Compliance Test Report for ANSI/TIA-968-B Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network

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Report Number:	0905HOC_FireFocus_TIA968
Date of Testing:	23 August 2011
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File Number:	AMP110802
Equipment Name(s):	Fire Focus
Equipment Model Number(s):	FFO-1127
Equipment Description:	Fire Alarm Control Panel
Test Specification(s):	ANSI/TIA-968-B
Result*:	Complies
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* See Report Summary page for further details and any conditions.

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Report Summary

The Fire Focus Model No: FFO-1127 was supplied for ANSI/TIA-968-B testing by Hockiki America Corporation.

The device under test (DUT) was a Fire Alarm Control Panel with an on-board dial up modem for connection to the PSTN. It was equipped with 2 sets of terminal blocks for connection to 2 PSTN lines sharing the single dial up modem. The DUT's software selected the phone line to use. Each tip-ring line pair was also series connected to terminals for connection to extension telephones.

DUT Firmware Boot Version: 1.0.0

The Fire Focus Model No: FFO-1127 **COMPLIES** with all the relevant mandatory tested clauses of ANSI/TIA-968-B.

Possible Test Case Verdicts

- Test case does not apply to the test object ·····N(A)
- Test object does meet the requirements·····P(ass)
- Test object does not meet the requirements·····F(ail)
- Test was not performed·····NT (not tested)
- Noted ·····ND

ANSI/TIA-968-B Test Results

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Clause	**Requirements**	**Remarks**	**Verdict**
1	**SCOPE, PURPOSE, AND APPLICATION**		**ND**
1.1	**SCOPE**		**ND**
1.2	**PURPOSE**		**ND**
1.3	**APPLICATION**		**ND**
2	**NORMATIVE REFERENCES**		**ND**
3	**TERMS AND DEFINITIONS**		**ND**
3.1	**DEFINITIONS**		**ND**
3.2	**ACRONYMS & ABBREVIATIONS**		**ND**
4	**COMMON REQUIREMENTS**		**P**
4.1	**ENVIRONMENTAL SIMULATION**		**P**
4.1.1	Mechanical shock:	DUT was within a wall mounted enclosure.	N
4.1.1.1	Hand-held items normally used at head height: 18 random drops from a height of 1.5 meters onto concrete covered with 3 mm asphalt tile or similar surface.		N
4.1.1.2	Table (desk)-top equipment 0–5 kg: Six random drops from a height of 750 mm onto concrete covered with 3 mm asphalt tile or similar surface.		N
4.1.1.3	The drop tests specified in 4.1.1 shall be performed as follows: The unit shall be positioned prior to release to ensure as nearly as possible that for every six drops there is one impact on each of the major surfaces and that the surface to be struck is approximately parallel to the impact surface.		N
4.1.2	Telephone line surge – Type A:		P
4.1.2.1	Metallic: Two metallic voltage surges (one of each polarity) shall be applied between any pair of connections on which lightning surges may occur; this includes:	See appendix B.	P
	a) tip to ring;		P
	b) tip-1 to ring-1; and		N
	c) For a four-wire connection that uses simplex signaling, tip to ring-1 and ring to tip-1.		N
4.1.2.1.1	The surge shall have an open circuit voltage waveform in accordance with figure 2 having a front time (tf) of 6 µs minimum to 10 µs maximum, and a decay time (td) of 560 µs minimum to 860 µs maximum. It shall have a short circuit current wave shape in accordance with figure 3 having a front		P

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Clause	**Requirements**	**Remarks**	**Verdict**
	time (tf) of 5 µs minimum to 10 µs maximum, and a decay time (td) of 560 µs minimum to 760 µs maximum. The peak voltage shall be 800 V minimum to 880 V maximum, and the peak short circuit current shall be 100 A minimum to 115 A maximum.		
4.1.2.1.2	Surges shall be applied as follows:		P
	a) With the equipment in all states that can affect compliance with the requirements of this Standard. If an equipment state cannot be achieved by normal means of power, it shall be achieved artificially;		P
	b) With equipment leads not being surged (including telephone connections, auxiliary leads, and terminals for connection to non-approved equipment) terminated in a manner that occurs in normal use;		ND
	c) Under reasonably foreseeable disconnection of primary power sources, with primary power cords plugged and unplugged, if so configured.		ND
4.1.2.2	Longitudinal: Two longitudinal voltage surges (one of each polarity) shall be applied to any pair of connections on which lightning surges may occur. This includes the tip-ring pair and the tip-1—ring-1 pair, to earth grounding connections, and to all leads intended for connection to non-approved equipment, connected together. Surges shall be applied as follows:	See appendix B.	P
	a) With the equipment in all states that can affect compliance with the requirements of this Standard. If an equipment state cannot be achieved by normal means of power, it shall be achieved artificially;		P
	b) With equipment leads not being surged (including telephone connections, auxiliary leads, and terminals for connection to non-approved equipment) terminated in a manner that occurs in normal use;		ND
	c) Under reasonably foreseeable disconnection of primary power sources, as for example, with primary power cords plugged and unplugged.		ND
4.1.2.3	Failure modes resulting from application of Type A telephone line surges: Regardless of operating state, equipment and circuitry are allowed to be in violation of the transverse balance requirements of section 5 and, for terminal equipment connected to local area data channels, the longitudinal voltage requirements of subclause 5.2.1.4.3, if:	Transverse balance was not violated.	P
	a) Such failure results from an intentional, designed failure mode that has the effect of connecting telephone or auxiliary connections with earth ground; and,		ND
	b) If such a failure mode state is reached, the equipment is designed so that it would become substantially and noticeably		ND

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Clause	**Requirements**	**Remarks**	**Verdict**
	unusable by the user, or an indication is given (e.g., an alarm), in order that such equipment can be immediately disconnected or repaired.		
4.1.2.2.1	The surge shall have an open circuit voltage waveform in accordance with figure 2 with a front time (tf) of 6 µs minimum to 10 µs maximum, and a decay time (td) of 160 µs minimum to 260 µs maximum. It shall have a short circuit current wave shape in accordance with figure 3 having a front time (tf) of 5 µs minimum to 10 µs maximum, and a decay time (td) of 160 µs minimum to 210 µs maximum. The peak voltage shall be 1500 V minimum to 1650 V maximum, and the peak short circuit current shall be 200 A minimum to 230 A maximum.		P
4.1.3	Telephone line surge – Type B:		P
4.1.3.1	Metallic: Two metallic voltage surges (one of each polarity) shall be applied to equipment between any pair of connections on which lightning surges may occur; this includes:	See appendix B.	P
	a) tip to ring;		P
	b) tip-1 to ring-1; and		N
	c) for a 4-wire connection that uses simplex signaling, tip to ring-1 and ring to tip-1.		N
	The surge shall have an open circuit voltage waveform in accordance with figure 2 having a front time (tf) of 9 µs ± 2.7 µs and a decay time (td) of 720 µs ± 144 µs and shall have a short circuit current wave shape in accordance with figure 3 having a front time (tf) of 5 µs ± 1.5 µs and a decay time (td) of 320 µs ± 64 µs. The peak voltage shall be at least 1000 V minimum to 1100 V maximum, and the peak short circuit current shall be at least 25 A minimum to 27.5 A maximum. The wave shapes are based on the use of ideal components in figure 1 with S2 in position M. Surges shall be applied:		P
	a) With the equipment in all states that can affect compliance with the requirements of this Standard. If an equipment state cannot be achieved by normal means of power, it shall be achieved artificially.		P
	b) With equipment leads not being surged (including telephone connections, auxiliary leads, and terminals for connection to non-approved equipment) terminated in a manner that occurs in normal use.		ND
	c) Under reasonably foreseeable disconnection of primary power sources, as for example, with primary power cords plugged and unplugged.		ND
4.1.3.2	Longitudinal: Two longitudinal voltage surges (one of each polarity) shall be	See appendix B.	P

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Clause	**Requirements**	**Remarks**	**Verdict**
	applied to any pair of connections on which lightning surges may occur. This includes the tip-ring pair and the tip-1 ring-1 pair to earth grounding connections and to all leads intended for connection to non-approved equipment, connected together. Surges shall be applied as follows:		
	a) With the equipment in all states that can affect compliance with the requirements of this Standard. If an equipment state cannot be achieved by normal means of power, it shall be achieved artificially.		P
	b) With equipment leads not being surged (including telephone connections, auxiliary leads, and terminals for connection to non-approved equipment) terminated in a manner that occurs in normal use.		ND
	c) Under reasonably foreseeable disconnection of primary power sources, as for example with primary power cords plugged and unplugged.		ND
	For each output lead of the surge generator, with the other lead open, the surge shall have an open circuit voltage waveform in accordance with figure 2 having a front time (tf) of 9 µs ± 2.7 µs and a decay time (td) of 720 µs ± 144 µs and shall have a short circuit current wave shape in accordance with figure 3 having a front time (tf) of 5 µs ± 1.5 µs and a decay time (td) of 320 µs ± 64 µs. The peak voltage shall be 1500 V minimum to 1650 V maximum, and the peak short circuit current shall be 37.5 A minimum to 41.3 A maximum. The wave shapes are based on the use of ideal components in figure 1 with S2 in position L.		P
4.1.3.3	Failure modes resulting from application of Type B telephone line surges: Approved terminal equipment and approved protective circuitry shall withstand the energy of Type B surge without causing permanent opening or shorting of the interface circuit and without sustaining damage that will affect compliance with this Standard.		P
4.1.4	Power line surge:		P
4.1.4.1	Six power line surges (three of each polarity) shall be applied between the phase and neutral terminals of the AC power line while the equipment is being powered. The surge shall have an open circuit voltage waveform in accordance with figure 2 having a front time (tf) of 1 µs minimum to 2 µs maximum, and a decay time (td) of 10 µs minimum to 19 µs maximum, and shall have a short circuit current wave shape in accordance with figure 3 with a front time (tf) of 1 µs minimum to 2 µs maximum, and a decay time (td) of 10 µs minimum to 19 µs maximum. The peak voltage shall be 2500 V minimum to 2750 V maximum, and the peak short circuit current shall be 1000 A minimum to 1250 A maximum. Surges shall be applied:	See appendix B.	P

