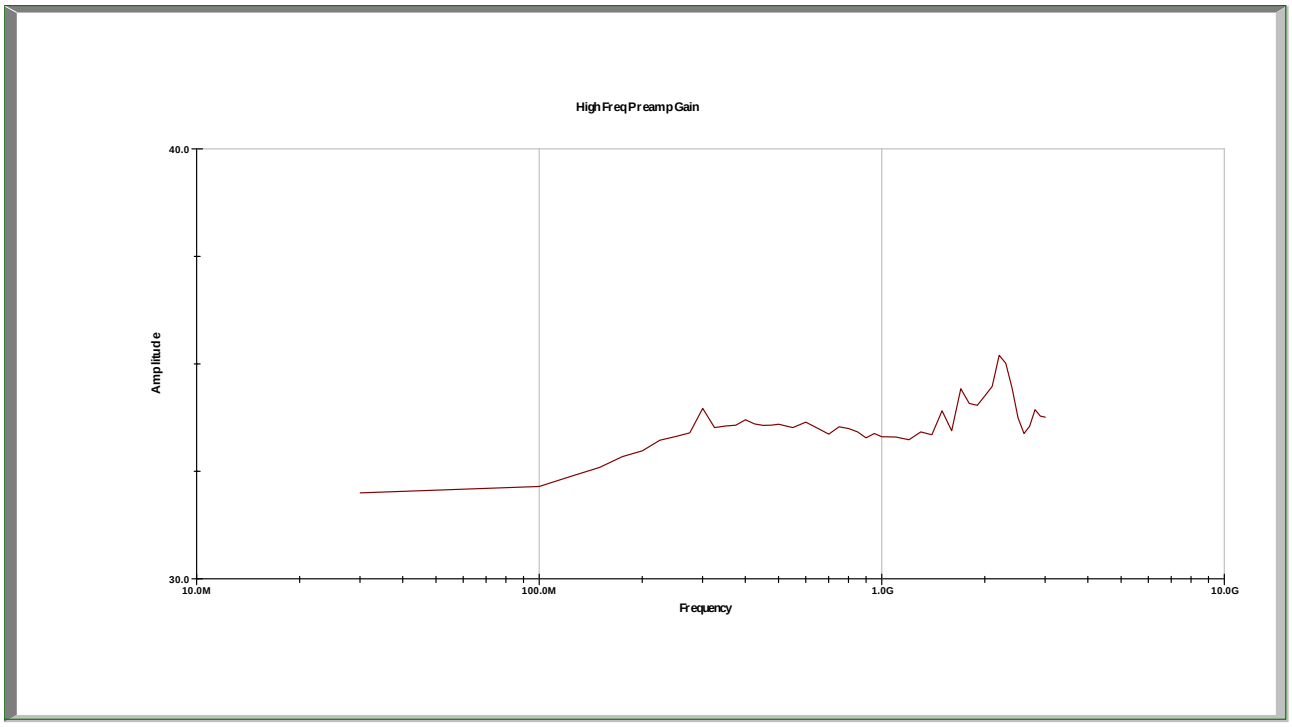
Typical antennas for BPL Certification testing	
Frequency Range	**Antenna**
9kHz-30MHz	Active Loop (corrected to E-field by adding 51.2dB)
30-1000MHz	Bilog

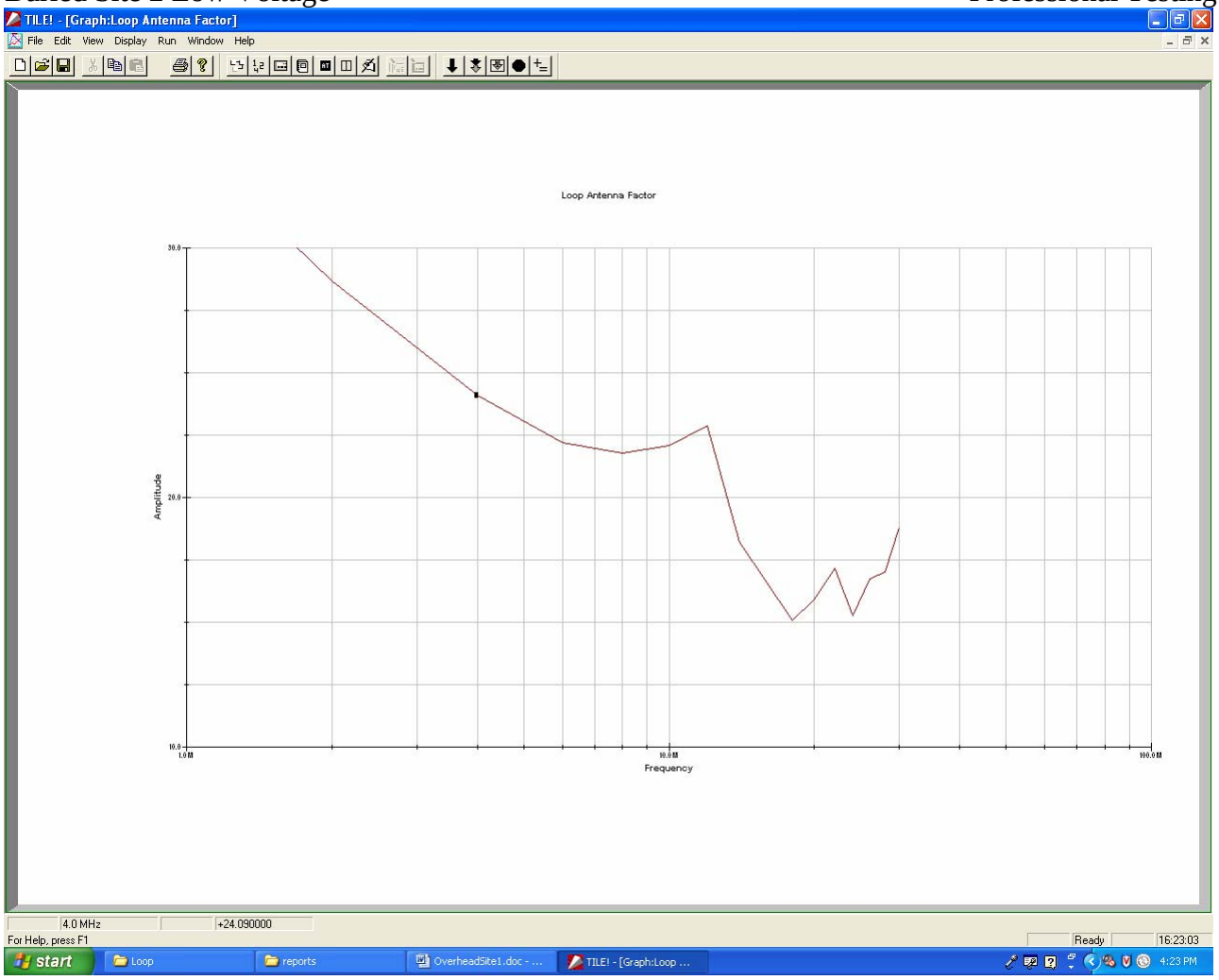
EQUIPMENT LIST

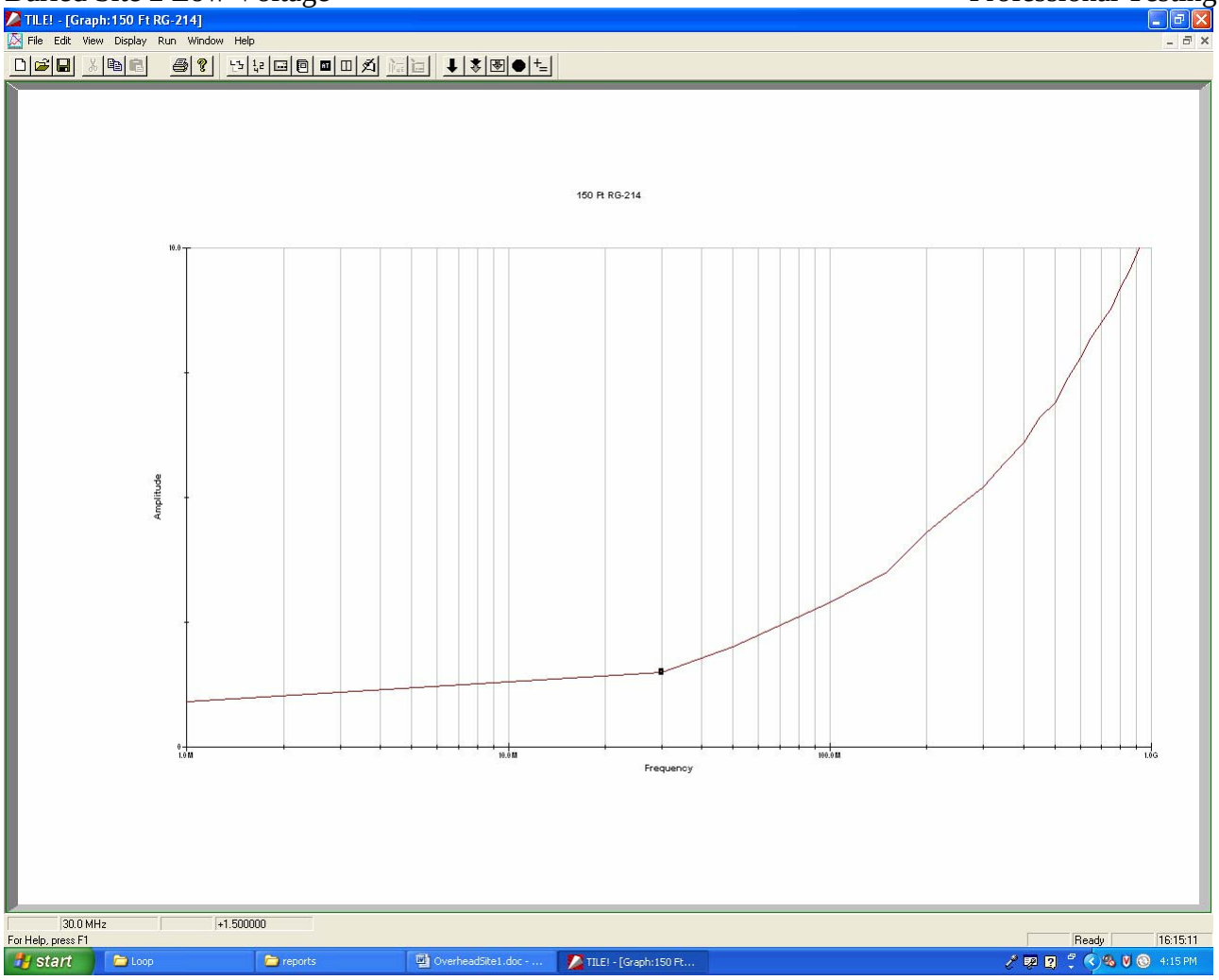
Manufacturer	Description	Model Number	Serial Number	Cal Due
PTI	1.9 MHz High Pass Filter		1182	15 Aug. 2008
Hewlett Packard	EMC Spectrum Analyzer	8591EM	3322A09711	0410	7 Dec. 2007
Hewlett Packard	Preamplifier	8447A	2439A09711	1260	9 April 2008
Miteq	Preamplifier	4888		1453	1 May 2008
Tektronix	Preselector	2706	B010106	0746	29 Nov. 07
ETS	Passive loop antenna	6512	Prototype	0351	22 Dec. 2007
AH Systems	Bilog Antenna	SAS-521-2 2662	436		15 Aug. 2008
ETS	Non-metallic tripod	4-TR	N/A	0944	N/A
Pasternak	RG-214, 150 ft.				28 Oct. 2008
Lufkin	Tape measure	30’	N/A		N/A

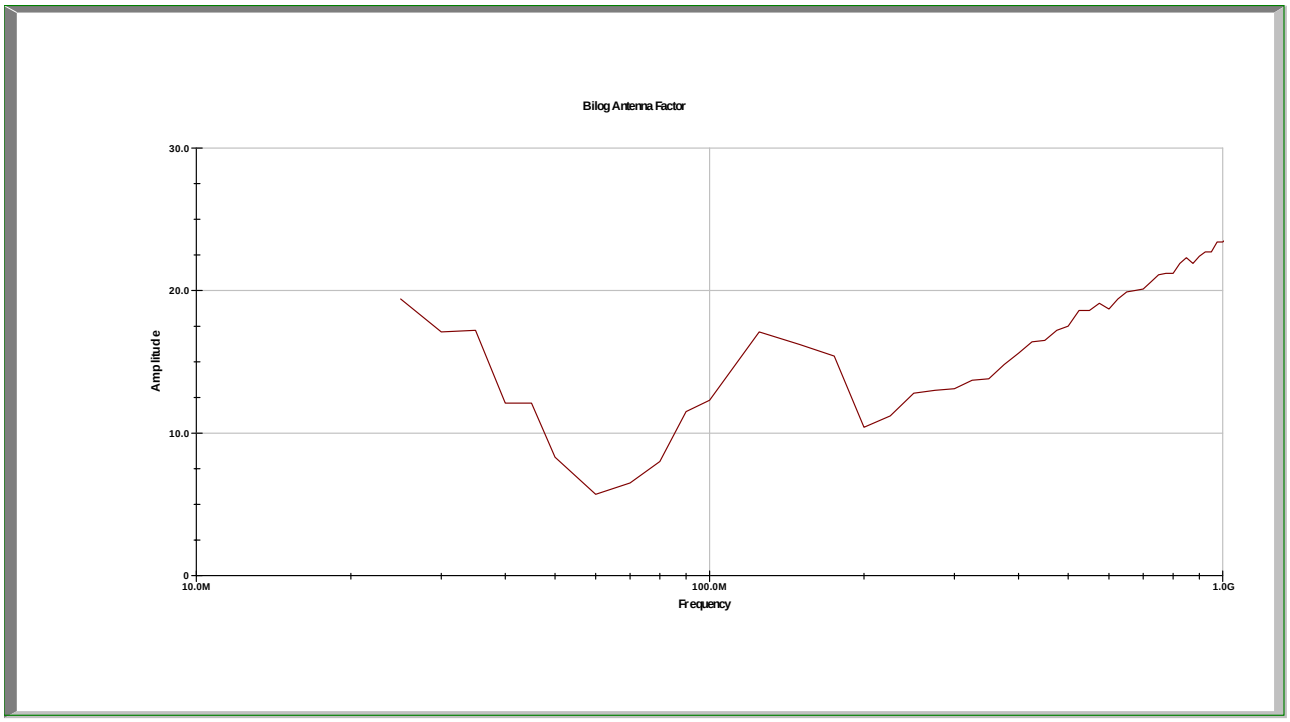
SUPPORTING EQUIPMENT DOCUMENTATION CHECKLIST		✓
Preamplifier gain VS frequency curve	Attached to test report	✓
Type N Cable insertion loss VS frequency curve	Attached to test report	✓
Antenna factor VS frequency curves for all antennas used in this test	Attached to test report	✓


TILE! - [Graph:Low Freq Preamp Gain]
File Edit View Display Run Window Help
Low Freq Preamp Gain
30.0
28.0
Amplitude
1.0 M
10.0 M
100.0 M
Frequency
1.0 MHz
+29.550100
For Help, press F1
Ready
16:05:30
start
Loop
TILE! - [Graph:Low Fr...
4:05 PM


High Freq Preamp Gain
40.0
30.0
Amplitude
10.0M
100.0M
1.0G
10.0G
Frequency


TILE! - [Graph:Loop Antenna Factor]
File Edit View Display Run Window Help
Loop Antenna Factor
30.0
20.0
10.0
Amplitude
1.0 M
10.0 M
100.0 M
Frequency
4.0 MHz
+24.090000
For Help, press F1
Ready
16:23:03
start
Loop
reports
OverheadSite1.doc - ...
TILE! - [Graph:Loop ...
4:23 PM


TILE! - [Graph:150 Ft RG-214]
File Edit View Display Run Window Help
150 Ft RG-214
Amplitude
Frequency
30.0 MHz
+1.500000
For Help, press F1
Ready
16:15:11
start
Loop
reports
OverheadSite1.doc - ...
TILE! - [Graph:150 Ft...
4:15 PM

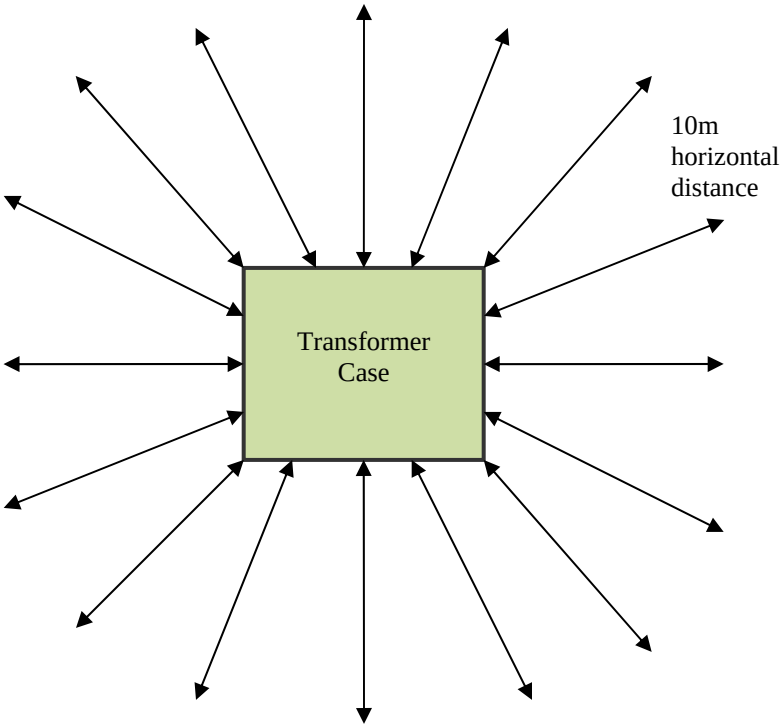

Bilog Antenna Factor
30.0
20.0
10.0
0
Amplitude
10.0M
100.0M
1.0G
Frequency

MEASUREMENT POSITIONS

Underground line installations are those in which the BPL device is mounted on a pad-mounted transformer housing or junction box and couples only onto underground cables. Access BPL Underground installations require measuring radiated fields along 16 radials at 10 meters distance from the edge of the above ground transformer where the Access BPL equipment is located to find the maximum emissions. For consistency, set the radials to compass settings so that North is facing towards the top of the page. (12:00 Noon) Number measurement points clockwise from 1 to 16.

If necessary, due to ambient emissions, measurements can be performed at a distance of 3 meters. Slant-range distance corrections are made in accordance with Section 15.31(f) of the Rules. Measurements are made at positions around the perimeter of the in-ground power transformer where the maximum emissions occur. If directional radiation patterns are detected, additional azimuth angles should be investigated.

Example of Access BPL Underground Measurements



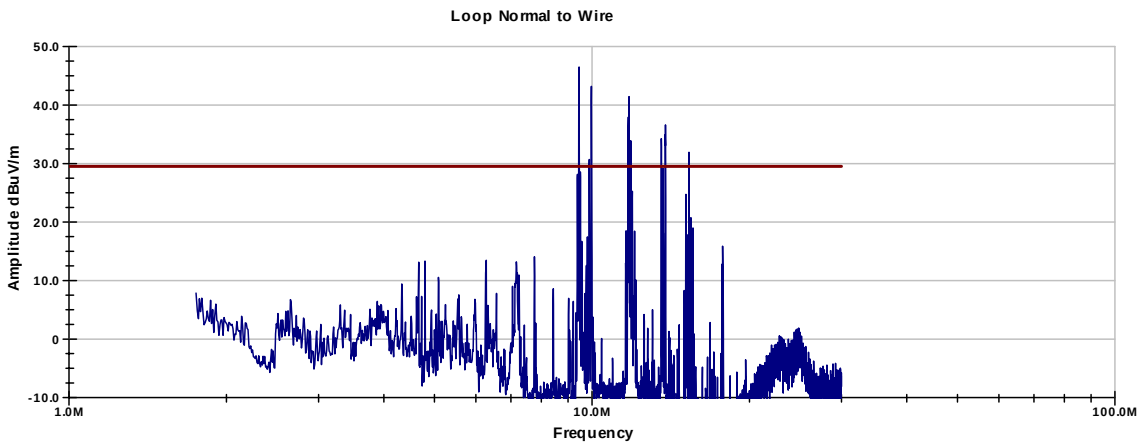

Bossuit Drive
Misty Morning Trce
Descartes Drive
South Peek Road
N29.687309, W95.760542
Beechnut Boulevard
Laguna Trace Street
Canal Road

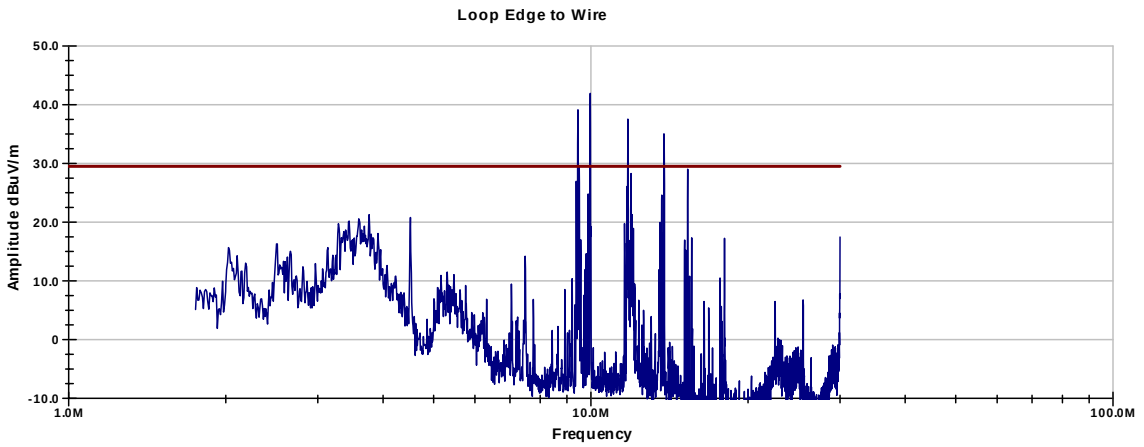
TESTING BELOW 30 MHz
1.705 MHz (or lowest frequency generated) to 30 MHz

