Broadband over Power Lines (BPL)

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

Access-Overhead 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.

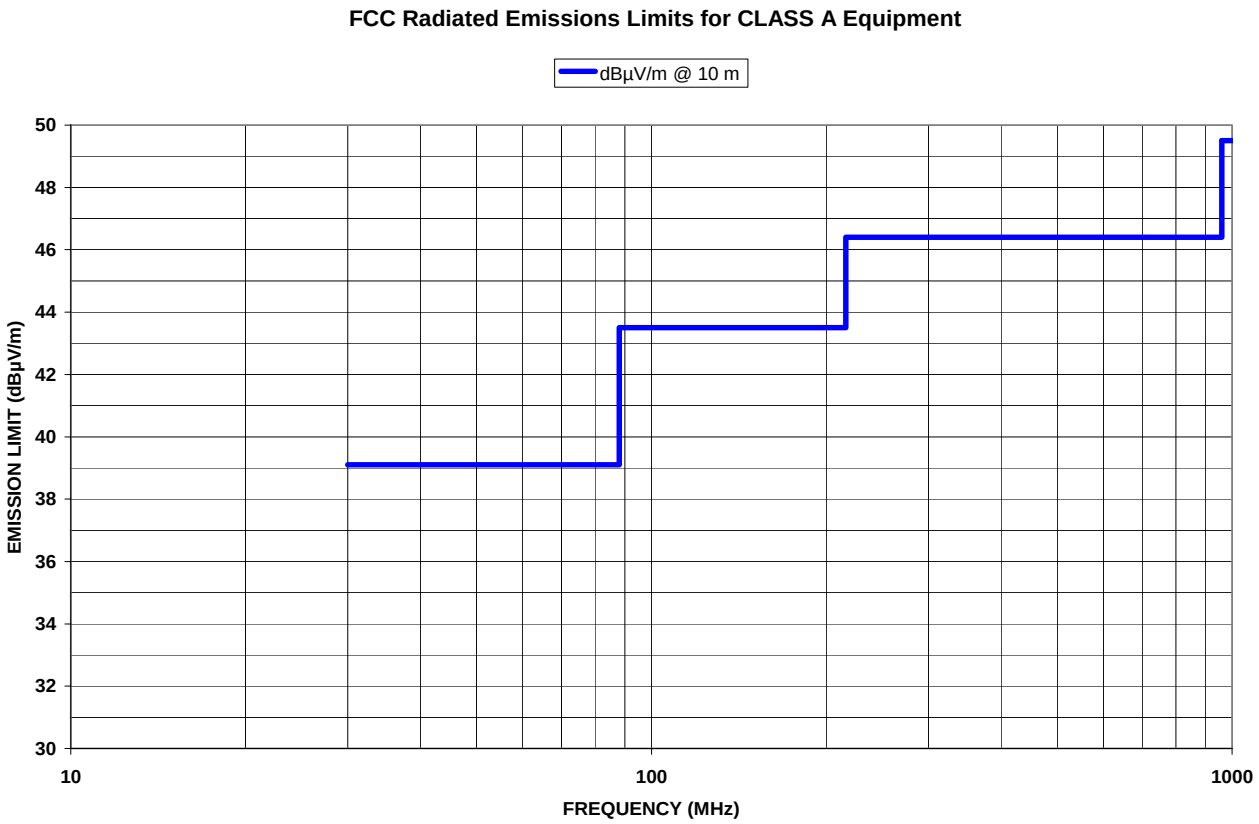
Rationale for selection of test site:
This site was chosen as one of three representative installations for this component because it is accessible. The location being next to a park provides ample room to stage the measurement equipment. There are no buildings, fences, or obstructions that would cause reflections or disturbances to the measurements.

OBJECT

This test procedure outlines the specific electromagnetic compatibility (EMC) emissions testing requirements applicable to Access BPL Overhead 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	46.4 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)


FCC Radiated Emissions Limits for CLASS A Equipment
dBµV/m @ 10 m
EMISSION LIMIT (dBµV/m)
50
48
46
44
42
40
38
36
34
32
30
10
100
1000
FREQUENCY (MHz)

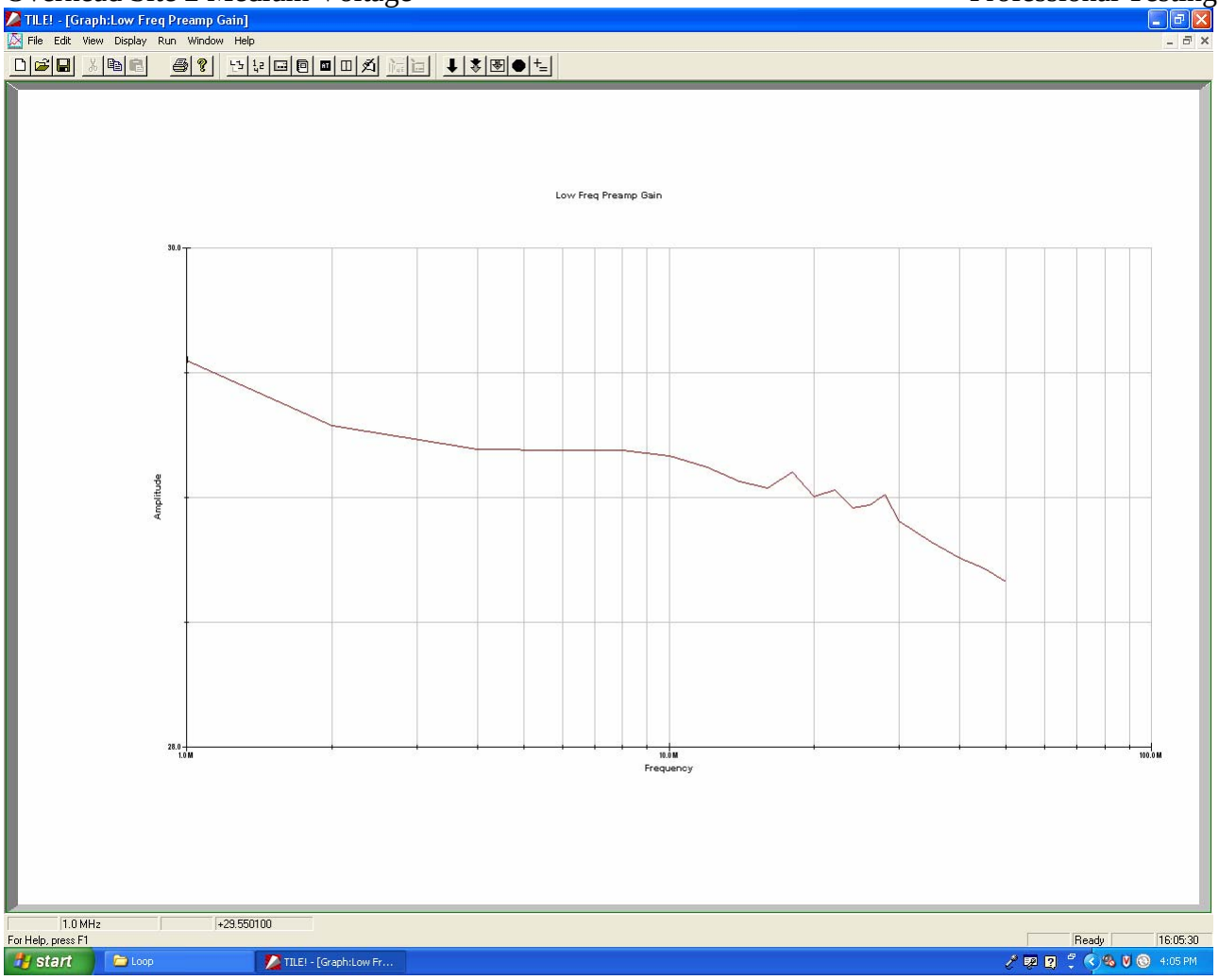
Unintentional Radiator Upper Frequency Range of Measurement	
Highest frequency used in the device (MHz)	**Upper Frequency of Measurement (MHz)**
1.705-108MHz	1,000MHz
108-500MHz	2,000MHz
500-1,000MHz	5,000MHz
Above 1,000MHz	5th Harmonic <40GHz

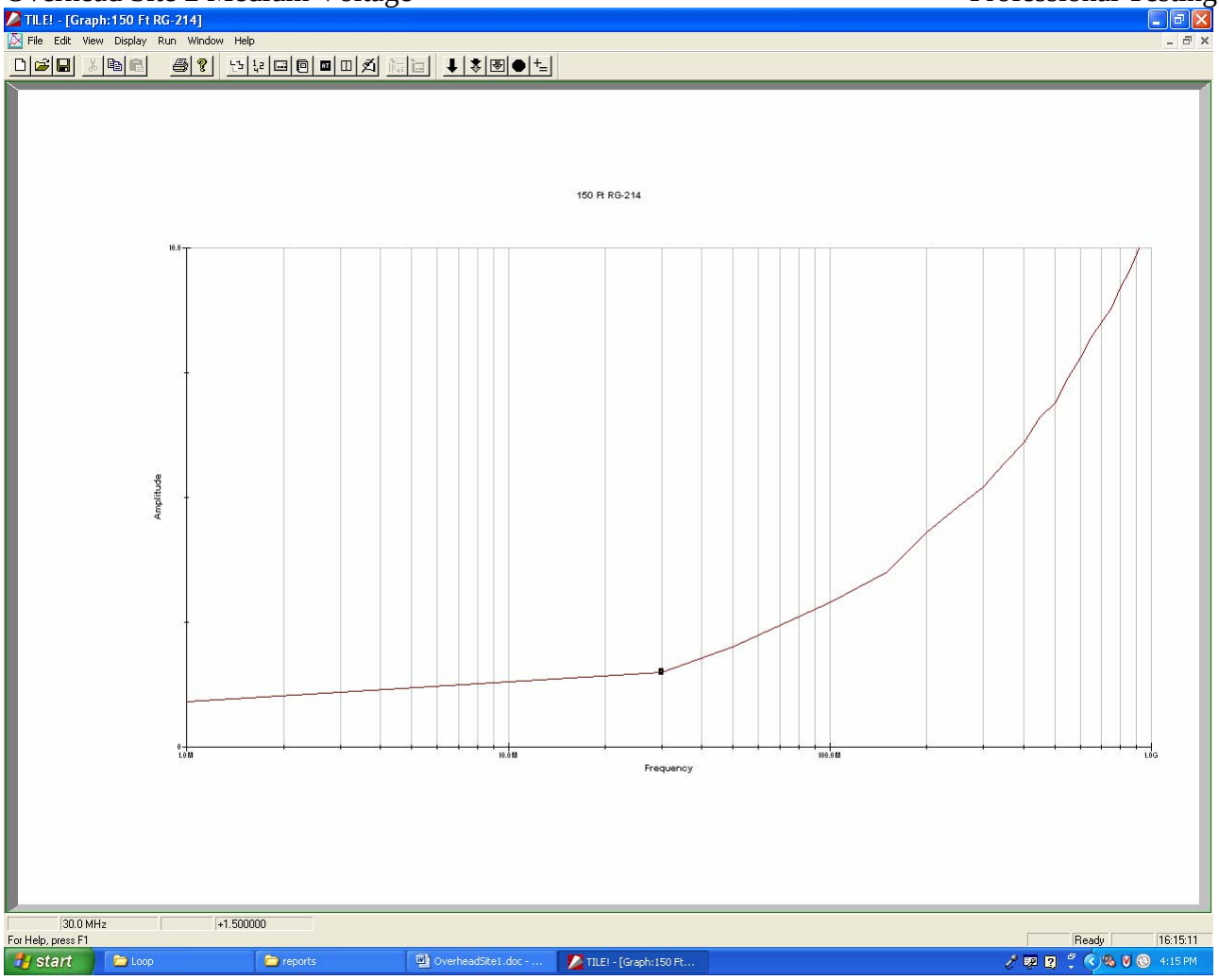
The upper frequency of measurement for this test is ___1000__ MHz.

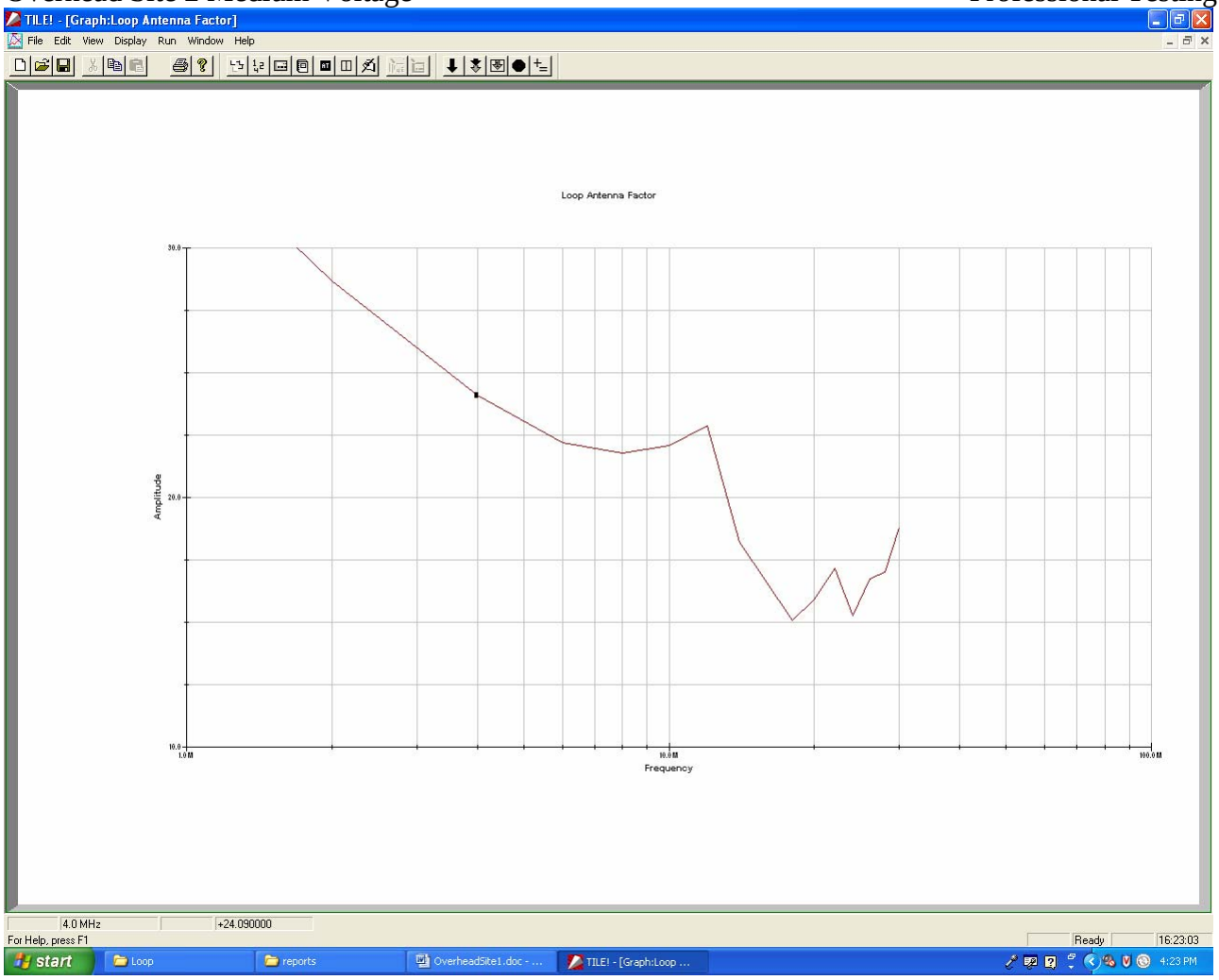
Typical antennas for BPL Certification testing	
Frequency Range	**Antenna**
9kHz-30MHz	Passive Loop (corrected to E-field by adding 51.2dB)
30-1000MHz	BiLog (or other E-field antenna)

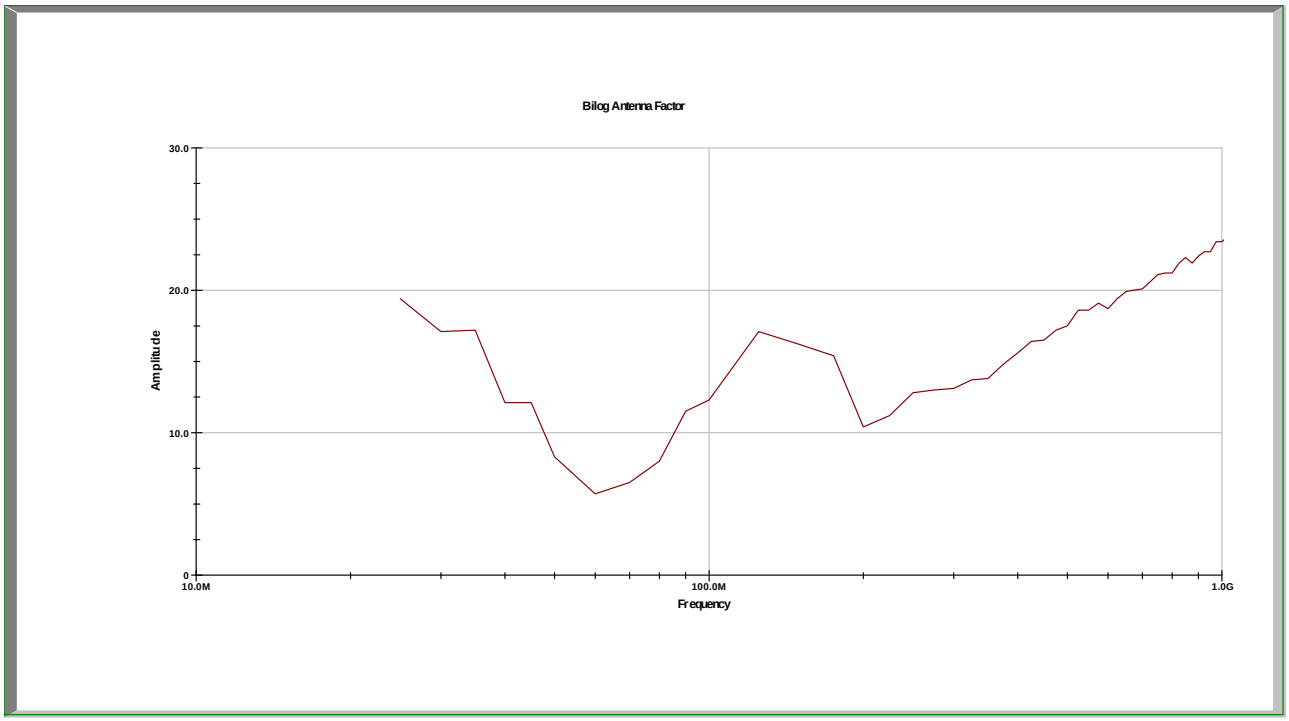
EQUIPMENT LIST					
Manufacturer	**Description**	**Model Number**	**Serial Number**	**ASSET #**	**Cal Due**
PTI	1.9 MHz High Pass Filter			1182	15 Aug. 2008
Hewlett Packard	EMC Spectrum Analyzer	8591EM	3322A09711	0410	7 Dec. 2007
Hewlett Packard	Preamplifier	8447A	2439A09711	1260	9 April 2008
Miteq	Preamplifier	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


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


TILE! - [Graph:Loop Antenna Factor]
File Edit View Display Run Window Help
Loop Antenna Factor
Amplitude
30.0
20.0
10.0
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

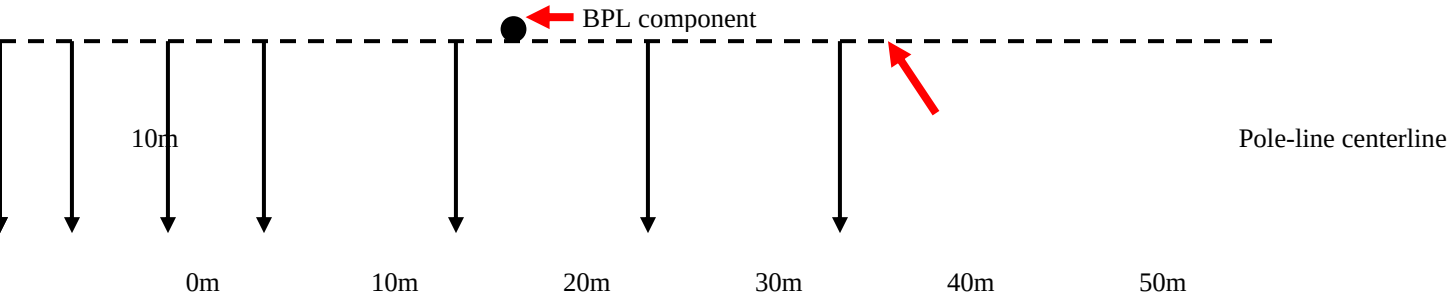

Bilog Antenna Factor
Amplitude
30.0
20.0
10.0
0
10.0M
100.0M
1.0G
Frequency

MEASUREMENT POSITIONS

Access BPL Overhead lines require measurements at fixed horizontal distances from the power line where the Access BPL signal injection source is installed. The receive antenna is moved down line, parallel to the power line, starting from the Access BPL signal injection equipment location, to find the maximum emissions at each frequency within the frequency range of the Access BPL device. The down-line measurement distances are to be specified in terms of the wavelength of the Access BPL mid band frequency.

"Testing shall be performed at distances of 0, ¼, ½, ¾, and 1 wavelength down the line from the BPL injection point on the power line. Wavelength spacing is based on the mid-band frequency used by the EUT. In addition, if the mid-band frequency exceeds the lowest frequency injected onto the power line by more than a factor of two, testing shall be extended in steps of ½ wavelength of the mid-band frequency until the distance equals or exceeds ½ wavelength of the lowest frequency injected."