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Clause	**Requirements**	**Remarks**	**Verdict**
4.1.4.2	Failure modes resulting from application of power line surge. Approved terminal equipment and approved protective circuitry shall comply with all the criteria in this Standard, both prior to and after the application of the power line surge specified in 4.1.4, notwithstanding that this surge may result in partial or total destruction of the equipment under test.		P
4.2	**LEAKAGE CURRENT LIMITATIONS** Leakage current shall not exceed 10 mA peak at any time during the 90 second test interval described below when the 50-60 Hz AC test voltage in table 1 is applied between the test points in table 1. The 10 mA peak maximum leakage current limitation may be increased as described in 4.2.6 to accommodate cable capacitance associated with multi-unit equipment. The test voltage in table 1 assumes that the terminal equipment has a rated input voltage of less than 250 volts. This Standard does not address leakage current requirements applicable to terminal equipment with a rated input voltage of greater than 250 volts.	See appendix B.	**P**
4.2.1	Test interval: The 90 second leakage current test interval shall consist of a 30 second time period during which the test voltage applied between the points in table 1 is gradually increased from zero to the maximum value listed in table 1 followed immediately by a 60-second time period during which the test voltage is maintained at the value listed in table 1.		ND
	(a) All telephone connections; (b) All power connections; (c) All possible combinations of exposed conductive surfaces on the exterior of such equipment or circuitry including grounding connection points, but excluding terminals for connection to other terminal equipment; (d) All terminals for connection to approved protective circuitry or non-approved equipment; (e) All auxiliary lead terminals; (f) All E&M lead terminals, and (g) All PR, PC, CY1 and CY2 leads.		ND
	Table 1 - Voltage Applied for Various Combinations of Electrical Connections **Voltage Source Connected Between:** / **AC Value*** (a) and (b) — 1500 (a) and (c) — 1000 (a) and (d) — 1000 (a) and (e) — 1000		ND

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Clause	**Requirements**	**Remarks**	**Verdict**
	(a) and (f) 1000 (a) and (g) 1000 (b) and (c) 1500 (b) and (d) 1500 (b) and (e) 1500 (b) and (f) 1500 (b) and (g) 1500 (c) and (e) 1000 (c) and (f) 1000 (d) and (e) 1000 (d) and (f) 1000 (e) and (f) 1000 *Value to which test voltage is gradually increased.		
4.2.2	Equipment states:		ND
4.2.3	Treatment of filters on telephone leads:		ND
4.2.4	Removal of intentional DC path to ground used for protection purposes:	MOVs to ground were removed for leakage tests.	ND
4.2.5	Exclusion for intentional DC conducting path to ground:		ND
4.2.6	Multiple unit equipment interconnected by cables:		ND
4.2.7	RF filters and surge protectors on the line side of power supplies:		ND
4.3	**HAZARDOUS VOLTAGE LIMITATIONS**		**P**
4.3.1	General requirement: Under no condition of failure of approved terminal equipment or approved protective circuitry that can be conceived to occur in the handling, operation or repair of such equipment or circuitry, shall the open circuit voltage on telephone connections exceed 70 V_P after one second, except for voltages for network control signaling, alerting and supervision.	See appendix B.	P
4.3.2	Connection of non-approved equipment to approved terminal equipment or approved protective circuitry:	Connectors well separated but cabling by installer.	ND
4.3.3	Non-hazardous voltage source		ND
4.3.4	Intentional paths to ground (as required by clause 4.1):		P

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Clause	**Requirements**	**Remarks**	**Verdict**
4.3.4.1	Connections with operational paths to ground: Approved terminal equipment and approved protective circuitry having an intentional DC conducting path to earth ground at operational voltages that was excluded during the leakage current test of clause 4.2 shall have a DC current source applied between the following points: a) Telephone connections, including tip, ring, tip-1, ring-1, E&M leads and auxiliary leads b) Earth grounding connections For each test point, the current shall be gradually increased from zero to 1 A, then maintained for one minute. The voltage between (a) and (b) shall not exceed 0.1 V at any time. In the event there is a component or circuit in the path to ground, the requirement shall be met between the grounded side of the component or circuit and the earth grounding connection.		N
4.3.4.2	Connections with protection paths to ground: Approved terminal equipment and protective circuitry having an intentional DC conducting path to earth ground for protection purposes at the leakage current test voltage that was removed during the leakage current test of clause 4.2 shall, upon its replacement, have a 50 or 60 Hz voltage source applied between the following points: a) Connections used for simplex signaling including tip and ring, tip-1 and ring-1, E&M leads and auxiliary leads, and; b) Earth grounding connections. The voltage shall be gradually increased from zero to 120 V rms for approved terminal equipment, or 300 V rms for protective circuitry, and then maintained for one minute. The current between (a) and (b) shall not exceed 10 mA_P at any time. As an alternative to carrying out this test on the complete equipment or device, the test may be carried out separately on components, subassemblies, and simulated circuits, outside the unit, provided that the test results would be representative of the results of testing the complete unit.	Tip/ring to earth 120Vrms tested after reinstalling MOVs following leakage tests.	P
4.3.5	Other hazardous voltage limitations:		N
4.4	**BILLING PROTECTION**		**P**
4.4.1	Call duration requirements on data equipment: For data equipment connected to the public switched network, or to tie trunks, or to private lines that access the public switched network, approved data terminal equipment and approved protective circuitry shall comply with the following requirements when answering an incoming call, except in off-hook states in which the signals are transmitted and/or received by electro-acoustic transducers only. This is applicable to approved terminal equipment and approved protective circuitry employed with digital services where such digital services are interconnected with the analog telephone network.		P

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Clause	**Requirements**	**Remarks**	**Verdict**
4.4.1.1	Approved protective circuitry connected to associated data equipment shall assure that the signal power limitations are met for at least the first 2 seconds after the off-hook condition is presented to the telephone network in response to an incoming call.		N
4.4.1.2	Approved terminal equipment for data applications shall assure that, when an incoming telephone call is answered, the answering terminal equipment prevents both transmission and reception of data for at least the first two seconds after the answering terminal equipment transfers to the off-hook condition. For the purpose of this requirement, a fixed sequence of signals that is transmitted (and originated within) and/or received by the approved terminal equipment each time it answers an incoming call shall not be considered data, provided that such signals are for one or more of the following purposes: a) Disabling echo control devices, b) Adjusting automatic equalizers and gain controls, c) Establishing synchronization, or d) Signaling the presence and if required, the mode of operation, of the data terminal at the remote end of a connection.	Answered with modem answer tone.	P
4.4.2	Voice and data equipment on-hook signal requirements: For approved voice and data equipment connected to the public switched network, or to tie trunks, or to private lines that access the public switched network, approved protective circuitry and approved terminal equipment shall comply with the following on-hook signal requirements:		P
4.4.2.1	The total power delivered into a two-wire loop simulator circuit or into the transmit and receive pairs of a four-wire loop simulator or into a 600 ohms termination (where appropriate) in the on-hook state by analog voice-band equipment shall not exceed -55 dBm within the voice band. Approved protective circuitry shall also assure that for any input level up to 10 dB above the overload point, the power to a two-wire loop simulator circuit or the transmit and receive pairs of a four-wire loop simulator circuit or into a 600 ohms termination (where appropriate) does not exceed the above limits.	-62 dBm	P
4.4.2.2	The total power delivered into a two-wire loop simulator circuit or into the transmit and receive pairs of a four-wire loop simulator circuit, in the on-hook state, by reverse-battery equipment shall not exceed -55 dBm within the voice band, unless the equipment is arranged to inhibit in-coming signals.		N
4.4.2.3	On-hook requirements for approved subrate and 1.544Mbps digital terminal equipment.		N
4.4.3	Signaling interference requirements:		P
4.4.3.1	The signal power delivered to the network interface by the		P

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	approved terminal equipment and from signal sources internal to approved protective circuitry in the 2450 Hz to 2750 Hz band shall be less than or equal to the power present simultaneously in the 800 Hz to 2450 Hz band for the first 2 seconds after going to the off-hook state.		
4.4.3.2	Approved terminal equipment for connection to subrate or 1.544 Mbps digital services shall not deliver digital signals to the telephone network with equivalent power in the 2450 to 2750 Hz band as derived by a zero level decoder conforming to the requirements of subclause 4.5.2 unless an equal or greater amount of equivalent power is present in the 800 to 2450 Hz band for the first two seconds after going to the off-hook state. (See the definition for “equivalent power” in section 3.)		N
4.4.4	Other billing protection requirements: Additional billing protection requirements are given in subclause 5.1.13.4 for analog DID interfaces and in 5.2.4.9 for DS1 and ISDN PRI interfaces.		N
4.5	**ENCODED ANALOG CONTENT**		**N**
4.5.1	Encoded analog content limits:		N
4.5.2	Zero level decoder requirements:		N
4.6	**CONNECTORS &WIRING CONFIGURATIONS**		**ND**
4.6.1	Introduction: Connection of terminal equipment to the telephone network shall be made through a connector conforming to TIA-1096-A or by direct attachment to wiring installed by the provider(s) of wire line telecommunications including, but not limited to, splicing, bridging, twisting, and soldering. Hardware used to mount, protect, and enclose standard jacks is not described in this Standard or TIA-1096-A. The only requirement on connecting blocks, housings, dust covers, outdoor boxes, and the like that contain standard network jacks is that they shall accept standard plugs with cordage.	PCB wire terminal blocks provided for terminating phone wires.	ND
4.6.2	Wiring configurations: The connectors specified in TIA-1096-A shall be wired in accordance with any of the applicable wiring configurations provided in T1.TR.5-1999. The applicable connector and connector wiring configuration for approved TE shall be identified in consumer instructions and product approval documentation.		ND
4.6.2.1	Universal Service Ordering Code: A universal service ordering code (USOC) is specified in T1.TR.5-1999 for each wiring configuration. These USOCs are generic service ordering codes that are used or recognized by most wireline carriers. If a customer wishes to have the wireline carrier install a jack or wiring configuration, the appropriate USOC needs to be specified when the customer requests		ND

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Clause	**Requirements**	**Remarks**	**Verdict**
	service installation.		
4.6.2.2	Default connector wiring configuration: In the absence of a request for a specific type of jack and wiring configuration, wireline carriers will typically install a 6-position non-keyed jack with the RJ11W (for wall mounted equipment) or RJ11C (for all other equipment) wiring configuration shown in fig. 5.		ND
4.6.3	Multi-line, private branch exchange (PBX), and key telephone systems:		ND
4.7	**ALLOWABLE NET AMPLIFICATION BETWEEN PORTS**		**N**
5	**INTERFACE REQUIREMENTS**		**P**
5.1	**ANALOG VOICE BAND INTERFACE REQUIREMENTS**		**P**
5.1.1	General analog voice band signal power limits:		P
5.1.1.1	Limits on signal power shall be met at the interface for all two-wire network ports and, where applicable, to both transmit and receive pairs of all four-wire network ports.		P
5.1.1.2	Signal power measurements shall be made using terminations as specified in each of the following limitations.		ND
5.1.1.3	The transmit and receive pairs for four-wire network ports shall be measured with the pair not under test connected to a termination equivalent to that specified for the pair under test.		N
5.1.2	Limitations on signals not intended for network control signaling:		P
5.1.2.1	For all interfaces except lossless tie trunk, OPS, or private line interfaces using ringdown or in-band signaling, the power of all signal energy other than live voice, in the 200–3995 Hz voice band, delivered by approved terminal equipment or approved protective circuitry to the appropriate loop simulator – other than non permissive data equipment or data protective circuitry – shall not exceed -9 dBm when averaged over any 3-second interval.	<-9.6 dBm	P
5.1.2.2	For two-wire and four-wire lossless tie trunk interfaces, the maximum power of other than live voice signals delivered to a 600 ohm termination shall not exceed -11 dBm when averaged over any 3-second interval.		N
5.1.2.3	OPS interfaces: The maximum power of other than live voice delivered to an OPS line simulator circuit shall not exceed -9 dBm, when averaged over any 3- second interval.		N
5.1.2.4	Approved test equipment or approved test circuitry: The maximum signal power delivered to a loop simulator circuit shall not exceed 0 dBm when averaged over any 3-second interval.		P
5.1.2.5	For voice band private line interfaces using ringdown or in-band		P