1. Contact the BPL system operator and set the EUT for MAXIMUM power and MAXIMUM burst rate before **Certification** testing. If **Validation** testing is performed there is no need for MAXIMUM power testing and only COMPLIANCE (operating) power is used.
2. Set the EMI Receiver or Spectrum Analyzer to 9 kHz IF bandwidth and PEAK detection. Set the frequency step size for 4.5 kHz (half the IF bandwidth) and scan the spectra from the lowest frequency generated (but never below 1.705 MHz) to 30 MHz for BPL emissions. When using spectrum analyzers, scan smaller sub-ranges to allow at least three pixels on the analyzer's screen to fit within the 9 kHz bandwidth. EXAMPLE: (400 pixels/3) x 9 kHz restricts scan widths to 1.2 MHz (100 kHz/div maximum) Covering 2-30 MHz would require 28 sub-ranges each 1MHz wide. (100 kHz/div x 10 div on-screen)
3. Orient the loop antenna broadside to the transformer. Identify the six highest BPL emissions. (validate these choices by AM demodulating them and listening for voice or music)
4. Rotate the magnetic loop at least 180 degrees about its vertical axis to maximize each of these readings prior to measurement.
5. Validate that the OVERLOAD indicator on the active loop antenna is not illuminated and that the Spectrum Analyzer does not use a pre-amplifier and is not being overloaded. Increase the analyzer's input attenuation to verify that the instrument is not in amplitude compression by making sure all signals move in 10dB increments with the attenuator setting.
6. Ensure that the data repetition rate is at least 20 Hz by demodulating the audio on each of the six signals. If so, use Quasi-Peak detection on just those six loudest BPL signals and enter the receiver voltages (dBμV) into the worksheet below. If the burst rate is less than 20 Hz enter the Peak voltages into the worksheet below and indicate which detector was used. (P or QP)

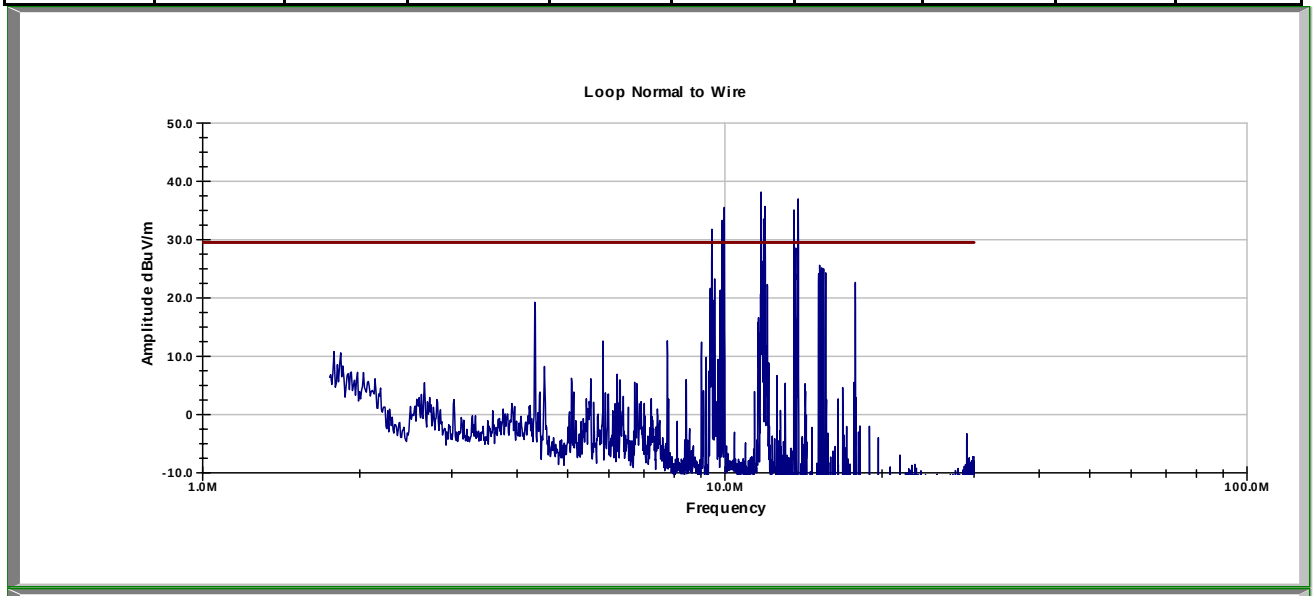
7. If voice, non-BPL data or music is demodulated that candidate emission is eliminated and the Receiver is tuned to the next loudest emission for demodulation and identification to find the six highest BPL emissions.
8. Validate that the calculations employed are the same as shown in the worksheet if software is used for this measurement.
9. Capture a complete spectrum of this frequency range for inclusion into the Test Report. (from more than one scan)
10. For **Certification** testing, contact the BPL system operator and set the EUT down to its COMPLIANCE power setting. Tell the operator how many dB the system needs to be attenuated for compliance with the FCC limits on field strengths (or below them).

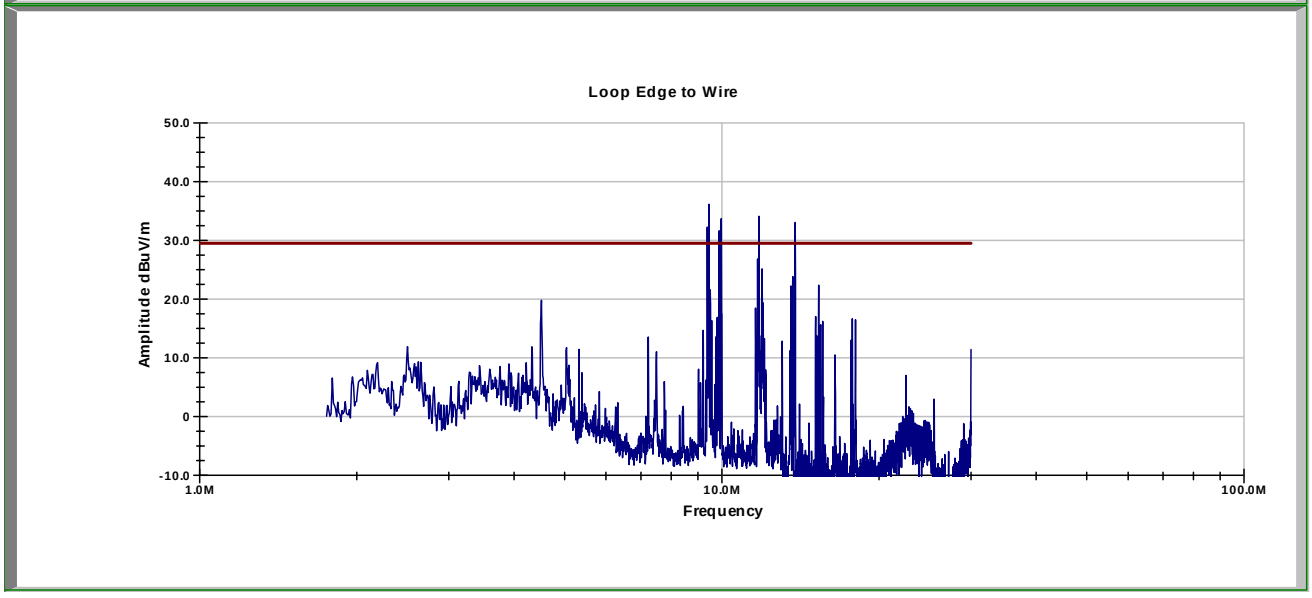
Field Strengths (location 1) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	35.3	29.2	28.6	0.3	19.1	15.9	29.5	-13.6	P
2.509	37	29.2	27.9	0.3	19.1	16.9	29.5	-12.6	P
3.763	44.8	29.2	26.7	0.3	19.1	23.5	29.5	-6.0	P
5.308	36.8	29.2	23.7	0.3	19.1	12.5	29.5	-17.0	P
24.853	33.9	28.9	15.6	0.5	19.1	2.0	29.5	-27.5	P
29.956	32.8	28.6	18.7	0.5	19.1	4.3	29.5	-25.2	P



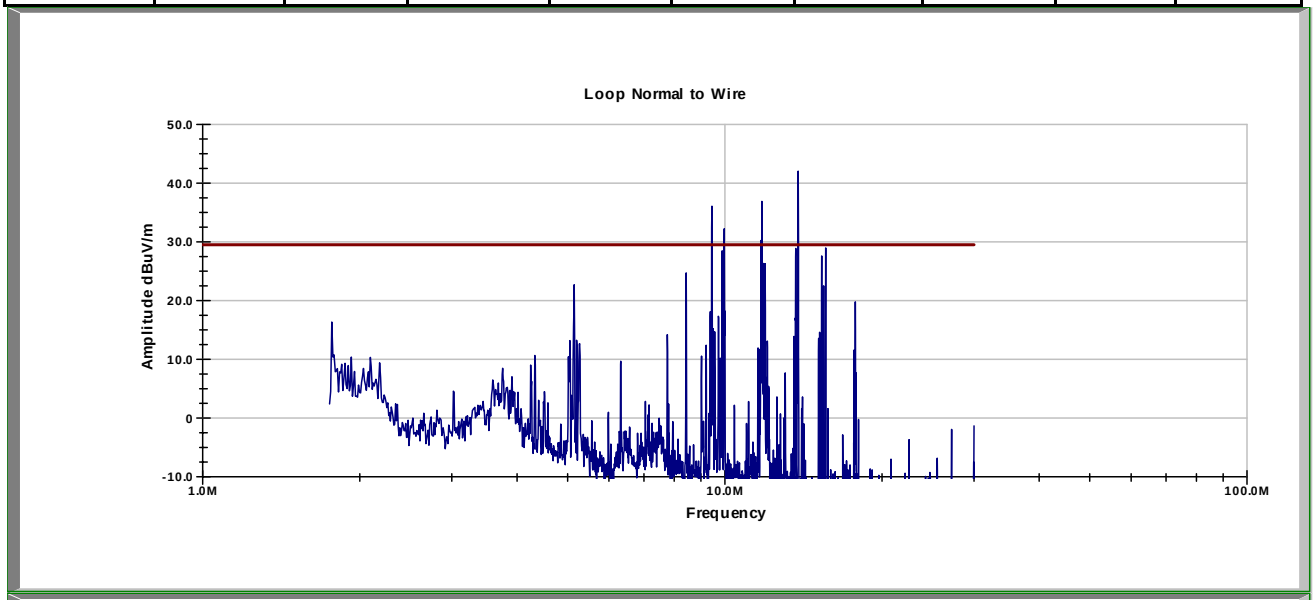


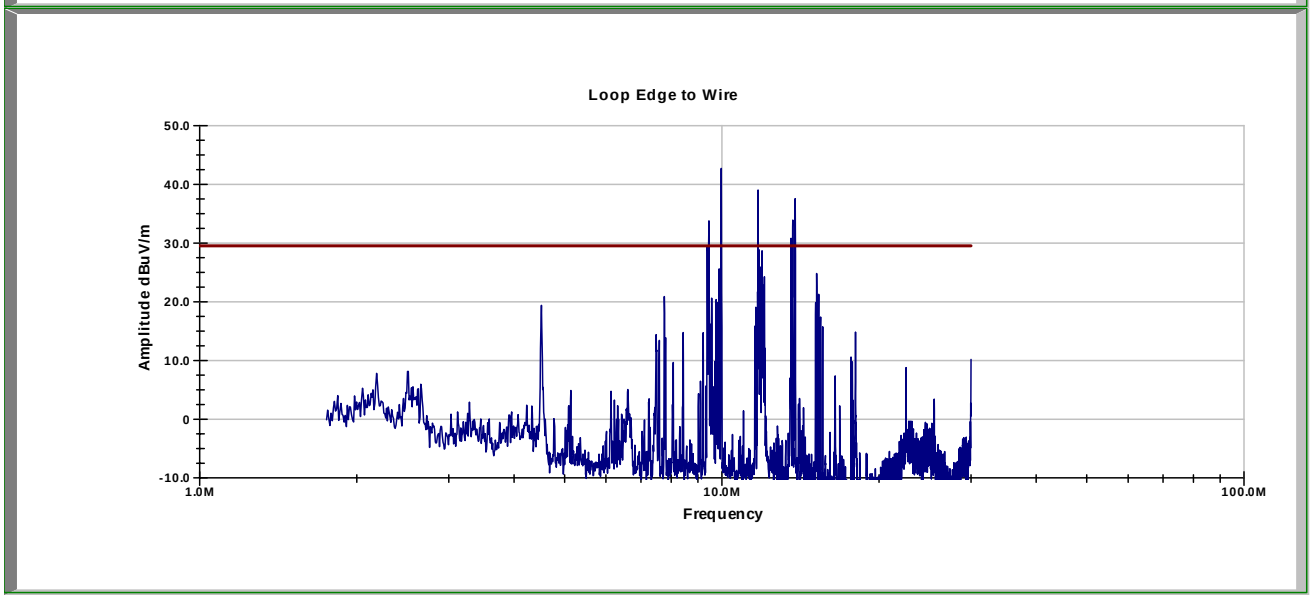
Field Strengths (location 2) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.191	29.2	29.2	28.4	0.3	19.1	9.6	29.5	-19.9	P
2.5	32.6	29.2	27.9	0.3	19.1	12.5	29.5	-17.0	P
3.436	31.5	29.2	27.0	0.3	19.1	10.5	29.5	-19.0	P
3.913	32.8	29.2	26.5	0.3	19.1	11.3	29.5	-18.2	P
5.988	29.5	29.2	23.4	0.3	19.1	5.0	29.5	-24.5	P
22.964	33.1	29.1	17.1	0.5	19.1	2.4	29.5	-27.1	P



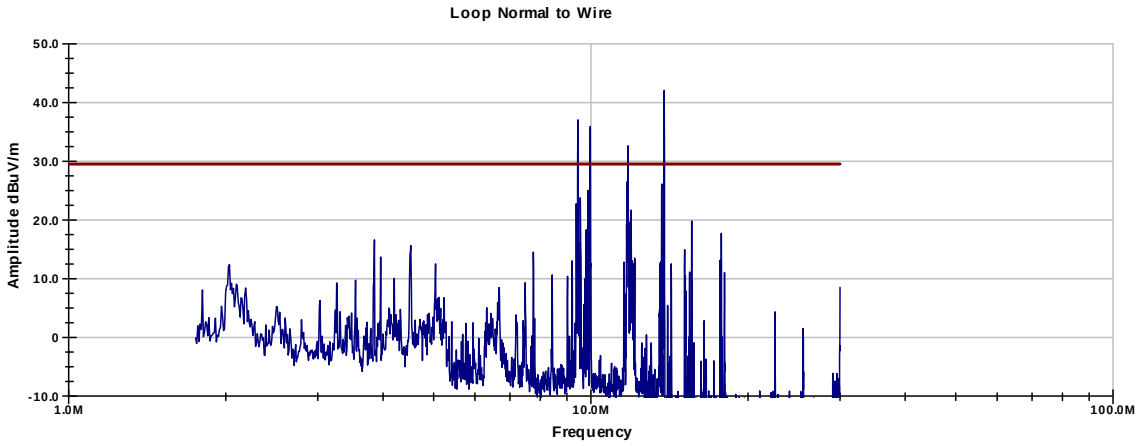


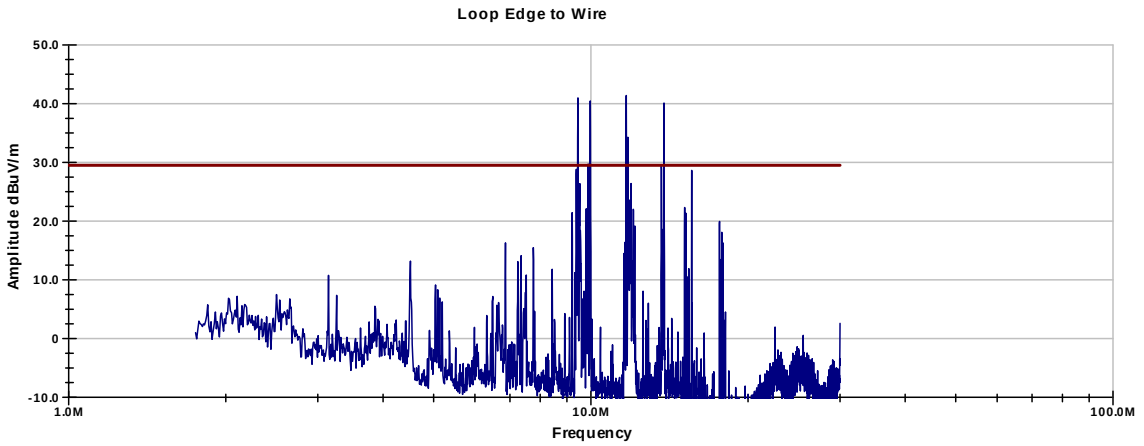
Field Strengths (location 3) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.094	30.1	29.2	28.5	0.3	19.1	10.6	29.5	-18.9	P
2.5	28.8	29.2	27.9	0.3	19.1	8.7	29.5	-20.8	P
3.754	32	29.2	26.7	0.3	19.1	10.7	29.5	-18.8	P
6.597	30.7	29.2	22.2	0.3	19.1	4.9	29.5	-24.6	P
23.114	31.5	29.1	17.1	0.5	19.1	0.9	29.5	-28.6	P
29.223	26.3	28.6	18.1	0.5	19.1	-2.9	29.5	-32.4	P



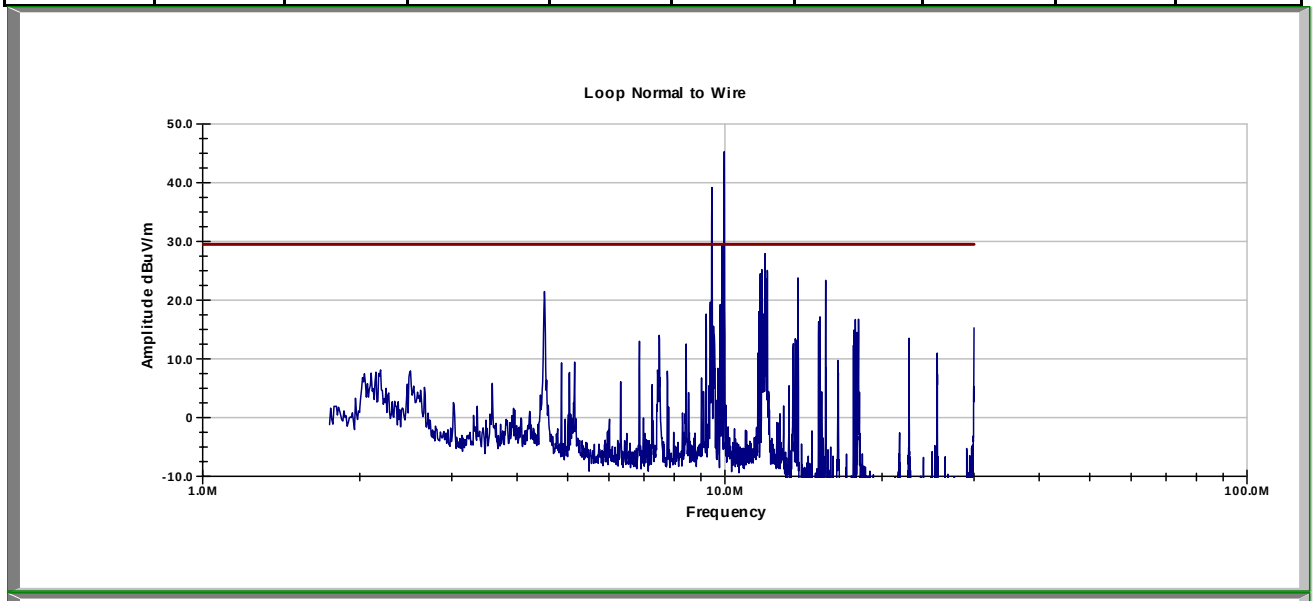


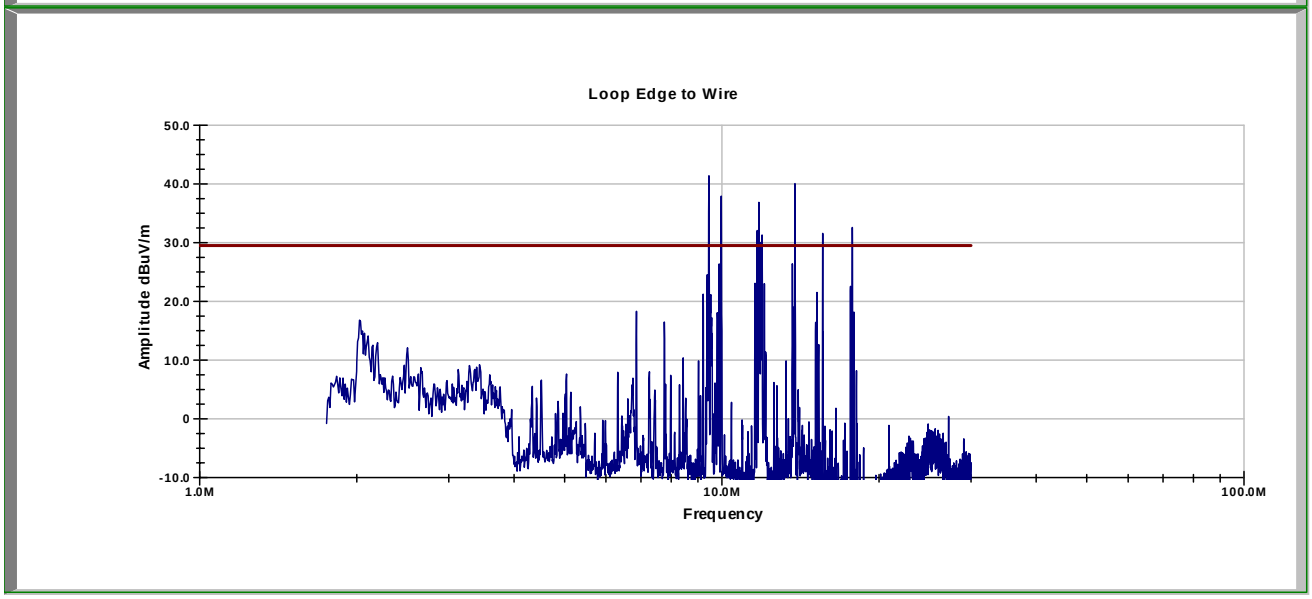
Field Strengths (location 4) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.033	32.1	29.2	28.6	0.3	19.1	12.7	29.5	-16.8	P
2.5	28.2	29.2	27.9	0.3	19.1	8.1	29.5	-21.4	P
5.034	33.5	29.2	23.7	0.3	19.1	9.3	29.5	-20.2	P
6.676	34.5	29.2	22.2	0.3	19.1	8.7	29.5	-20.8	P
23.114	29.4	29.1	17.1	0.5	19.1	-1.2	29.5	-30.7	P
25.003	30.2	28.9	15.8	0.5	19.1	-1.5	29.5	-31.0	P