Example of Access BPL Overhead Measurements



CALCULATION OF MEASUREMENT POSITIONS			
FCC Example:		**Actual Installation being tested:**	
Frequency range of BPL component:	3-27MHz	Frequency range of BPL component:	2-32MHz
Midband frequency: = (24/ 2) + 3	15MHz	Midband frequency: = ((H-L)/2) + L	17 MHz
Midband frequency wavelength: = v/f	20m	Midband frequency wavelength: = v/f	17.6 m
Lowest injected frequency	3 MHz	Lowest injected frequency	2MHz
Lowest frequency wavelength: =v/f	100m	Lowest frequency wavelength: = v/f	150 m
Midband frequency exceed lowest by >2:1?	(yes)	Midband frequency exceed lowest by >2:1?	Yes
If yes, add positions at ½ midband wavelength intervals up to ½ wavelength of lowest frequency.		If yes, add positions at ½ midband wavelength intervals up to ½ wavelength of lowest frequency.	
(First five points) = (1/4 of midband wavelength)	0, 5, 10, 15, 20m	(First five points) = (1/4 of midband wavelength)	0, 4.41, 8.82, 13.23, 17.64
Add ½ midband wavelengths of 10 meters up to ½ of lowest frequency wavelength of 100 meters.	10m steps up to 50m	Add ½ midband wavelengths of 8.82 meters up to ½ of lowest frequency wavelength of 150m meters.	26.4, 35.3, 44.1, 52.9, 61.8, 70.6,
(additional points) =	30m, 40m, 50m	(additional points) =	79.4

SETUP CHECKLIST	✓
For Certification testing the EUT Power Setting is at MAXIMUM and the settings necessary for COMPLIANCE to the Part 15 limits are noted. These two EUT power settings are included in the Test Report.	
EUT burst rate (duty factor) is set to MAXIMUM for Certification and the settings necessary for COMPLIANCE to the Part 15 limits are noted. The two EUT burst rates are included in the Test Report.	✓

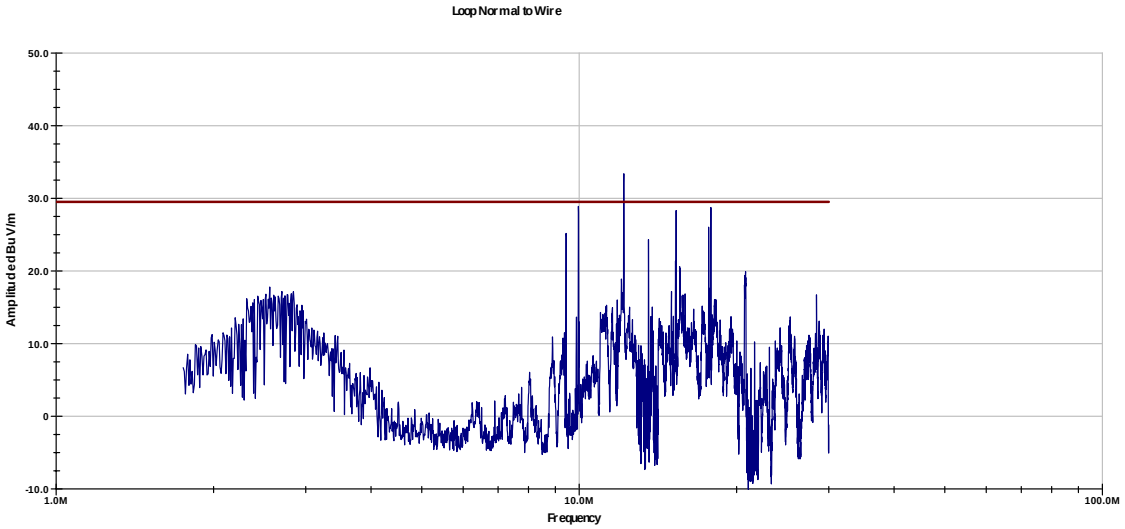
Run the initial scan in ½ bandwidth steps using peak detection to quickly identify BPL signals. Below 1,000MHz check if <20 Hz burst rate then use peak detection, if >20 Hz use quasi-peak detection on the six loudest BPL signals. (demodulate measured signals to make sure they are not ambient, music or voice)	✓
Above 1,000 MHz use peak detection to identify peaks and then use AVERAGE detection for measurements.	✓
Set up first measurement point near EUT at 10 meters lateral distance from pole-line centerline.	✓
Mount active loop antenna onto 1m tripod and power the test equipment.	✓
Make sure ambient signals are 6dB below the applicable Part 15 limit, otherwise move tripod to 3 meters lateral distance and re-check ambient levels. (If the Limit is less than 6dB above ambient, re-attempt the measurement at night)	
Photograph the test site at this time for inclusion into the Test Report.	✓

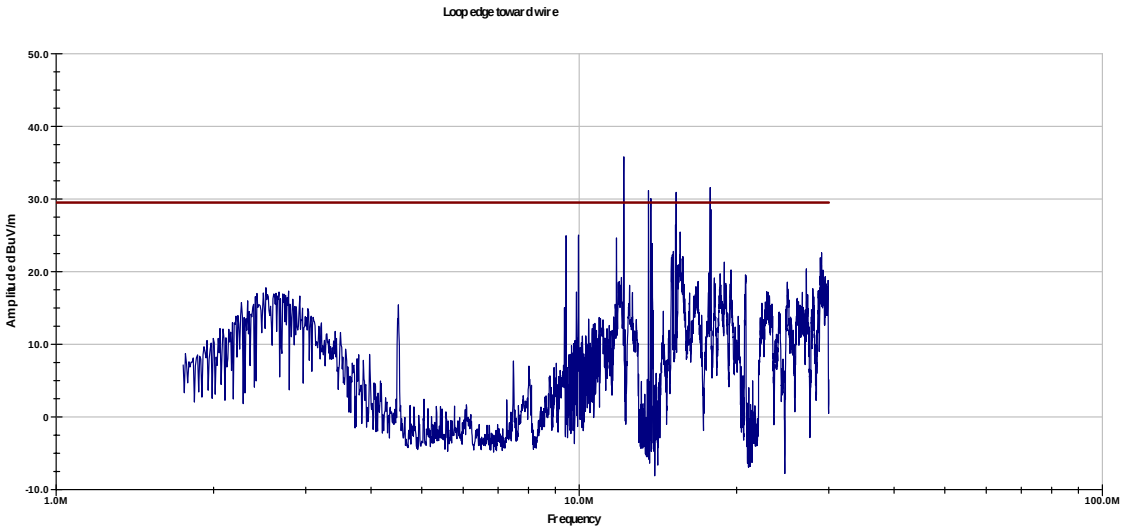
TESTING BELOW 30 MHz
1.705 MHz to 30 MHz

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 pole line. 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)

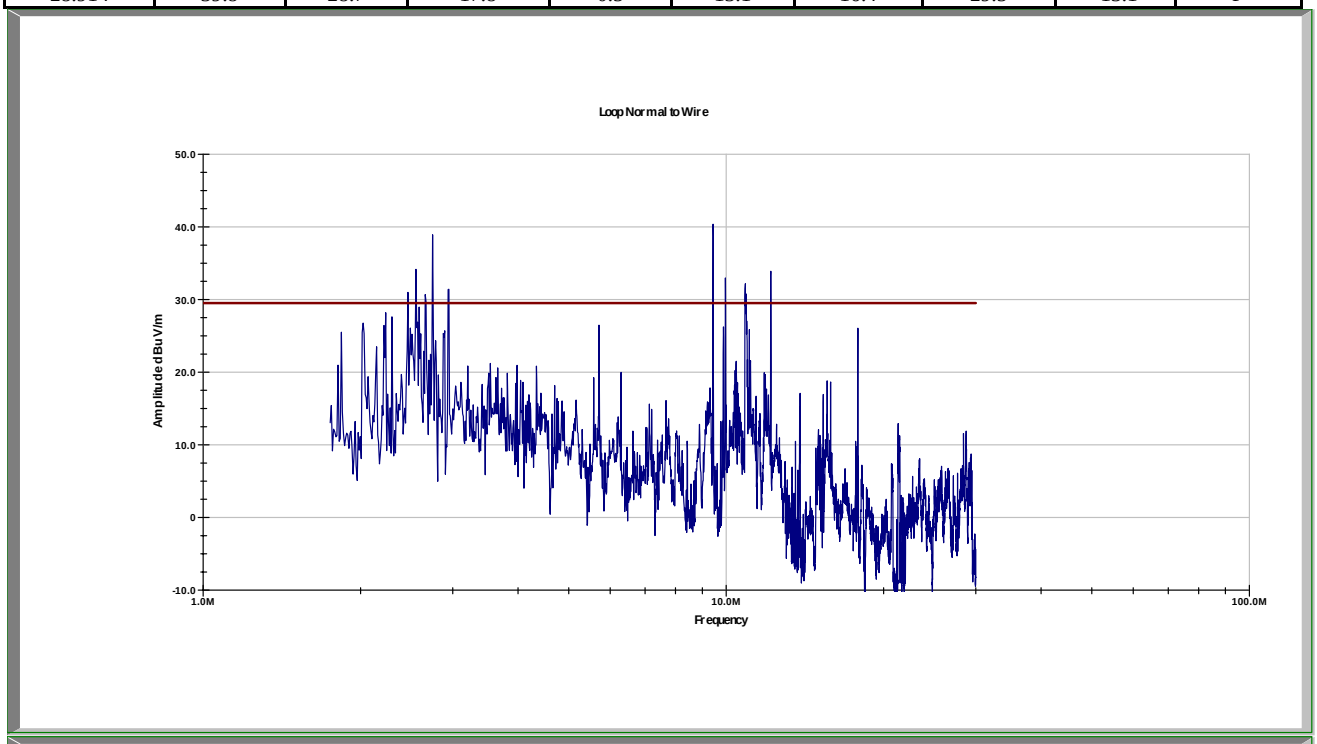
7. If voice, non-BPL data or music is demodulated that candidate emission is eliminated and the Receiver is tuned to the next loudest emission for demodulation and identification to find the six highest BPL emissions.
8. Validate that the calculations employed are the same as shown in the worksheet if 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).

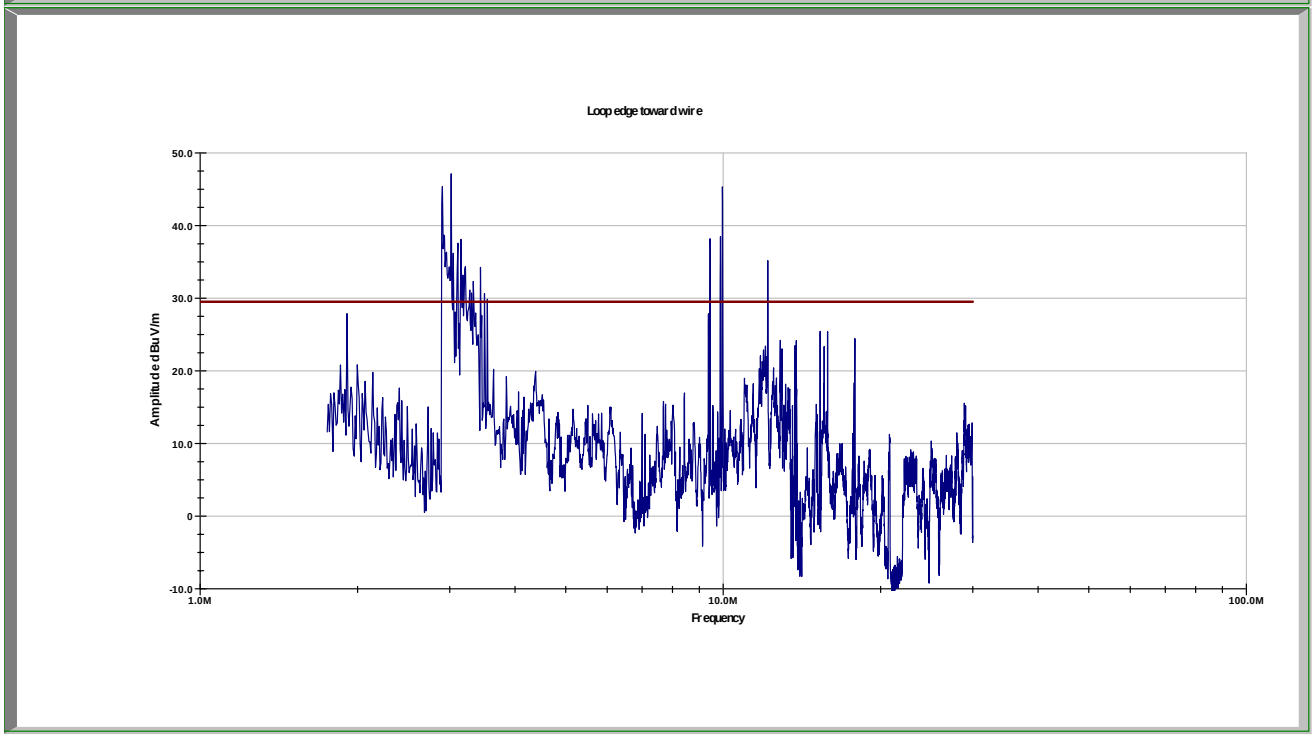
Field Strengths (location 1) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.518	32.6	29.2	27.8	0.3	13.1	18.4	29.5	-11.1	P
2.88	32.7	29.2	27.3	0.3	13.1	18.0	29.5	-11.5	P
12.043	38.6	29.2	22.8	0.4	13.1	19.5	29.5	-10.0	P
14.233	37.6	29.2	18.0	0.4	13.1	13.7	29.5	-15.8	P
16.873	44.8	29.2	17.1	0.4	13.1	20.0	29.5	-9.5	P
29.073	46.7	28.6	18.0	0.5	13.1	23.4	29.5	-6.1	P


Loop Normal to Wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

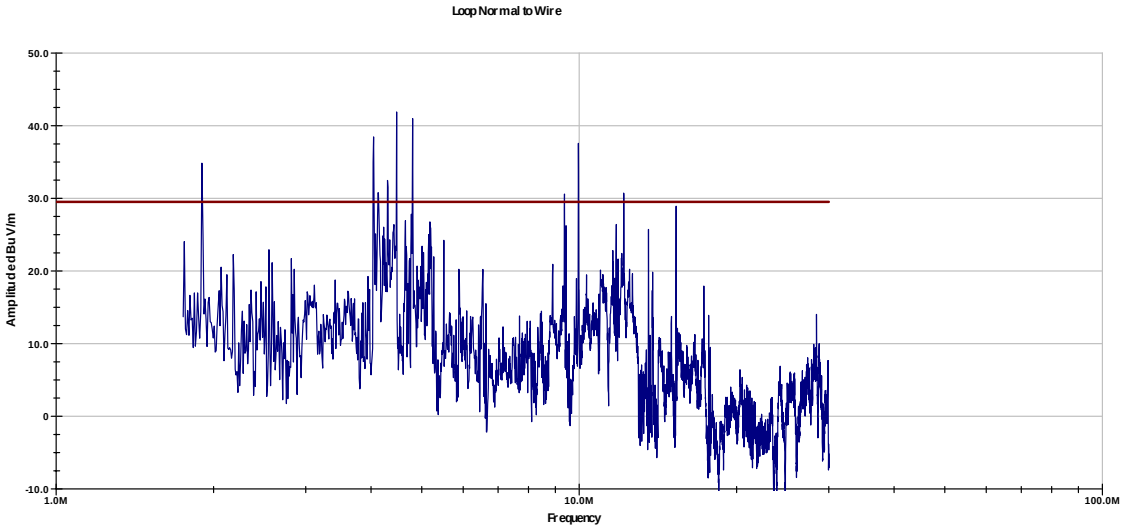

Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

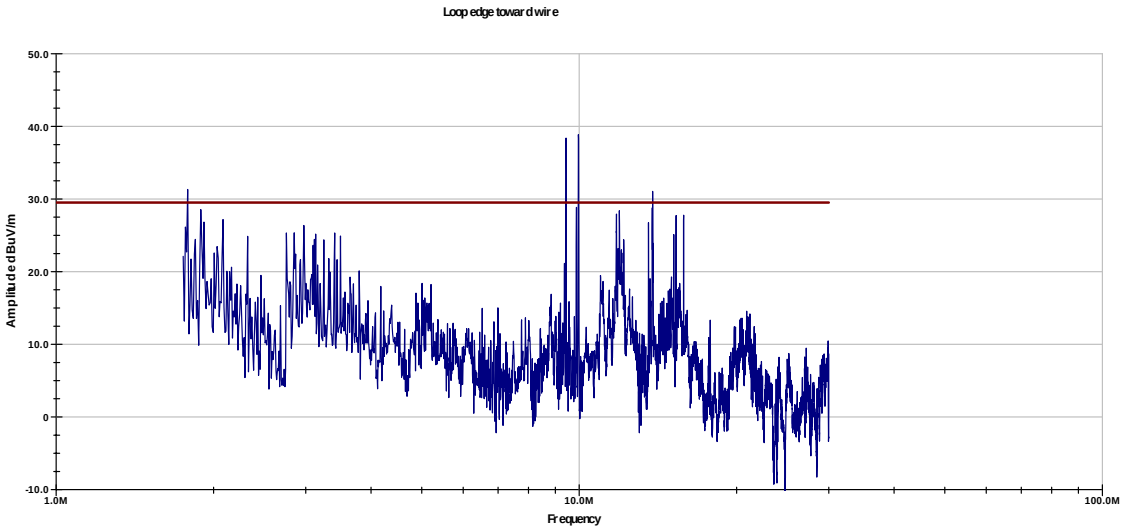
Field Strengths (location 2) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.9	36.1	29.2	27.2	0.3	13.1	21.3	29.5	-8.2	QP
4.8	37.43	29.2	23.6	0.3	13.1	19.1	29.5	-10.4	QP
12.043	42.8	29.2	22.8	0.4	13.1	23.7	29.5	-5.8	P
28.914	39.8	28.7	17.8	0.5	13.1	16.4	29.5	-13.1	P