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	signaling, the maximum power of other than live voice signals delivered to a 600 ohm termination shall not exceed -13 dBm when averaged over any 3-second interval.		
5.1.2.6	For voice band private line interfaces using in-band signaling in the band 2600 ±□150 Hz, the maximum power delivered to a 600 ohm termination shall not exceed -8 dBm during the signaling mode. The maximum power delivered to a 600 ohm termination in the on-hook steady state supervisory condition shall not exceed -20 dBm. The maximum power of other than live voice signals delivered to a 600 ohm termination during the non-signaling mode and for other in-band systems shall not exceed -13 dBm when averaged over any 3-second interval.		N
5.1.2.7	Data terminal equipment: Approved data circuit terminal equipment shall be capable of operation in at least one of the states discussed in the lettered list below. The output power level of the data circuit terminal equipment shall not be alterable by the customer to levels that exceed the signal power limits specified.		P
	a) Data circuit terminal equipment intended to operate with a programming resistor for signal level control shall provide the programmed levels given in table 4 within +/- 1 dB. The voltages impressed on resistor Rp by the data equipment shall not cause power dissipation in Rp in excess of 50 milliwatts. Figure 6 below was used in calculating values of the programming resistors and may be useful in implementing the automatic control of signal power output in the programmed data equipment.		N
	b) Data circuit terminal equipment intended to operate in the fixed loss loop (FLL) state shall not transmit signal power that exceeds -4 dBm, in the 200- 3995 Hz voice band, when averaged over any and all 3-second intervals.		N
	c) Data circuit terminal equipment not operating in accordance with (a) or (b) above shall not transmit signals from 200 to 3995 Hz that exceed -9 dBm, when averaged over any and all 3-second intervals.	< -9.6 dBm	P
5.1.3	Limitations on signals intended for network control signaling:		P
5.1.3.1	For all operating conditions except tie trunk applications, the maximum power in the frequency band between 200 Hz and 3995 Hz delivered to a loop simulator circuit shall not exceed the following when averaged over any 3-second interval:	See appendix C.	P
	a) 0 dBm when used for network control (for example, DTMF, MF, and coin deposit signals);		P
	b) 0 dBm when DTMF is used for manual entry end-to-end signaling and the device does not generate more than 40 DTMF digits per manual key stroke;		N
	c) -9 dBm in all other cases (for example, when DTMF or MF		N

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	digits are used to represent ASCII characters in end-to-end data communications applications, or when a device generates more than 40 DTMF digits per manual key stroke in end-to-end signaling applications).		
5.1.3.2	For tie trunk applications, the maximum power delivered to a 600 ohm termination for approved terminal equipment and approved protective circuitry under all operating conditions shall not exceed -4 dBm over any 3-second interval.		N
5.1.4	Limitations at the interface from non-approved external signal sources: For approved terminal equipment or approved protective circuitry with non-approved signal source input, such as music on hold, the voice band metallic signal power requirements in 5.1.1 of this Standard shall be met using an input signal with a frequency range of 200 Hz to 4000 Hz with a level 10 dB higher than the overload point.		N
5.1.5	Through transmission limitations:		N
5.1.6	Signal power in the 3995–4005 Hz frequency band:	See appendix C.	P
5.1.6.1	Power resulting from internal signal sources contained in approved protective circuitry and approved terminal equipment (voice and data), not intended for network control signaling: For all operating conditions of approved terminal equipment and approved protective circuitry that incorporate signal sources other than sources intended for network control signaling, the maximum power delivered by such sources in the 3995–4005 Hz band to an appropriate simulator circuit, shall be 18 dB below maximum permitted power specified in subclauses 5.1.2 and 5.1.3 for the voice band.		P
5.1.6.2	Terminal equipment with provision of through-transmission from other equipment: The loss in any through-transmission path of approved terminal equipment and approved protective circuitry at any frequency in the 600 to 4000 Hz band shall not exceed, by more than 3 dB, the loss at any frequency in the 3995 to 4005 Hz band, when measured into an appropriate simulator circuit from a source that appears as 600 ohms across tip and ring.	< 0.1 dB variation	P
5.1.7	Longitudinal voltage at frequencies below 4 kHz: The weighted rms voltage averaged over 100 ms that results from component longitudinal voltages in the 100 Hz to 4 kHz band after weighting according to the transfer function of f/4000 where f is the frequency in Hz, shall not exceed the maximum indicated under the conditions stated in subclause 5.1.9. During ringing, the maximum weighted rms voltage shall not exceed -20dBV for the frequency range 300 Hz to 4 kHz. Average magnitudes may be used for signals that have peak-to-rms ratios of 20 dB and less. The rms limitations shall be used instead of average values if the peak-torms ratio of the interfering signal exceeds this value.	See appendix C.	P

<table>
<tr><th colspan="4">ANSI/TIA-968-B</th></tr>
<tr><th>Clause</th><th>Requirements</th><th>Remarks</th><th>Verdict</th></tr>
<tr><td></td><td>
<table>
<tr><td>Frequency range</td><td>Maximum weighted rms voltage</td><td>Impedance</td></tr>
<tr><td>100 Hz to 4 kHz</td><td>-30 dBV</td><td>500 ohms</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>5.1.8</td><td>Voltage in the 4 kHz to 30 MHz frequency range:
Except as noted, rms voltage as averaged over 100 ms at the telephone connections of approved terminal equipment and approved protective circuitry in all of the possible 8 kHz bands within the indicated frequency range and under the conditions specified in 5.1.5.9 shall not exceed the maximum indicated below. For subclauses 5.1.8.1 and 5.1.8.3, ‘‘f’’ shall be the center frequency in kHz of each of the possible 8 kHz bands beginning at 8 kHz.</td><td></td><td>P</td></tr>
<tr><td>5.1.8.1</td><td>Metallic voltage, 4 kHz to 270 kHz:
<table>
<tr><th>Centre frequency (f) of 8-kHz band</th><th>Max voltage in all 8kHz bands</th><th>Metallic terminating impedance</th></tr>
<tr><td>8 kHz to 12 kHz</td><td>-(6.4 + 12.6 log f) dBV</td><td>300Ω</td></tr>
<tr><td>12 kHz to 90 kHz</td><td>(23 - 40 log f) dBV</td><td>135Ω</td></tr>
<tr><td>90 kHz to 266 kHz</td><td>-55 dBV</td><td>135Ω</td></tr>
</table>
</td><td>Refer to Appendix C</td><td>P</td></tr>
<tr><td>5.1.8.2</td><td>Metallic voltage, 270 kHz to 30 MHz.
The rms value of the metallic voltage components in the frequency range of 270 kHz to 30 MHz shall, averaged over 2 μs, not exceed -15 dBV. This limitation applies with a metallic termination having an impedance of 135 Ω.
NOTE - A filter between the TE and the network interface may be necessary to meet this requirement.</td><td>Refer to Appendix C
RMS value
< -55dBV</td><td>P</td></tr>
<tr><td>5.1.8.3</td><td>Longitudinal voltage, 4 kHz to 270 kHz.
<table>
<tr><td>Centre frequency (f) of 8-kHz band</td><td>Max voltage in all 8kHz bands</td><td>Metallic terminating impedance</td></tr>
<tr><td>8 kHz to 12 kHz</td><td>-(18.4 + 20 log f) dBV</td><td>500Ω</td></tr>
<tr><td>12 kHz to 42 kHz</td><td>(3 - 40 log f) dBV</td><td>90Ω</td></tr>
<tr><td>42 kHz to 266 kHz</td><td>-62 dBV</td><td>90Ω</td></tr>
</table>
</td><td>Refer to Appendix C</td><td>P</td></tr>
<tr><td>5.1.8.4</td><td>Longitudinal voltage, 270 kHz to 6 MHz:
The rms value of the longitudinal voltage components, in the frequency range of 270 kHz to 6 MHz shall not exceed -30 dBV with a longitudinal termination having an impedance of 90 ohms.</td><td>Refer to Appendix C
RMS value
< -30dBV</td><td>P</td></tr>
<tr><td>5.1.9</td><td>Conditions for requirements in subclauses 5.1.7 and 5.1.8:</td><td></td><td>ND</td></tr>
</table>

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Clause	**Requirements**	**Remarks**	**Verdict**
5.1.9.1	All approved terminal equipment and approved protective circuitry shall comply with the limitations in the off-hook state over the range of loop currents that would flow with the equipment connected to an appropriate simulator circuit.		ND
5.1.9.2	Approved terminal equipment and approved protective circuitry with provision for through-transmission from other equipments shall comply with the limitations with a 1000 Hz tone applied from a 600 ohms source (or, if appropriate a source which reflects a 600 ohms impedance across tip and ring) at the maximum level that would be applied during normal operation. Approved protective circuitry for data shall also comply with the tone level 10 dB higher than the overload point.		N
5.1.9.3	For approved terminal equipment or approved protective circuitry with non-approved signal source input, such as music on hold, the out of band signal power requirements shall be met using an input signal with a frequency range of 200 Hz to 20 kHz and the level set at the overload point.		N
5.1.10	Analog voice band transverse balance limits:		P
5.1.10.1	Technical description and application: VL is the longitudinal voltage produced across a longitudinal termination RL of 500 ohms and VM is the metallic voltage across the tip-ring or tip-1 and ring-1 interface of the input port when a voltage in the frequency range from 200 Hz to 4 kHz is applied at all values of DC loop current that the port under test is capable of drawing when attached to the appropriate loop from a balanced source with a metallic impedance RM = 600 ohms as shown in figure 8. The source voltage shall be set such that VM = 0.775Vrms when a termination of RM is substituted for the terminal equipment.)		ND
5.1.10.2	The minimum transverse balance specified in table 5 shall be equaled or exceeded for all two-wire network ports, OPS line ports and the transmit pair (tip and ring) and receive pair (tip-1 and ring-1) of all four-wire network ports simulator circuits at all values of DC loop current that the port under test is capable of drawing when attached to the appropriate loop. An illustrative test circuit that satisfies the above conditions is shown in figure 8 for analog. The test circuit shall be balanced to 20 dB greater than the equipment standard for all frequencies specified (using trimmer capacitors C3 and C4), with a 600 ohm resistor substituted for the equipment under test. Other means may be used to determine the specified transverse balance, provided that adequate documentation of the appropriateness, precision, and accuracy of the alternative means is provided.		P
5.1.10.3	The minimum transverse balance requirements specified in 5.1.10.4 shall be equaled or exceeded under all reasonable conditions of the application of earth ground to the equipment or protective circuitry under test.		P
5.1.10.4	Analog voice band equipment: All approved analog voice band equipment shall be tested in the off-hook state. The minimum	Measured: > 63 dB	P