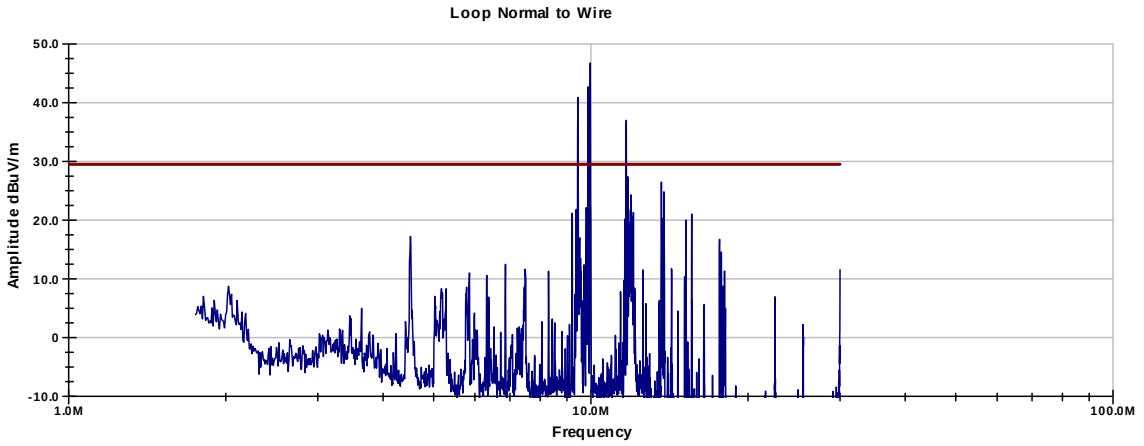


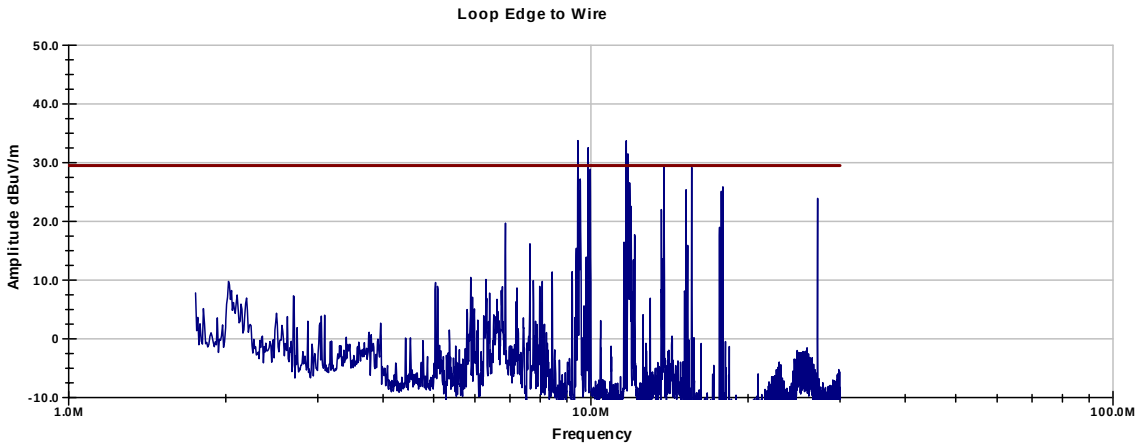
Field Strengths (location 5) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	36.5	29.2	28.6	0.3	19.1	17.1	29.5	-12.4	P
2.5	32.8	29.2	27.9	0.3	19.1	12.7	29.5	-16.8	P
3.436	32	29.2	27.0	0.3	19.1	11.0	29.5	-18.5	P
3.595	30.7	29.2	26.9	0.3	19.1	9.6	29.5	-19.9	P
23.273	28.3	29.1	17.1	0.5	19.1	-2.3	29.5	-31.8	P
24.853	31.2	28.9	15.6	0.5	19.1	-0.7	29.5	-30.2	P



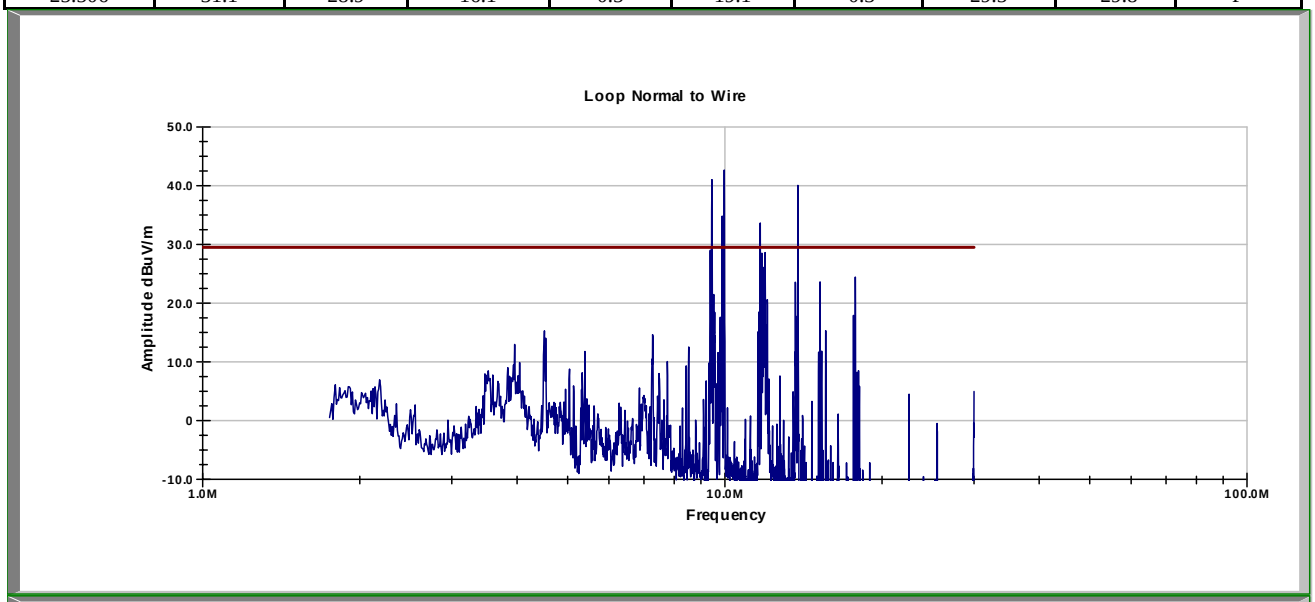


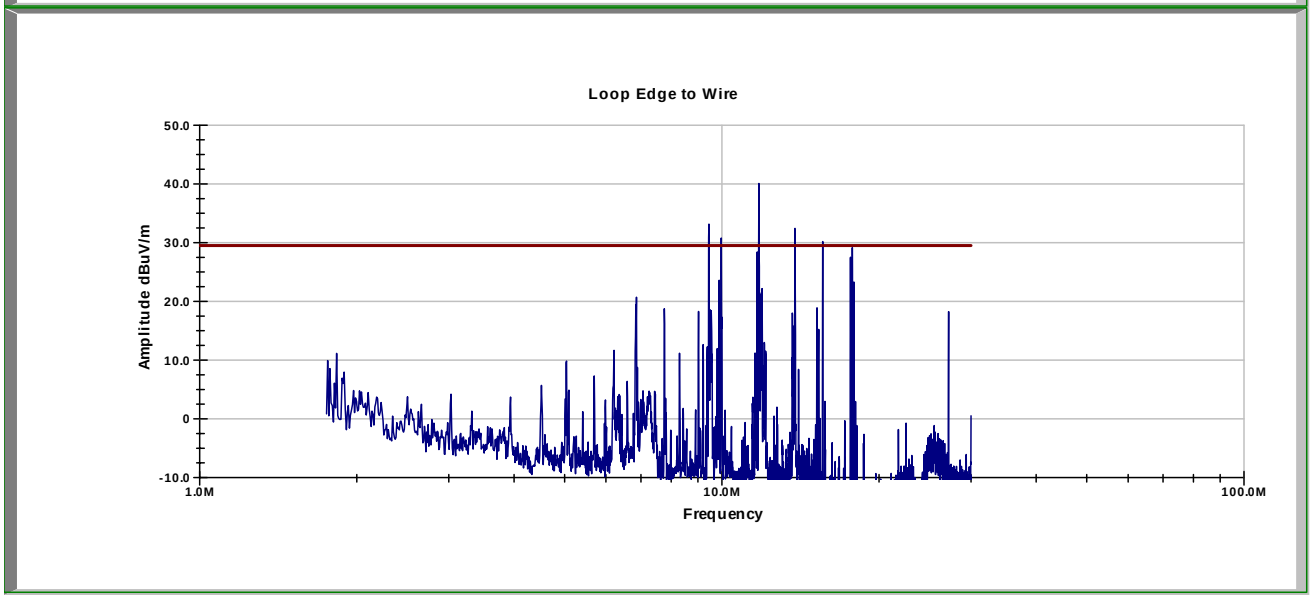
Field Strengths (location 6) 1.705 MHz – 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	29.4	29.2	28.6	0.3	19.1	10.0	29.5	-19.5	P
2.5	25.1	29.2	27.9	0.3	19.1	5.0	29.5	-24.5	P
3.639	28.2	29.2	26.8	0.3	19.1	7.0	29.5	-22.5	P
4.416	27.2	29.2	23.8	0.3	19.1	3.0	29.5	-26.5	P
22.955	27.8	29.1	17.1	0.5	19.1	-2.9	29.5	-32.4	P
25.524	30.3	28.9	16.2	0.5	19.1	-1.0	29.5	-30.5	P



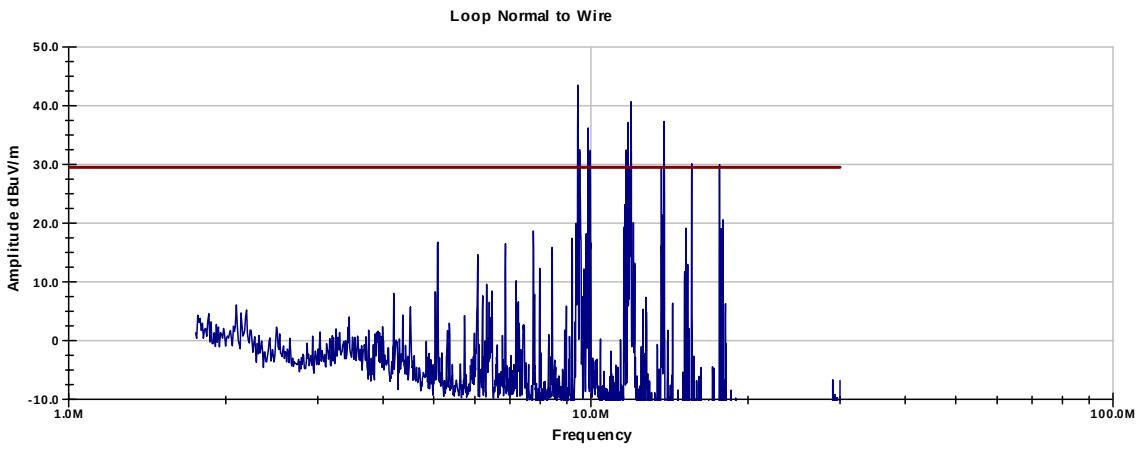


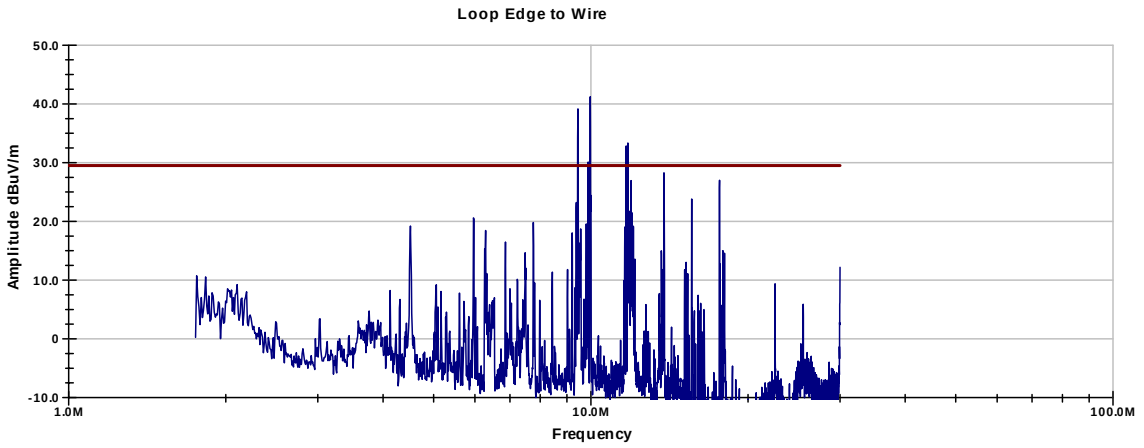
Field Strengths (location 7) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.183	26.9	29.2	28.4	0.3	19.1	7.3	29.5	-22.2	P
3.524	31.5	29.2	26.9	0.3	19.1	10.4	29.5	-19.1	P
3.957	36.9	29.2	26.4	0.3	19.1	15.3	29.5	-14.2	P
5.131	31.1	29.2	23.7	0.3	19.1	6.8	29.5	-22.7	P
7.065	31	29.2	22.3	0.3	19.1	5.3	29.5	-24.2	P
25.506	31.1	28.9	16.1	0.5	19.1	-0.3	29.5	-29.8	P



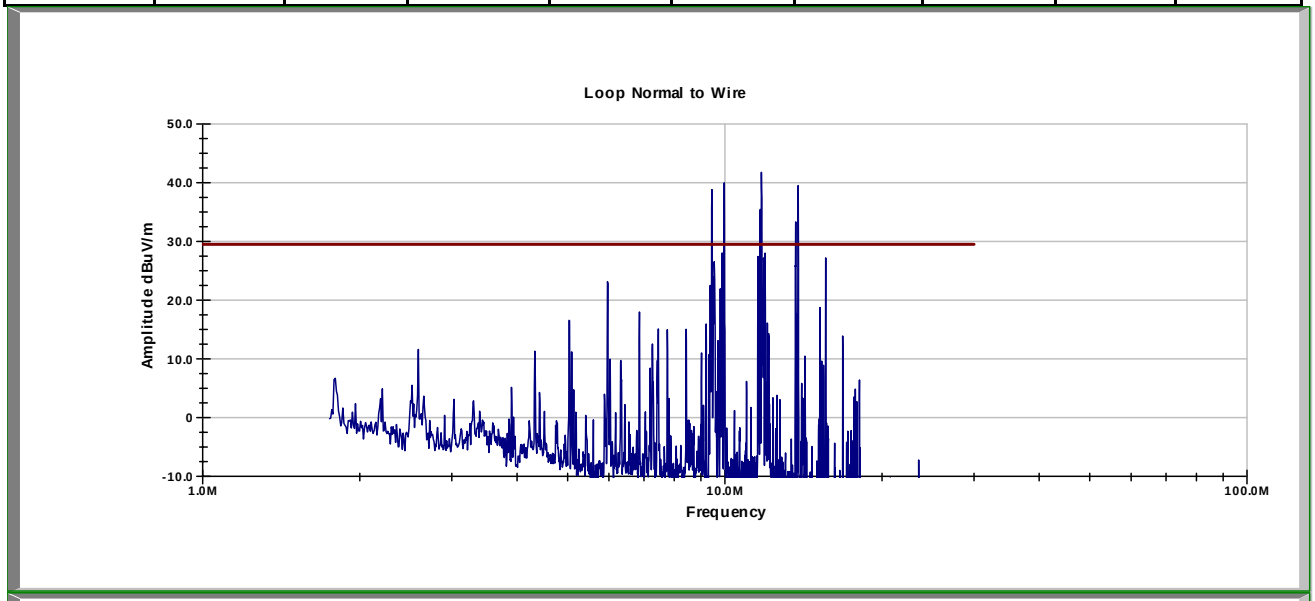


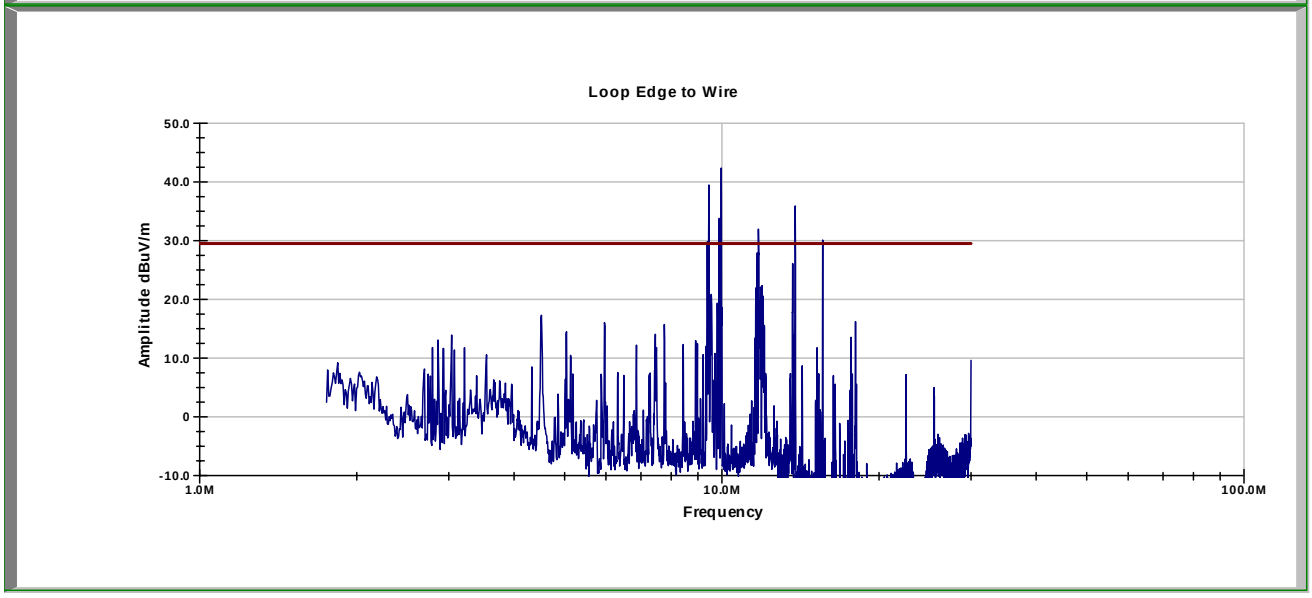
Field Strengths (location 8) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.103	29.5	29.2	28.5	0.3	19.1	10.0	29.5	-19.5	P
2.492	23.6	29.2	27.9	0.3	19.1	3.5	29.5	-26.0	P
3.763	28.3	29.2	26.7	0.3	19.1	7.0	29.5	-22.5	P
6.47	34.5	29.2	22.2	0.3	19.1	8.7	29.5	-20.8	P
12.741	34.1	29.2	21.2	0.4	19.1	7.4	29.5	-22.1	P
25.515	37.5	28.9	16.1	0.5	19.1	6.1	29.5	-23.4	P



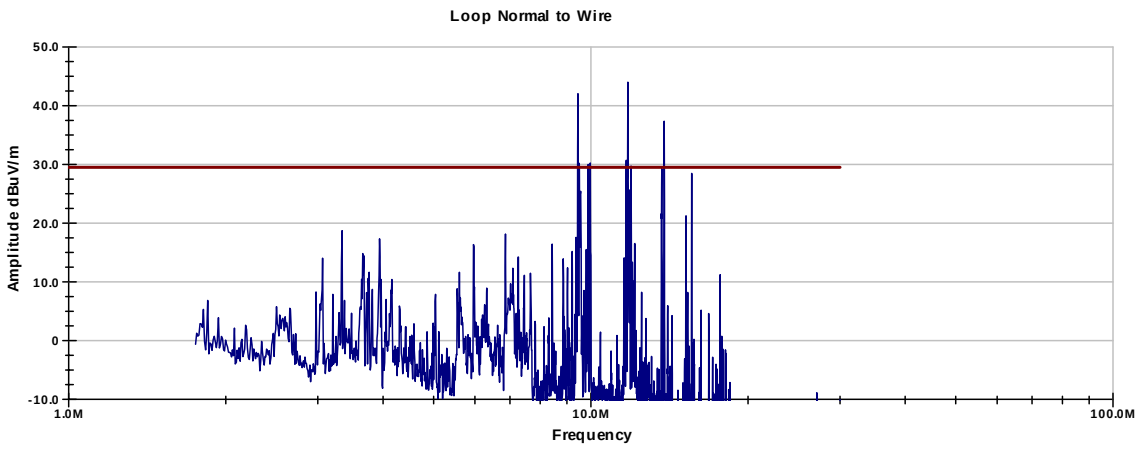


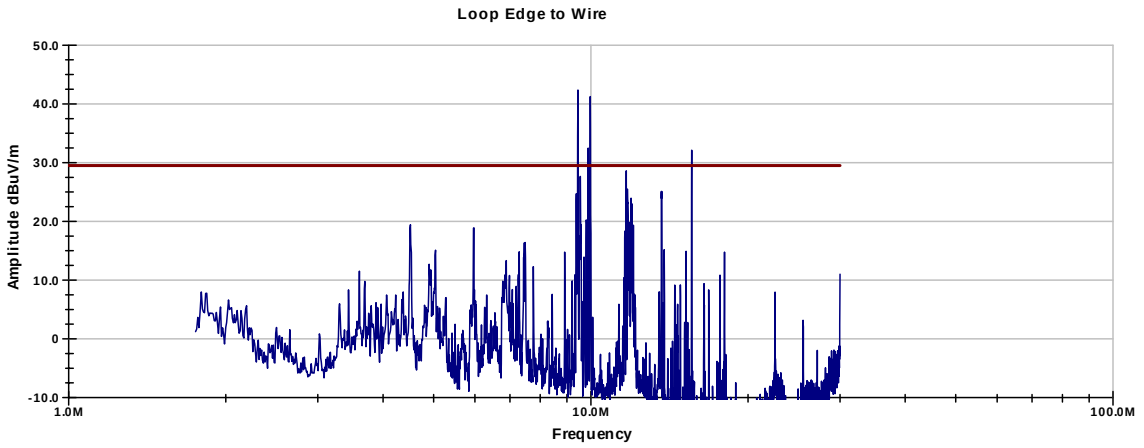
Field Strengths (location 9) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.015	26.7	29.2	28.7	0.3	19.1	7.4	29.5	-22.1	P
2.695	29.3	29.2	27.6	0.3	19.1	8.9	29.5	-20.6	P
3.542	33.6	29.2	26.9	0.3	19.1	12.5	29.5	-17.0	P
3.957	29.5	29.2	26.4	0.3	19.1	7.9	29.5	-21.6	P
25.948	28.3	28.9	16.4	0.5	19.1	-2.8	29.5	-32.3	P
29.974	26.6	28.6	18.8	0.5	19.1	-1.8	29.5	-31.3	P