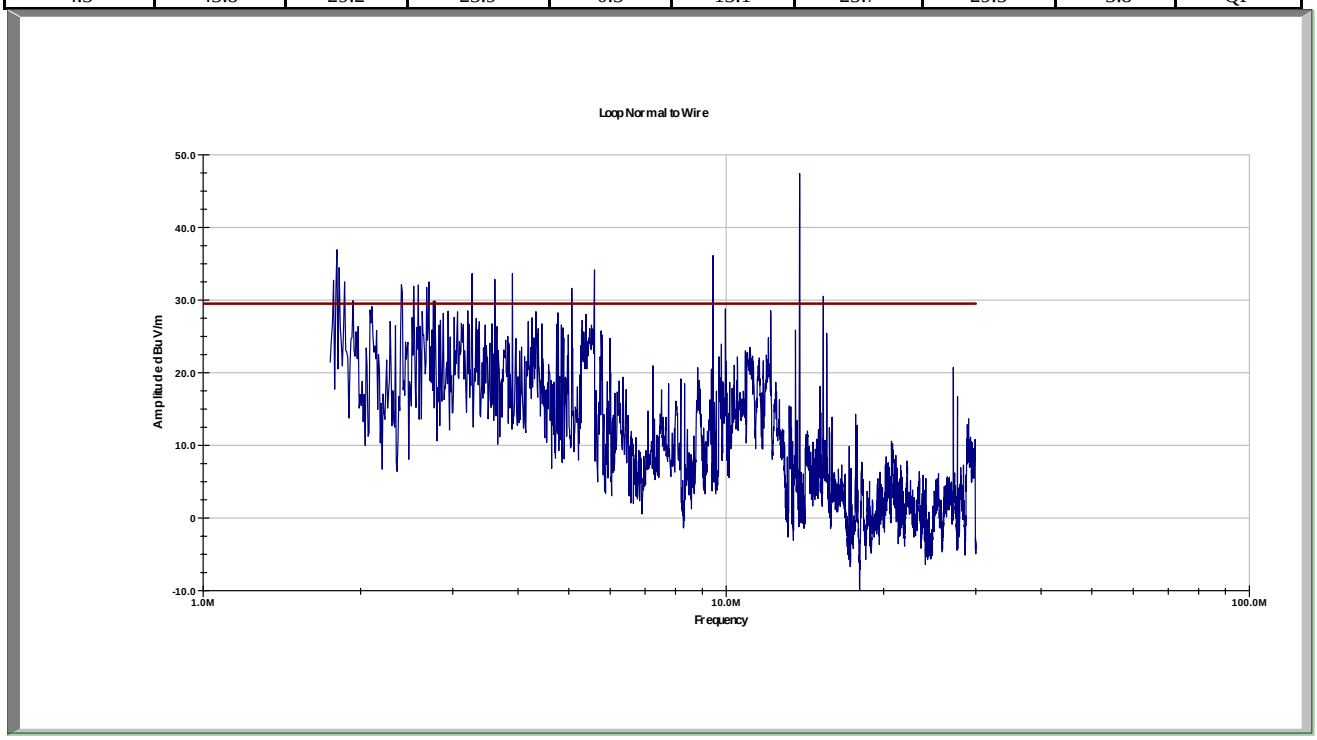


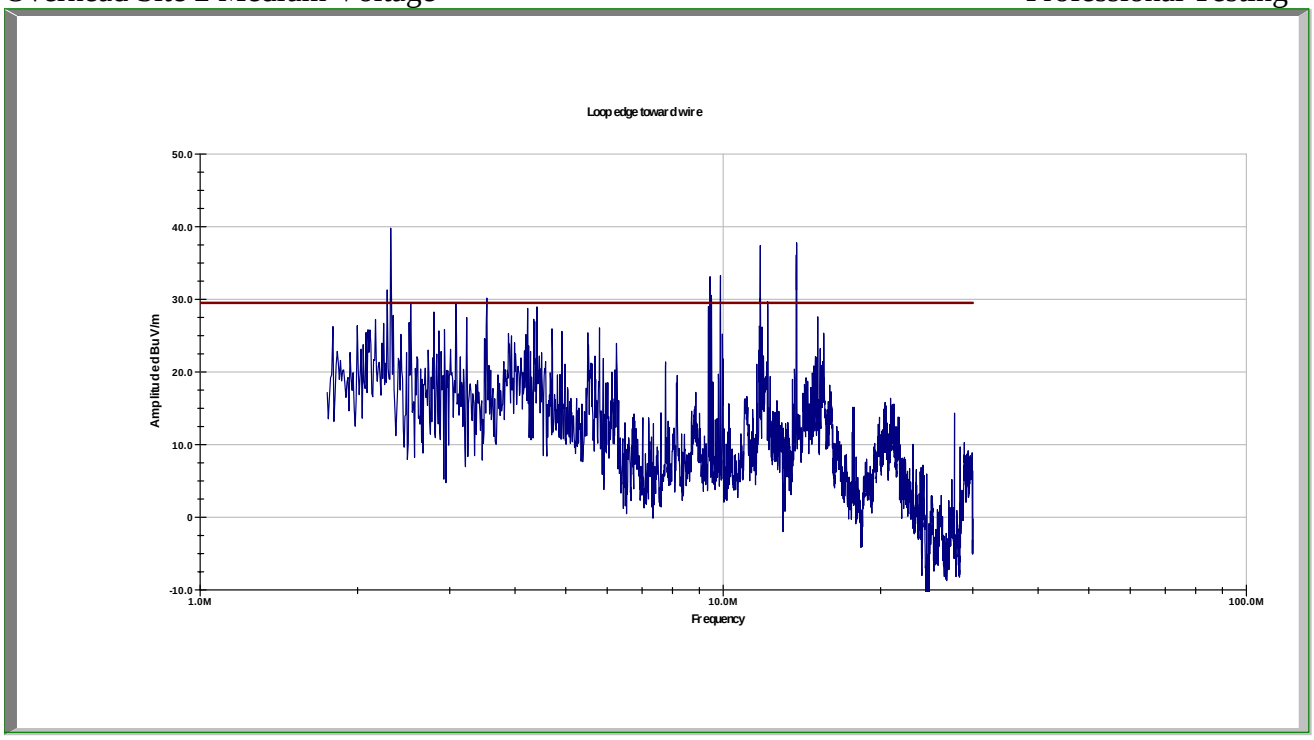
Field Strengths (location 3) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.033	37.2	29.2	28.6	0.3	13.1	23.8	29.5	-5.7	P
3.136	41.4	29.2	27.4	0.3	13.1	26.8	29.5	-2.7	P
15.01	44	29.2	17.8	0.4	13.1	19.9	29.5	-9.6	P
4.5	41.89	29.2	23.8	0.3	13.1	23.7	29.5	-5.8	QP
20.907	40.2	29.2	15.7	0.4	13.1	14.1	29.5	-15.4	P
28.429	38.7	28.7	17.4	0.5	13.1	14.8	29.5	-14.7	P


Loop Normal to Wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

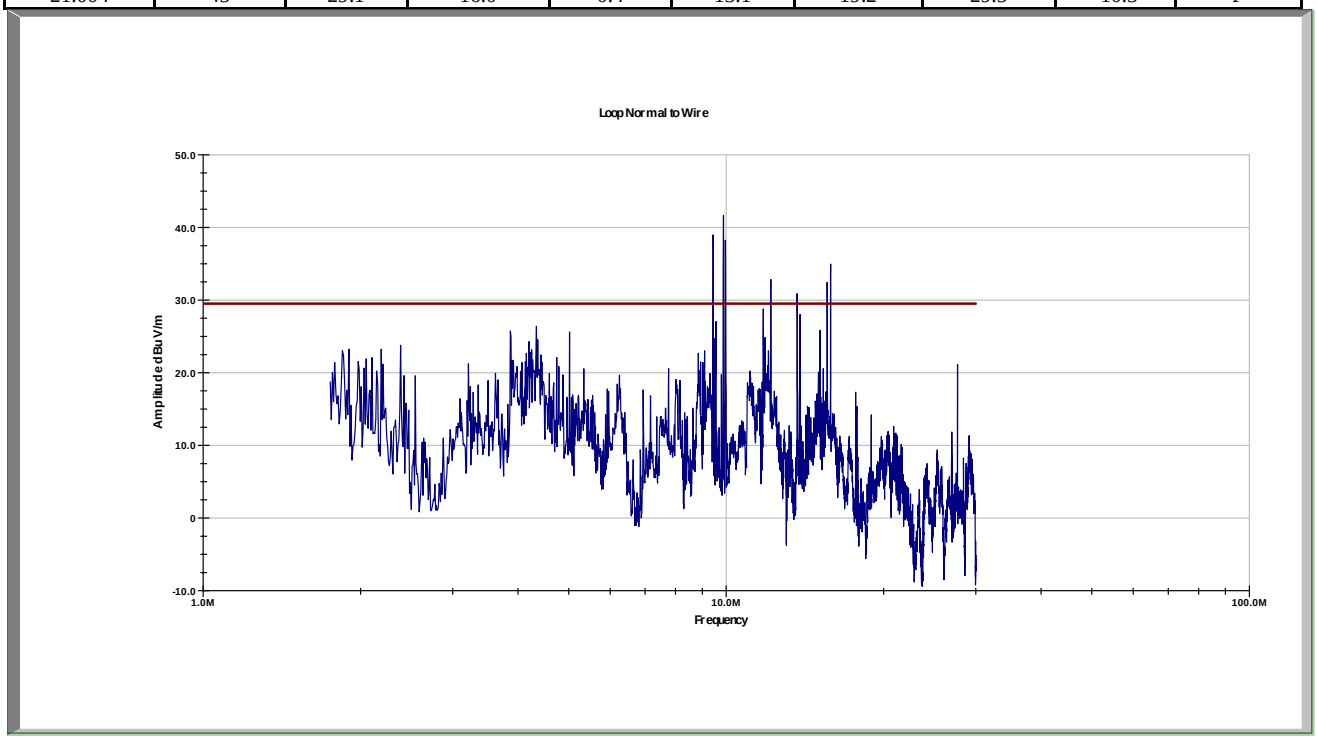

Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

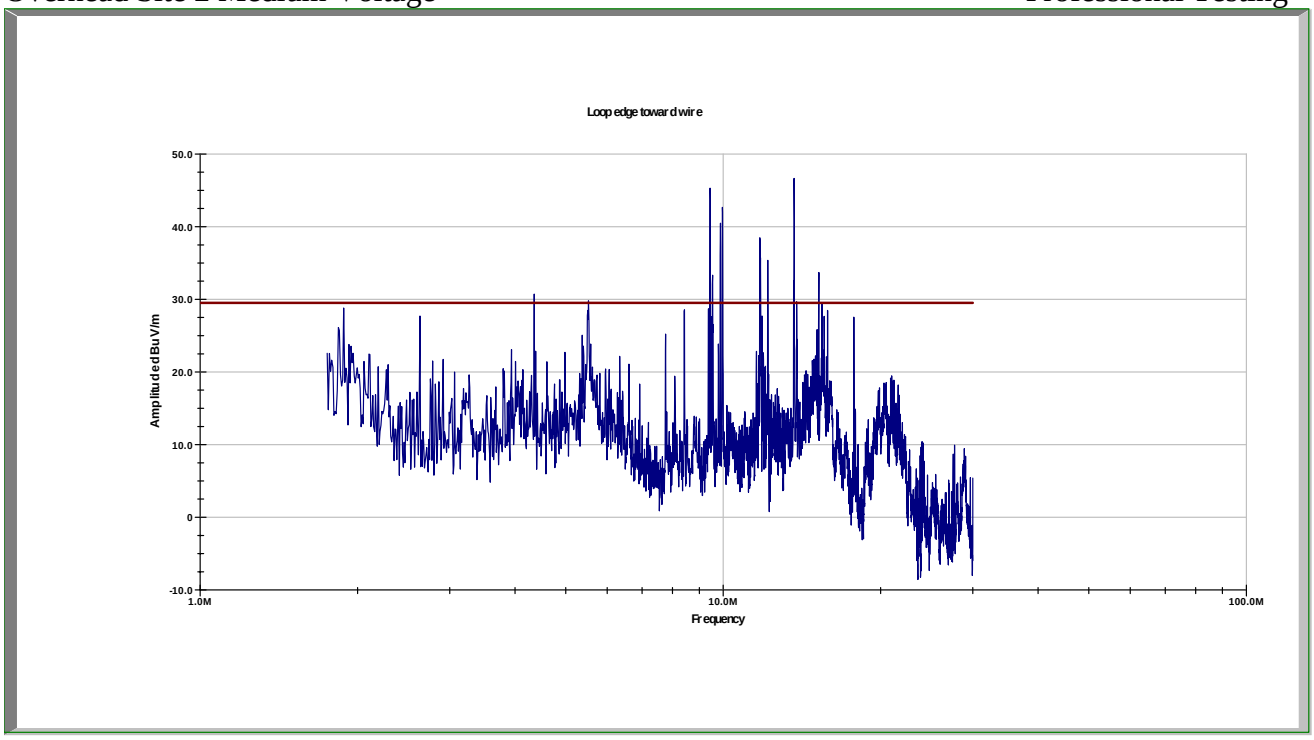
Field Strengths (location 4) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2	36.5	29.2	28.7	0.3	13.1	23.2	29.5	-6.3	QP
2.1	41.3	29.2	28.5	0.3	13.1	27.8	29.5	-1.7	QP
5.4	35.6	29.2	23.6	0.3	13.1	17.2	29.5	-12.3	QP
2.3	35.21	29.2	28.2	0.3	13.1	21.4	29.5	-8.1	QP
2.1	35.28	29.2	28.5	0.3	13.1	21.8	29.5	-7.7	QP
4.3	43.8	29.2	23.9	0.3	13.1	25.7	29.5	-3.8	QP



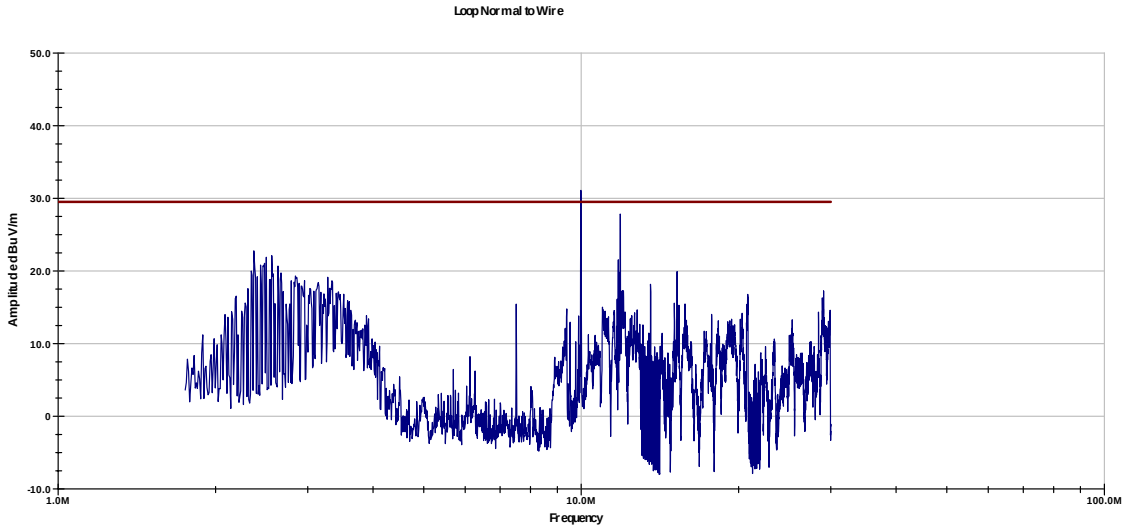

Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

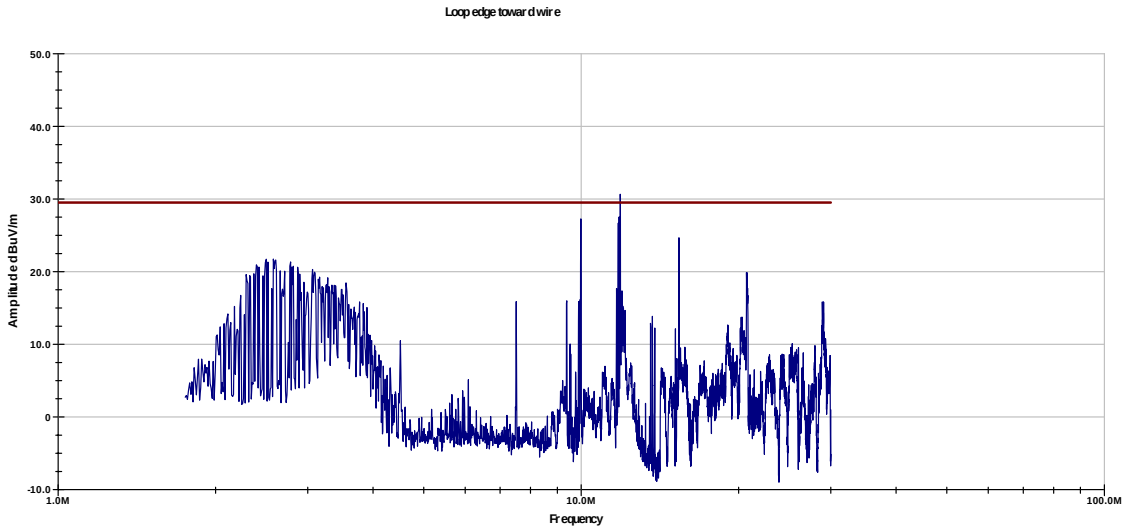
Field Strengths (location 5) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
5.8	34.84	29.2	23.5	0.3	13.1	16.4	29.5	-13.1	QP
15.5	29.04	29.2	17.6	0.4	13.1	4.8	29.5	-24.7	QP
1.838	39.1	29.2	30.3	0.3	13.1	27.4	29.5	-2.1	P
3.869	43.6	29.2	26.5	0.3	13.1	28.1	29.5	-1.4	P
15.009	46.9	29.2	17.8	0.4	13.1	22.8	29.5	-6.7	P
21.004	45	29.1	16.0	0.4	13.1	19.2	29.5	-10.3	P




Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

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
2.368	37.3	29.2	28.1	0.3	13.1	23.4	29.5	-6.1	P
2.562	37.1	29.2	27.8	0.3	13.1	22.9	29.5	-6.6	P
3.551	35.6	29.2	26.9	0.3	13.1	20.5	29.5	-9.0	P
19.38	39.9	29.2	15.1	0.4	13.1	13.2	29.5	-16.3	P
25.321	39.1	28.9	16.0	0.5	13.1	13.6	29.5	-15.9	P
29.073	41.3	28.6	18.0	0.5	13.1	18.0	29.5	-11.5	P