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Clause	**Requirements**	**Remarks**	**Verdict**
	transverse balance requirement in the off-hook state shall be 40 dB, throughout the range of frequencies specified in table 5. For some categories of equipment, transverse balance requirements also apply to the on-hook state. When both off-hook and on-hook requirements apply, they shall be: Table 5	200 Hz to 4 kHz, Offhook and onhook, before and after surge tests.	
5.1.10.4.1	For analog one-port two-wire terminal equipment with loop start, ringdown, or inband signaling or for voice band metallic channel applications, both off-hook and on-hook requirements shall apply. The tip-ground state of loop start central office implemented telephones is excluded from this requirement.		P
5.1.10.4.2	For analog one-port equipment with ground start and reverse-battery signaling only off-hook requirements shall apply.		N
5.1.10.4.3	For analog approved protective circuitry for two-wire applications with loop start, ringdown, or in-band signaling, or for voice band metallic channel applications, both off-hook and on-hook requirements shall apply. Criteria shall be met with either terminal of the interface to other equipment connected to earth ground. The interface to other equipment shall be terminated in an impedance reflected to the telephone connection as 600 ohms in the off-hook state of the approved protective circuit, and the interface shall not be terminated in the on-hook state. The arrangement of figure 9 shall be used where the impedance Z shall be selected so that the reflected impedance at tip and ring is 600 ohms.		N
5.1.10.4.4	For analog approved protective circuitry with ground start and reverse-battery signaling only off-hook requirements shall apply.		N
5.1.10.4.5	For analog multi-port equipment with loop start signaling both off-hook and onhook requirements shall apply.		ND
5.1.10.4.6	For analog multi-port equipment with ground start and reverse-battery signaling, only off-hook requirements shall apply.		N
5.1.10.4.7	For analog approved terminal equipment and protective circuitry for four-wire network ports, both the off-hook and on-hook requirements shall apply. The pairs not under test shall be terminated in a metallic impedance of 600 ohms.		N
5.1.10.4.8	For analog PBX equipment (or similar systems) with class B or class C off premises interfaces, only off-hook requirements shall apply.		N
5.1.11	Loop start interfaces:		P
5.1.11.1	General: Requirements in this section shall apply to the tip and ring conductors of two-wire and four-wire loop start interfaces in the following configuration:		ND
5.1.11.1.1	The tip and ring conductors shall be connected together and treated as one of the conductors of a tip and ring pair.		ND

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Clause	**Requirements**	**Remarks**	**Verdict**
5.1.11.1.2	The tip-1 and ring-1 conductors shall be connected together and treated as the other conductor of a tip and ring pair.		ND
5.1.11.1.3	Figure 11 shows a loop simulator for 2-wire loop start interfaces that is referenced for several requirements in clauses 4.4 and 5.1. The alternative termination in figure 13 may be used during signal power compliance testing in place of R1 (600 ohms) in the applicable loop simulator circuit.		ND
5.1.11.1.4	Figure 12 defines the loop simulator for 4-wire loop start interfaces that is referenced for several requirements in clauses 4.4 and 5.1 Figure 13 is an alternative termination for use in the four-wire loop simulator circuits.		ND
5.1.11.1.5	References will be made to simulated ringing throughout this subclause. Ringing voltages which shall be used and impedance limitations associated with simulated ringing are shown in table 6.		ND
5.1.11.2	Limitations on equipment intended for operation on loop start telephone facilities: Approved terminal equipment and approved protective circuitry shall conform to the following limitations.	See appendix C.	P
5.1.11.2.1	On-hook resistance, metallic and longitudinal (up to 100 VDC): The on-hook DC resistance between the tip and ring conductors of a loop start interface, and between each of the tip and ring conductors and earth ground, shall be greater than 5 M ohms for all DC voltages up to and including 100 V.	See appendix C.	P
5.1.11.2.2	On-hook resistance, metallic and longitudinal (100 to 200 VDC): The on-hook DC resistance between tip and ring conductors of a loop start interface, and between each of the tip and ring conductors and earth ground shall be greater than 30 k ohms for all DC voltages between 100 and 200 V.	See appendix C.	P
5.1.11.2.3	DC current during ringing: During the application of simulated ringing, as listed in table 6, to a loop start interface, the total DC current shall not exceed 3.0 mA. The equipment shall comply for each ringing type that is listed as part of the ringer equivalence.	See appendix C.	P
5.1.11.2.4	Ringing frequency impedance (metallic): During the application of simulated ringing, as listed in table 6 to a loop start interface, the impedance between the tip and ring conductors (defined as the quotient of applied AC voltage divided by resulting true rms current) shall be greater than or equal to the value specified in table 6. The equipment shall comply for each ringing type that is listed as part of the ringer equivalence.	See appendix C.	P
5.1.11.2.5	Ringing frequency impedance (longitudinal): During the application of simulated ringing as listed in table 6 to a loop start interface, the impedance between each of the tip and ring conductors and ground shall be greater than 100 k ohms. The equipment shall comply with each ringing type listed in the ringer equivalence.	See appendix C.	P

<table>
<tr><th colspan="4">ANSI/TIA-968-B</th></tr>
<tr><th>Clause</th><th>Requirements</th><th>Remarks</th><th>Verdict</th></tr>
<tr><td></td><td>Table 6 –
Simulated ringing voltages and impedance limitations
<table>
<tr><th>Ringing type</th><th>Range of compatible ringing frequencies (Hz)</th><th>Simulated ringing voltage on 56.5 VDC</th><th>Impedance limitation (ohms)</th></tr>
<tr><td>A</td><td>20± 3</td><td>40 to 130 V rms</td><td>1400</td></tr>
<tr><td></td><td>30± 3</td><td>40 to 130 V rms</td><td>1000</td></tr>
<tr><td>B</td><td>15.3 to 34</td><td>40 to 130 V rms</td><td>1600</td></tr>
<tr><td></td><td>>34 to 49</td><td>62 to 130 V rms</td><td>1600</td></tr>
<tr><td></td><td>>49 to 68</td><td>62 to 150 V rms</td><td>1600</td></tr>
</table></td><td></td><td>ND</td></tr>
<tr><td>5.1.11.2.6</td><td>Ringer equivalence definition: The ringer equivalence number shall be the value determined in 5.1.11.2.7 or 5.1.11.2.8, as appropriate, followed by the ringer type letter indicator representing the frequency range for which the number is valid. If ringer equivalence is to be stated for more than one ringing type, testing shall be performed at each frequency range to which ringer equivalence is to be determined in accordance with the above, and the largest resulting ringer equivalence number so determined shall be associated with each ringing type letter designation for which it is valid.</td><td>See appendix C.</td><td>P</td></tr>
<tr><td>5.1.11.2.7</td><td>Ringer equivalence for equipment operating on loop start telephone facilities: The ringer equivalence shall be five times the impedance limitation listed in table 6, divided by the minimum measured AC impedance, as defined in 5.1.11.2.8, during the application of simulated ringing as listed in table 6.</td><td>See appendix C.</td><td>P</td></tr>
<tr><td>5.1.11.2.8</td><td>Maximum ringer equivalence: All approved terminal equipment and approved protective circuitry that can affect the ringing frequency impedance shall be assigned a ringer equivalence. The sum of all such ringer equivalences on a given telephone line or loop shall not exceed 5. In some cases, a system that has a total ringer equivalence of 5 or more may not be usable on a given telephone line or loop.</td><td>See appendix C.</td><td>P</td></tr>
<tr><td>5.1.11.3</td><td>Transitioning to the off-hook state: Except as provided in 5.1.11.3.1 and 5.1.11.3.2 below, approved terminal equipment and approved protective circuitry shall not by design leave the on-hook state by operations performed on tip and ring leads for any other purpose than to request service or answer an incoming call. Make-busy indications shall be transmitted by the use of make-busy leads only as defined in clause 3.1.</td><td></td><td>P</td></tr>
<tr><td>5.1.11.3.1</td><td>Manual programming of memory dialing numbers: Terminal equipment the user places in the off-hook state for the purpose of manually placing telephone numbers in internal memory for subsequent automatic or repertory dialing shall be acceptable for connection to the telephone network provided it meets all other applicable requirements.</td><td></td><td>N</td></tr>
</table>

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Clause	**Requirements**	**Remarks**	**Verdict**
5.1.11.3.2	Automatic stutter dial tone detection.		N
5.1.11.4	Voice and data equipment loop current requirements for equipment connected to the public switched network: The loop current through approved terminal equipment or approved protective circuitry, when connected to a two-wire or fourwire loop simulator circuit with the 600 ohm resistor and 500 µF capacitor of the two-wire loop simulator circuit or both pairs of the four-wire loop simulator circuit disconnected shall, for at least 5 seconds after the equipment goes to the off-hook state or hold state that would occur when answering an incoming call:	See appendix C.	P
	a) Be at least as great as the current obtained in the same loop simulator circuit with minimum battery voltage and a maximum loop resistance when a 200 ohm resistance is connected across the tip and ring of the two-wire loop simulator circuit or connected across the tip/ring and tip-1/ring-1 conductors (tip and ring connected together and tip-1 and ring-1 connected together) of the four-wire loop simulator circuit in place of the approved terminal equipment or approved protective circuitry; or		ND
	b) Not decrease by more than 25% from its maximum value attained during this 5-second interval; unless the equipment is returned to the on-hook state during the above 5-second interval.	<1 %	P
5.1.12	Ground start interfaces:		N
5.1.13	Loop reverse-battery – Incoming:		N
5.1.14	Loop reverse-battery – Outgoing:		N
5.1.15	E&M:		N
5.1.16	Off premises station (OPS):		N
5.1.17	Private line (ringdown, voice band metallic, and in-band):		N
5.2	**LADC AND DIGITAL INTERFACE REQUIREMENTS**		**N**
5.2.1	Local area data channel (LADC):		N
5.2.2	Subrate digital and PSDS Type I interfaces:		N
5.2.3	PSDS Type II and Type III interfaces:		N
5.2.4	DS1 and ISDN PRI terminal equipment:		N
5.3	**ISDN & DSL INTERFACE REQUIREMENTS**		**N**
6	**SPECIAL CASES**		**P**
6.1	**COMPONENT APPROVAL**		**N**
6.2	**SERIES DEVICES**		**P**