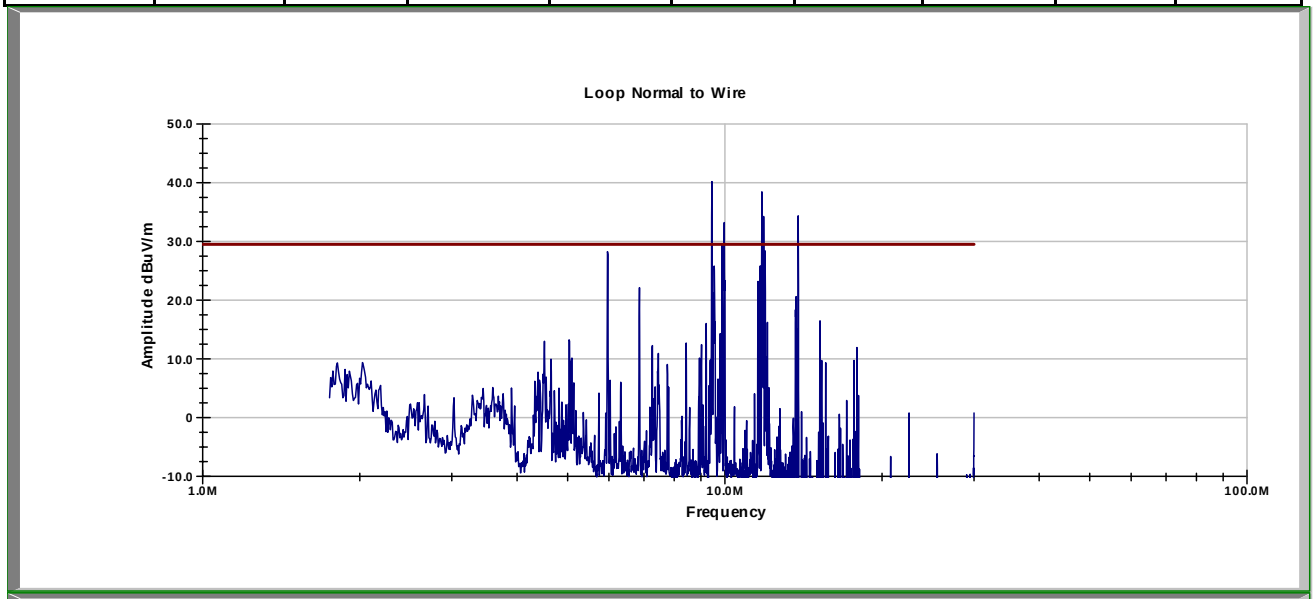


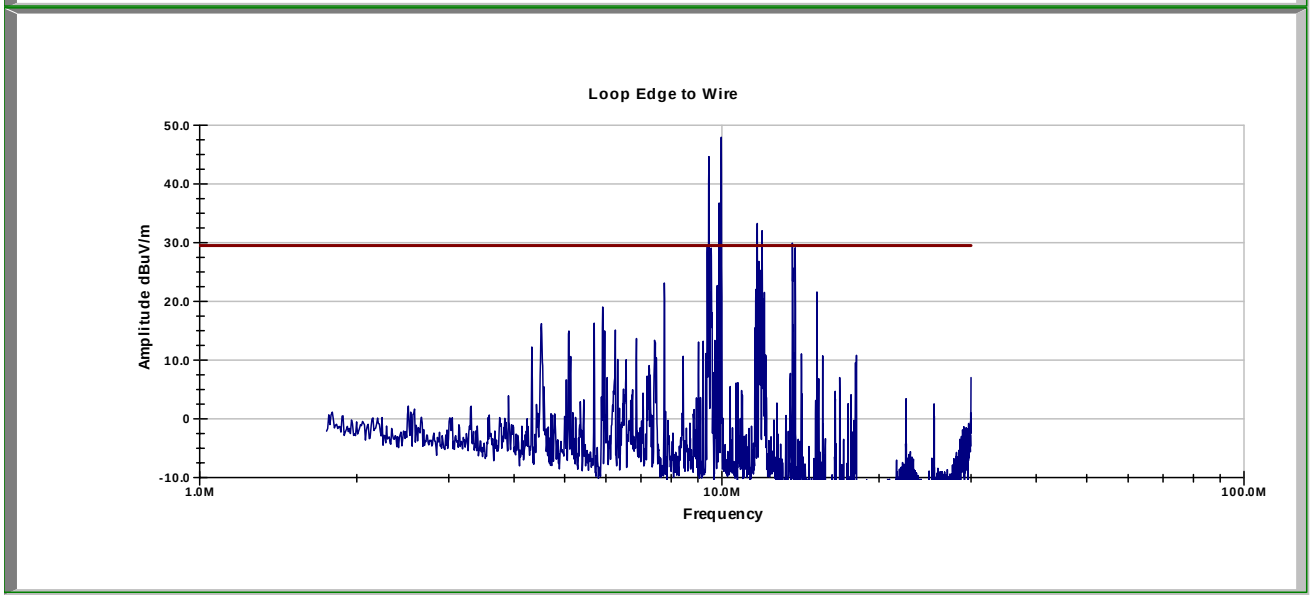
Field Strengths (location 10) 1.705 MHz – 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	26.3	29.2	28.6	0.3	19.1	6.9	29.5	-22.6	P
2.65	26.5	29.2	27.6	0.3	19.1	6.1	29.5	-23.4	P
3.675	37.8	29.2	26.8	0.3	19.1	16.6	29.5	-12.9	P
4.16	34.7	29.2	24.0	0.3	19.1	10.7	29.5	-18.8	P
6.323	35	29.2	22.2	0.3	19.1	9.2	29.5	-20.3	P
28.914	28.1	28.7	17.8	0.5	19.1	-1.3	29.5	-30.8	P



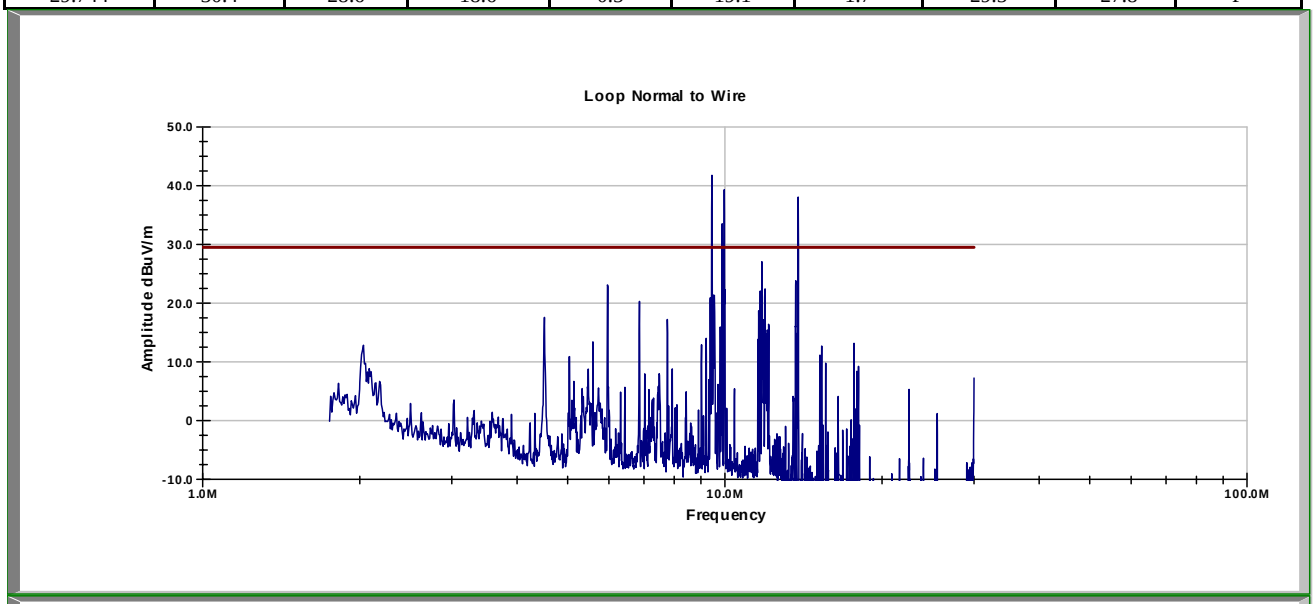


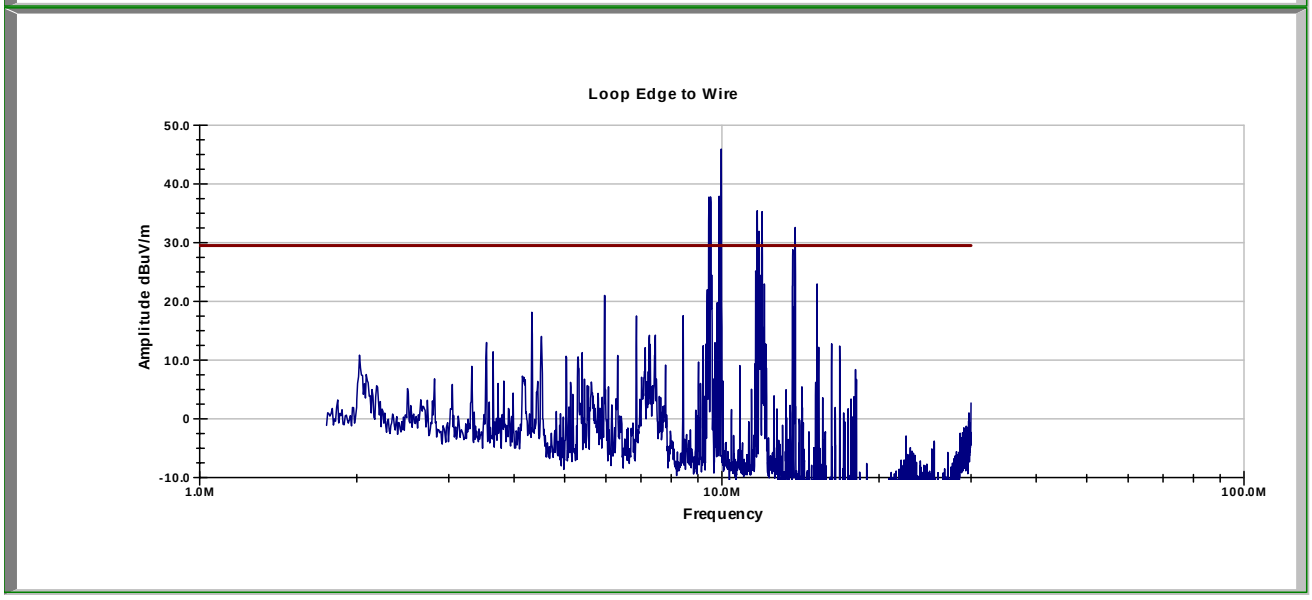
Field Strengths (location 11) 1.705 MHz – 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	29	29.2	28.6	0.3	19.1	9.6	29.5	-19.9	P
2.659	25	29.2	27.6	0.3	19.1	4.6	29.5	-24.9	P
3.595	28.3	29.2	26.9	0.3	19.1	7.2	29.5	-22.3	P
4.328	36.6	29.2	23.9	0.3	19.1	12.5	29.5	-17.0	P
22.973	26.2	29.1	17.1	0.5	19.1	-4.5	29.5	-34.0	P
29.073	28.7	28.6	18.0	0.5	19.1	-0.6	29.5	-30.1	P



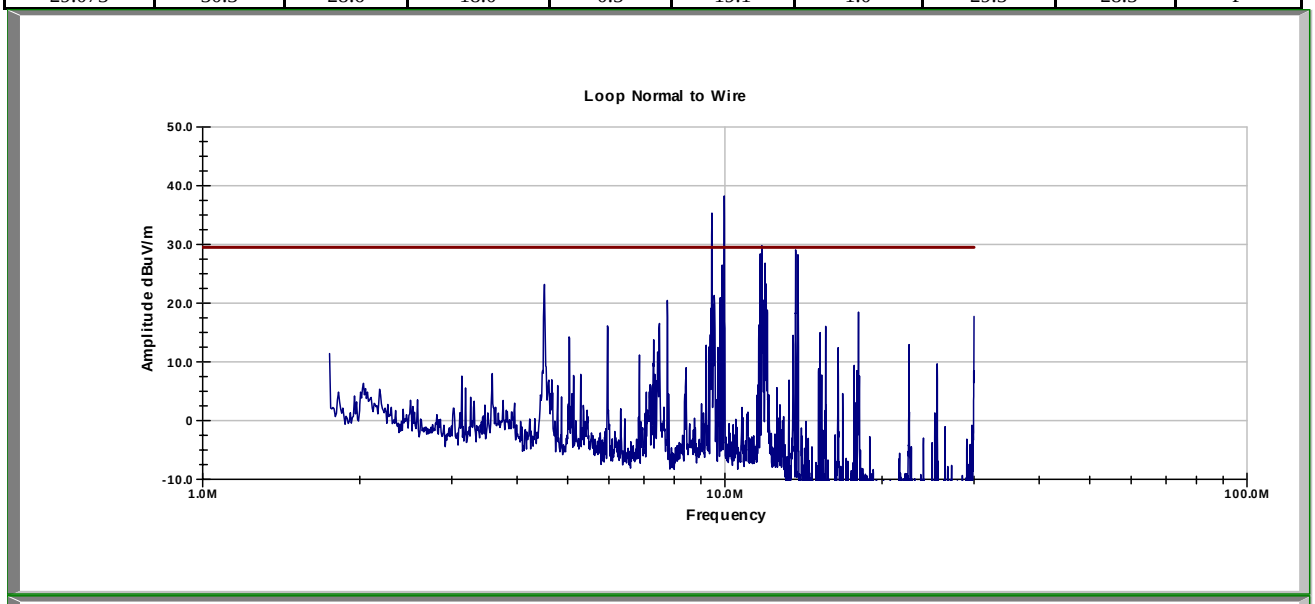


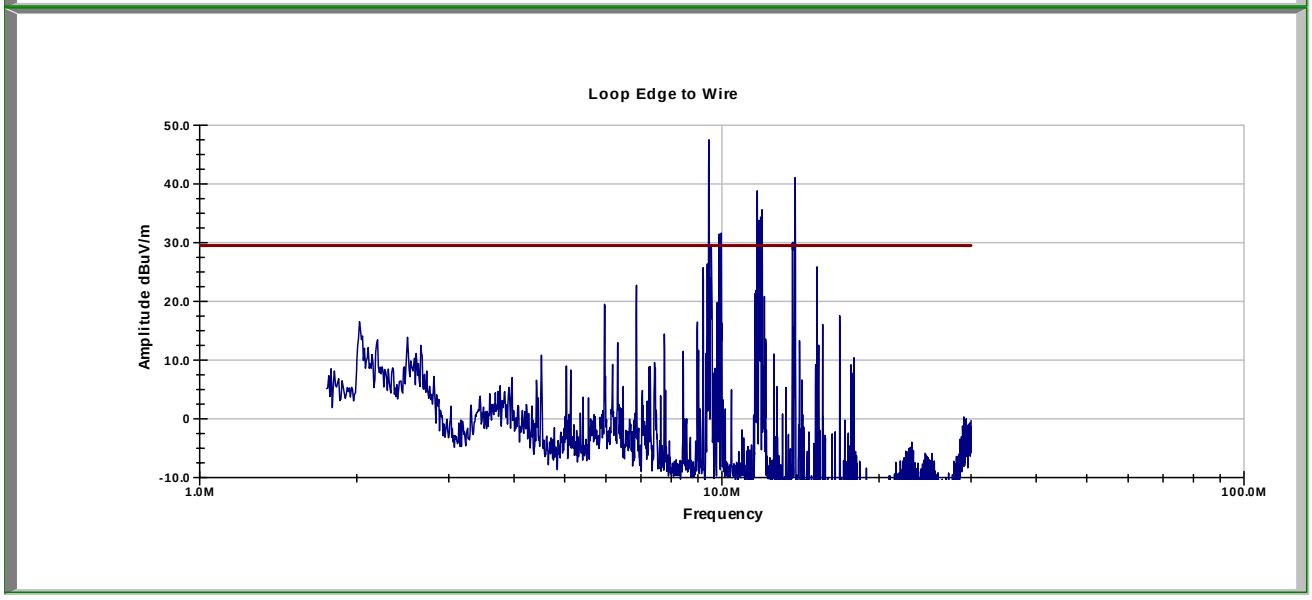
Field Strengths (location 12) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.033	32.5	29.2	28.6	0.3	19.1	13.1	29.5	-16.4	P
2.818	28.2	29.2	27.4	0.3	19.1	7.6	29.5	-21.9	P
4.151	31.5	29.2	24.0	0.3	19.1	7.5	29.5	-22.0	P
5.626	31.9	29.2	23.5	0.3	19.1	7.5	29.5	-22.0	P
22.964	26.9	29.1	17.1	0.5	19.1	-3.8	29.5	-33.3	P
29.744	30.4	28.6	18.6	0.5	19.1	1.7	29.5	-27.8	P



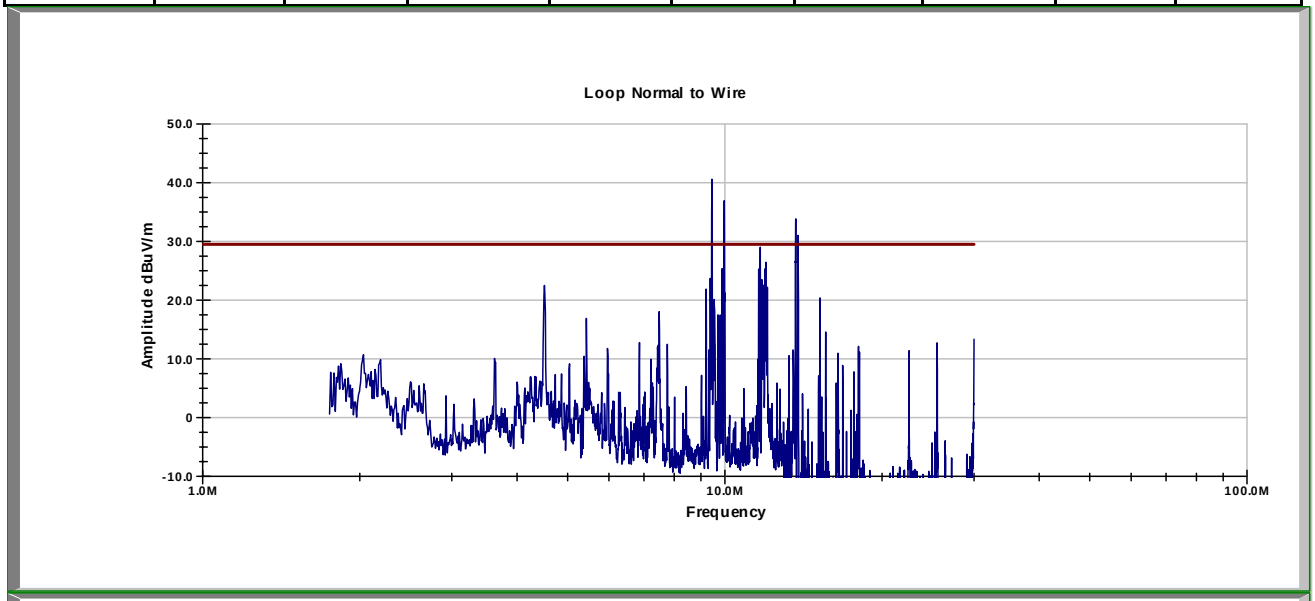


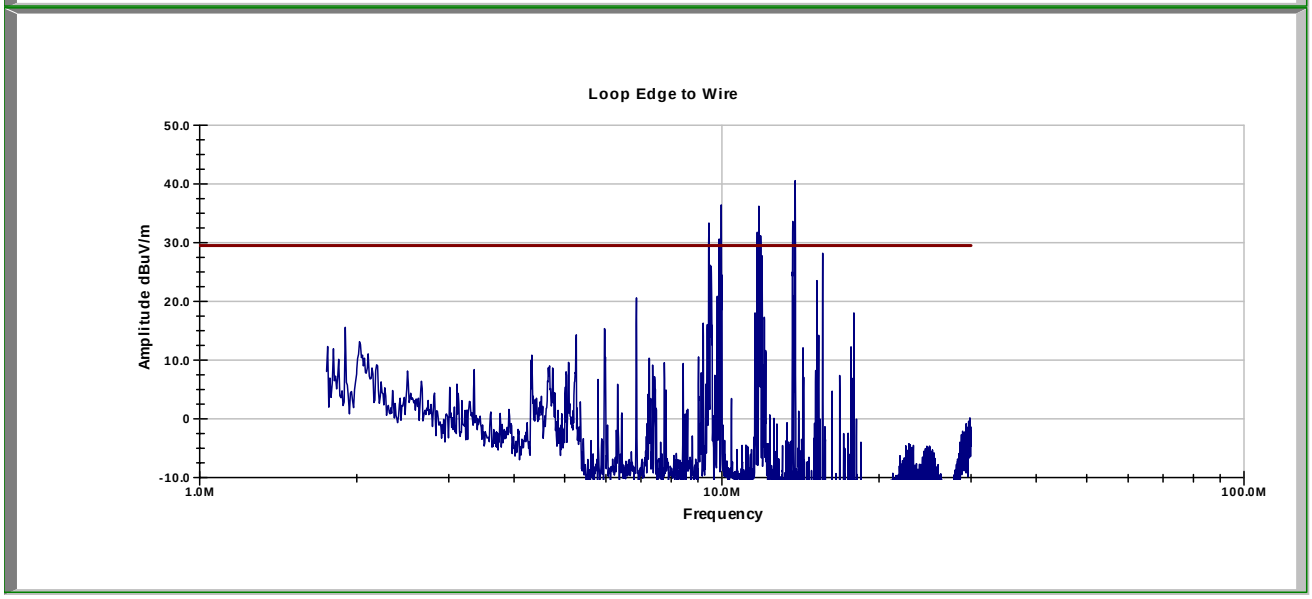
Field Strengths (location 13) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	36.2	29.2	28.6	0.3	19.1	16.8	29.5	-12.7	P
2.5	34.6	29.2	27.9	0.3	19.1	14.5	29.5	-15.0	P
3.586	31.2	29.2	26.9	0.3	19.1	10.1	29.5	-19.4	P
3.966	31.03	29.2	26.4	0.3	19.1	9.5	29.5	-20.0	P
22.964	26.9	29.1	17.1	0.5	19.1	-3.8	29.5	-33.3	P
29.073	30.3	28.6	18.0	0.5	19.1	1.0	29.5	-28.5	P