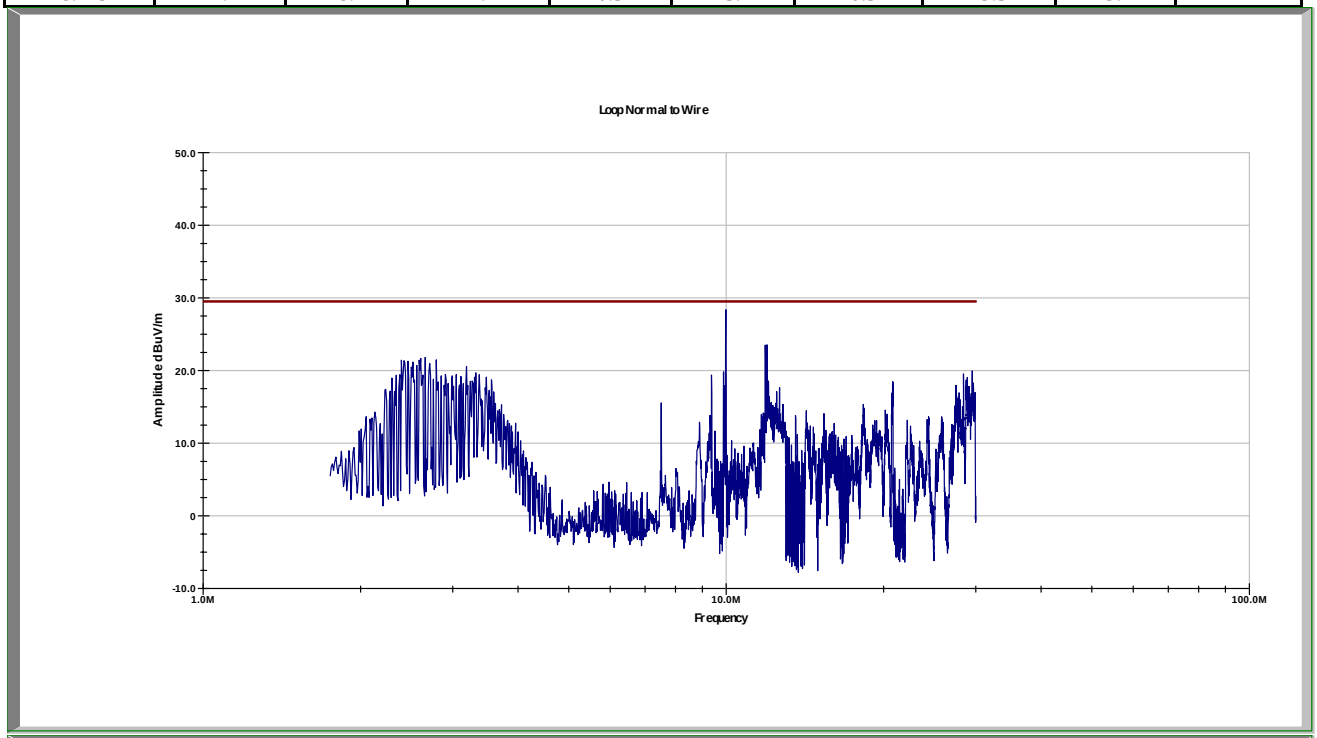


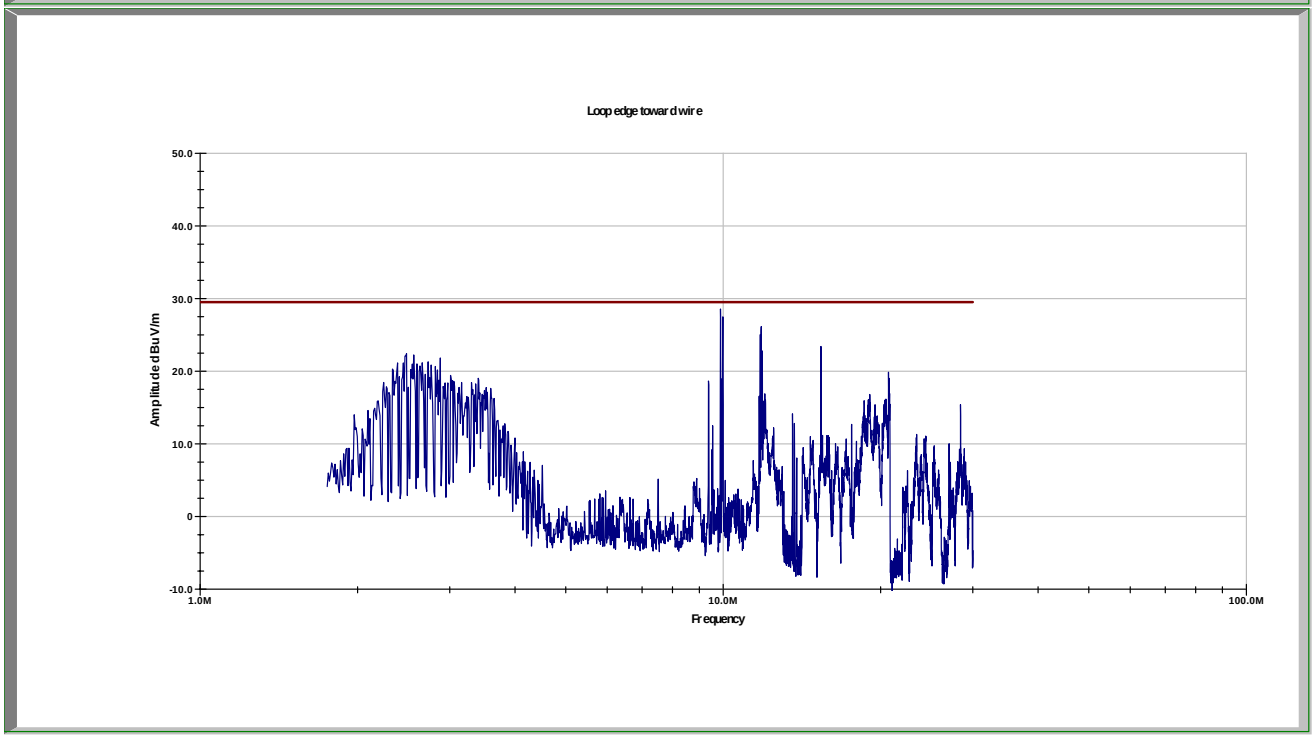


Field Strengths (location 7) 1.705 MHz – 30 MHz

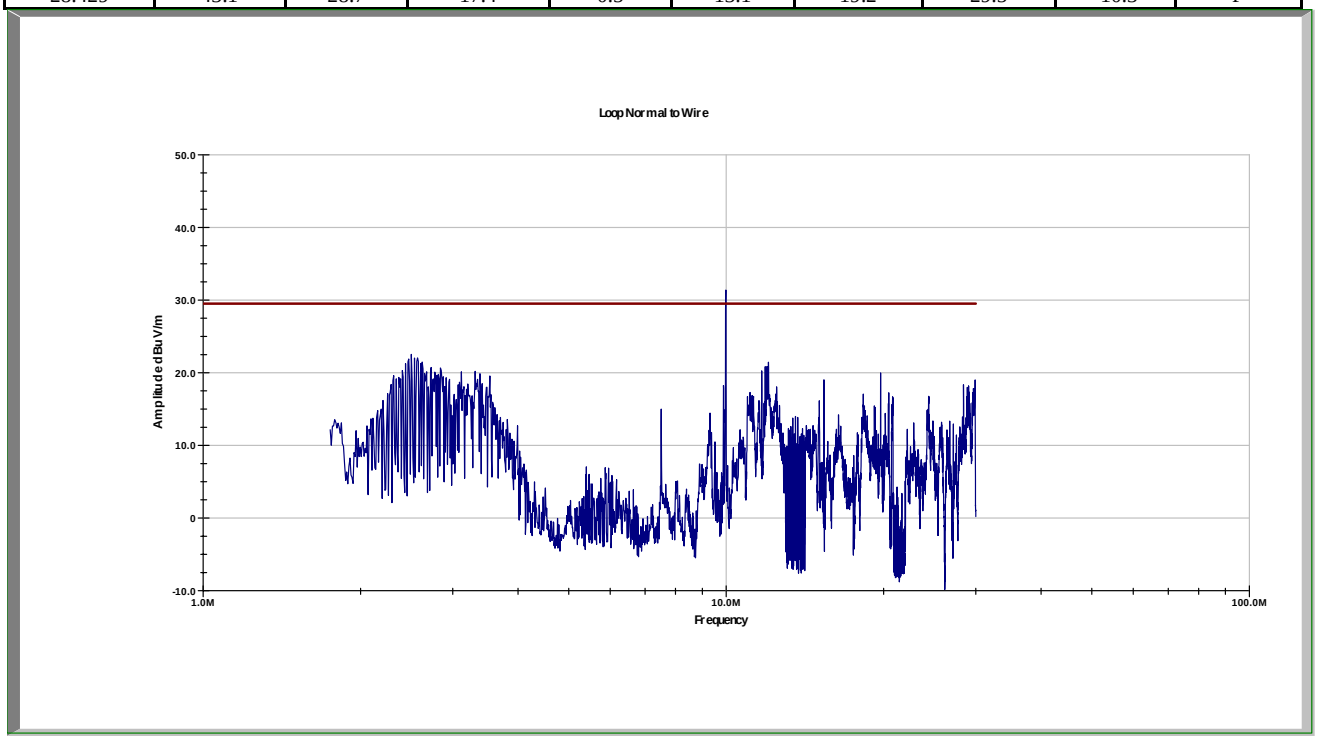
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.483	37.2	29.2	27.9	0.3	13.1	23.1	29.5	-6.4	P
2.88	37.5	29.2	27.3	0.3	13.1	22.8	29.5	-6.7	P
3.189	36.9	29.2	27.3	0.3	13.1	22.2	29.5	-7.3	P
3.56	35.9	29.2	26.9	0.3	13.1	20.8	29.5	-8.7	P
19.071	43.4	29.2	15.1	0.4	13.1	16.7	29.5	-12.8	P

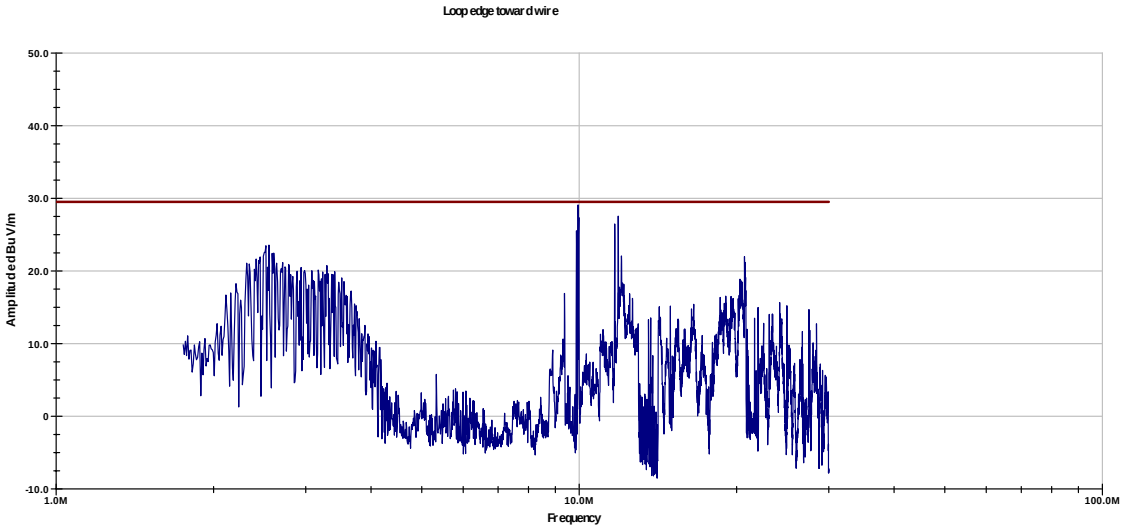
28.429	44.2	28.7	17.4	0.5	13.1	20.3	29.5	-9.2	P





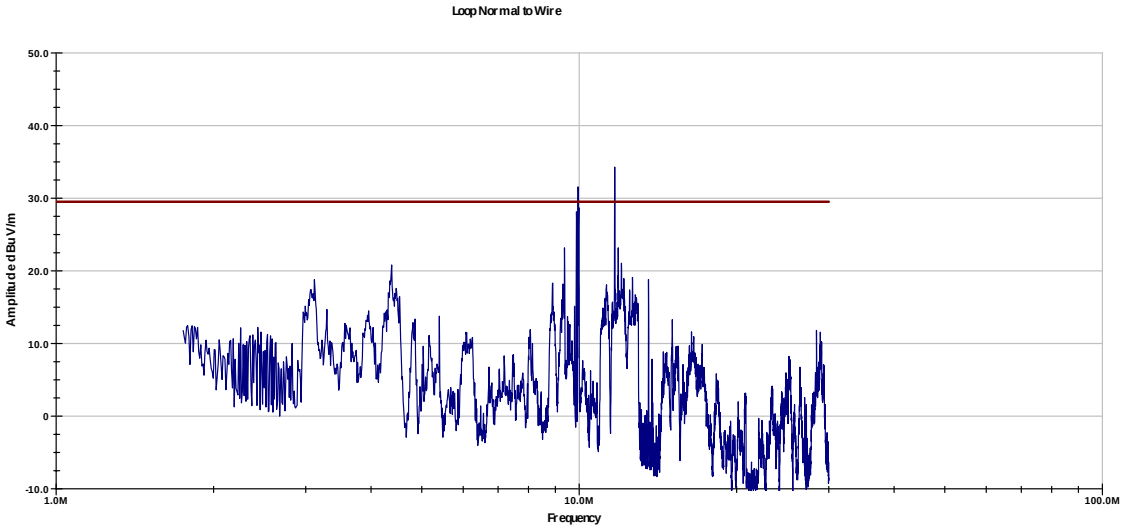
Field Strengths (location 8) 1.705 MHz – 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.553	38.5	29.2	27.8	0.3	13.1	24.3	29.5	-5.2	P
3.295	37.4	29.2	27.2	0.3	13.1	22.6	29.5	-6.9	P
12.044	41.5	29.2	22.8	0.4	13.1	22.4	29.5	-7.1	P
20.704	47.7	29.2	15.8	0.4	13.1	21.6	29.5	-7.9	P
24.385	43.3	29.0	15.4	0.5	13.1	17.1	29.5	-12.4	P
28.429	43.1	28.7	17.4	0.5	13.1	19.2	29.5	-10.3	P

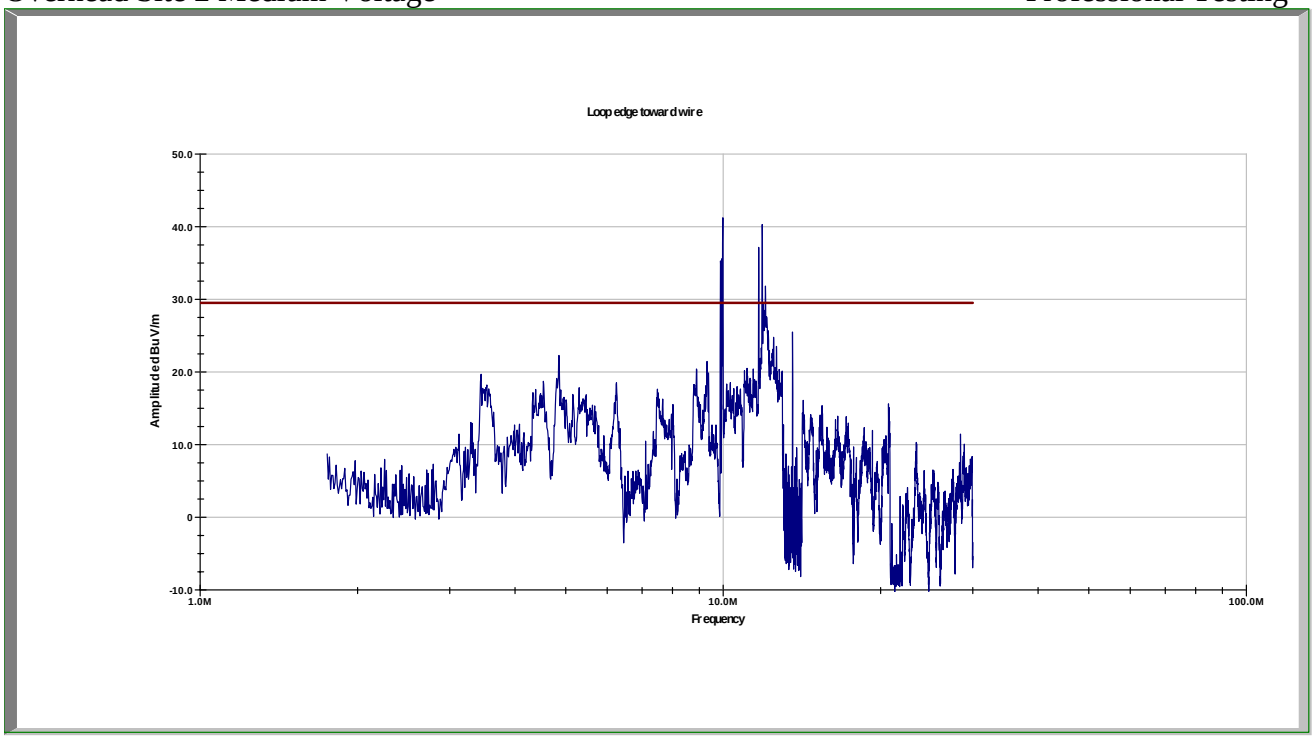




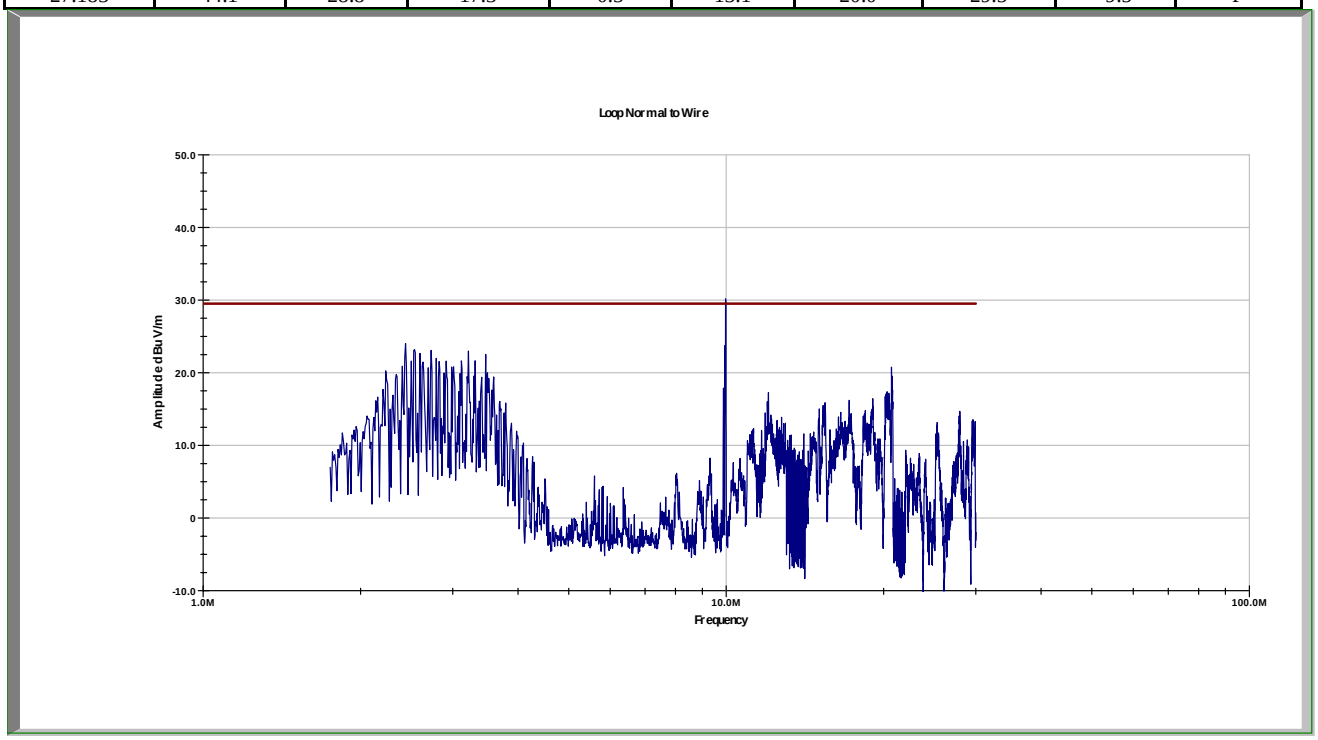
Field Strengths (location 9) 1.705 MHz– 30 MHz

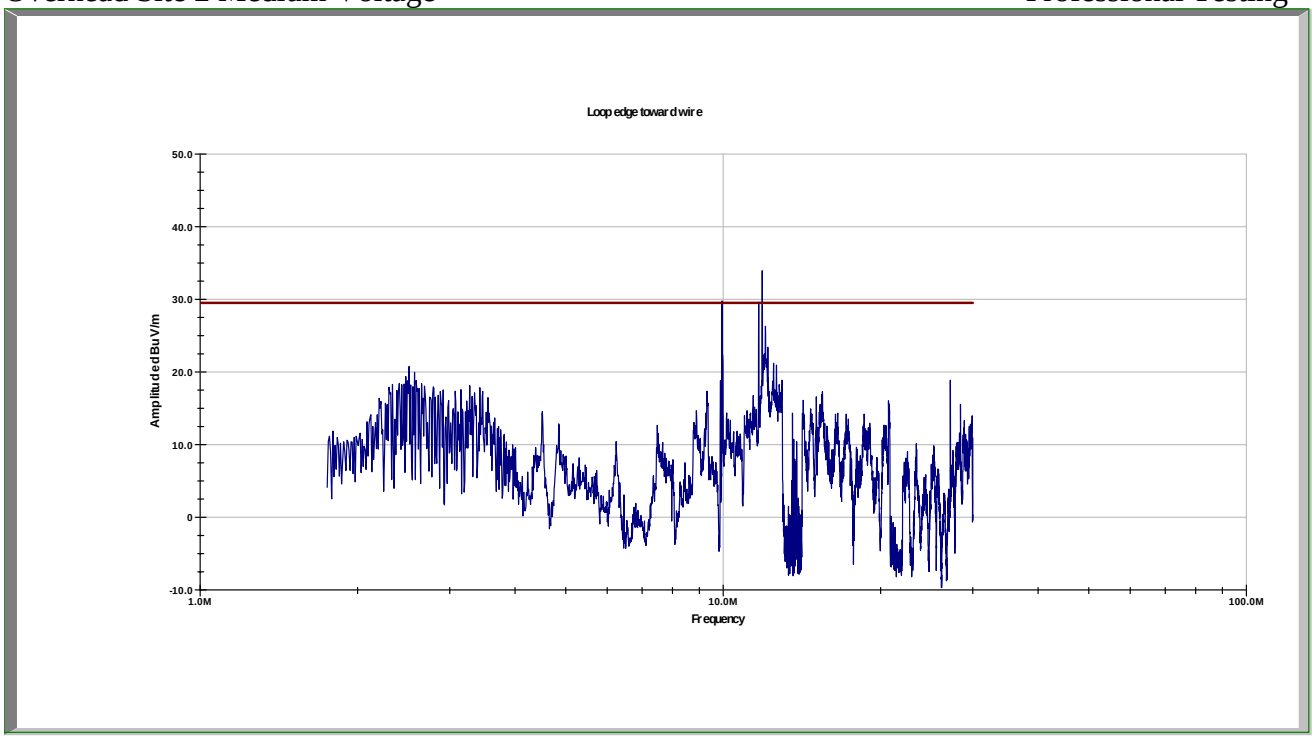
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
3.445	36.6	29.2	27.0	0.3	13.1	21.6	29.5	-7.9	P
4.381	39.4	29.2	23.9	0.3	13.1	21.3	29.5	-8.2	P
4.858	41.3	29.2	23.6	0.3	13.1	22.9	29.5	-6.6	P
6.252	38.7	29.2	22.2	0.3	13.1	18.9	29.5	-10.6	P
9.378	43.4	29.2	21.0	0.3	13.1	22.4	29.5	-7.1	P
11.982	47.8	29.2	20.2	0.4	13.1	26.1	29.5	-3.4	P



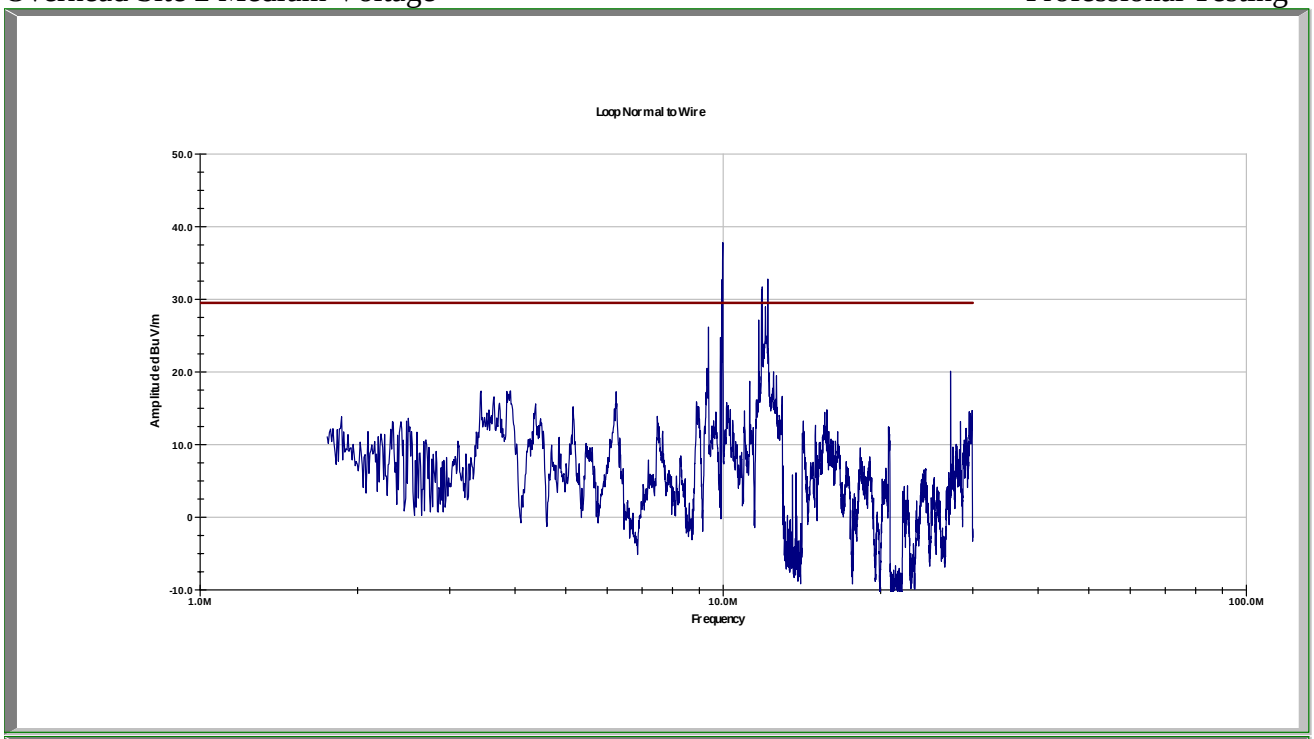

Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

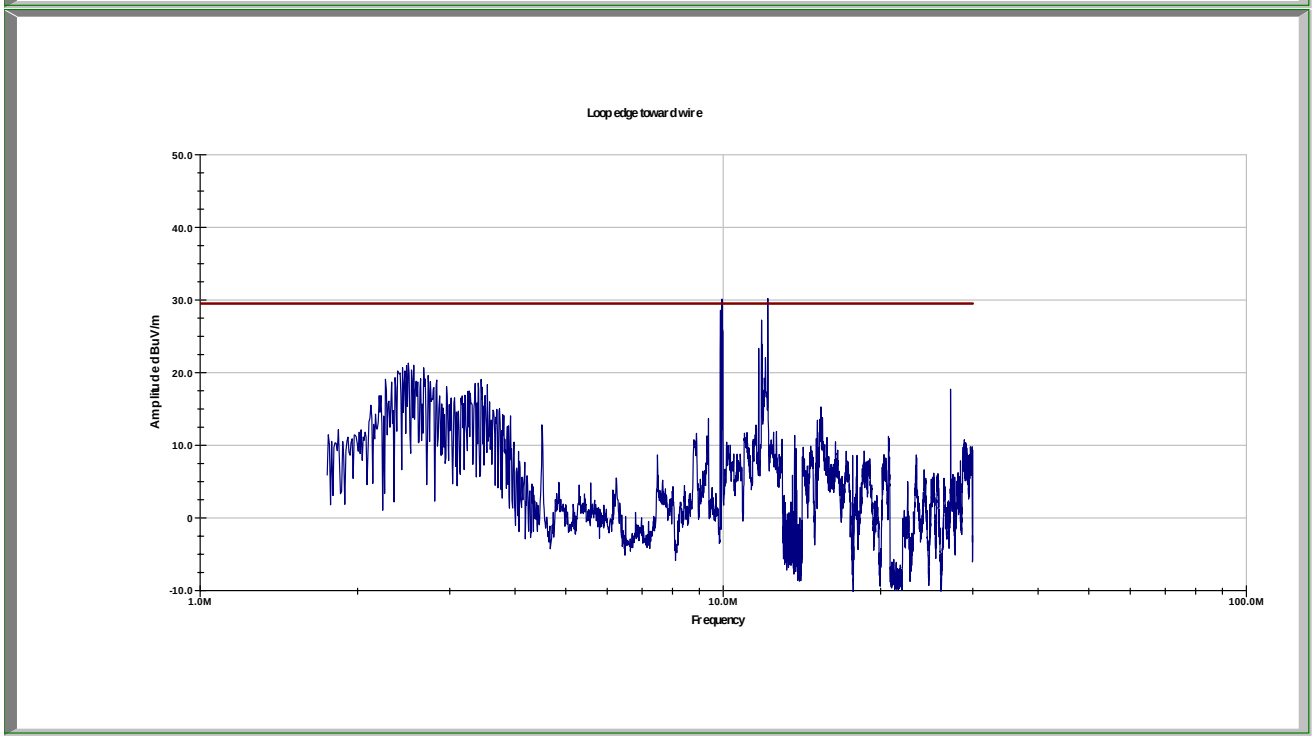
Field Strengths (location 10) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.439	38.7	29.2	28.0	0.3	13.1	24.7	29.5	-4.8	P
3.215	39.4	29.2	27.3	0.3	13.1	24.7	29.5	-4.8	P
3.471	39.5	29.2	27.0	0.3	13.1	24.5	29.5	-5.0	P
12.03	42.5	29.2	22.8	0.4	13.1	23.4	29.5	-6.1	QP
20.704	46.5	29.2	15.8	0.4	13.1	20.4	29.5	-9.1	P
27.183	44.1	28.8	17.3	0.5	13.1	20.0	29.5	-9.5	P