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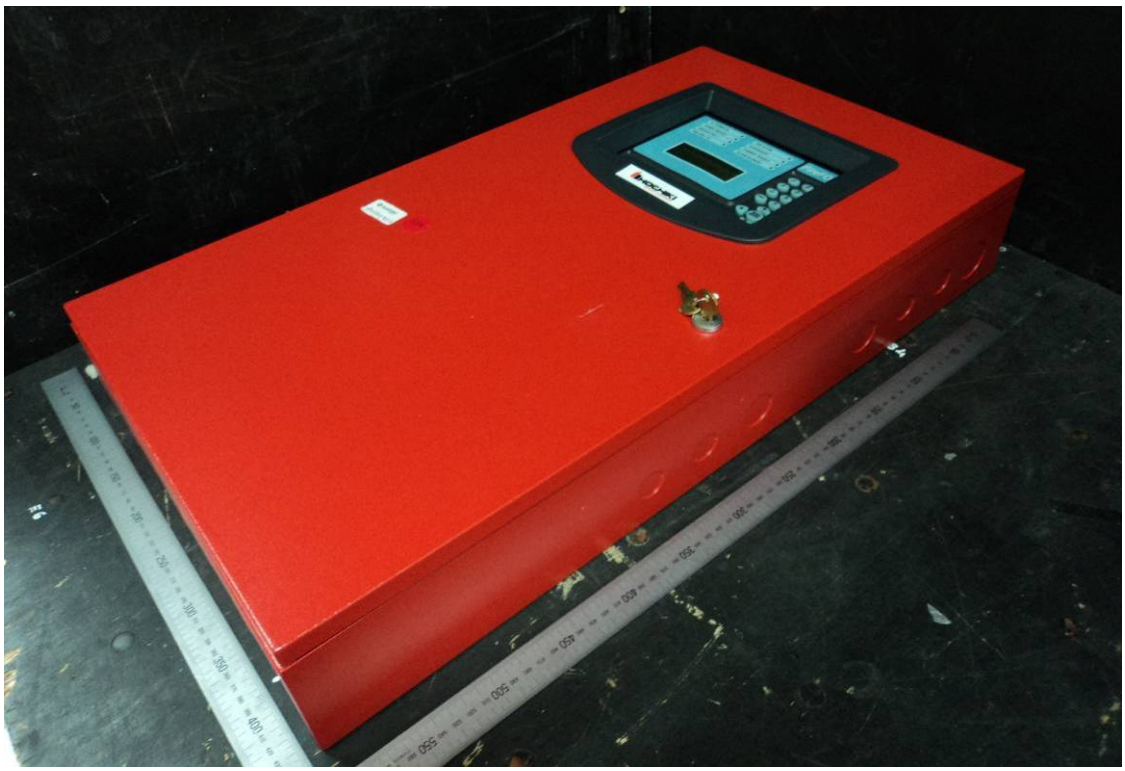
Clause	**Requirements**	**Remarks**	**Verdict**
6.2.1	Devices designed to be connected in series with other terminal equipment shall be tested for transverse balance in all modes that can occur in normal use. Criteria shall be satisfied for all ports when all of the ports not under test are terminated in networks that simulate conditions that can occur in normal use. For analog voice band equipment, an off-hook telephone may be simulated as shown in figure 65. An on-hook telephone may be simulated as shown in figure 66. An ADSL modem may be simulated as shown in figure 67.		P

***** End of Report Body *****

APPENDIX A: Photographic Record of Sample(s)






A3
AC POWER ON
POWER TROUBLE
GROUND FAULT
FIRE DRILL ON
FIRE ALARM
SUPERVISORY
COMMON TROUBLE
ALARM SILENCED
FireFOCUS
ACK

APPENDIX B: Common Requirements

4.1 Environmental Simulation

TIA-968	Description	Limit	Verdict
4.1.2.1	Tip/Ring Metallic Surge A, +/- Online	800 V	P
	Tip/Ring Metallic Surge A, +/- Offline	800 V	P
4.1.2.2	Longitudinal Surge A, +/- Online	1500 V	P
	Longitudinal Surge A, +/- Offline	1500 V	P
4.1.3.1	Tip/Ring Metallic Surge B, +/- Online	1000 V	P
	Tip/Ring Metallic Surge B, +/- Offline	1000 V	P
4.1.3.2	Longitudinal Surge B, +/- Online	1500 V	P
	Longitudinal Surge B, +/- Offline	1500 V	P
4.1.4	Phase/Neutral, 3 surges	2500 V	P

4.2 Leakage Current

TIA-968	Description	Limit	Result	Verdict
4.3	Telephone to surfaces 1000 VAC	<= 10 mA	< 10 mA	P
	Telephone to power 1500VAC	<= 10 mA	< 10 mA	P
	Telephone to aux 1000 VAC	<= 10 mA	< 10 mA	P
	Power to surfaces 2122 VDC	<= 10 mA	< 10 mA	P
	Power to aux. 2122 VDC	<= 10 mA	< 10 mA	P

4.3 Hazardous Voltage

TIA-968	Description	Limit	Result	Verdict
4.3.1	Tip/Ring Measurement	<= 70 Vp	< 2 Vp	P
	Tip/Earth	<= 70 Vp	< 5 Vp	P
	Ring/Earth	<= 70 Vp	< 5 Vp	P

APPENDIX C: Analogue Voice-band Interface

5.1.3 Voiceband Signal Power-Network Control Signals, DTMF (dBm)

a). Negative Polarity 400 Ω

Digit	Pre-surge	Post-surge	Limit	Verdict
1	-9.6 dBm	-23 dBm	<= 0 dBm	P
2	-9.7 dBm	-23 dBm	<= 0 dBm	P
3	-9.7 dBm	-23 dBm	<= 0 dBm	P
4	-9.7 dBm	-23 dBm	<= 0 dBm	P
5	-9.7 dBm	-23 dBm	<= 0 dBm	P
6	-9.7 dBm	-22 dBm	<= 0 dBm	P
7	-9.7 dBm	-23 dBm	<= 0 dBm	P
8	-9.7 dBm	-23 dBm	<= 0 dBm	P
9	-9.7 dBm	-23 dBm	<= 0 dBm	P
0	-9.6 dBm	-23 dBm	<= 0 dBm	P

b). Positive Polarity 1700 Ω

Digit	Pre-surge	Post-surge	Limit	Verdict
1	-8.9 dBm	-13 dBm	<= 0 dBm	P
2	-8.9 dBm	-13 dBm	<= 0 dBm	P
3	-8.9 dBm	-13 dBm	<= 0 dBm	P
4	-8.9 dBm	-13 dBm	<= 0 dBm	P
5	-8.9 dBm	-13 dBm	<= 0 dBm	P
6	-8.9 dBm	-13 dBm	<= 0 dBm	P
7	-8.9 dBm	-13 dBm	<= 0 dBm	P
8	-8.9 dBm	-13 dBm	<= 0 dBm	P
9	-8.9 dBm	-13 dBm	<= 0 dBm	P
0	-8.9 dBm	-13 dBm	<= 0 dBm	P

5.1.6 Signal Power 3995 - 4005 Hz. (Non Network Control) (dBm)

Conditions	Pre-surge	Post-surge	Limit	Verdict
DTMF	< -55 dBm	< -55 dBm	<= -27 dBm	P
1/0 Transmission	< -55 dBm	< -55 dBm	<= -27 dBm	P

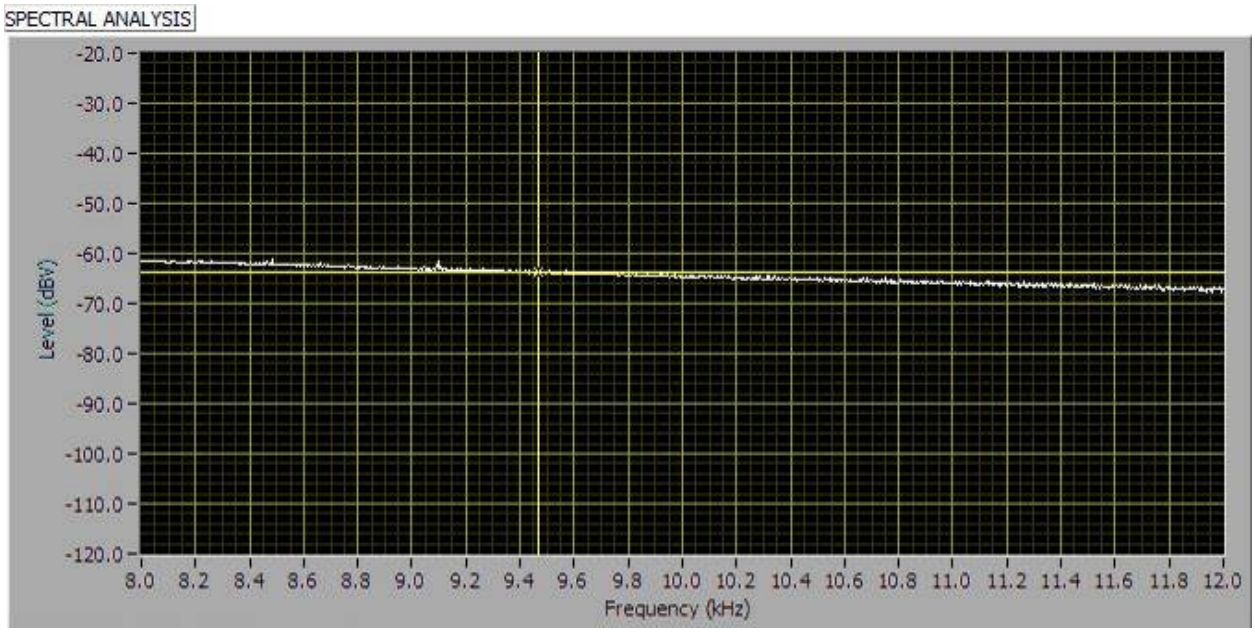
5.1.7 Longitudinal Voltage at Frequencies below 4kHz