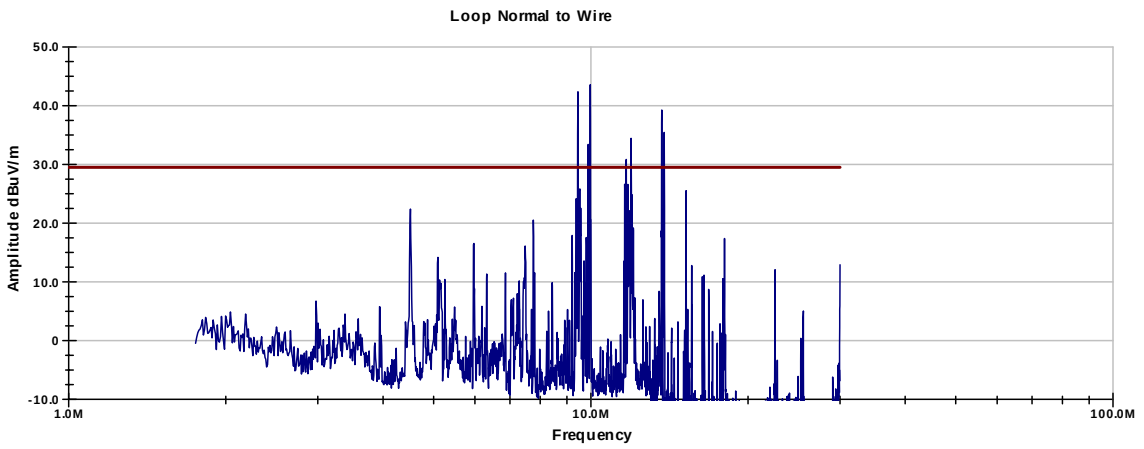


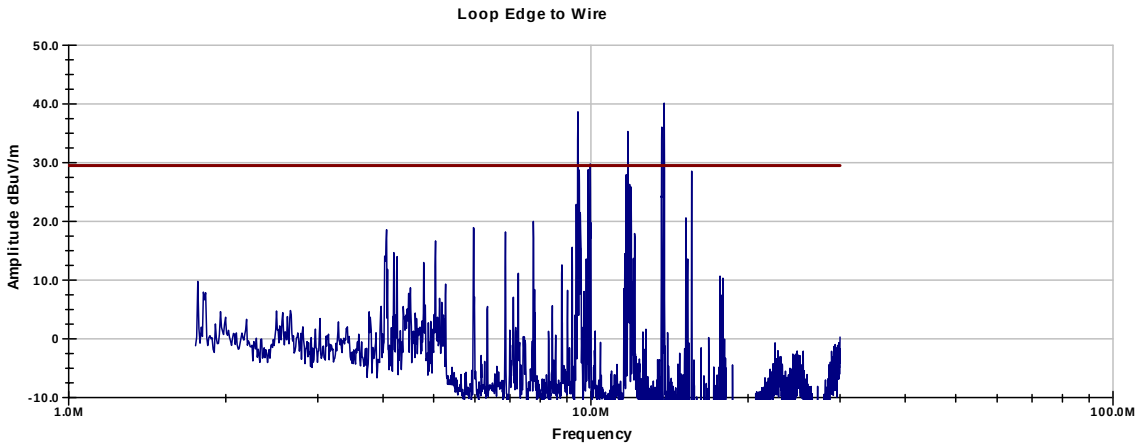
Field Strengths (location 14) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	32.8	29.2	28.6	0.3	19.1	13.4	29.5	-16.1	P
2.5	28.8	29.2	27.9	0.3	19.1	8.7	29.5	-20.8	P
4.001	30.1	29.2	24.1	0.3	19.1	6.2	29.5	-23.3	P
5.043	34.2	29.2	23.7	0.3	19.1	10.0	29.5	-19.5	P
25.542	30.7	28.9	16.2	0.5	19.1	-0.6	29.5	-30.1	P
29.938	28.5	28.6	18.7	0.5	19.1	0.0	29.5	-29.5	P



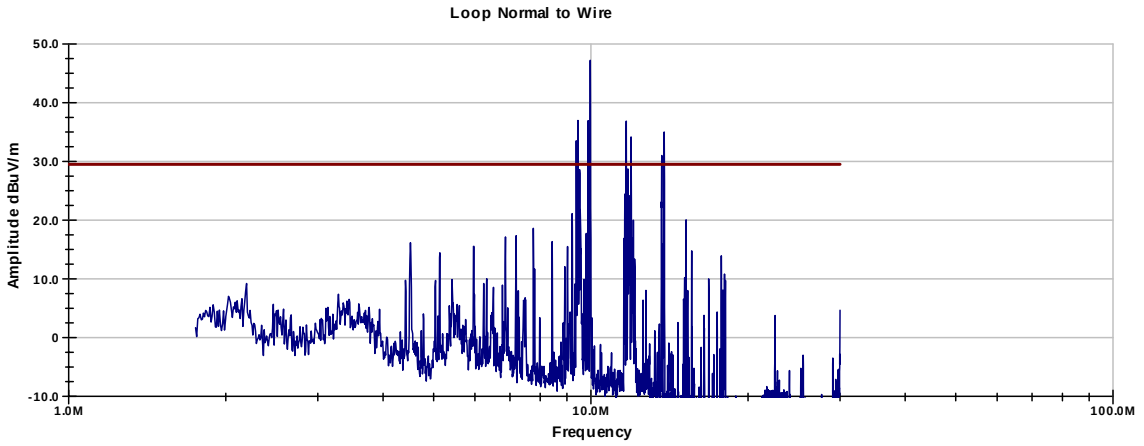


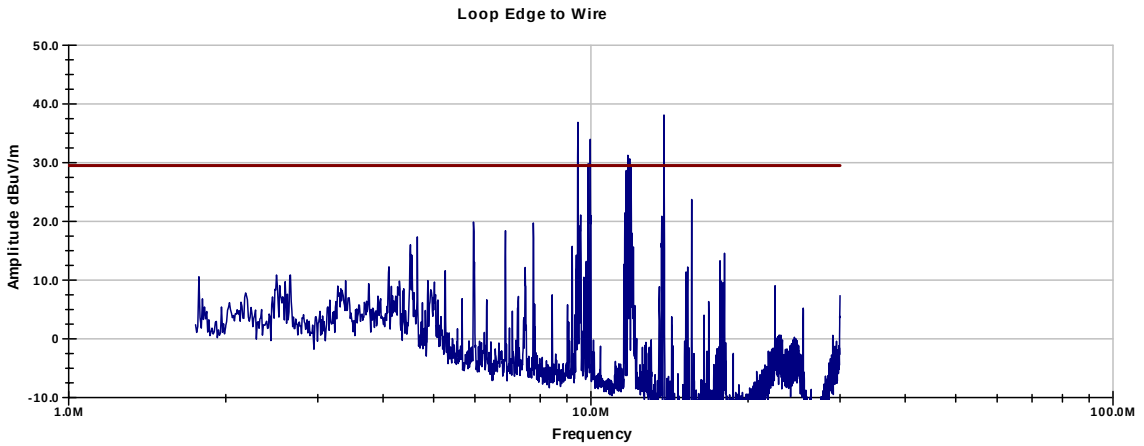
Field Strengths (location 15) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.041	24.6	29.2	28.6	0.3	19.1	5.2	29.5	-24.3	P
2.659	25.9	29.2	27.6	0.3	19.1	5.5	29.5	-24.0	P
3.763	28.2	29.2	26.7	0.3	19.1	6.9	29.5	-22.6	P
5.4484	31.2	29.2	23.6	0.3	19.1	6.8	29.5	-22.7	P
22.823	29.6	29.1	17.1	0.5	19.1	-1.1	29.5	-30.6	P
25.242	32.2	28.9	16.0	0.5	19.1	0.7	29.5	-28.8	P





Field Strengths (location 16) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.191	29.2	29.2	28.4	0.3	19.1	9.6	29.5	-19.9	P
2.5	31.6	29.2	27.9	0.3	19.1	11.5	29.5	-18.0	P
3.392	32.6	29.2	27.1	0.3	19.1	11.7	29.5	-17.8	P
5.043	34.8	29.2	23.7	0.3	19.1	10.6	29.5	-18.9	P
23.114	32.5	29.1	17.1	0.5	19.1	1.9	29.5	-27.6	P
24.544	32.6	29.0	15.5	0.5	19.1	0.5	29.5	-29.0	P



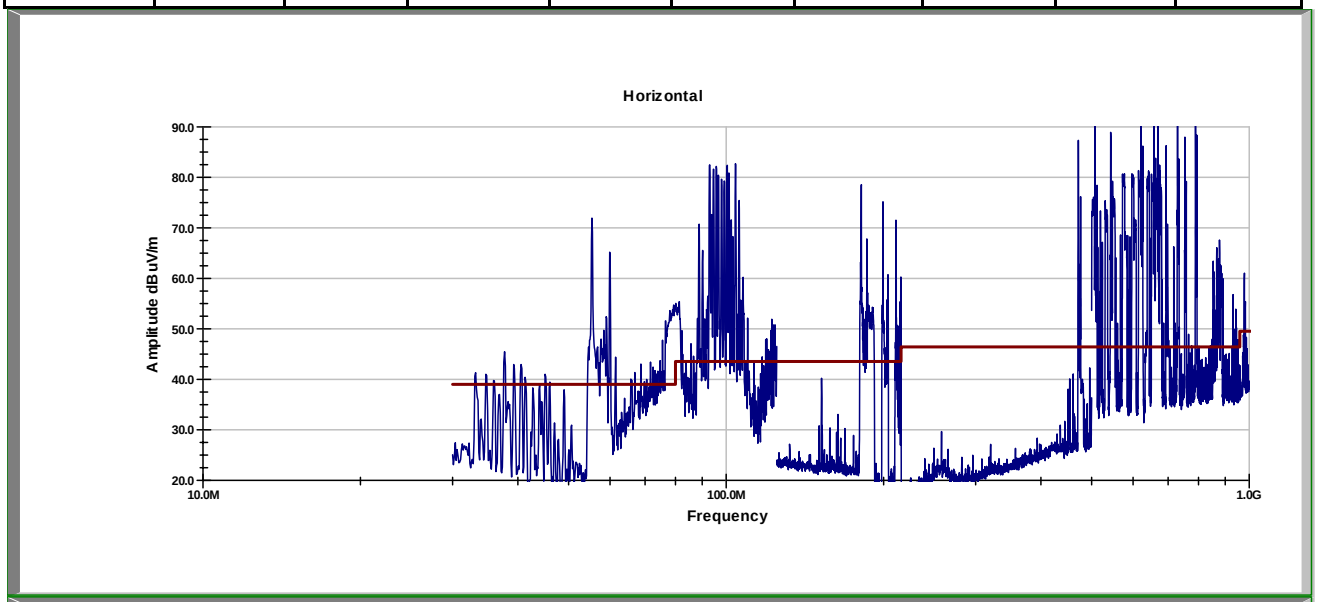


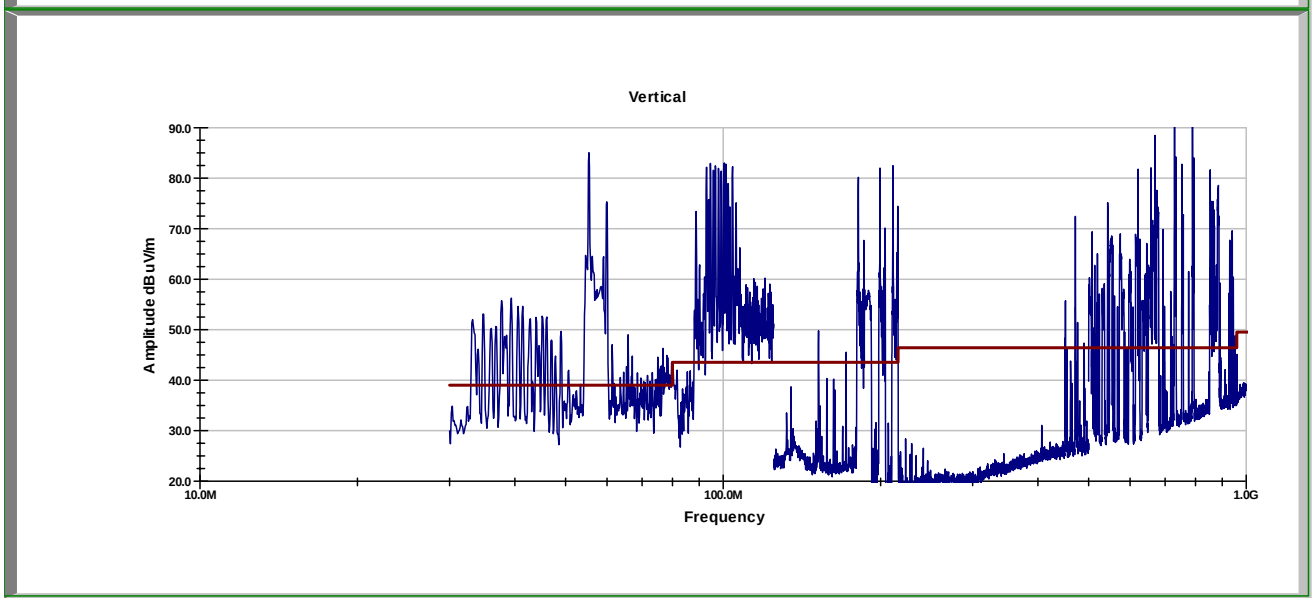
Field Strengths (all locations) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.024	36.5	29.2	28.6	0.3	19.1	17.1	29.5	-12.4	P
2.509	37	29.2	27.9	0.3	19.1	16.9	29.5	-12.6	P
3.542	33.6	29.2	26.9	0.3	19.1	12.5	29.5	-17.0	P
3.675	37.8	29.2	26.8	0.3	19.1	16.6	29.5	-12.9	P
3.763	44.8	29.2	26.7	0.3	19.1	23.5	29.5	-6.0	P
4.328	36.6	29.2	23.9	0.3	19.1	12.5	29.5	-17.0	P

TESTING ABOVE 30 MHz
30 MHz – 1,000 MHz

1. Contact the BPL system operator and set the EUT for MAXIMUM power and MAXIMUM burst rate before **Certification** testing. If **Validation** testing is performed there is no need for MAXIMUM power testing and only COMPLIANCE (operating) power is used.
2. Set the EMI Receiver or Spectrum Analyzer to 120 kHz IF bandwidth and PEAK detection. Set the frequency step size for 60 kHz (half the IF bandwidth) and scan the spectra from 30 MHz – 1,000 MHz for BPL emissions. For spectrum analyzers, scan smaller sub-ranges to allow at least three pixels on the analyzer's screen to fit within the 120 kHz bandwidth. EXAMPLE: (400 pixels/3) x 120 kHz restricts scan widths to 16 MHz (1 MHz/div maximum) Covering 30-1,000 MHz would require 97 sub-ranges each 10 MHz wide. (1 MHz/div x 10 div on-screen)
3. Orient the E-field antenna vertically and then horizontally to record data at both polarizations.
4. Identify the six highest BPL emissions in each polarization. (validate these choices by demodulating them and listening for voice or music)
5. Validate that the Spectrum Analyzer is using a pre-amplifier and it is not being overloaded. Increase the analyzer's input attenuation to verify that the instrument is not in amplitude compression by making sure all signals move in 10dB increments with the attenuator setting. Use the same technique with a fixed 10dB attenuator before the preamplifier to ensure that it is not being compressed
6. Validate that the repetition rate is at least 20 Hz by demodulating the audio on each of the six signals. If so, use Quasi-Peak detection on just those six loudest BPL signals and enter the receiver voltage into the worksheet below. If the burst rate is less than 20 Hz enter the Peak voltage into the worksheet below and indicate which detector was used.
7. If voice, non-BPL data or music is demodulated that candidate emission is eliminated and the Receiver is tuned to the next loudest emission for demodulation and identification to find the six highest BPL emissions.
8. Validate that the calculations employed are the same as shown in the worksheet if software is used for this measurement.
9. Capture a complete spectrum showing both polarizations for inclusion into the Test Report.
10. For **Certification** testing, contact the BPL system operator and set the EUT down to its COMPLIANCE power setting. Tell the operator how many dB the system needs to be attenuated for compliance with the FCC limits on field strengths (or below them).

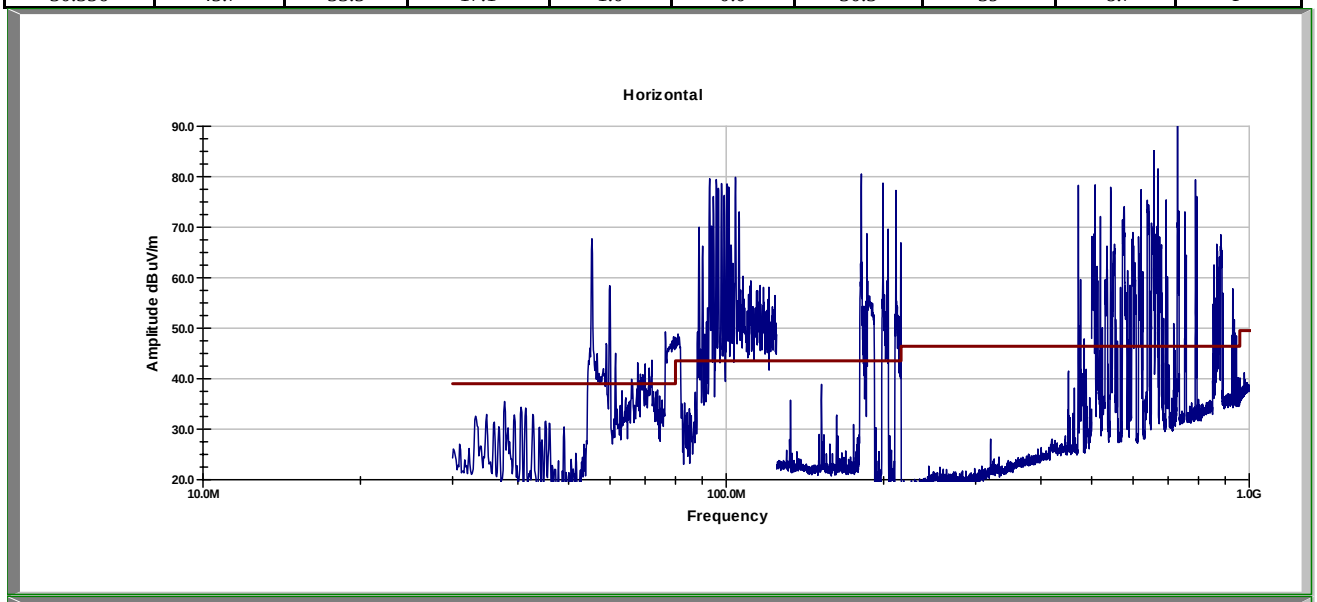
Field Strengths (location 1) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	47	33.5	17.1	1.0	0.0	31.6	39	-7.4	P
31.544	44.3	33.5	17.1	1.0	0.0	28.9	39	-10.1	P

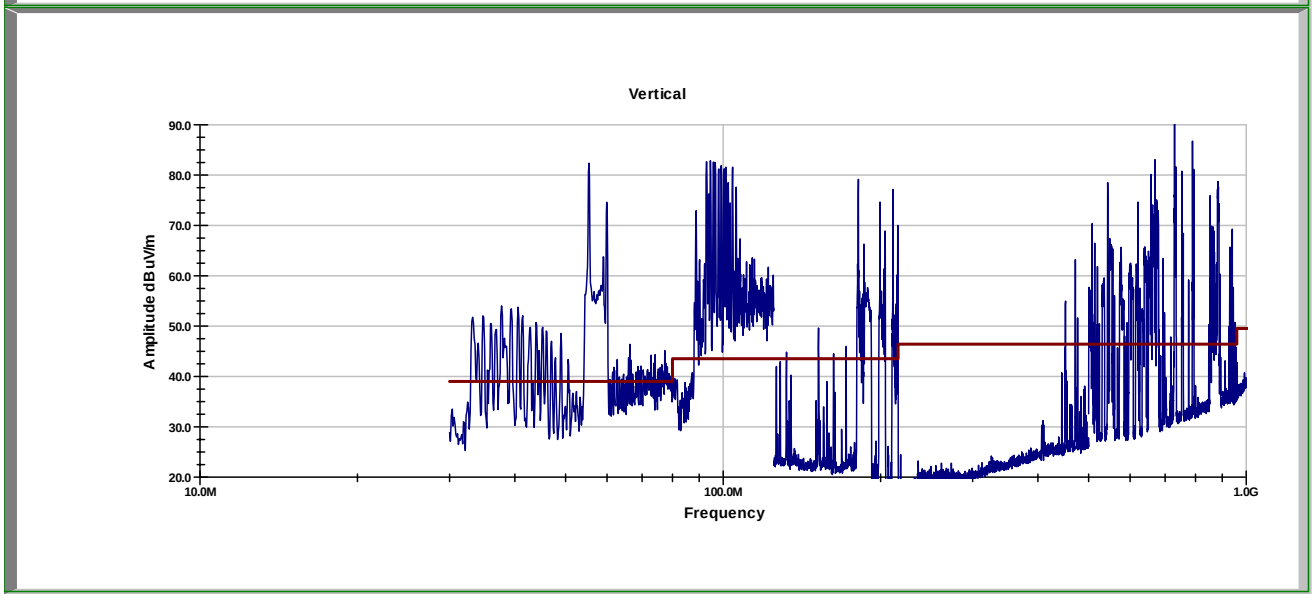




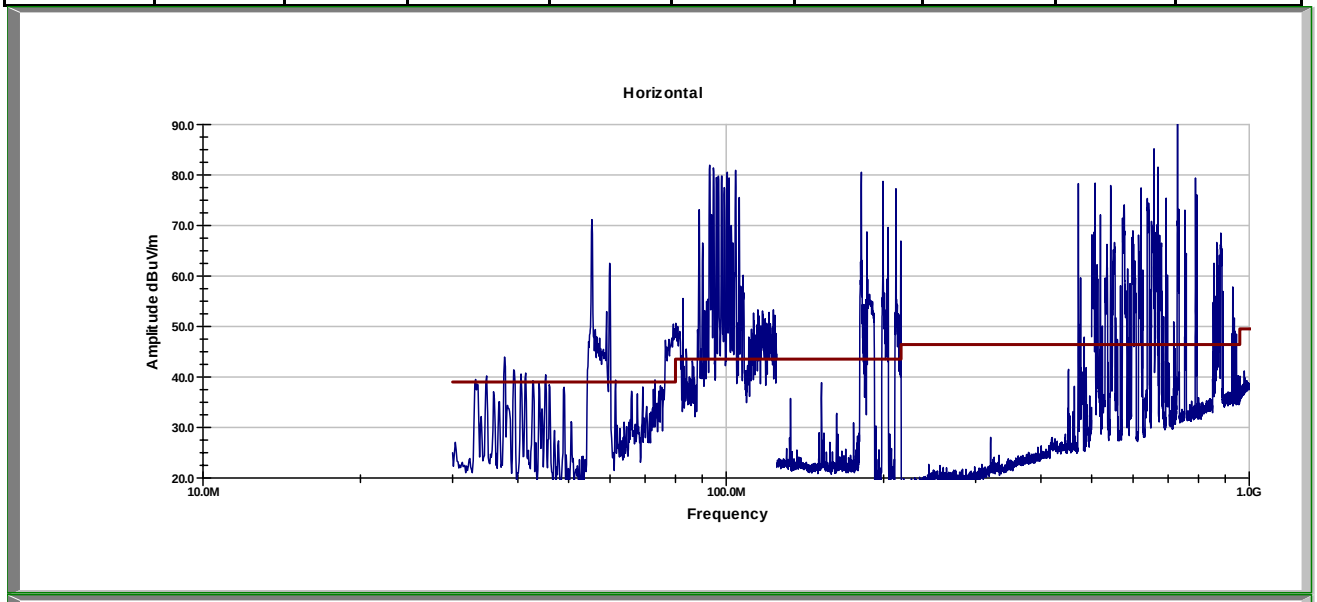
Field Strengths (location 2) 30 MHz– 1,000 MHz