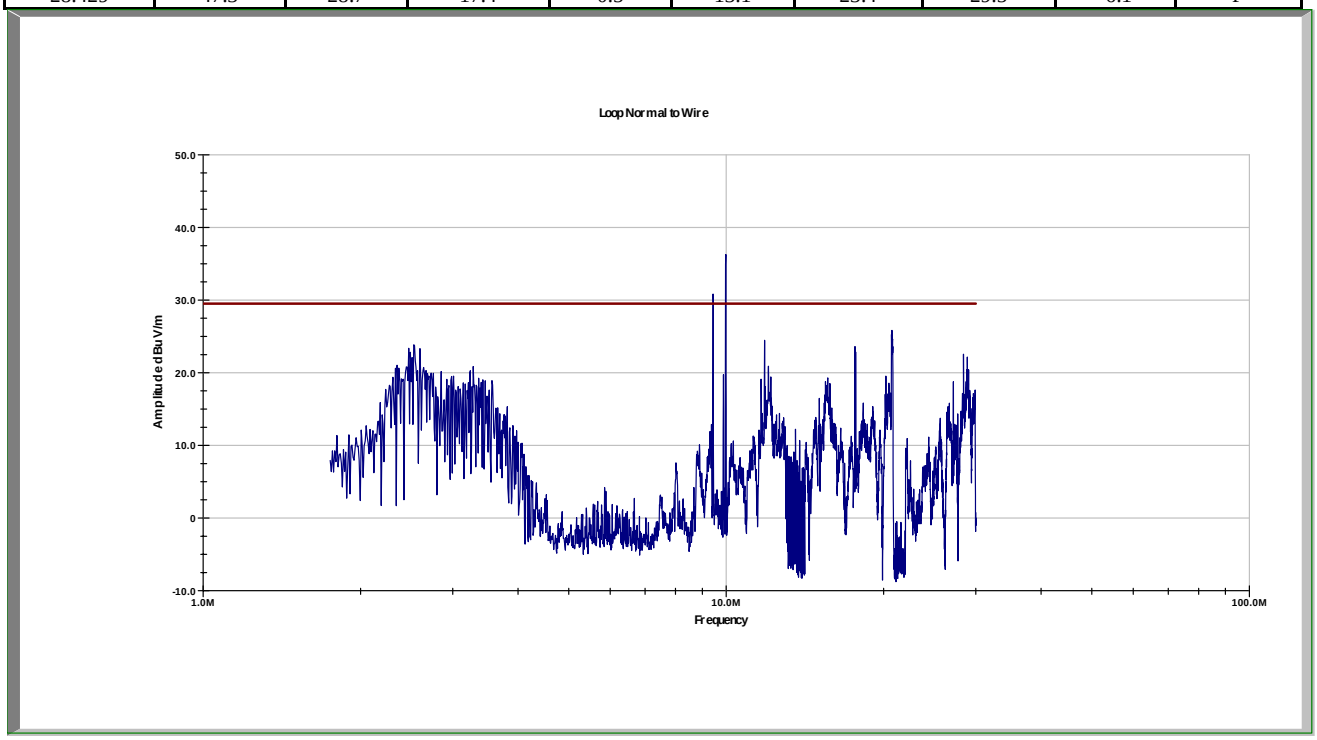

Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

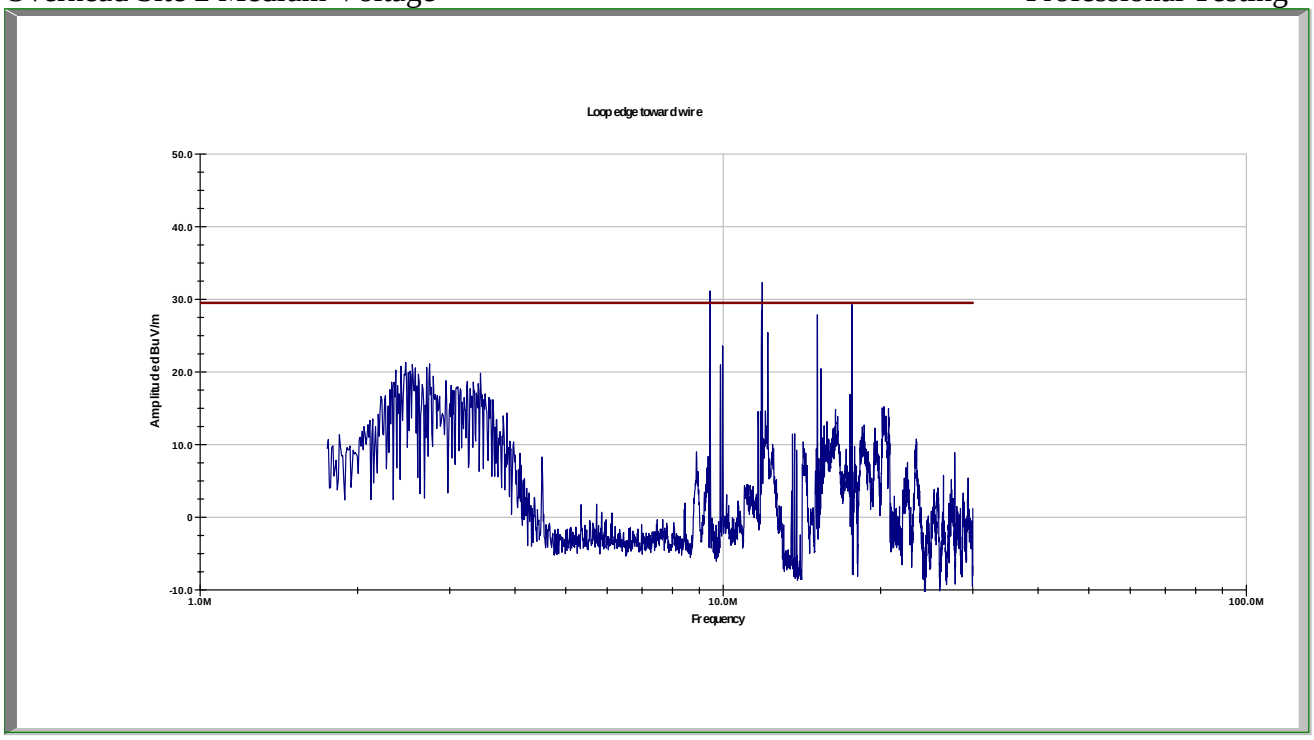
Field Strengths (location 11) 1.705 MHz– 30 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
2.5	36.1	29.2	27.9	0.3	13.1	22.0	29.5	-7.5	P
3.445	36	29.2	27.0	0.3	13.1	21.0	29.5	-8.5	P
6.244	37.4	29.2	22.2	0.3	13.1	17.6	29.5	-11.9	P
9.378	46.5	29.2	21.0	0.3	13.1	25.5	29.5	-4.0	P
15.381	40.3	29.2	17.7	0.4	13.1	16.1	29.5	-13.4	P
29.532	38.2	28.6	18.4	0.5	13.1	15.3	29.5	-14.2	P


Loop Normal to Wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency


Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

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
2.527	38.7	29.2	27.8	0.3	13.1	24.5	29.5	-5.0	P
3.286	37.4	29.2	27.2	0.3	13.1	22.6	29.5	-6.9	P
15.142	52.7	29.2	17.8	0.4	13.1	28.6	29.5	-0.9	P
17.641	52	29.2	17.7	0.4	13.1	27.9	29.5	-1.6	P
20.739	51.6	29.2	15.8	0.4	13.1	25.5	29.5	-4.0	P
28.429	47.3	28.7	17.4	0.5	13.1	23.4	29.5	-6.1	P




Loop edge toward wire
50.0
40.0
30.0
20.0
10.0
0
-10.0
Amplitude dBuV/m
1.0M
10.0M
100.0M
Frequency

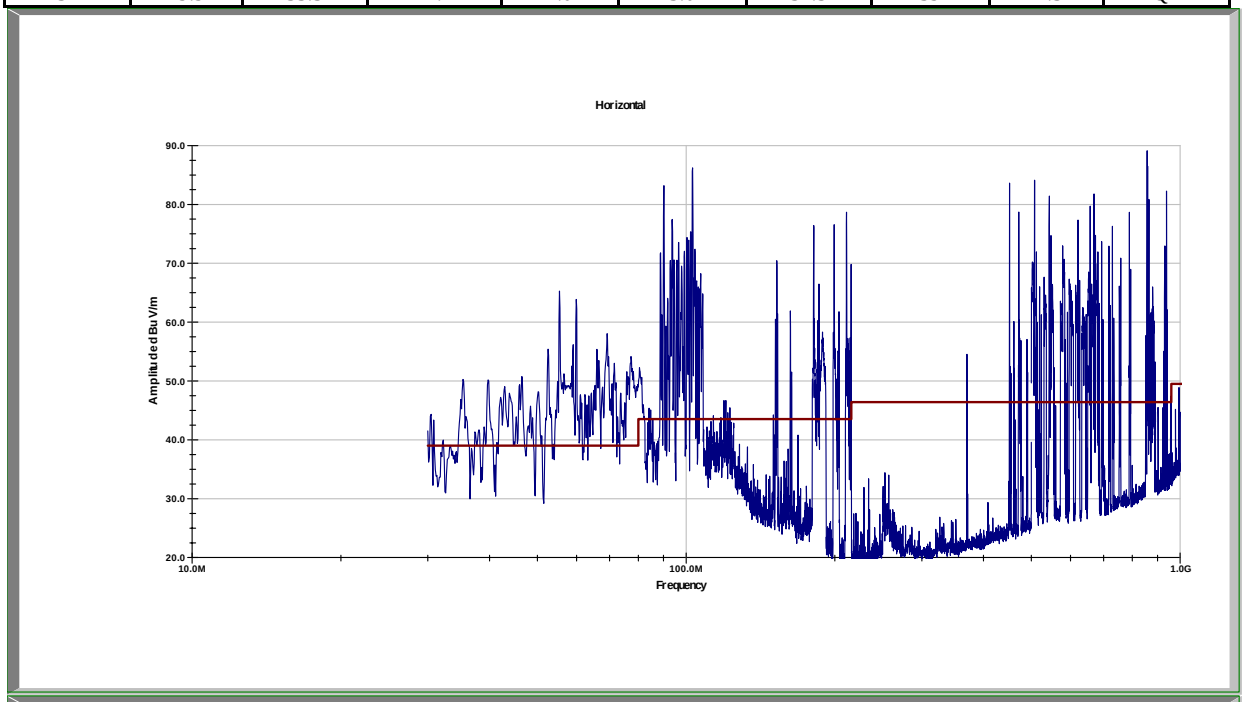
Field Strengths (all locations) 1.705 MHz– 30 MHz						
Frequencies of six (6) highest readings: (MHz)						
Test Results: PASS						

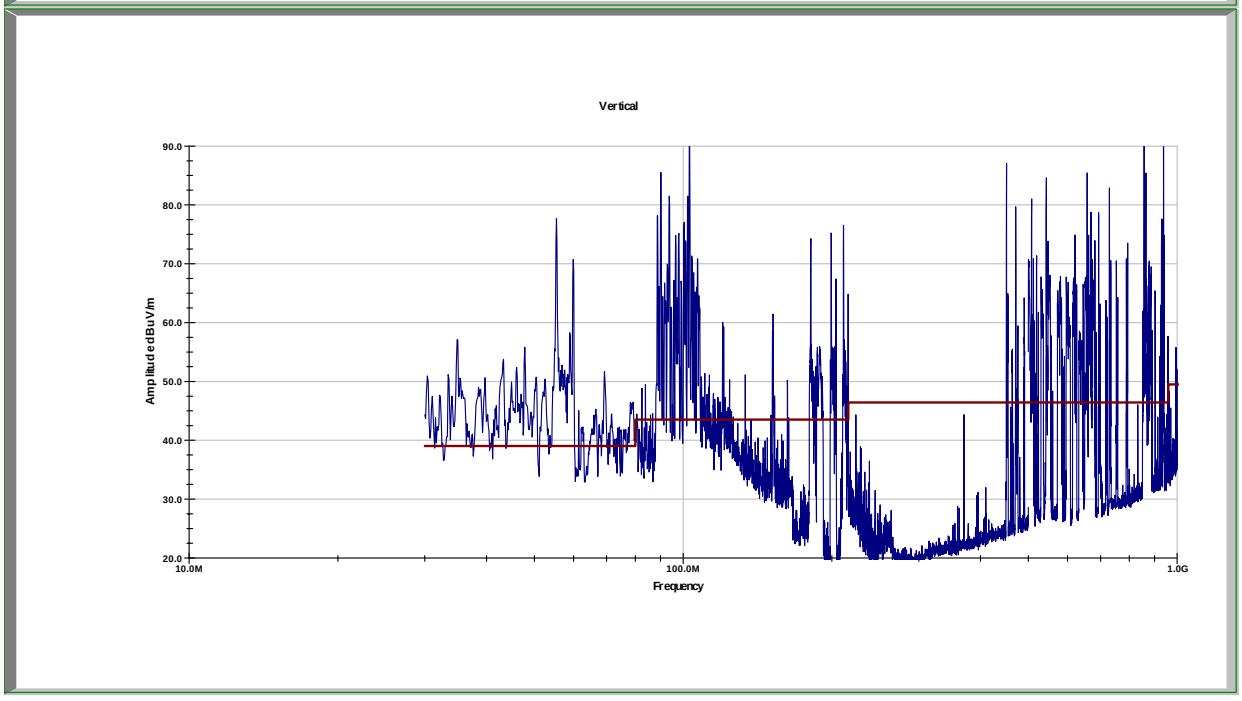
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
15.142	52.7	29.2	17.8	0.4	13.1	28.6	29.5	-0.9	P
3.869	43.6	29.2	26.5	0.3	13.1	28.1	29.5	-1.4	P
17.641	52.0	29.2	17.7	0.4	13.1	27.9	29.5	-1.6	P
2.1	41.3	29.2	28.5	0.3	13.1	27.8	29.5	-1.7	QP
1.838	39.1	29.2	30.3	0.3	13.1	27.4	29.5	-2.1	P
3.136	41.4	29.2	27.4	0.3	13.1	26.8	29.5	-2.7	P

TESTING ABOVE 30 MHz
30 MHz – 1,000 MHz

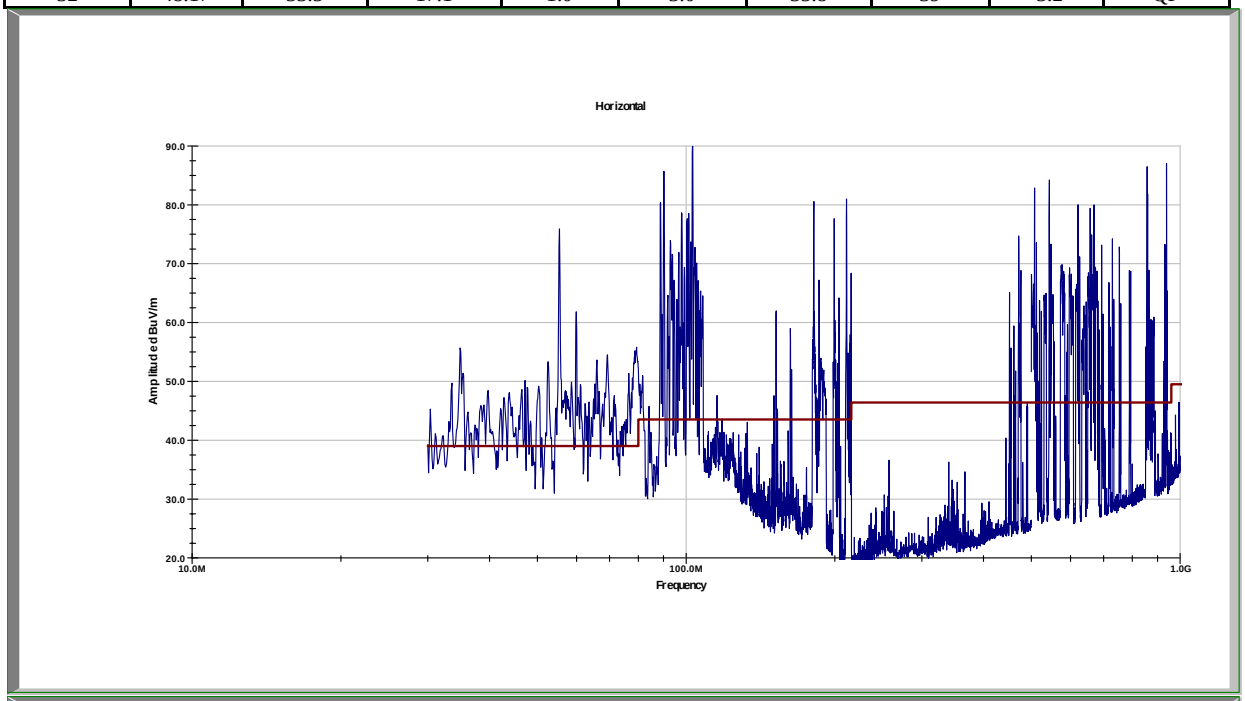
1. Contact the BPL system operator and set the EUT for MAXIMUM power and MAXIMUM burst rate before **Certification** testing. If **Validation** testing is performed there is no need for MAXIMUM power testing and only COMPLIANCE (operating) power is used.
2. Set the EMI Receiver or Spectrum Analyzer to 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).