	Pre-surge	Post-surge	Limit	Verdict
500Ω Positive Max Current	< -60 dBV	< -60 dBV	< -30 dBV	P
500Ω Negative Min Current	< -60 dBV	< -60 dBV	< -30 dBV	P
500Ω On hook	< -60 dBV	< -60 dBV	< -30 dBV	P

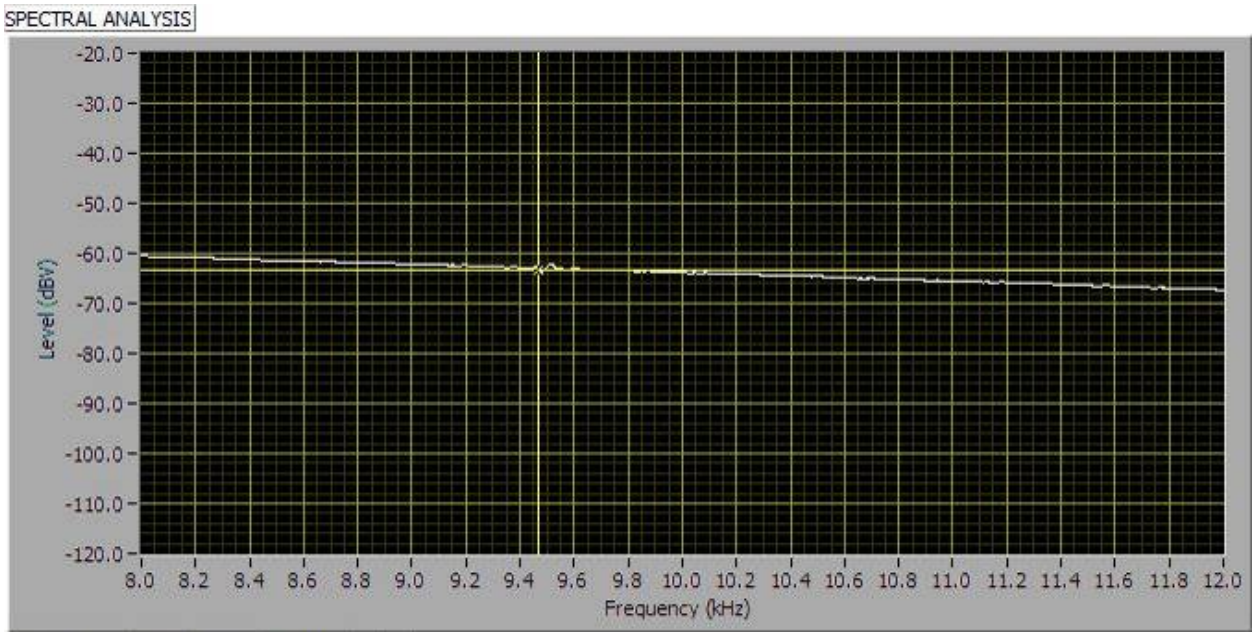
5.1.8.1 & 5.1.8.2 Metallic Voltage in the 8kHz to 30 MHz frequency range