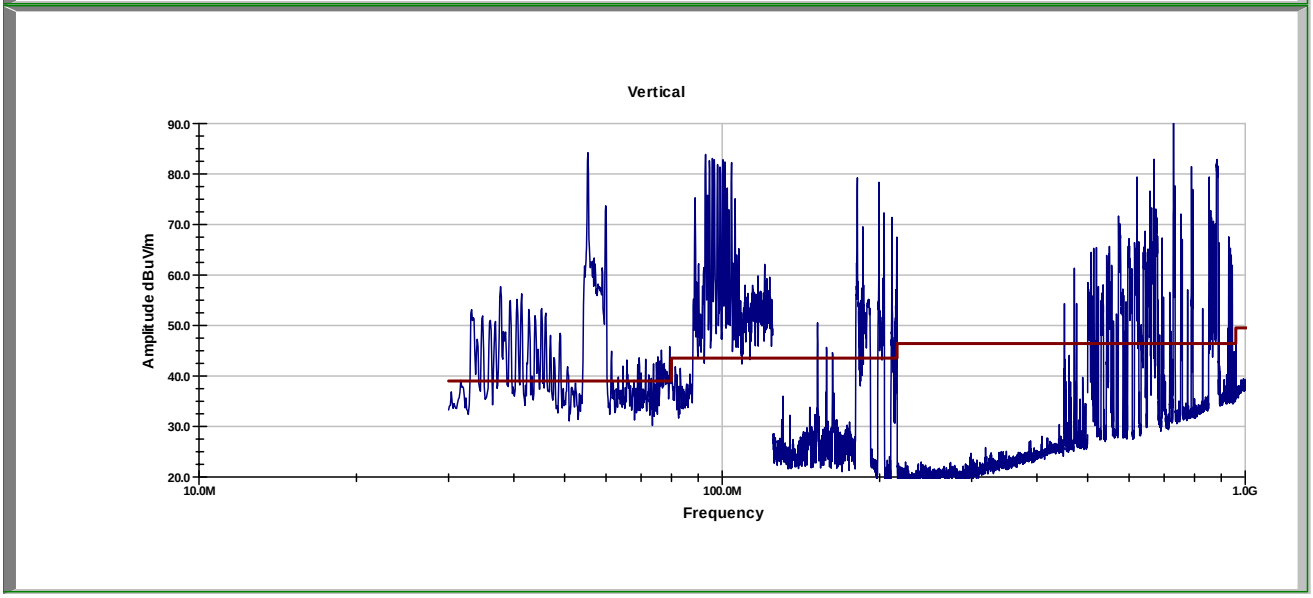
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	45.7	33.5	17.1	1.0	0.0	30.3	39	-8.7	P



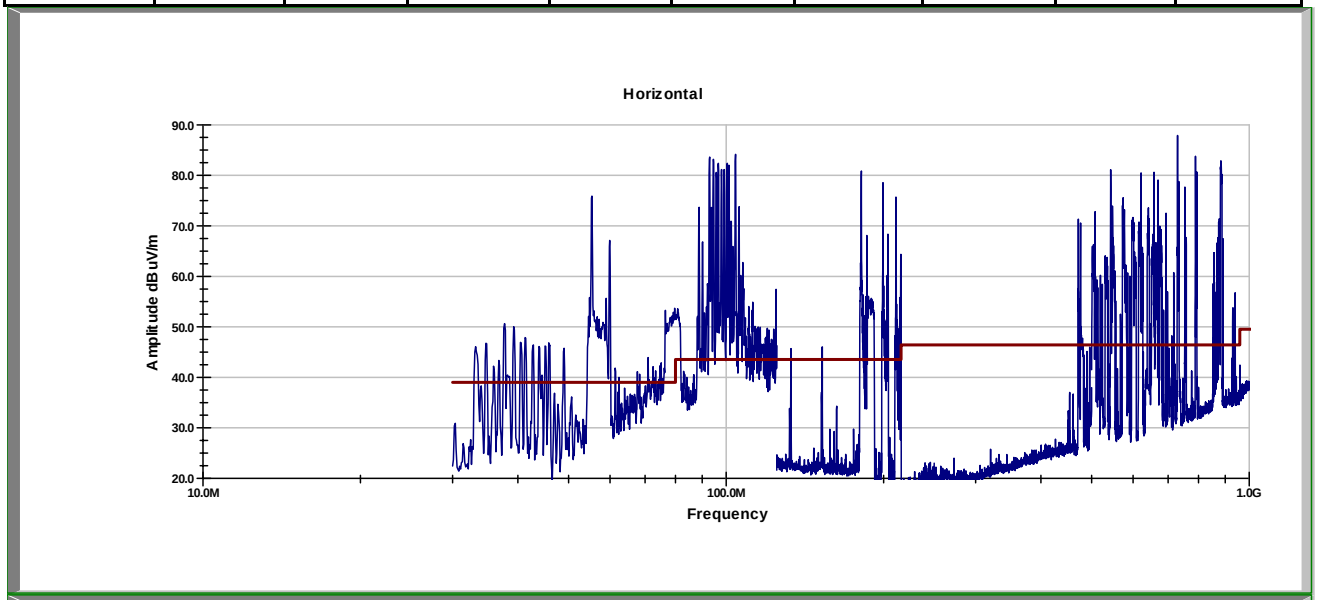


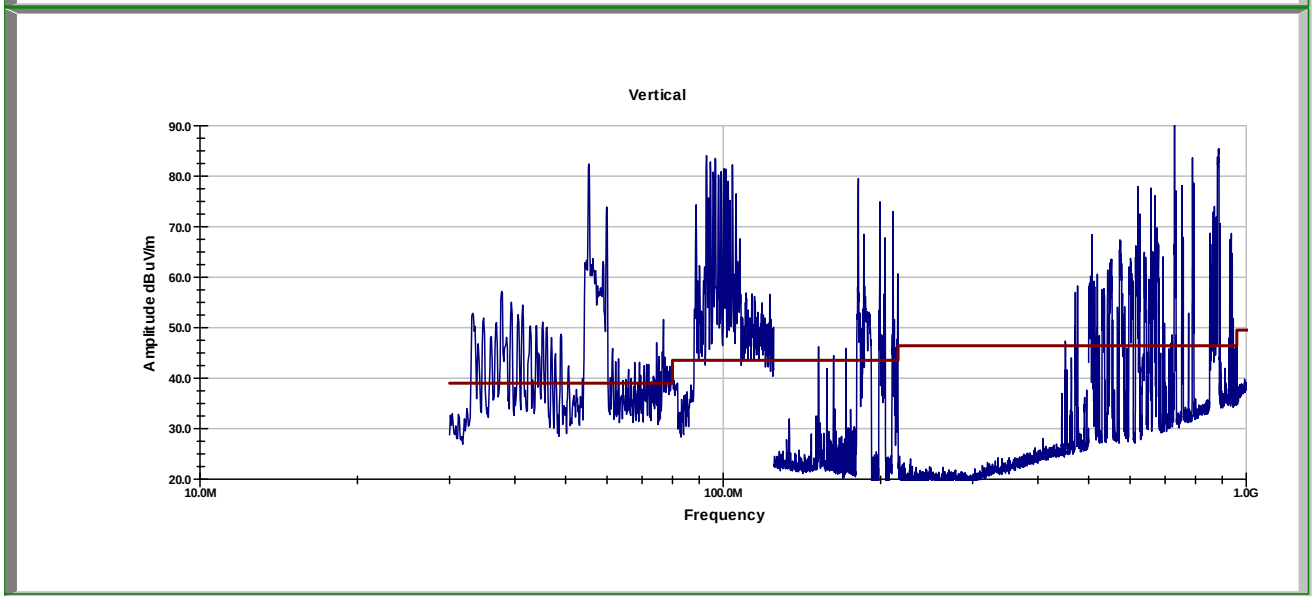
Field Strengths (location 3) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	47.3	33.5	17.1	1.0	0.0	31.9	39	-7.1	P
31.7	32.2	33.5	17.1	1.0	0.0	18.6	39	-22.2	QP
31.781	34.5	33.5	17.1	1.0	0.0	19.1	39	-19.9	P



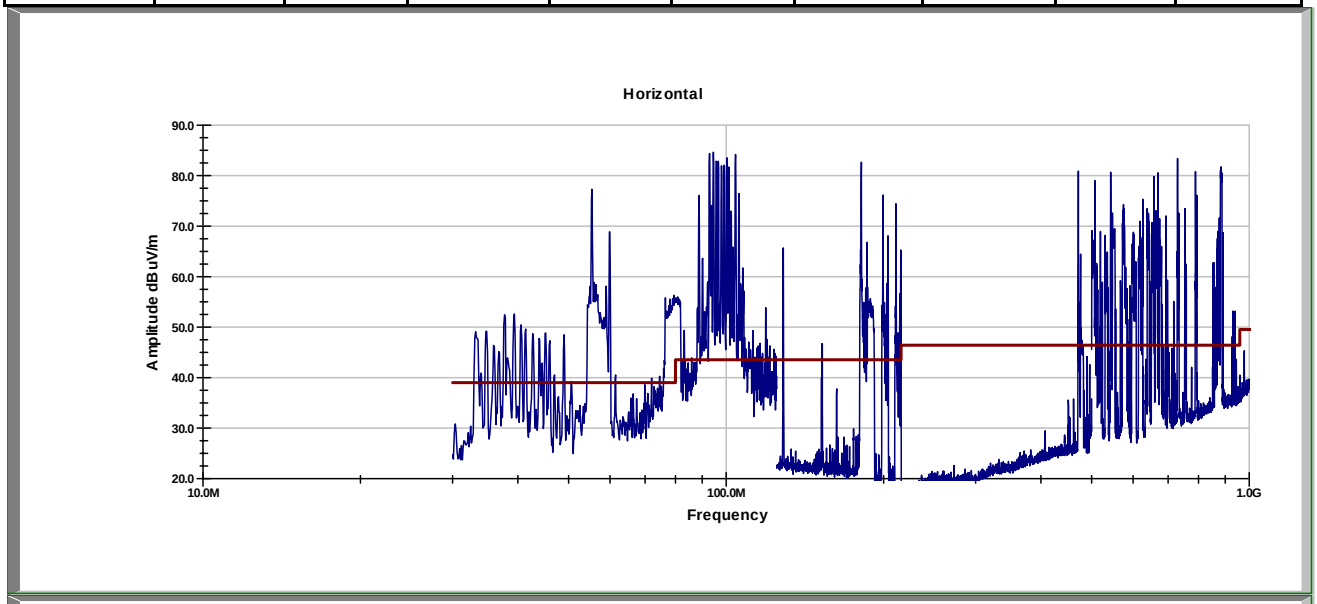


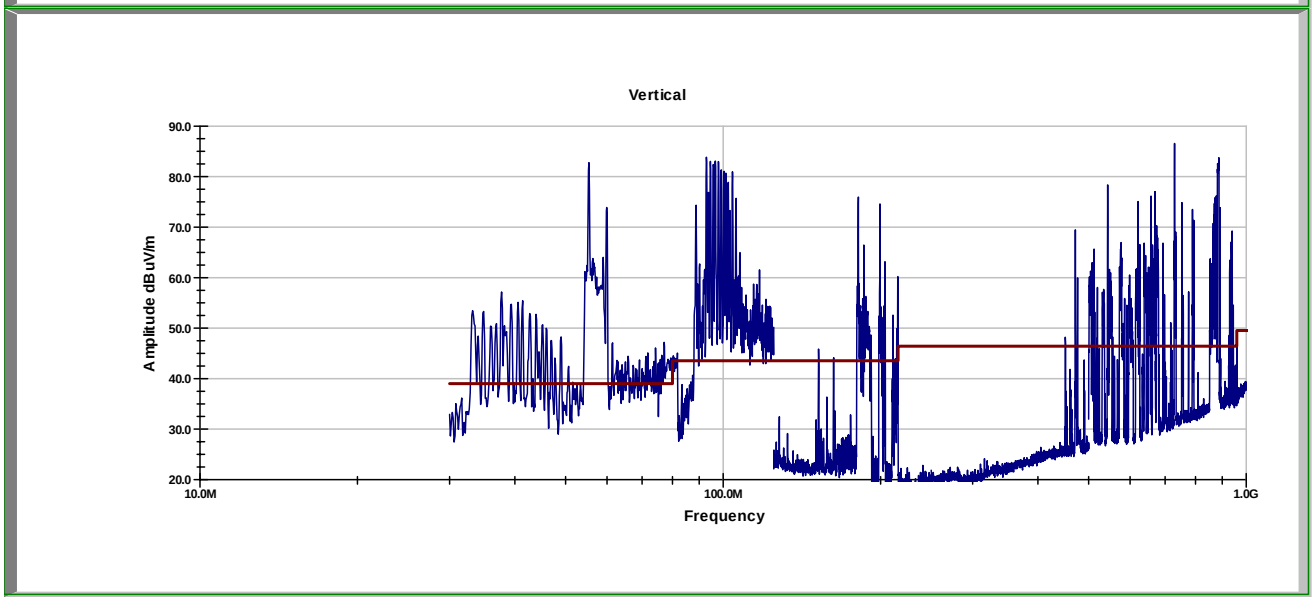
Field Strengths (location 4) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	45.1	33.5	17.1	1.0	0.0	29.7	39	-9.3	P
31.188	45	33.5	17.1	1.0	0.0	29.6	39	-9.4	P



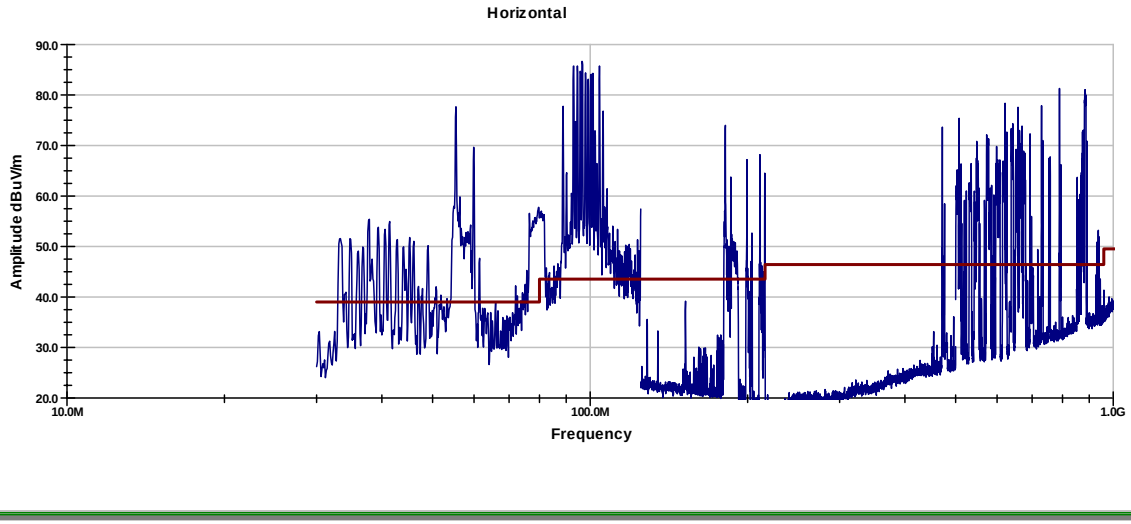


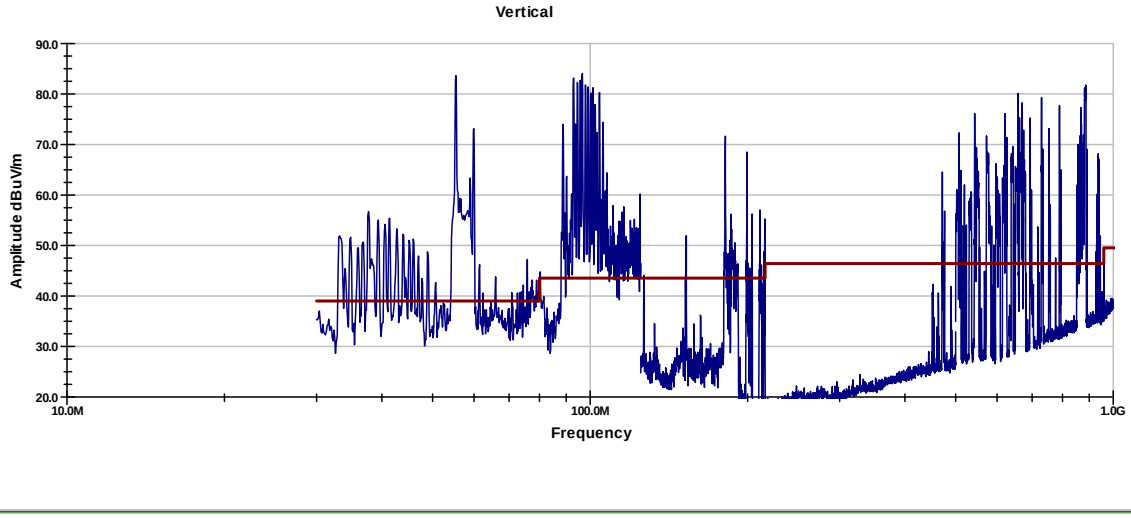
Field Strengths (location 5) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	45.1	33.5	17.1	1.0	0.0	29.7	39	-9.3	P
30.356	45.5	33.5	17.1	1.0	0.0	30.1	39	-8.9	P
30.831	47.2	33.5	17.1	1.0	0.0	31.8	39	-7.2	P
31.663	48.3	33.5	17.1	1.0	0.0	32.9	39	-6.1	P



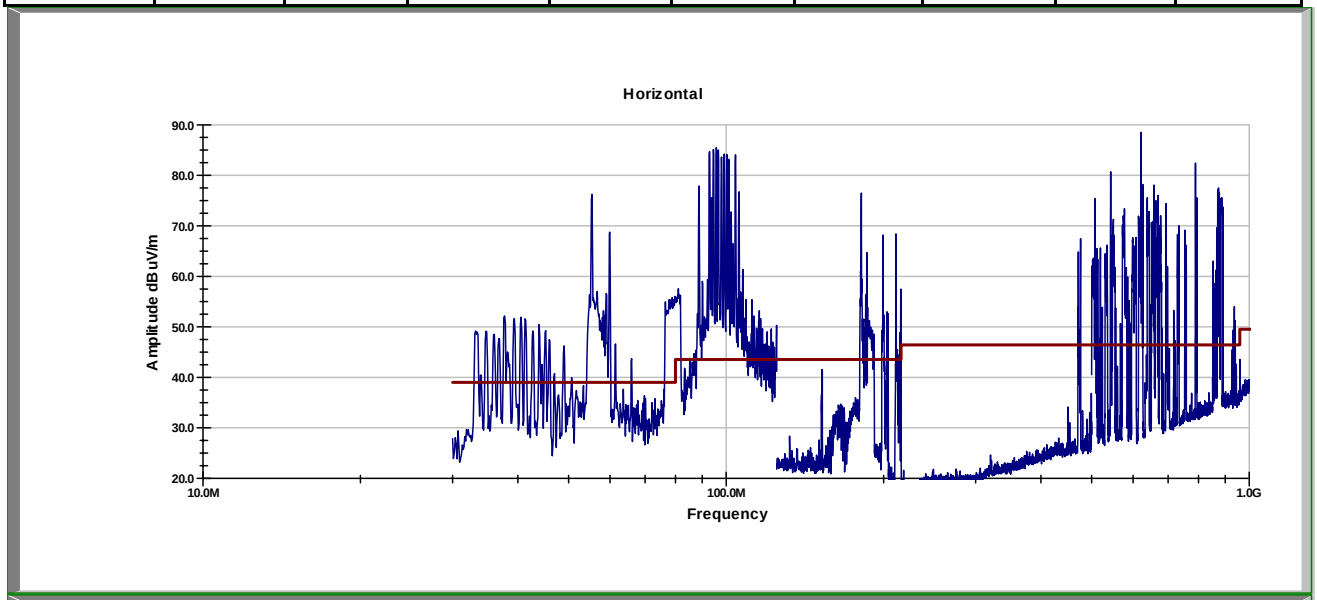


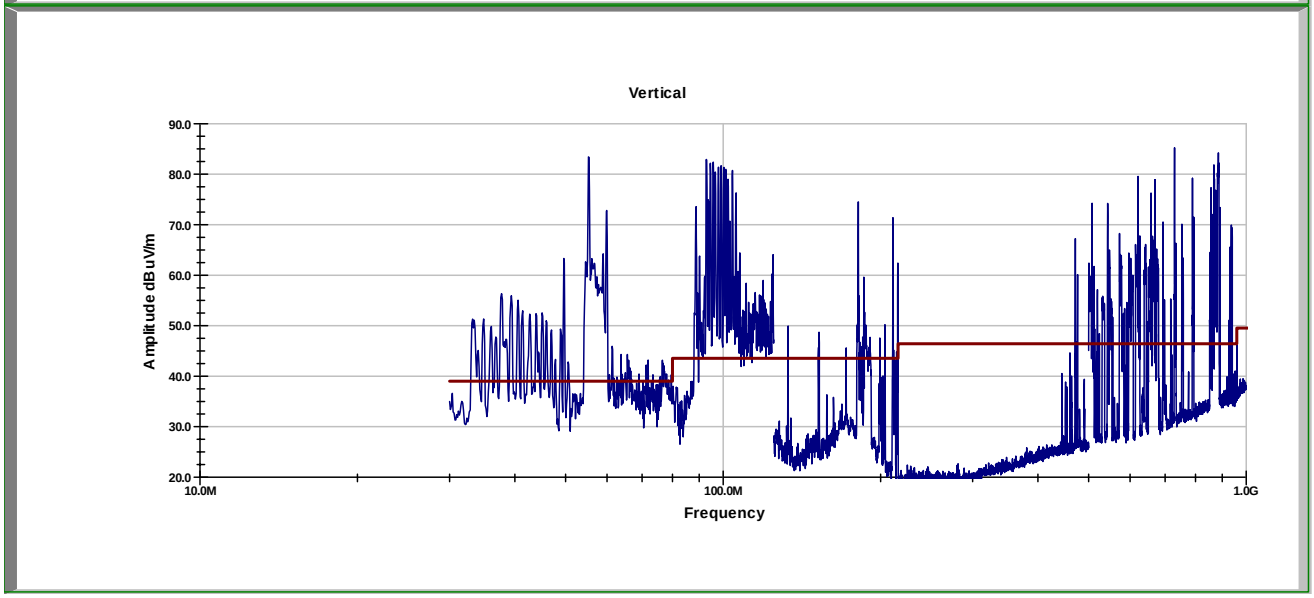
Field Strengths (location 6) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	49.2	33.5	17.1	1.0	0.0	33.8	39	-5.2	P
30.831	46.5	33.5	17.1	1.0	0.0	31.1	39	-7.9	P
31.663	47.5	33.5	17.1	1.0	0.0	32.1	39	-6.9	P