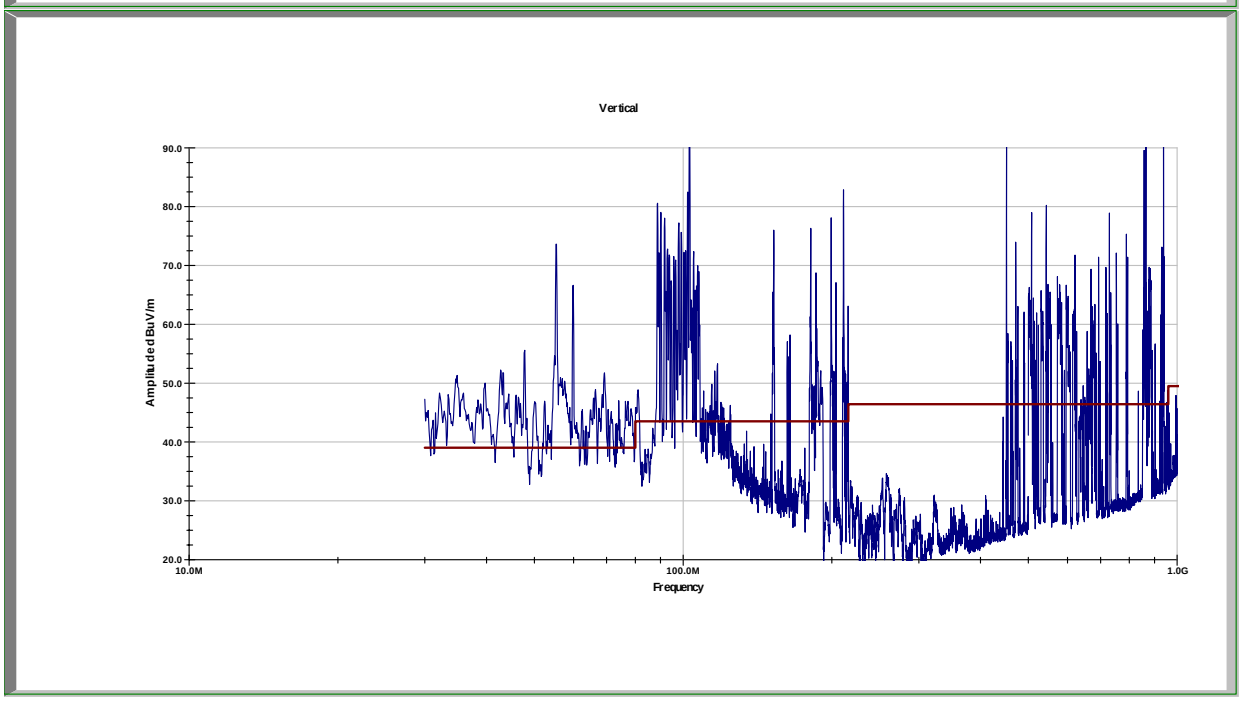
Field Strengths (location 1) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	33.6	33.5	17.1	1.0	3.0	21.2	39	-17.8	QP
30.5	49.8	33.5	17.1	1.0	3.0	37.4	39	-1.6	QP
31.5	43.9	33.5	17.1	1.0	3.0	31.5	39	-7.5	QP
32	49.9	33.5	17.1	1.0	3.0	37.5	39	-1.5	QP



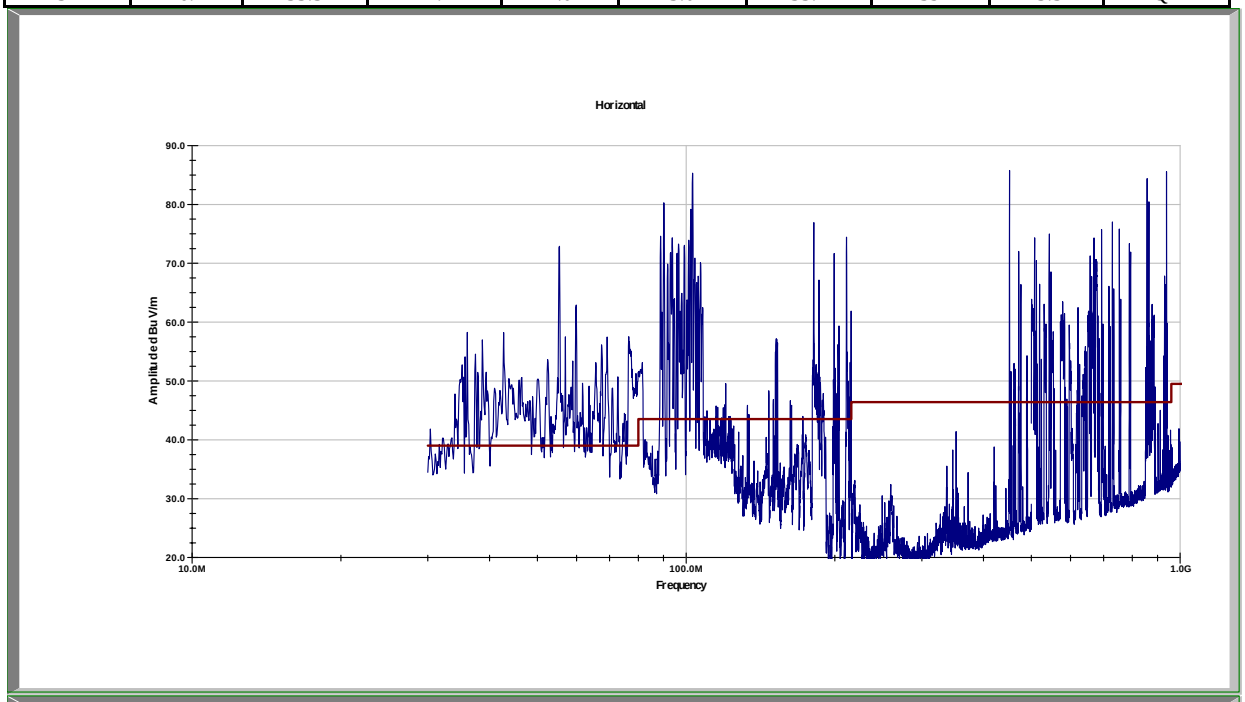


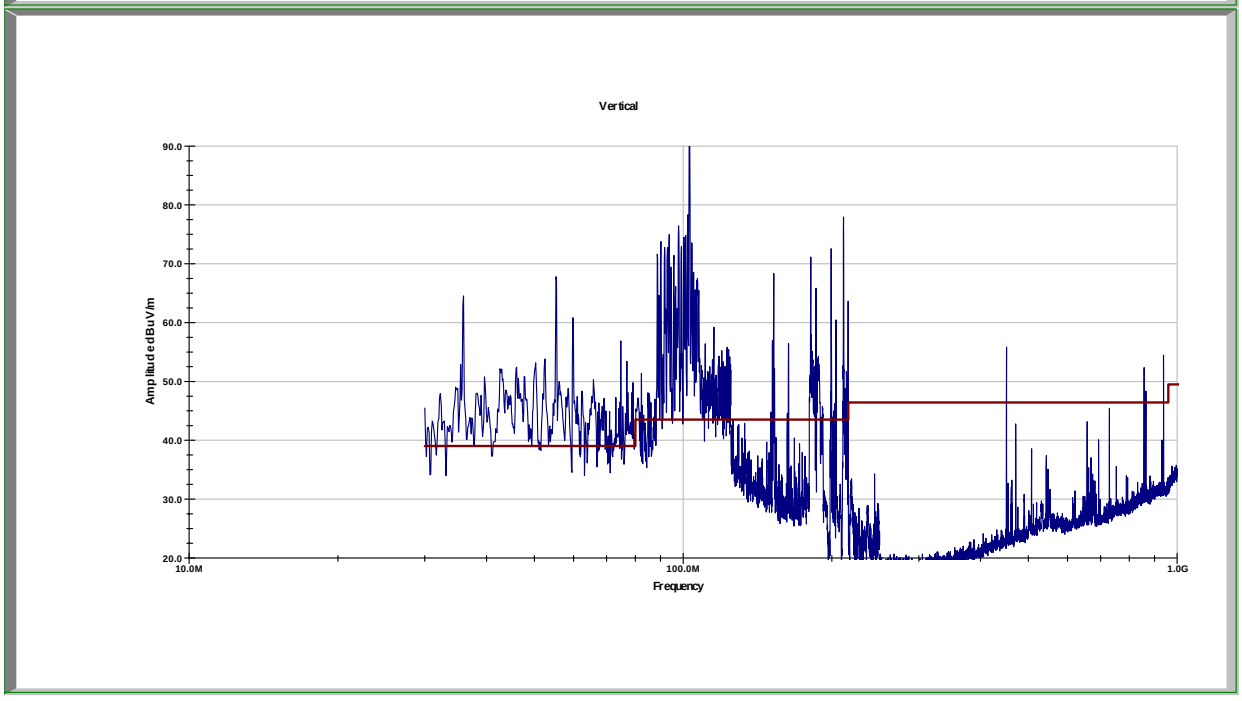
Field Strengths (location 2) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	45.4	33.5	17.1	1.0	3.0	33.0	39	-6.0	QP
30.5	48.82	33.5	17.1	1.0	3.0	36.4	39	-2.6	QP
31.5	43.95	33.5	17.1	1.0	3.0	31.6	39	-7.4	QP
32	48.17	33.5	17.1	1.0	3.0	35.8	39	-3.2	QP



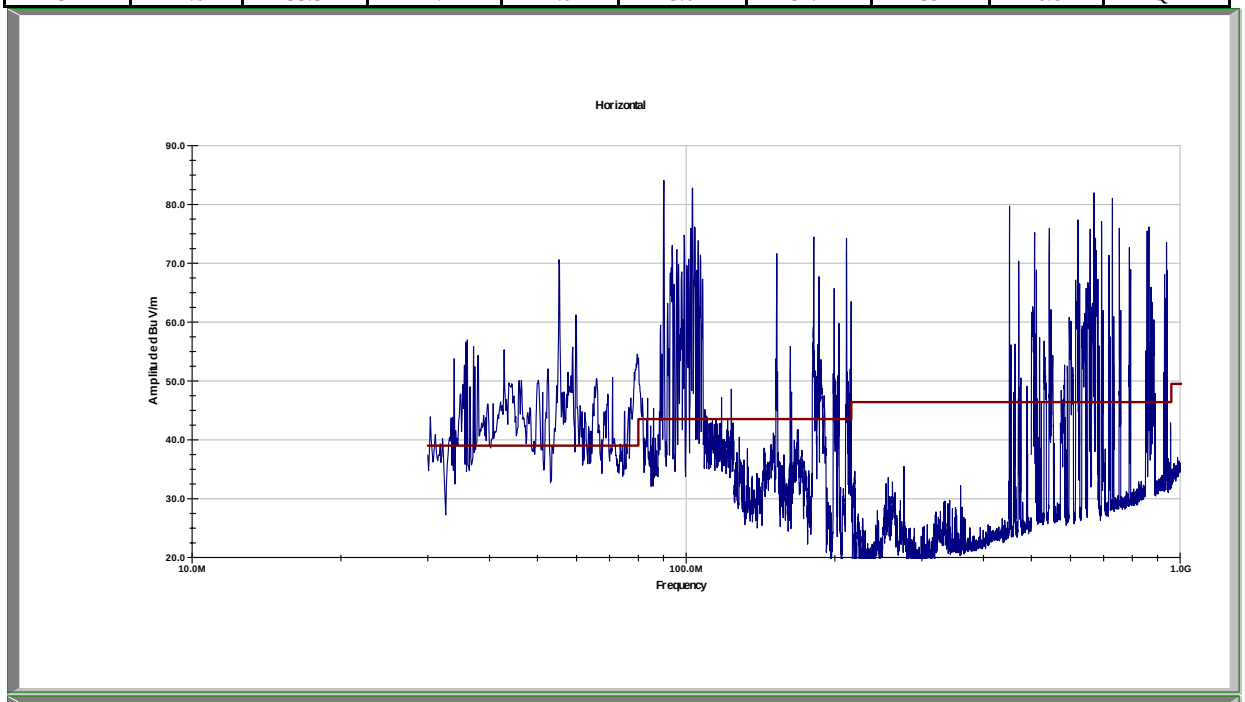


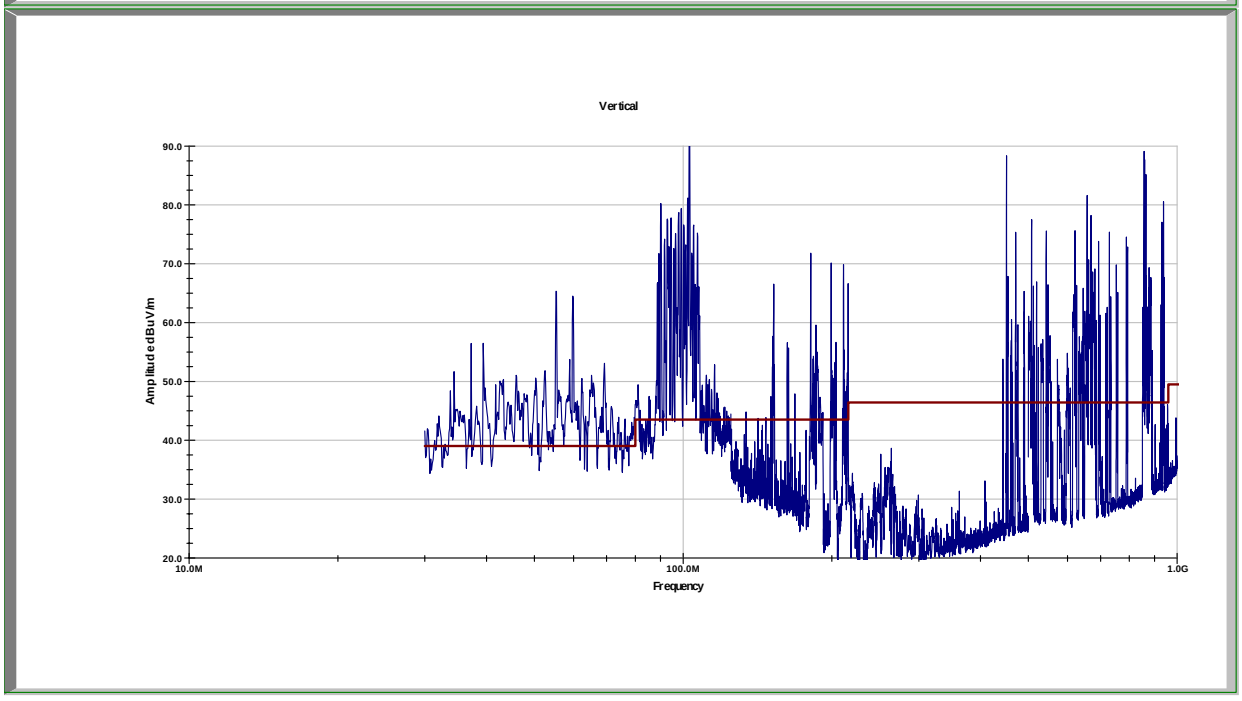
Field Strengths (location 3) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	44.9	33.5	17.1	1.0	3.0	32.5	39	-6.5	QP
30.5	43.3	33.5	17.1	1.0	3.0	30.9	39	-8.1	QP
31.5	43.5	33.5	17.1	1.0	3.0	31.1	39	-7.9	QP
32	46.1	33.5	17.1	1.0	3.0	33.7	39	-5.3	QP



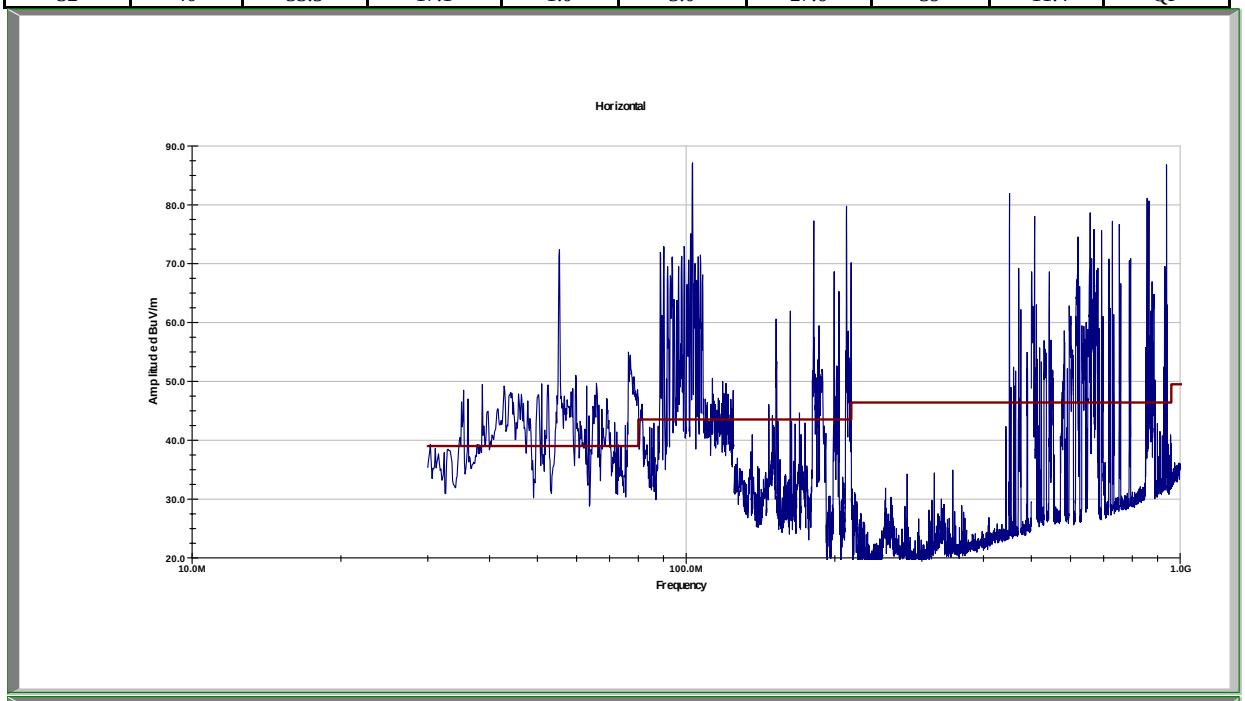


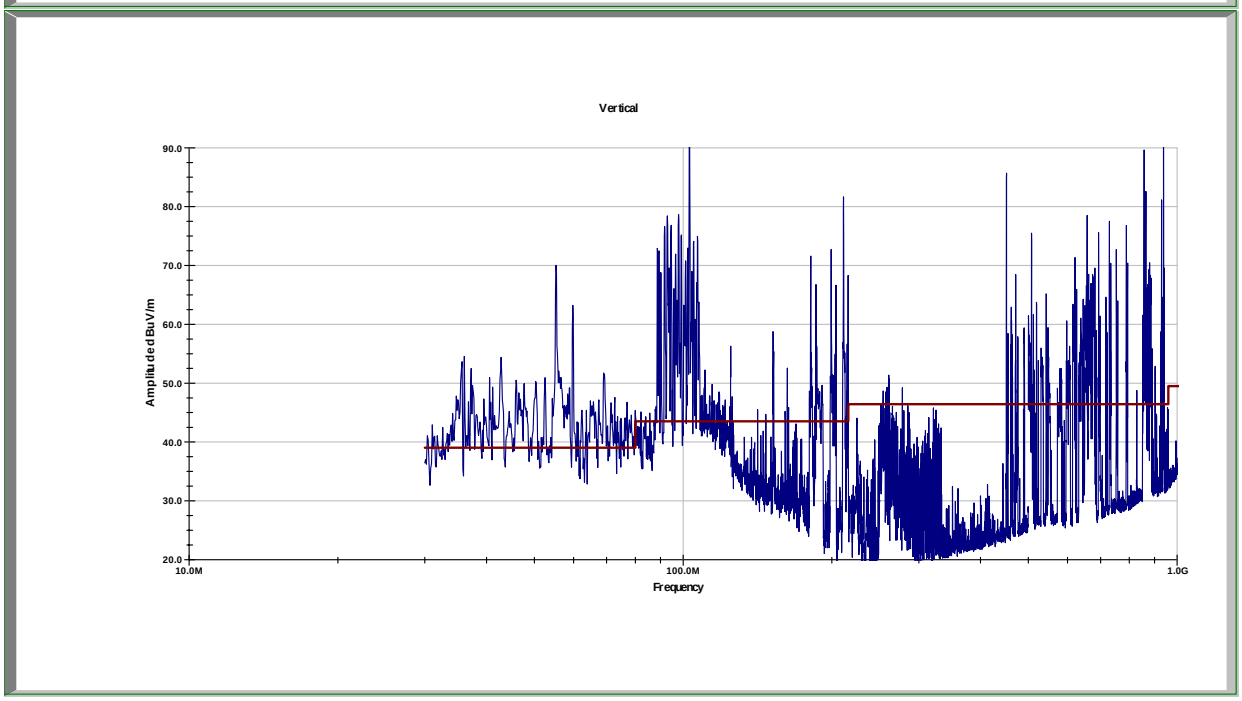
Field Strengths (location 4) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	41.1	33.5	17.1	1.0	3.0	28.7	39	-10.3	QP
30.5	43.6	33.5	17.1	1.0	3.0	31.2	39	-7.8	QP
31.5	42.2	33.5	17.1	1.0	3.0	29.8	39	-9.2	QP
32	44.6	33.5	17.1	1.0	3.0	32.2	39	-6.8	QP