a). Metallic 8 kHz to 12 kHz. Positive. 300 Ω. Max current

PRE-ENVIRONMENTAL

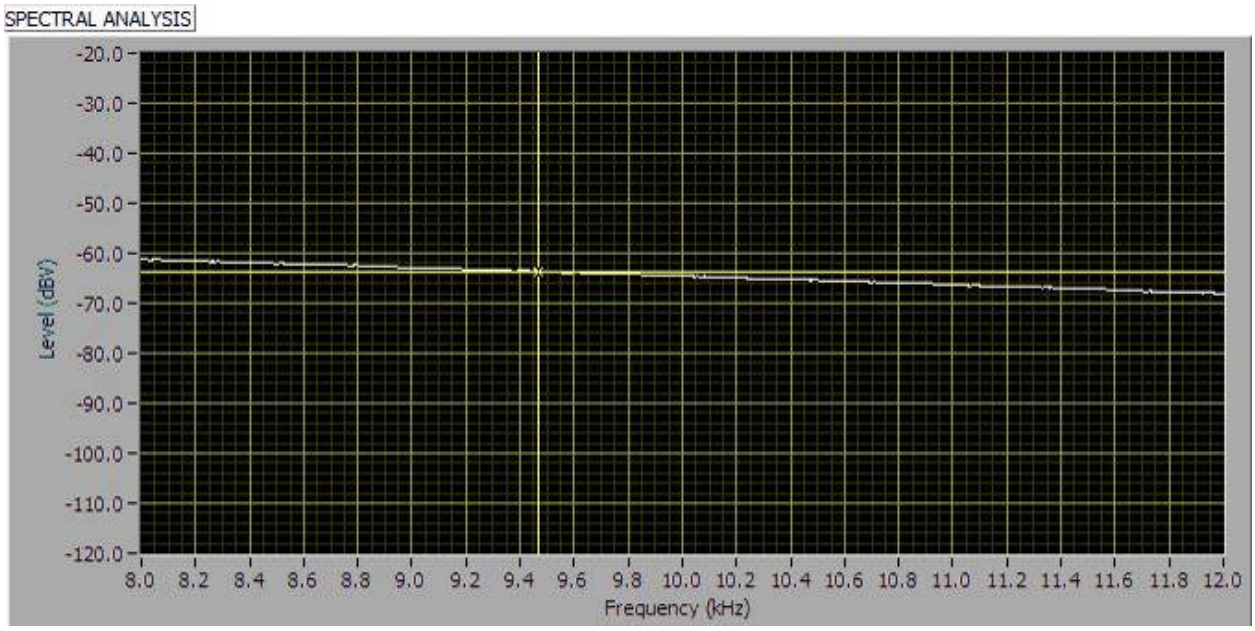


POST-ENVIRONMENTAL

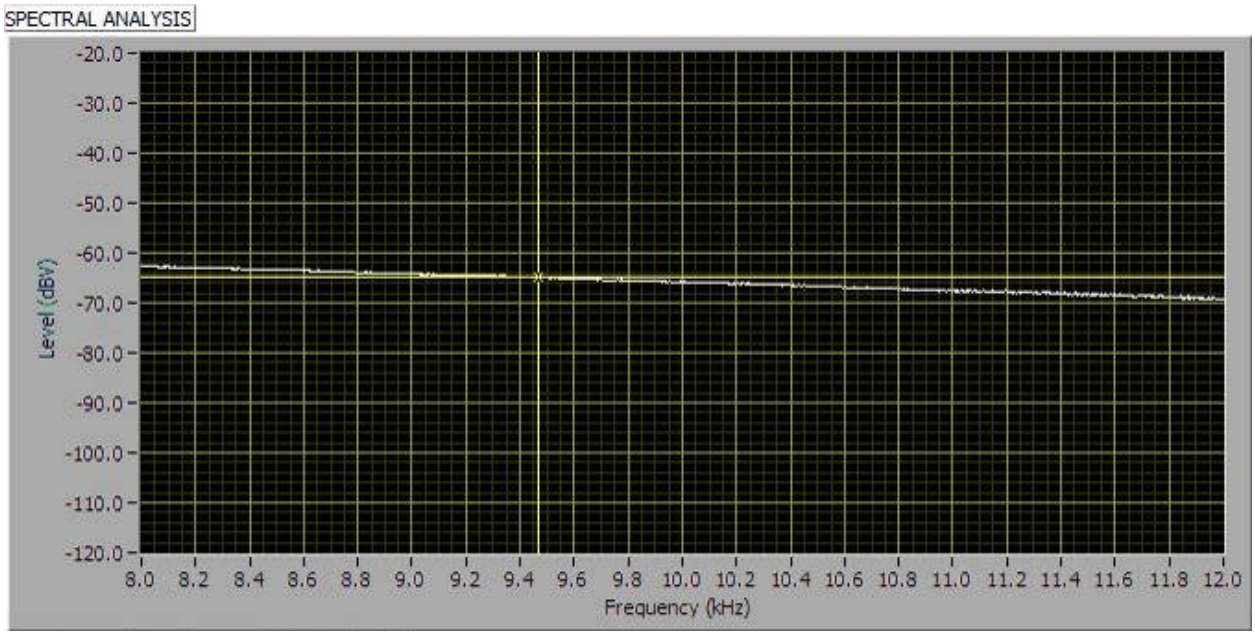


b). Metallic 8 kHz to 12 kHz. Negative. 300 Ω. Min current

PRE-ENVIRONMENTAL

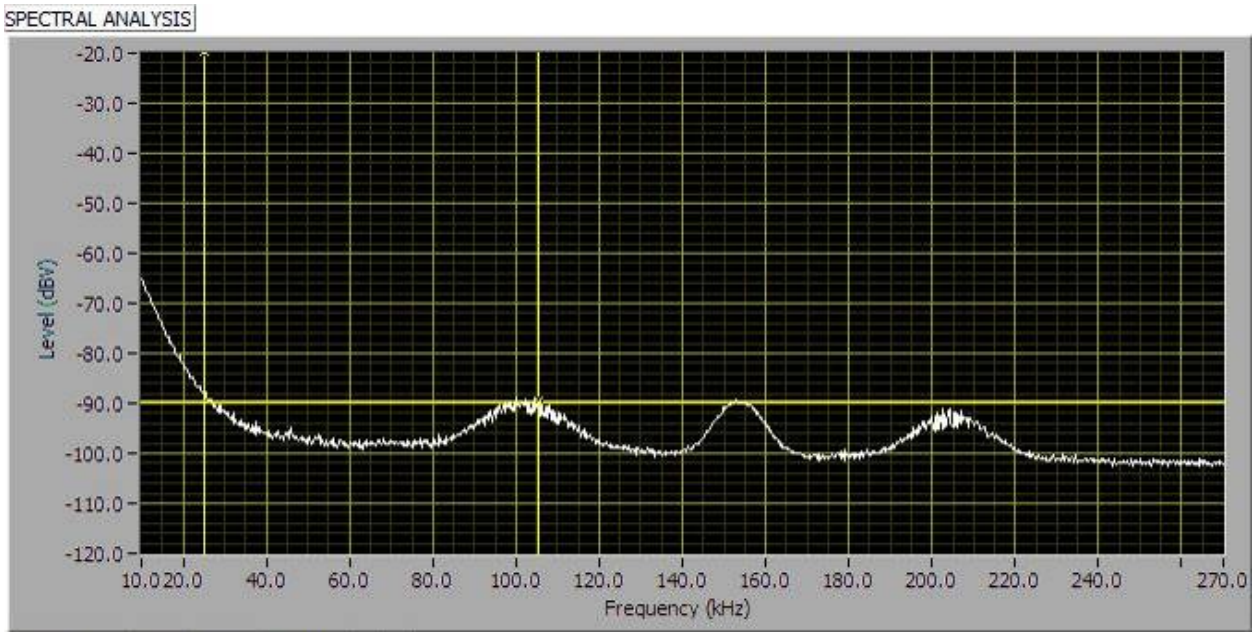


POST-ENVIRONMENTAL

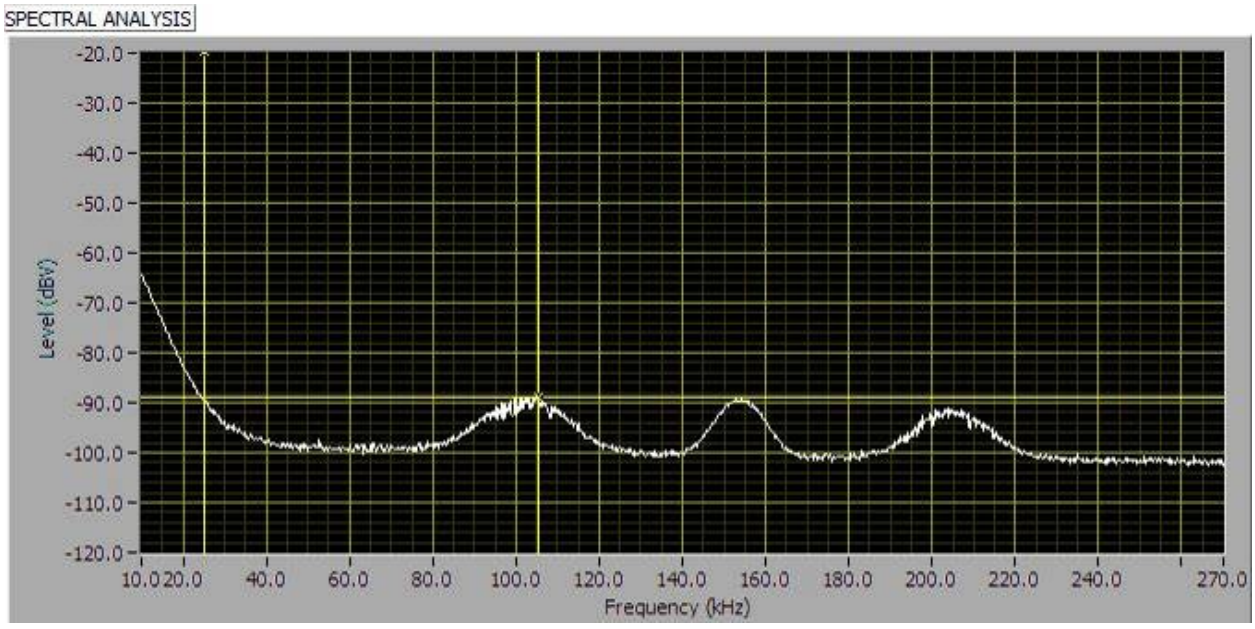


c). Metallic 12 kHz to 270 kHz. Positive. 135 Ω. Max current

PRE-ENVIRONMENTAL

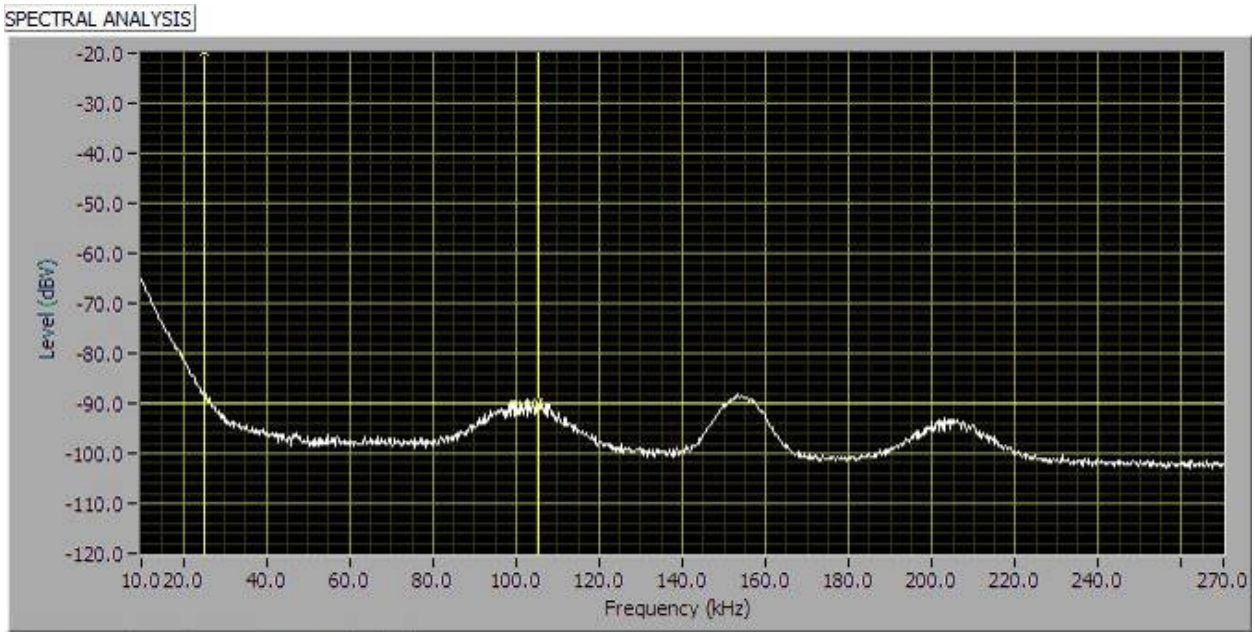


POST-ENVIRONMENTAL