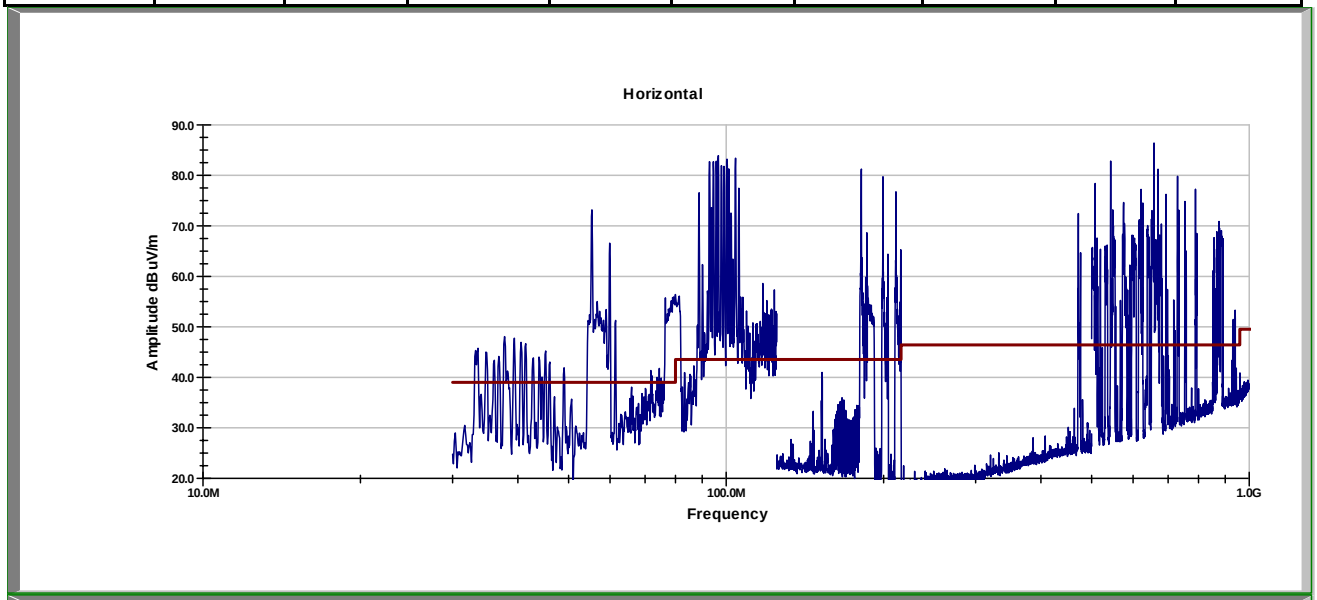


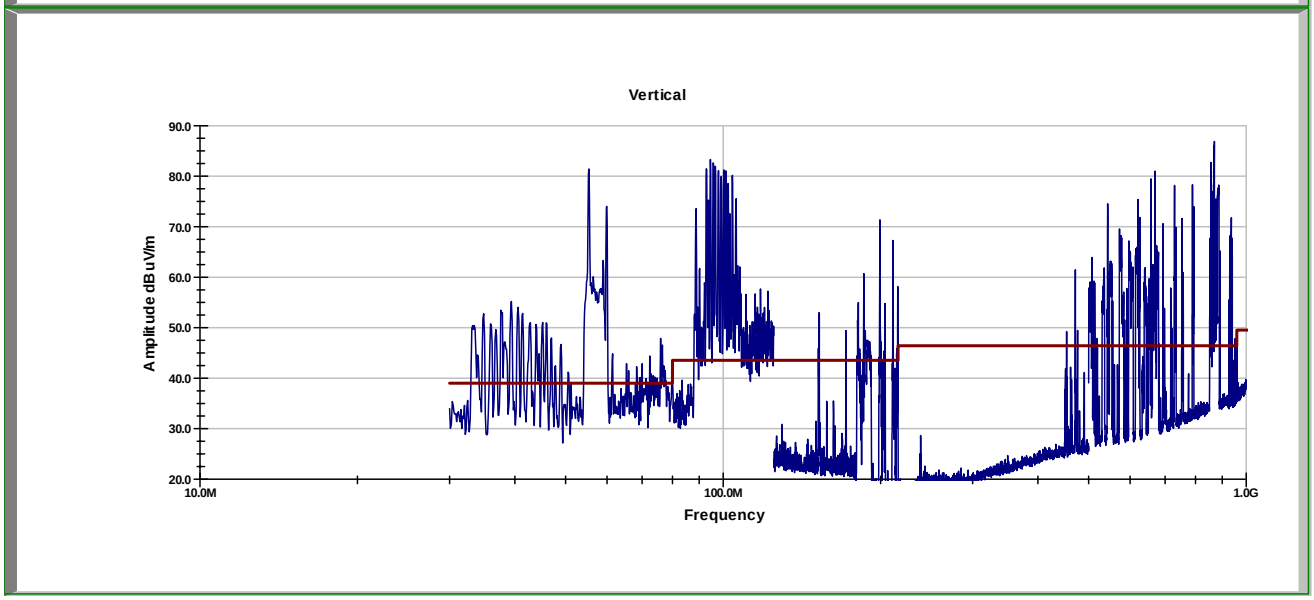
Field Strengths (location 7) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	48.8	33.5	17.1	1.0	0.0	33.4	39	-5.6	P
31.781	46.8	33.5	17.1	1.0	0.0	31.4	39	-7.6	P



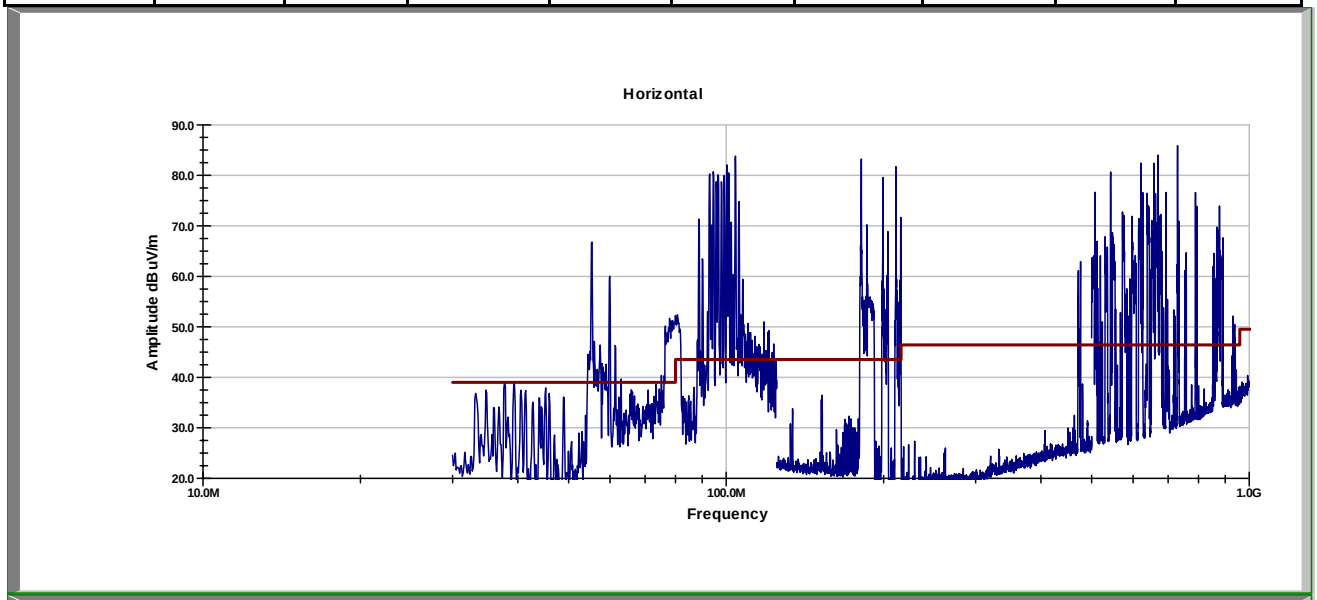


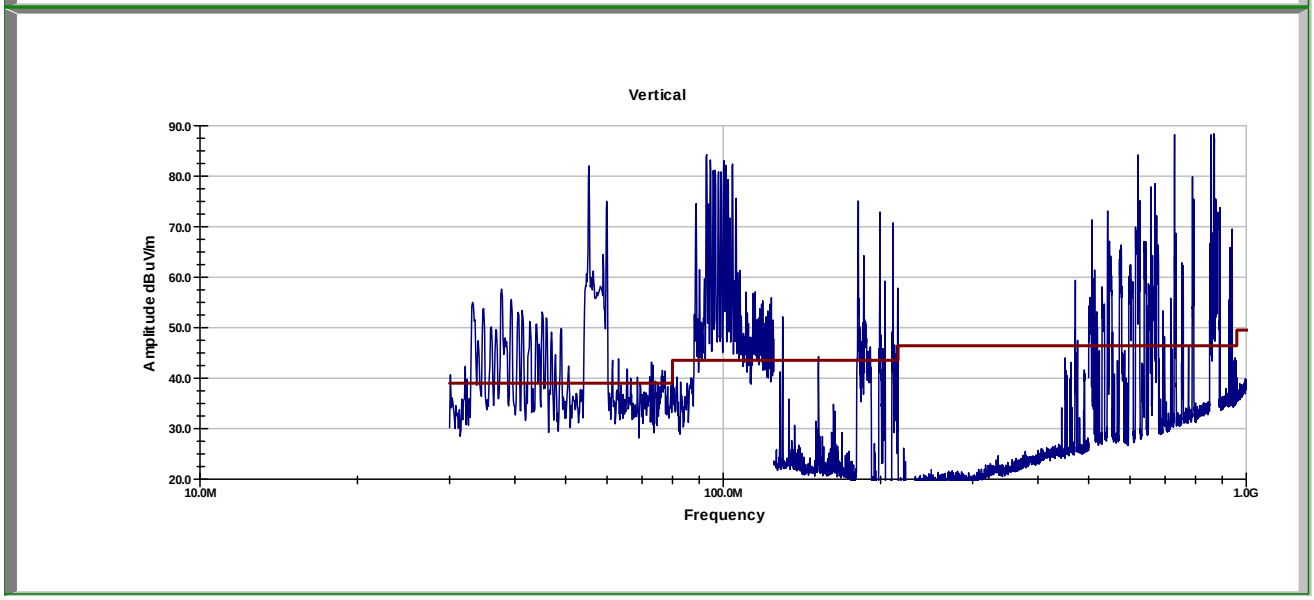
Field Strengths (location 8) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	46.2	33.5	17.1	1.0	0.0	30.8	39	-8.2	P
30.356	47.5	33.5	17.1	1.0	0.0	32.1	39	-6.9	P



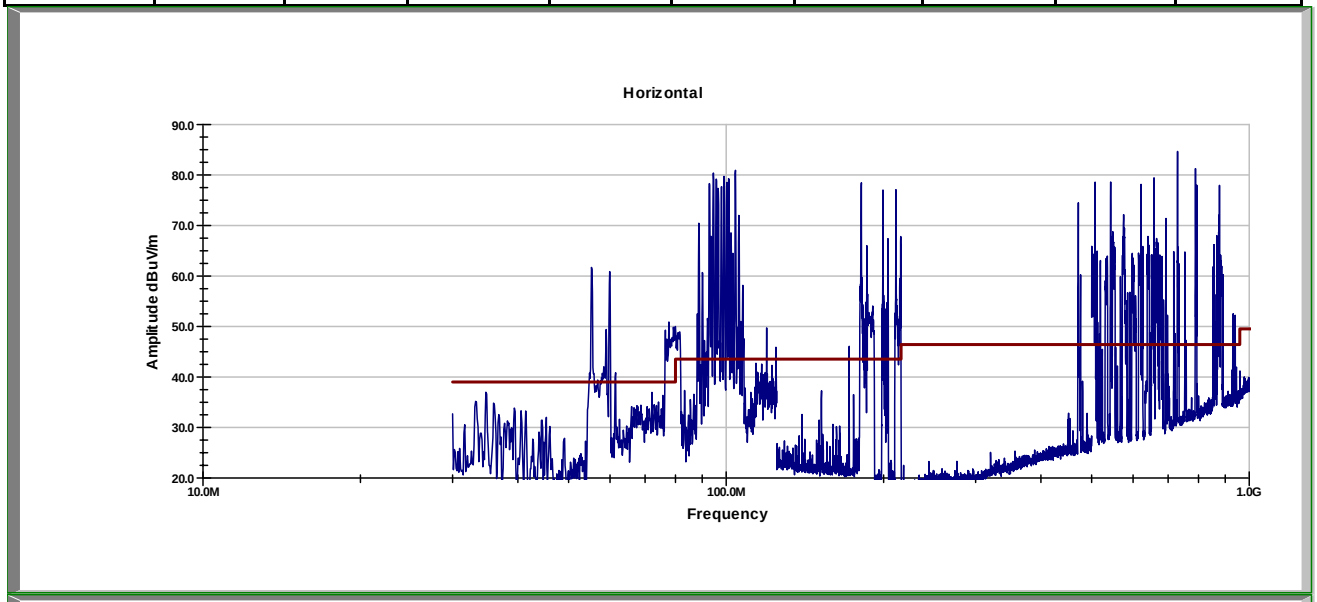


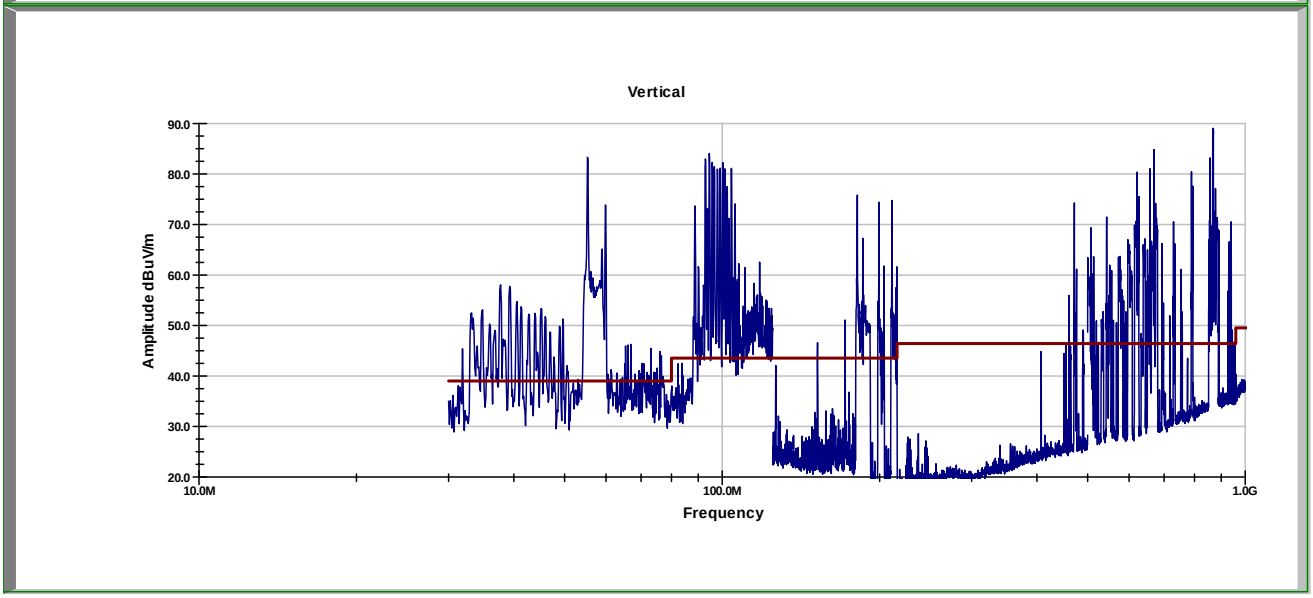
Field Strengths (location 9) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.1	32.2	33.5	17.1	1.0	0.0	18.5	39	-22.2	QP
30.356	47.5	33.5	17.1	1.0	0.0	32.1	39	-6.9	P



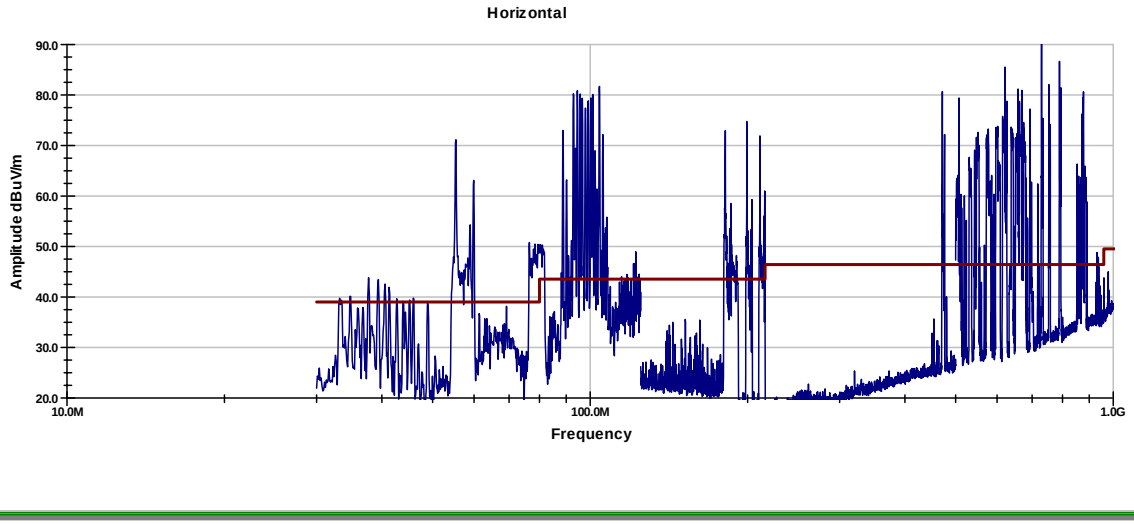


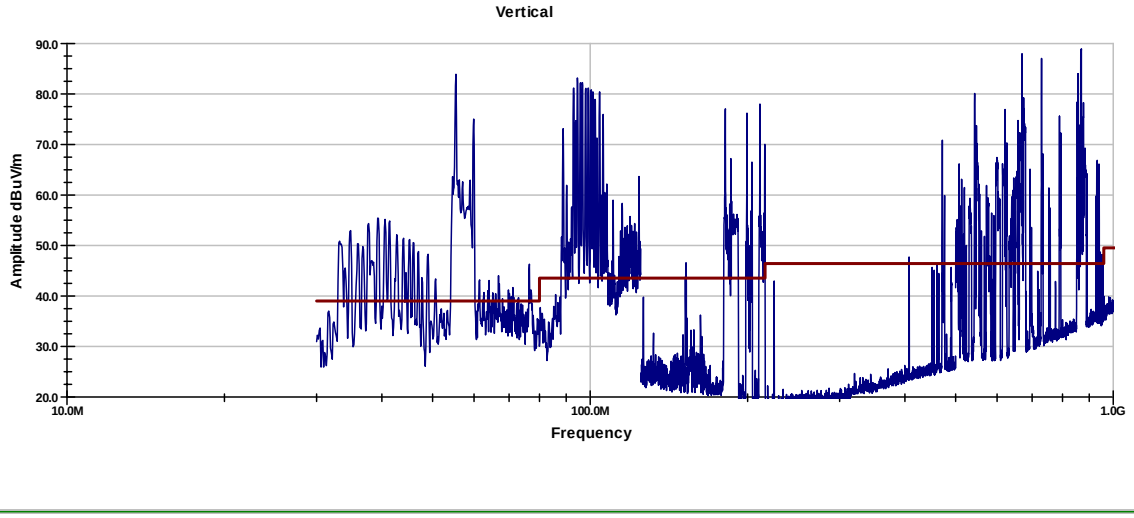
Field Strengths (location 10) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	47.2	33.5	17.1	1.0	0.0	31.8	39	-7.2	P
30.594	48.3	33.5	17.1	1.0	0.0	32.9	39	-6.1	P
31.306	50.2	33.5	17.1	1.0	0.0	34.8	39	-4.2	P



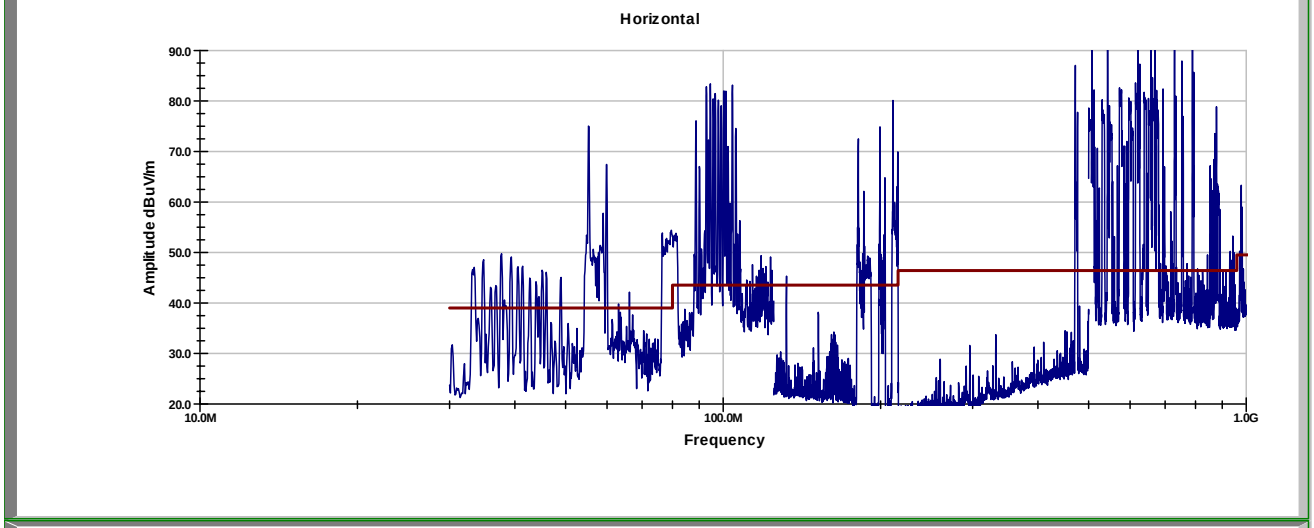


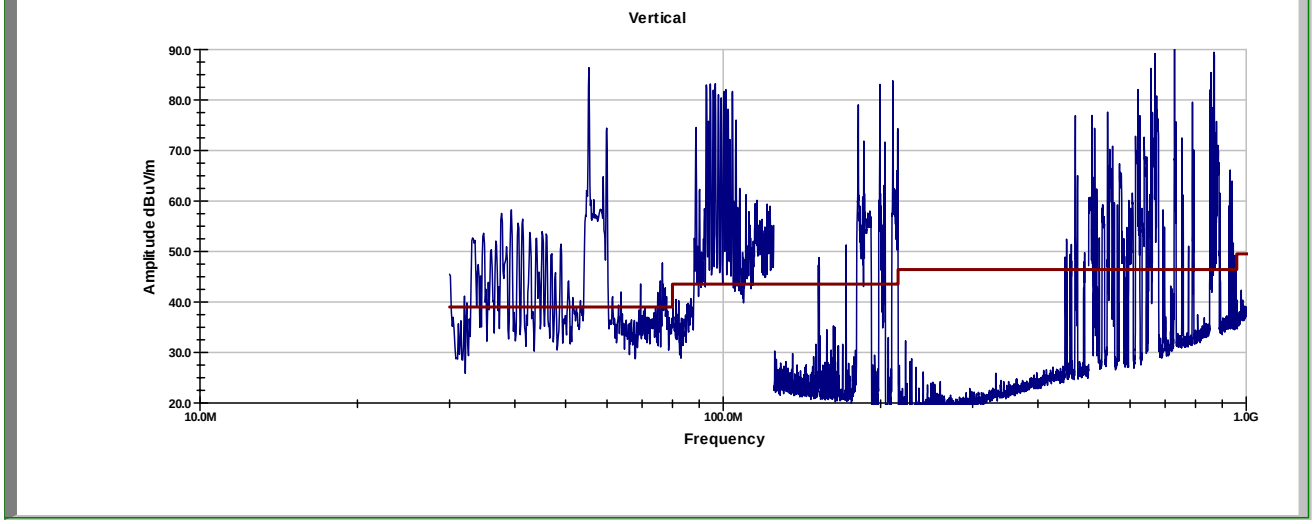
Field Strengths (location 11) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	45.4	33.5	17.1	1.0	0.0	30.0	39	-9.0	P
30.713	43.2	33.5	17.1	1.0	0.0	27.8	39	-11.2	P
31.663	49.1	33.5	17.1	1.0	0.0	33.7	39	-5.3	P