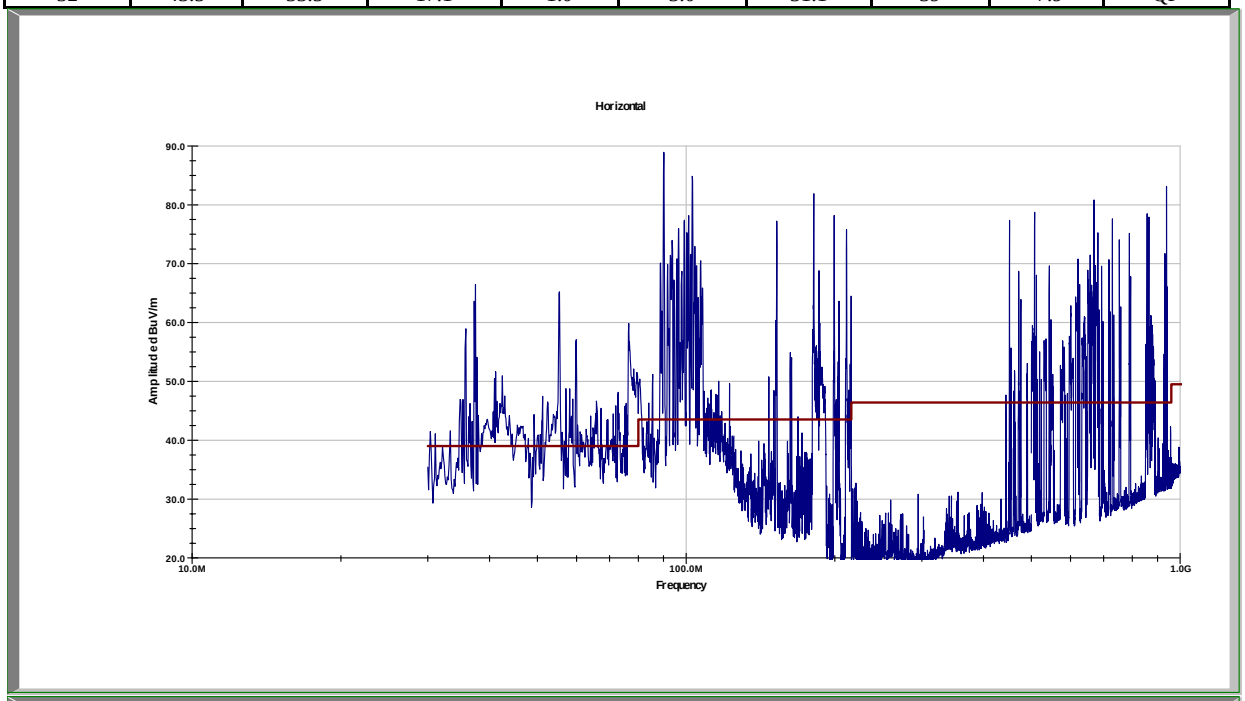


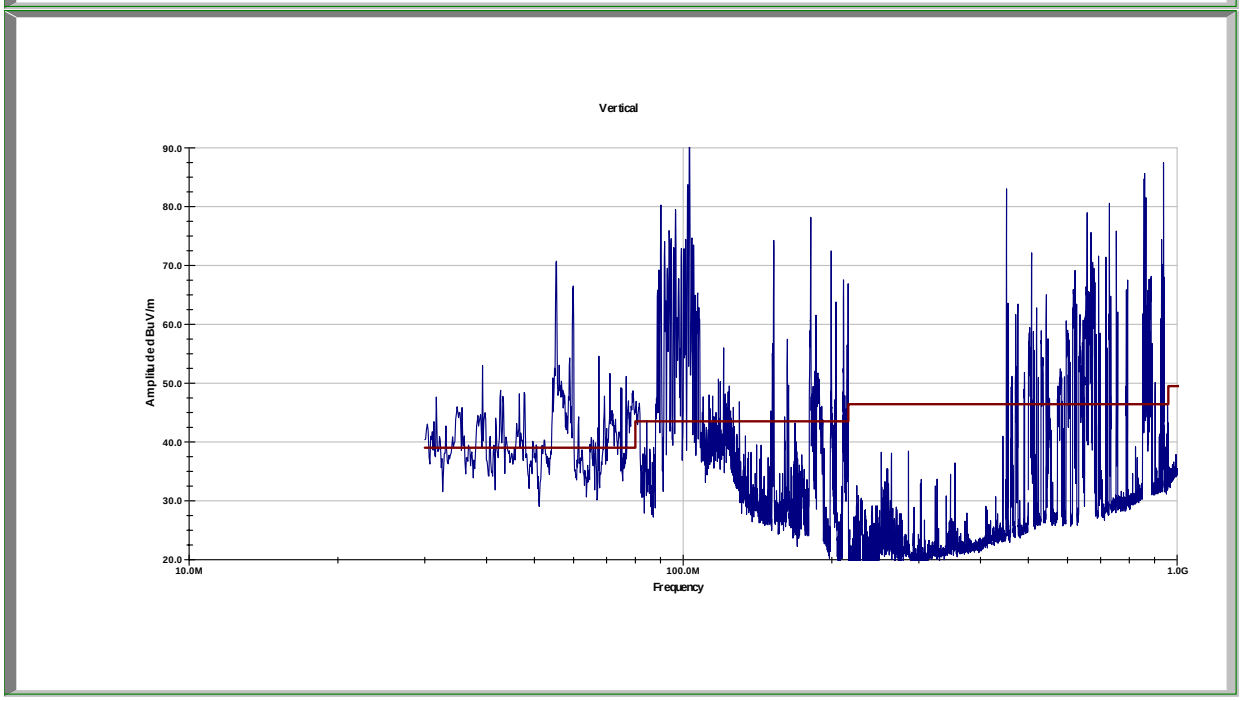
Field Strengths (location 5) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	41.2	33.5	17.1	1.0	3.0	28.8	39	-10.2	QP
30.5	46.2	33.5	17.1	1.0	3.0	33.8	39	-5.2	QP
31.5	40.3	33.5	17.1	1.0	3.0	27.9	39	-11.1	QP
32	40	33.5	17.1	1.0	3.0	27.6	39	-11.4	QP



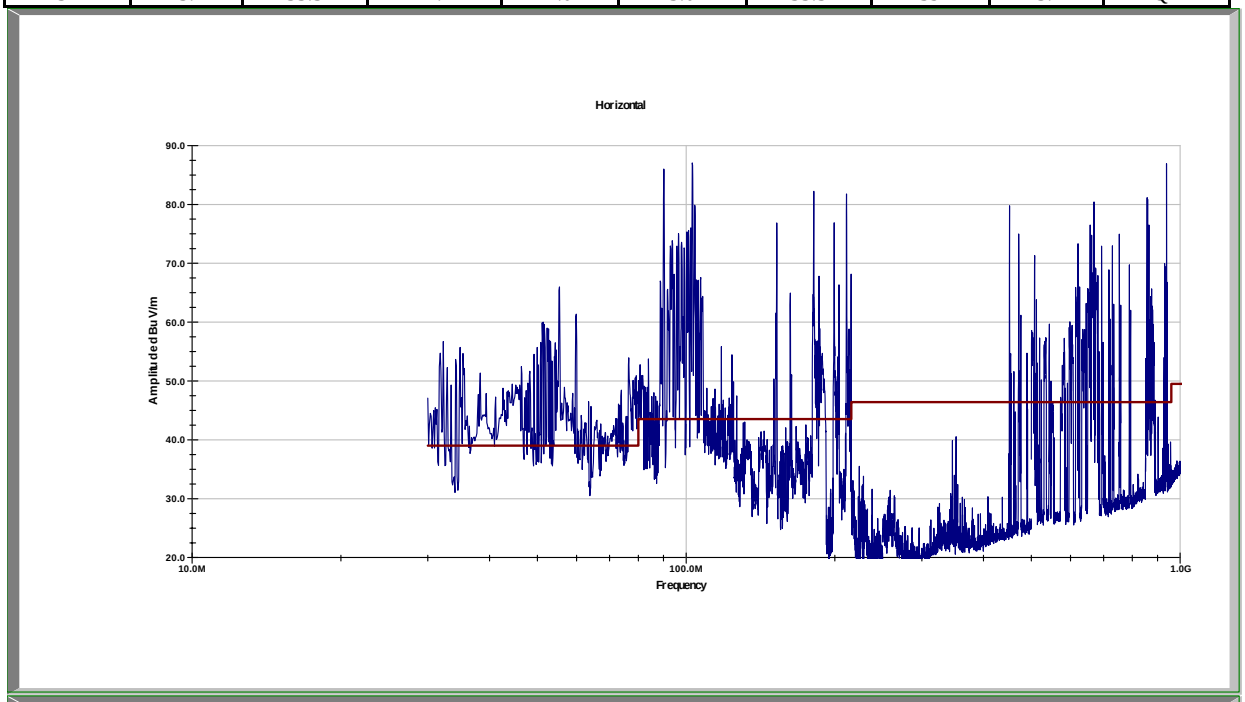


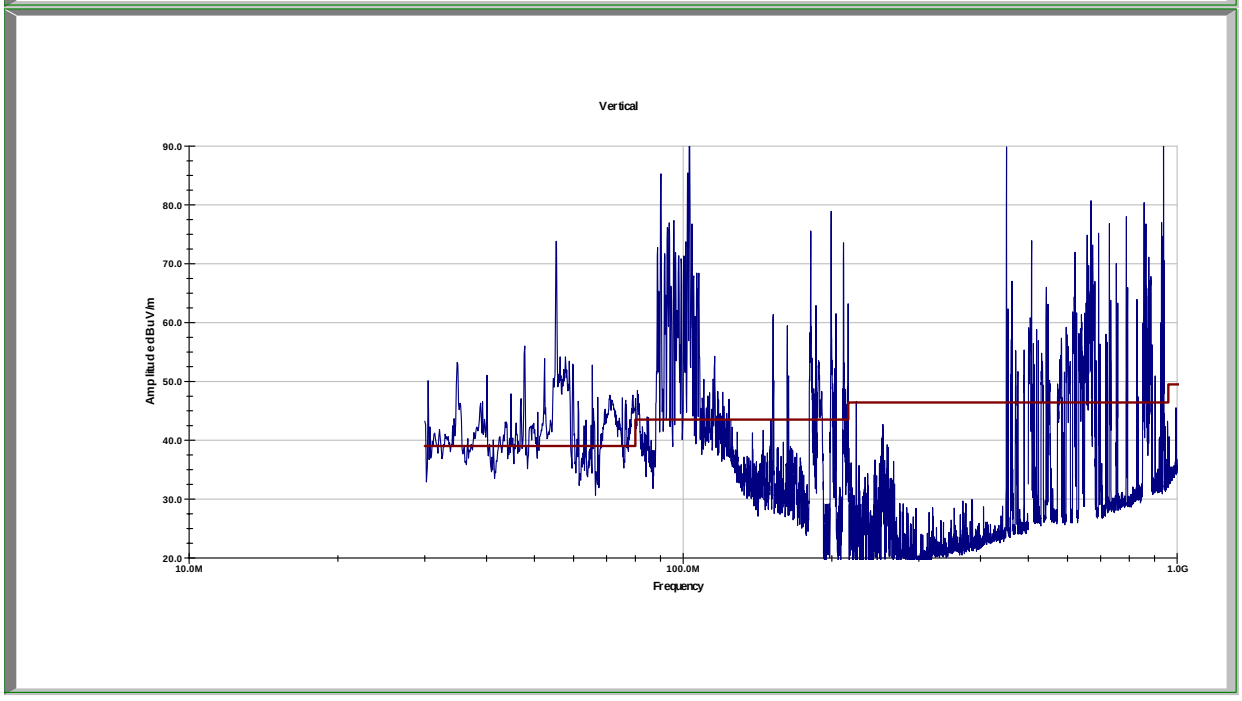
Field Strengths (location 6) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	43.5	33.5	17.1	1.0	3.0	31.1	39	-7.9	QP
30.5	44.1	33.5	17.1	1.0	3.0	31.7	39	-7.3	QP
31.5	39.5	33.5	17.1	1.0	3.0	27.1	39	-11.9	QP
32	43.5	33.5	17.1	1.0	3.0	31.1	39	-7.9	QP



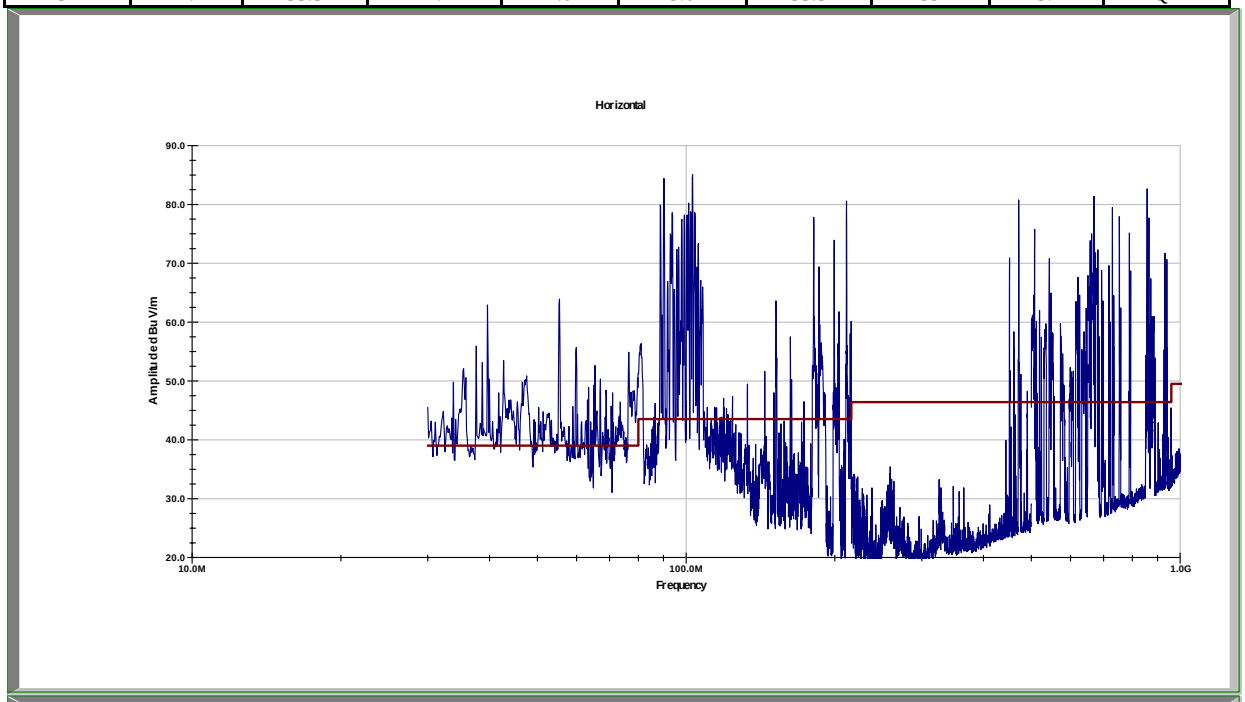


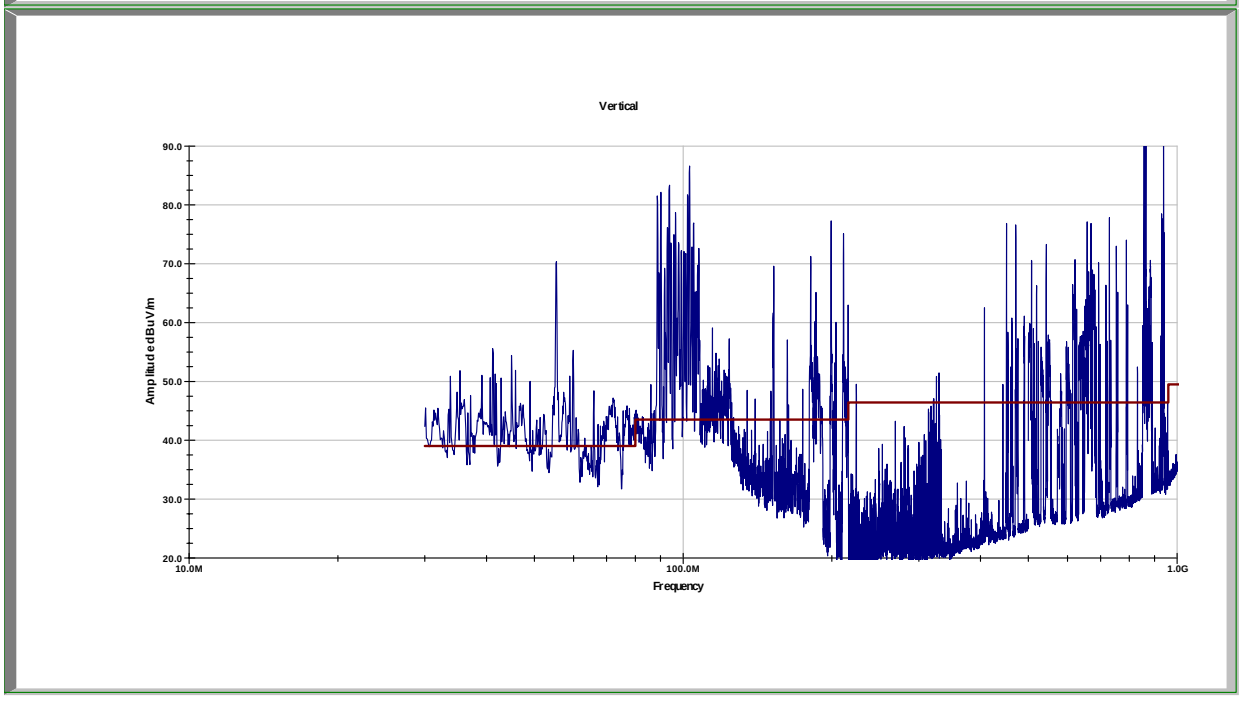
Field Strengths (location 7) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	44.1	33.5	17.1	1.0	3.0	31.7	39	-7.3	QP
30.5	46.1	33.5	17.1	1.0	3.0	33.7	39	-5.3	QP
31.5	45.7	33.5	17.1	1.0	3.0	33.3	39	-5.7	QP
32	45.7	33.5	17.1	1.0	3.0	33.3	39	-5.7	QP





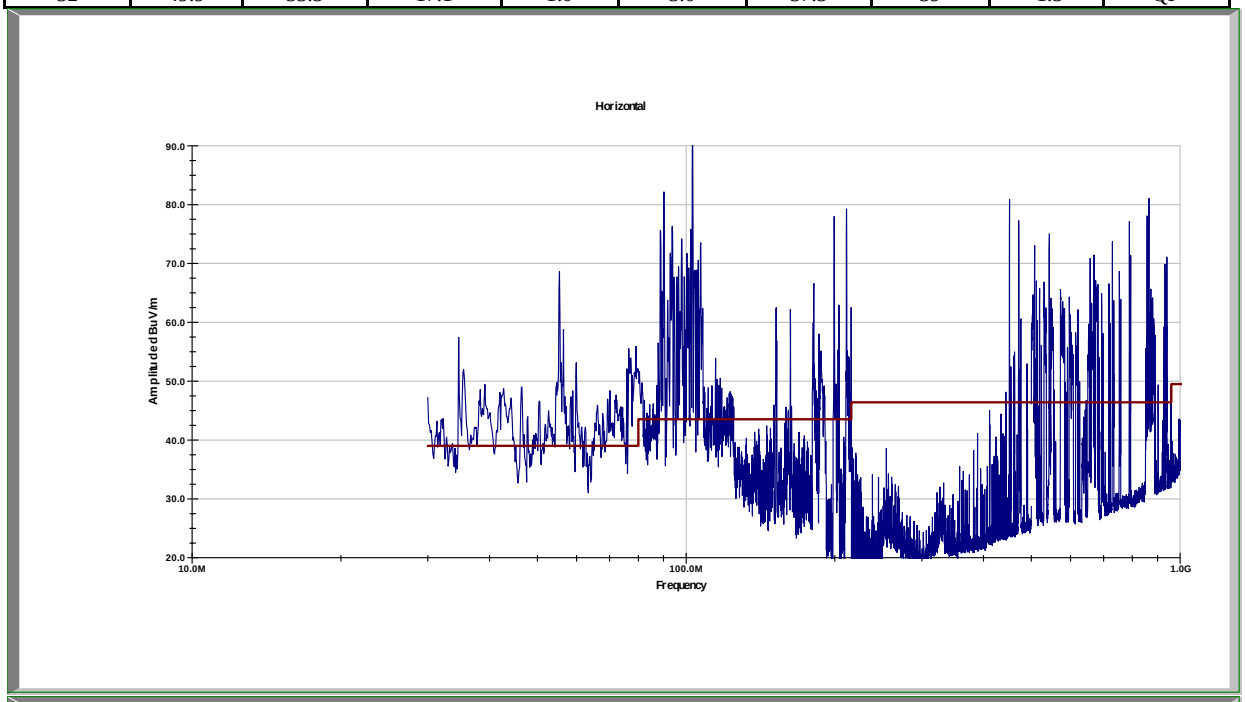
Field Strengths (location 8) 30 MHz– 1,000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	47.2	33.5	17.1	1.0	3.0	34.8	39	-4.2	QP
30.5	48.1	33.5	17.1	1.0	3.0	35.7	39	-3.3	QP
31.5	44.7	33.5	17.1	1.0	3.0	32.3	39	-6.7	QP
32	47.7	33.5	17.1	1.0	3.0	35.3	39	-3.7	QP