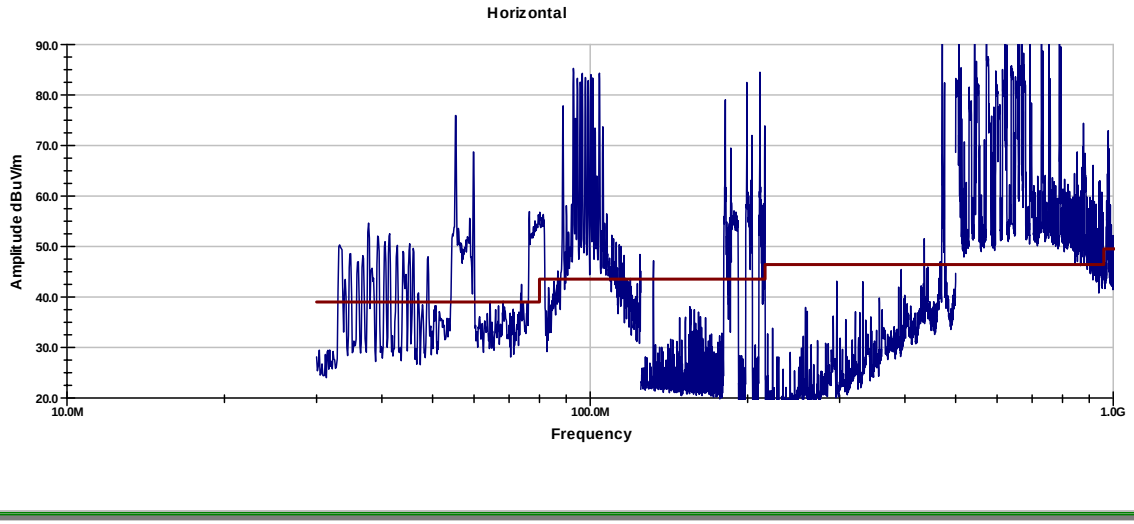


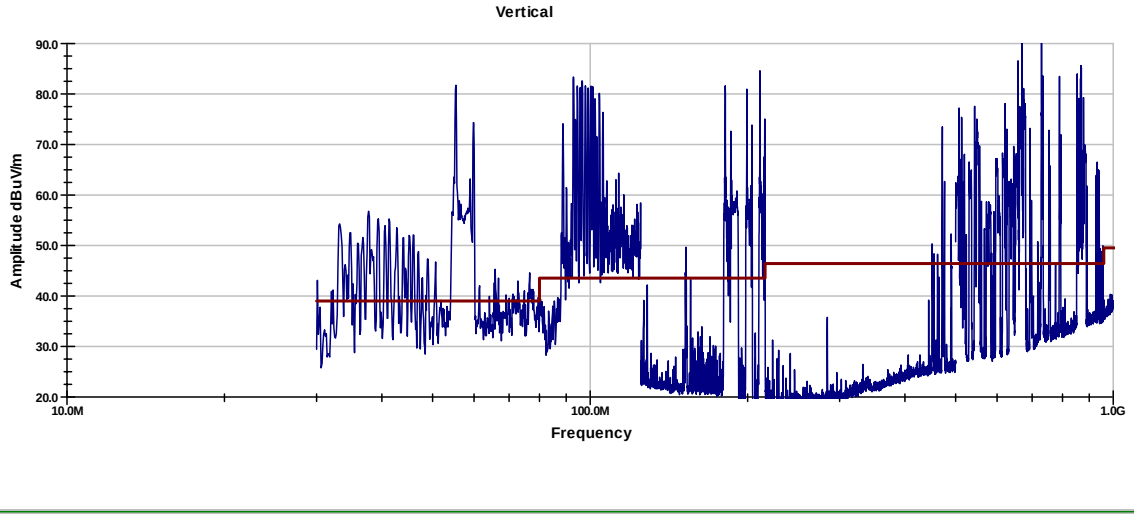
Field Strengths (location 12) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.1	34.5	33.5	17.1	1.0	0.0	20.8	39	-19.9	QP
31.544	48.4	33.5	17.1	1.0	0.0	33.0	39	-6.0	P
32	37.5	33.5	17.1	1.0	0.0	23.9	39	-16.9	QP



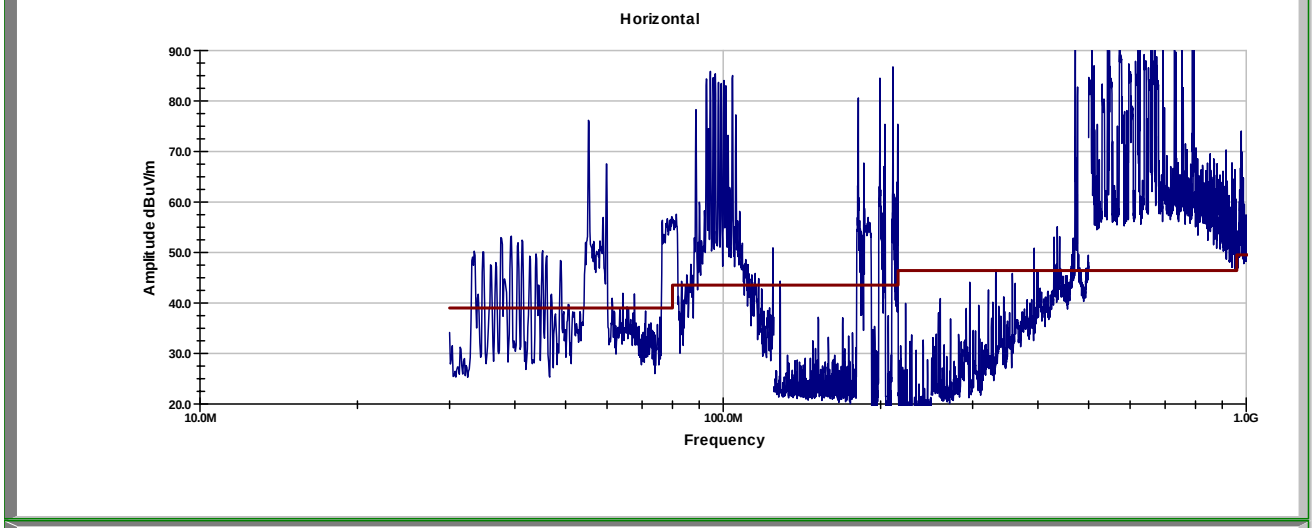


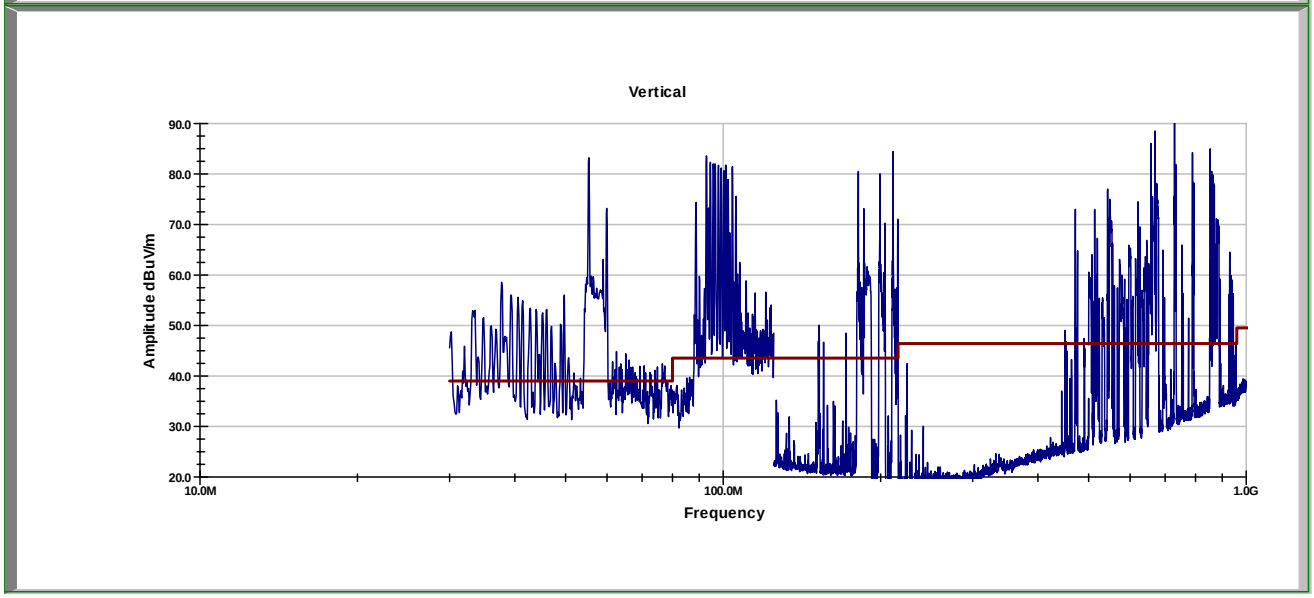
Field Strengths (location 13) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.1	26.8	33.5	17.1	1.0	0.0	11.4	39	-27.6	QP
30.475	50	33.5	17.1	1.0	0.0	34.6	39	-4.4	P
32	29.5	33.5	17.1	1.0	0.0	14.1	39	-24.9	QP



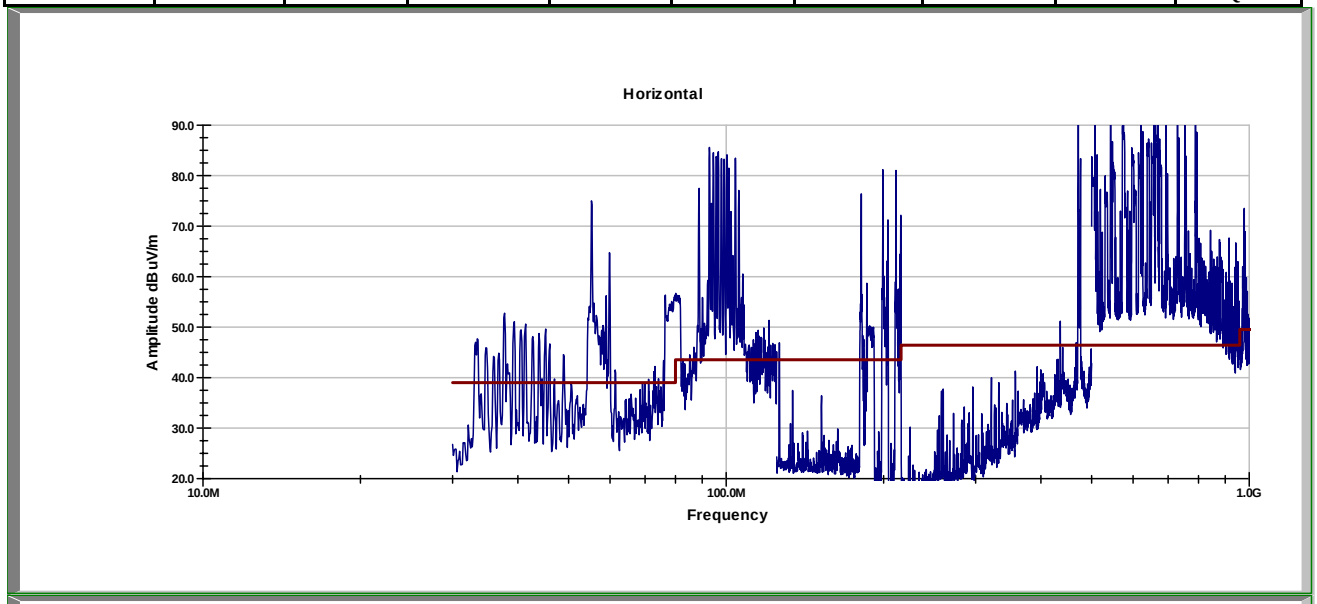


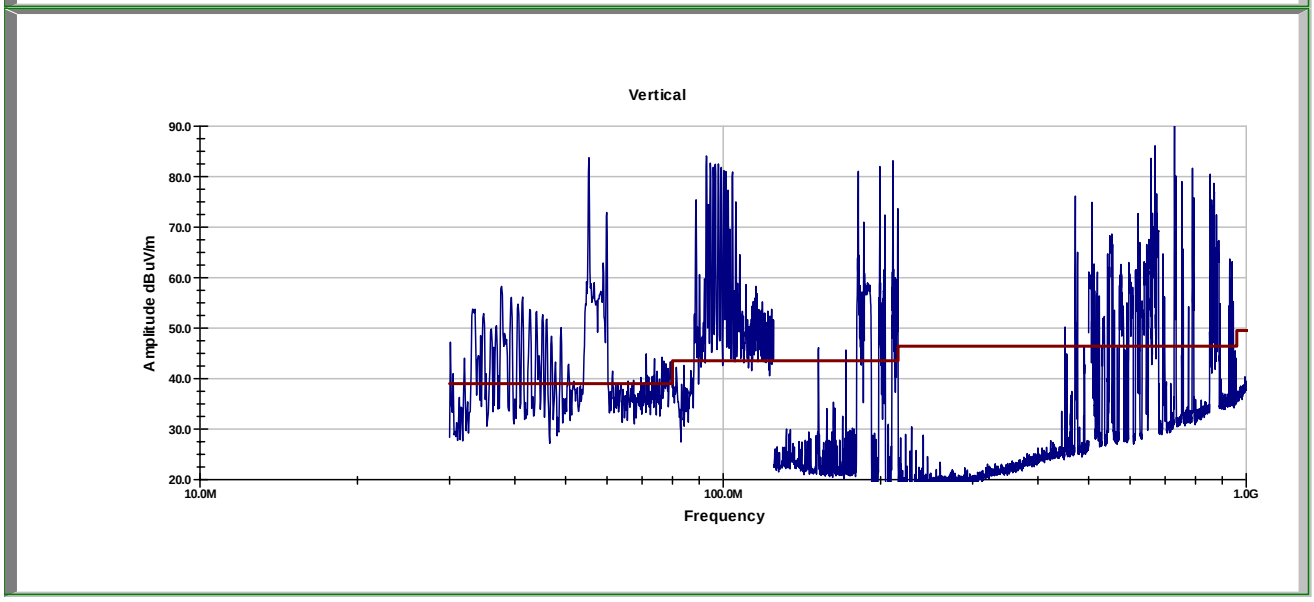
Field Strengths (location 14) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.1	33.5	33.5	17.1	1.0	0.0	18.1	39	-20.9	QP
31.069	50.2	33.5	17.1	1.0	0.0	34.8	39	-4.2	P
31.9	39.1	33.5	17.1	1.0	0.0	23.7	39	-15.3	QP



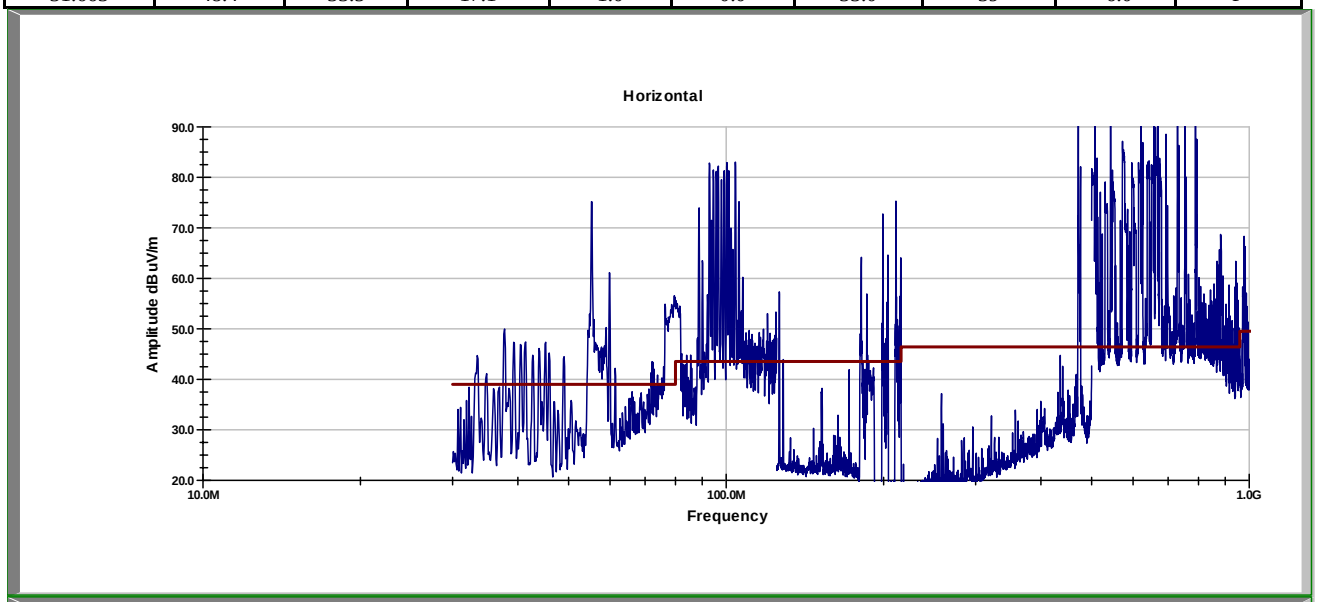


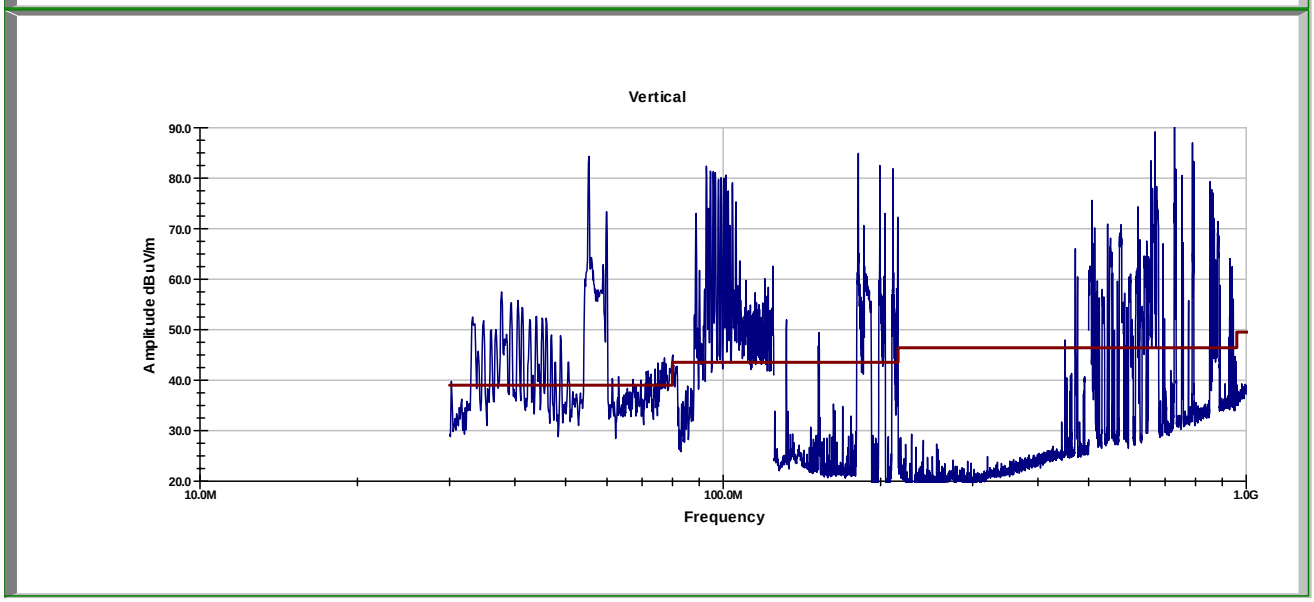
Field Strengths (location 15) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.1	31.5	33.5	17.1	1.0	0.0	16.1	39	-22.9	QP
30.5	31.9	33.5	17.1	1.0	0.0	16.5	39	-22.5	QP
31.306	48.4	33.5	17.1	1.0	0.0	33.0	39	-6.0	P
31.9	27.8	33.5	17.1	1.0	0.0	12.4	39	-26.6	QP





Field Strengths (location 16) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.1	29.3	33.5	17.1	1.0	0.0	13.9	39	-25.1	QP
31.663	48.4	33.5	17.1	1.0	0.0	33.0	39	-6.0	P





Examine all the data taken in this test sequence and enter the worst case corrected field strengths recorded regardless of location or polarization in the table below for inclusion in the Test Report. (Indicate polarization and whether Peak or Quasi-Peak detection was used on each reading)

Field Strengths (all locations) 30 MHz – 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30.356	49.2	33.5	17.1	1	0	33.8	39	-5.2	P
30.475	50	33.5	17.1	1	0	34.6	39	-4.4	P
31.069	50.2	33.5	17.1	1	0	34.8	39	-4.2	P
31.306	50.2	33.5	17.1	1	0	34.8	39	-4.2	P
31.544	48.4	33.5	17.1	1	0	33	39	-6	P
31.663	49.1	33.5	17.1	1	0	33.7	39	-5.3	P

Cumulative Test Results:	**PASS**
Name & Address of Testing Organization:	Professional Testing 1601 North A.W. Grimes Road Suite B Round Rock, Texas 78681
Test Engineer's Signature:	
Date:	
Name & Address of Entity requesting this test:	Corinex