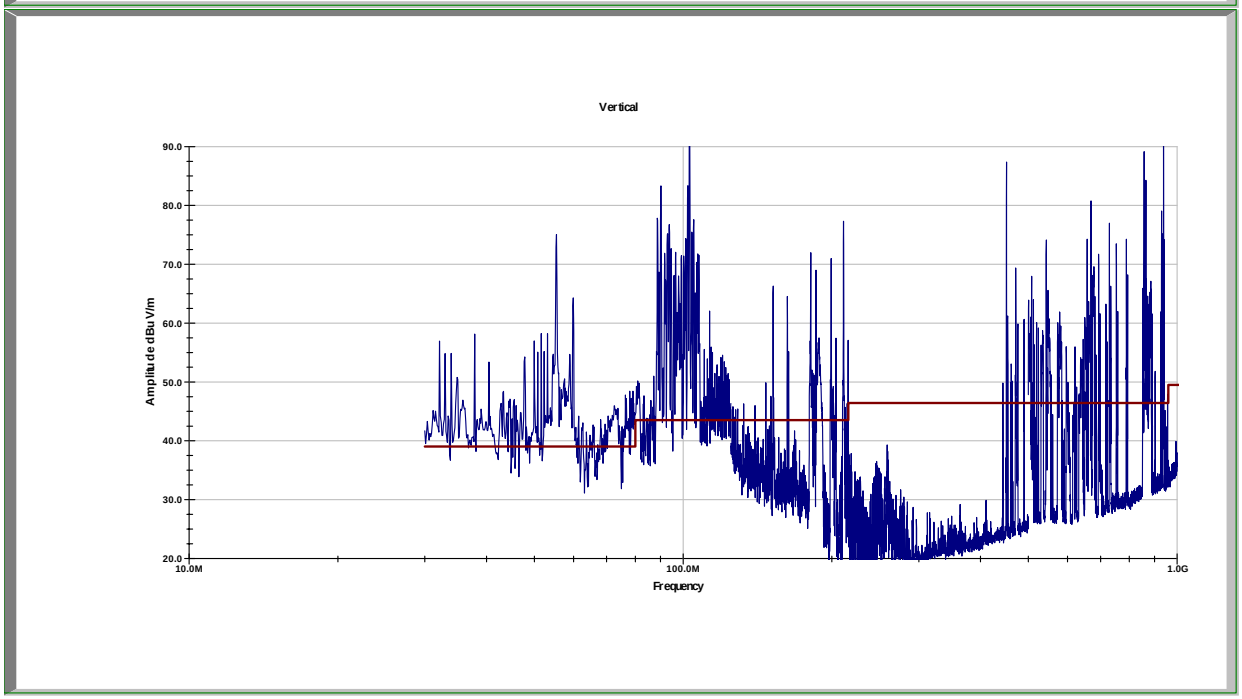




Field Strengths (location 9) 30 MHz– 1000 MHz

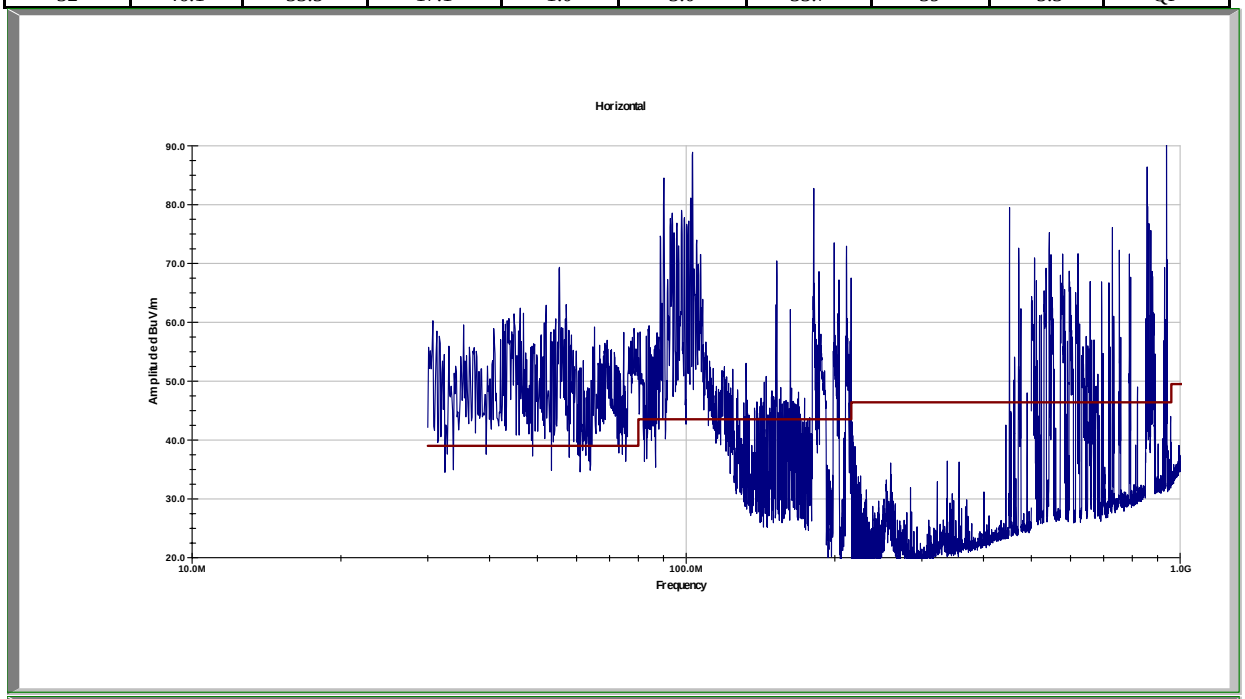
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	47	33.5	17.1	1.0	3.0	34.6	39	-4.4	QP
30.5	47.5	33.5	17.1	1.0	3.0	35.1	39	-3.9	QP
31.5	47.6	33.5	17.1	1.0	3.0	35.2	39	-3.8	QP
32	49.9	33.5	17.1	1.0	3.0	37.5	39	-1.5	QP

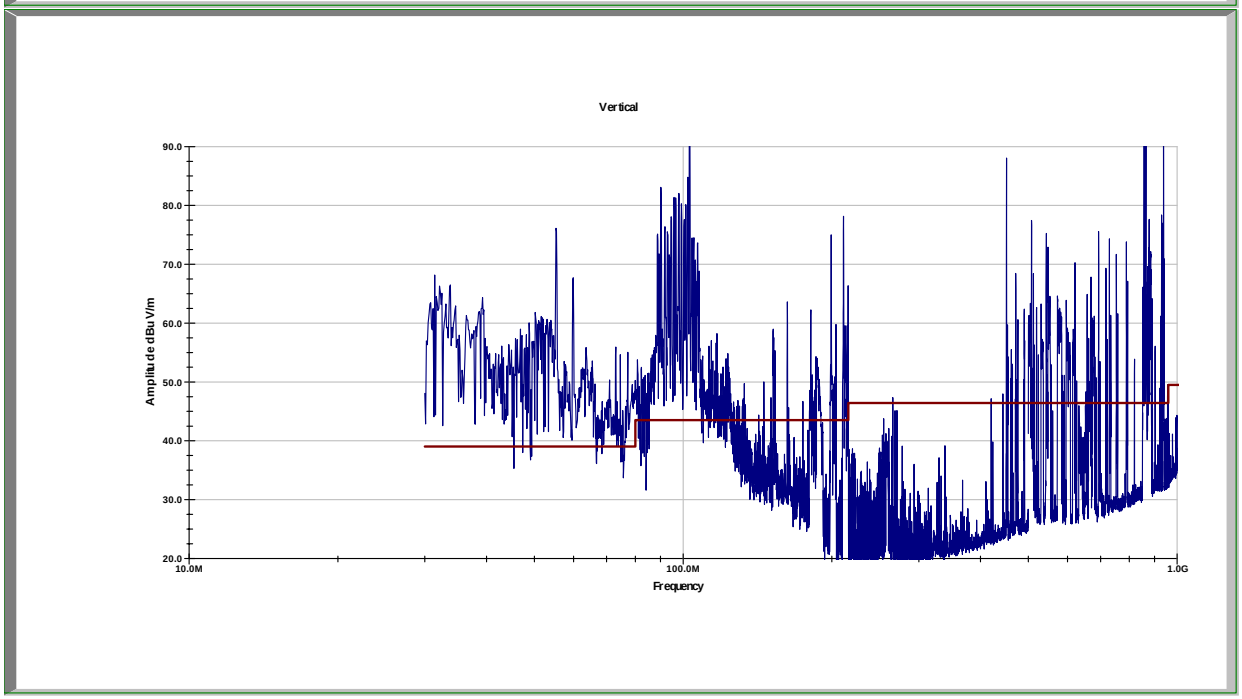




Field Strengths (location 10) 30 MHz– 1000 MHz

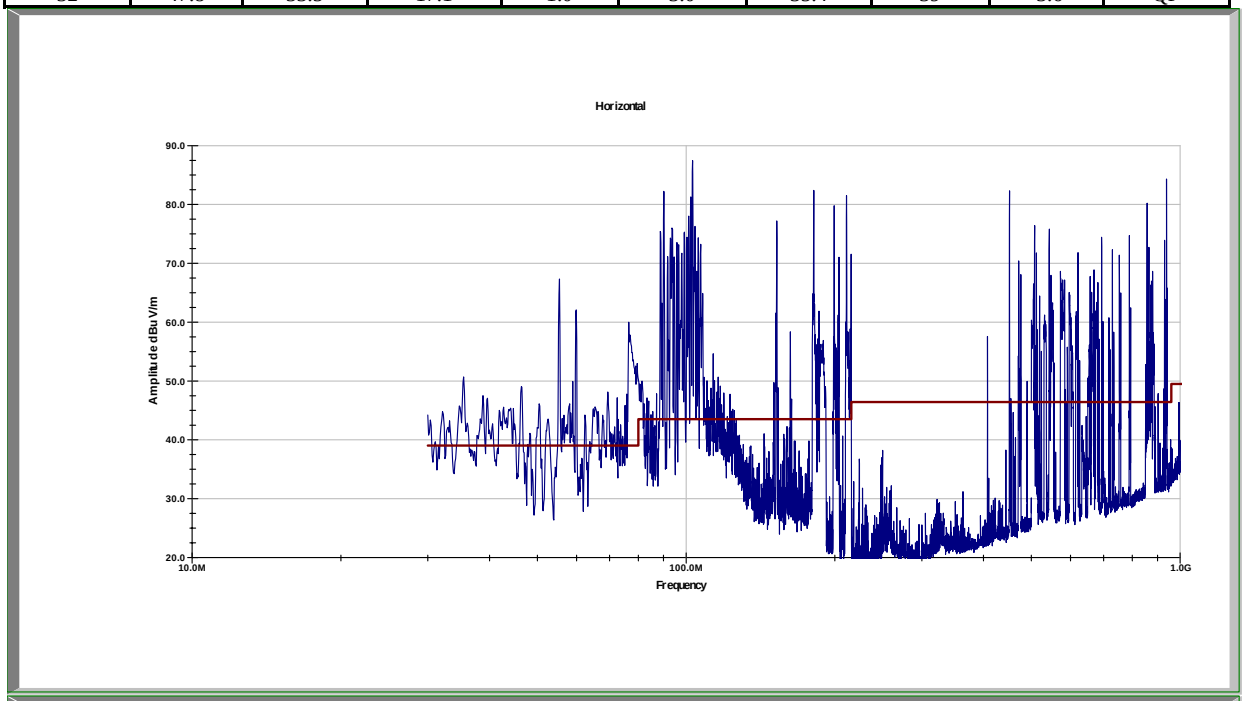
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	43.4	33.5	17.1	1.0	3.0	31.0	39	-8.0	QP
30.5	41.6	33.5	17.1	1.0	3.0	29.2	39	-9.8	QP
31.5	43.2	33.5	17.1	1.0	3.0	30.8	39	-8.2	QP
32	46.1	33.5	17.1	1.0	3.0	33.7	39	-5.3	QP

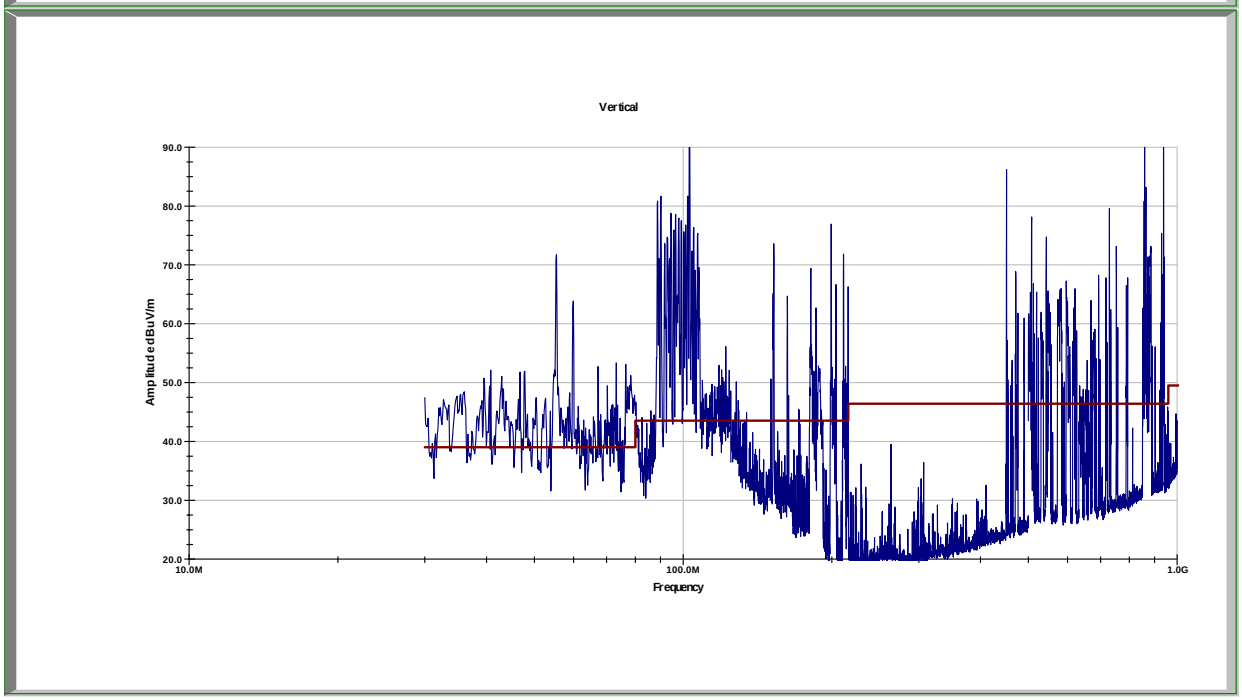




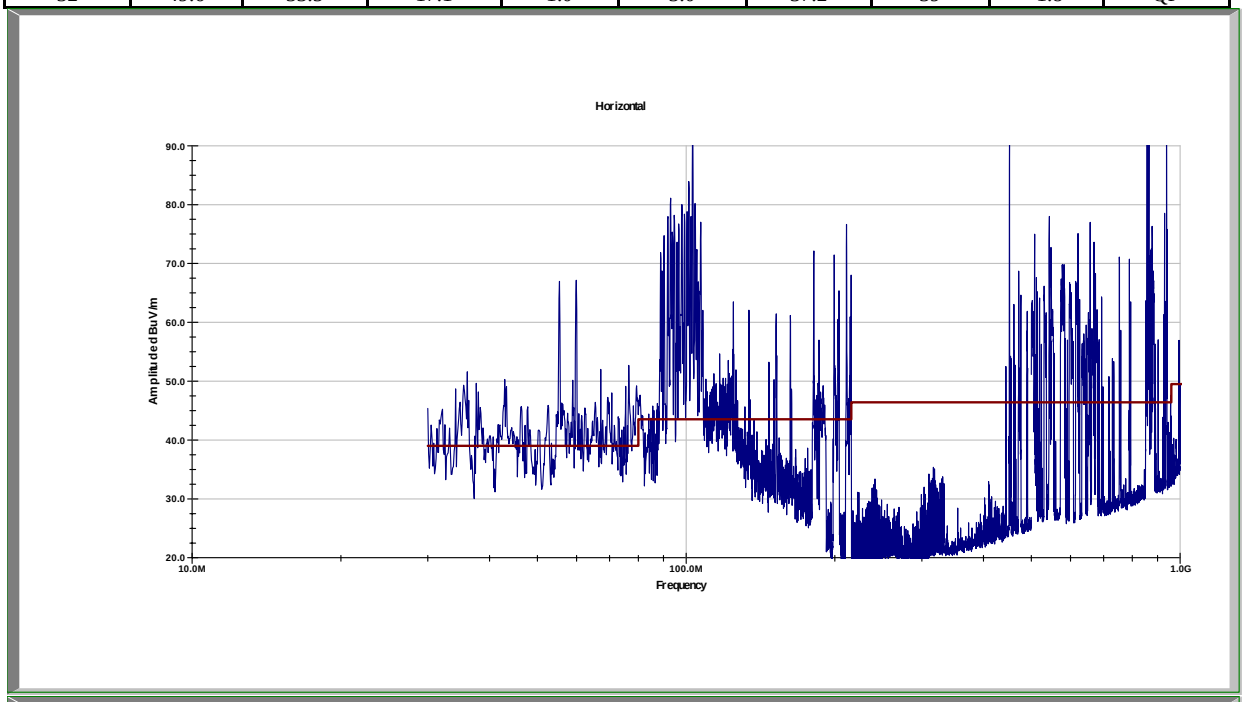
Field Strengths (location 11) 30 MHz– 1000 MHz

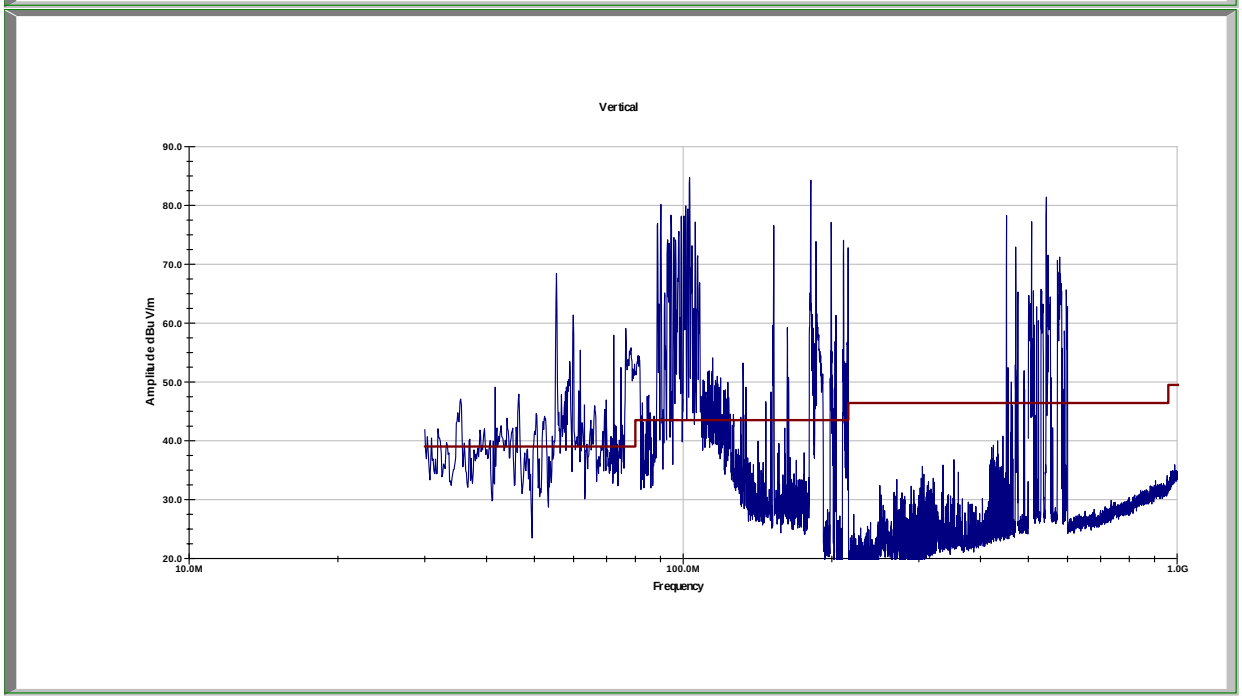
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	46.4	33.5	17.1	1.0	3.0	34.0	39	-5.0	QP
30.5	46.7	33.5	17.1	1.0	3.0	34.3	39	-4.7	QP
31.5	42.6	33.5	17.1	1.0	3.0	30.2	39	-8.8	QP
32	47.8	33.5	17.1	1.0	3.0	35.4	39	-3.6	QP





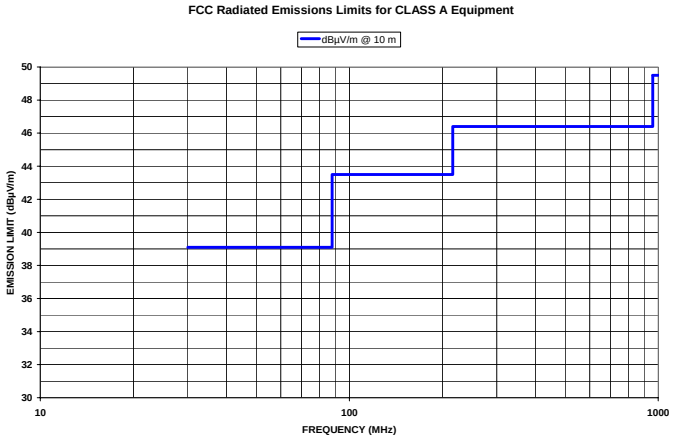
Field Strengths (location 12) 30 MHz– 1000 MHz									
Frequency (MHz)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Slant Factor (dB)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector Function
30	46.6	33.5	17.1	1.0	3.0	34.2	39	-4.8	QP
30.5	46.6	33.5	17.1	1.0	3.0	34.2	39	-4.8	QP
31.5	43.3	33.5	17.1	1.0	3.0	30.9	39	-8.1	QP
32	49.6	33.5	17.1	1.0	3.0	37.2	39	-1.8	QP





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
32	49.9	33.5	17.1	1	3	37.5	39	-1.5	QP
30	47.2	33.5	17.1	1	3	34.8	39	-4.2	QP
30.5	49.8	33.5	17.1	1	3	37.4	39	-1.6	QP
31.5	47.6	33.5	17.1	1	3	35.2	39	-3.8	QP

Ensue that the six **worst case** readings are below the limit line curve for this frequency range as shown below.



Ensure that the required information and signatures are entered in the table below.

Cumulative Test Results:	**PASS**
Name & Address of Testing Organization:	Professional Testing 1601 North A.W. Grimes Suite B Round Rock, Texas 78665
Test Engineer's Signature:	Michael A. Royer
Date:	12/20/07
Name & Address of Entity requesting this test:	Corinex