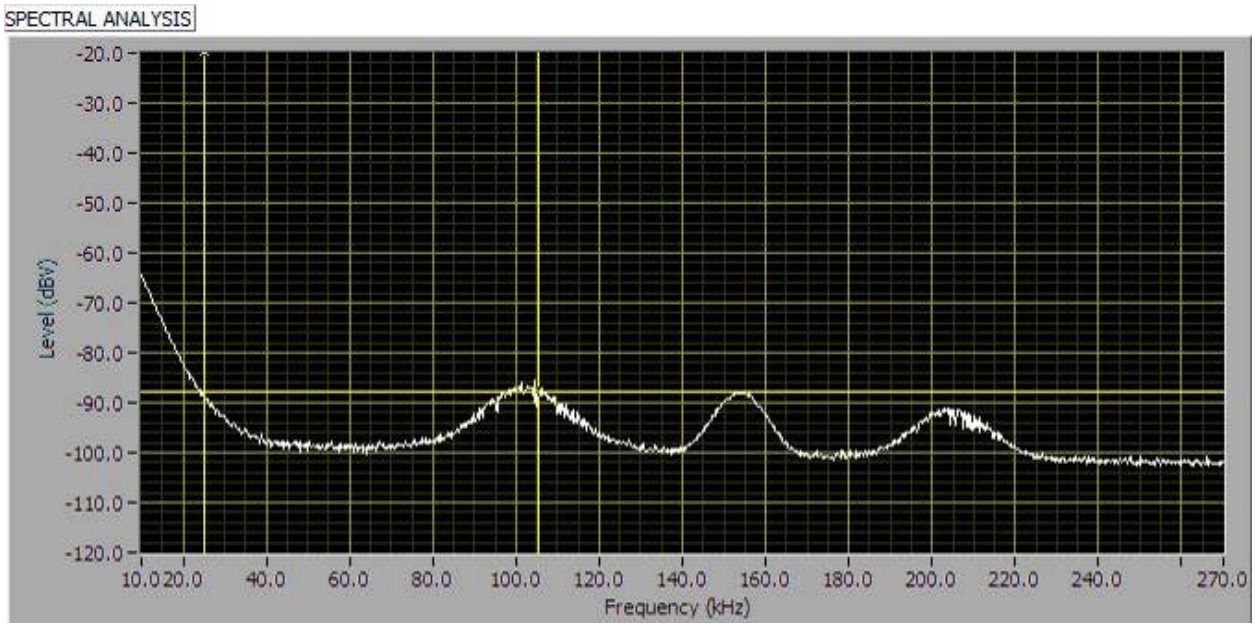


d). Metallic 12 kHz to 270kHz. Negative. 135 Ω. Min current

PRE-ENVIRONMENTAL

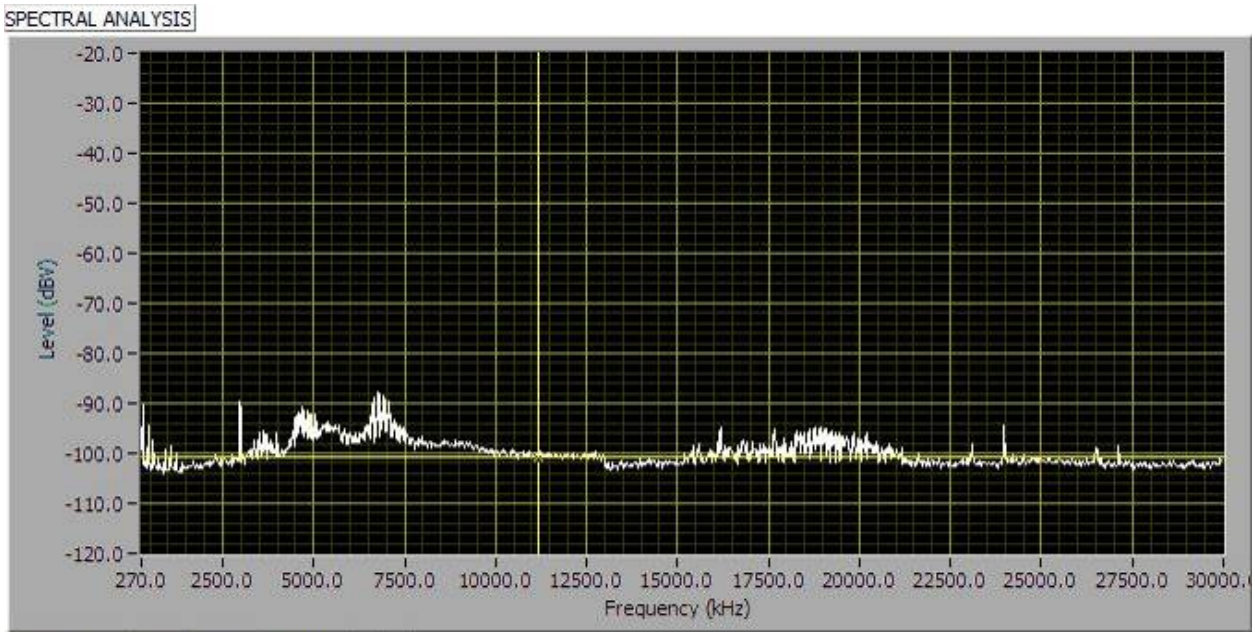


POST-ENVIRONMENTAL

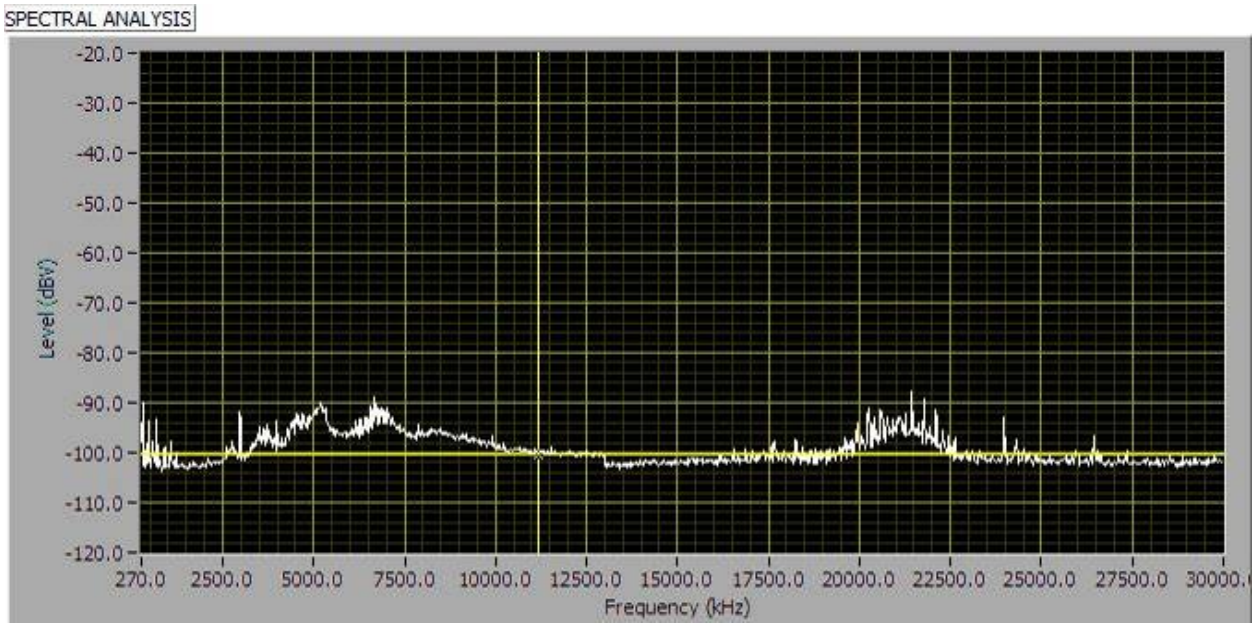


e). Metallic 270 kHz to 30 MHz. Positive. 135 Ω. Max current

PRE-ENVIRONMENTAL

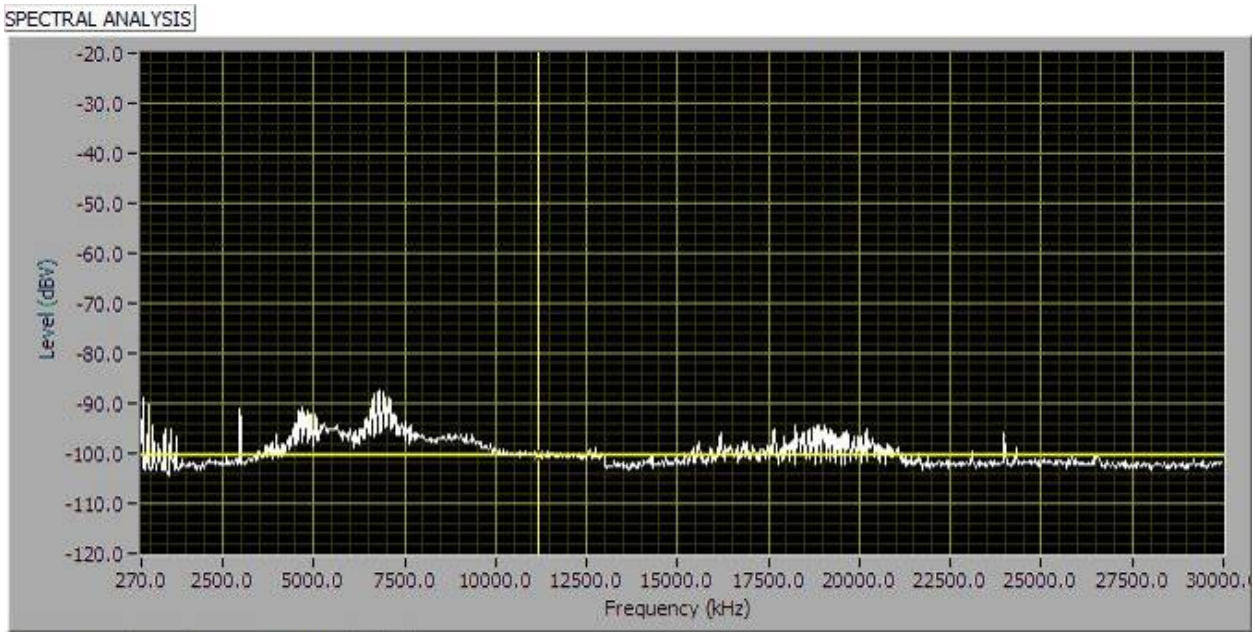


POST-ENVIRONMENTAL

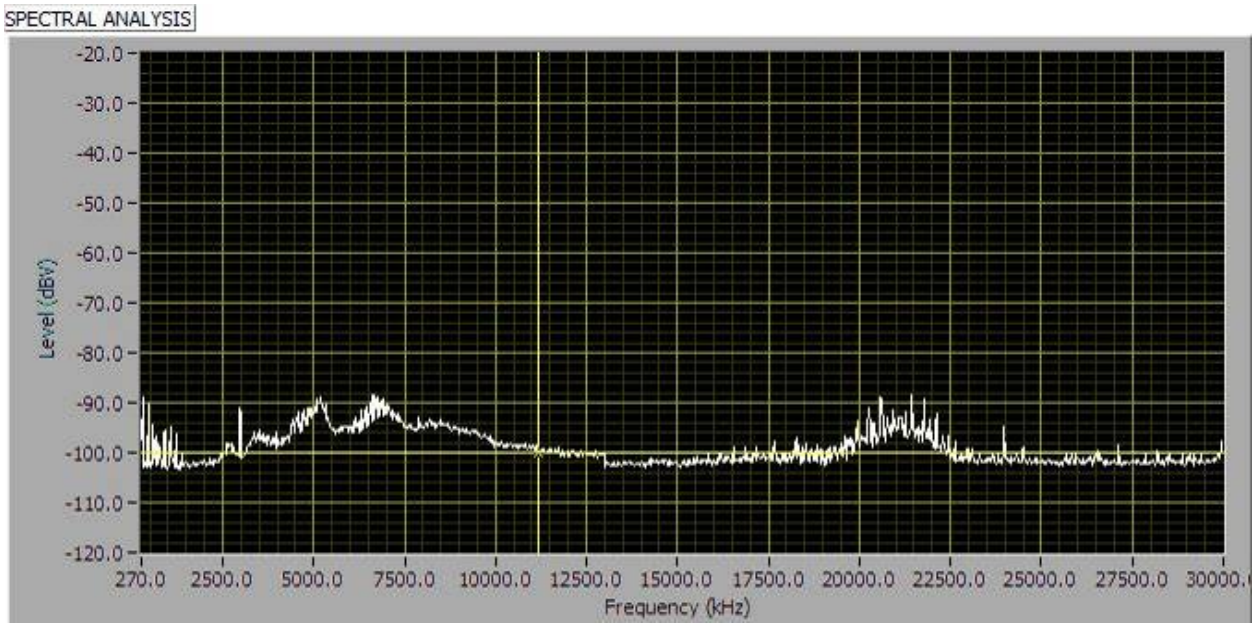


f). Metallic 270kHz to 30MHz. Negative. 135 Ω. Min current

PRE-ENVIRONMENTAL



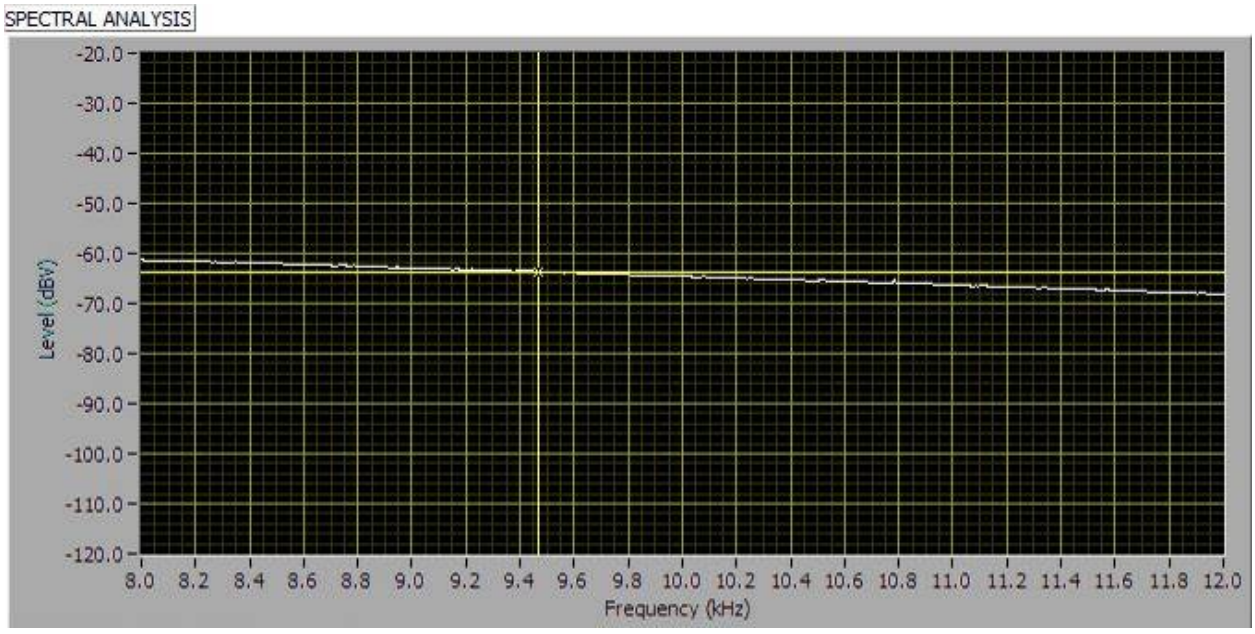
POST-ENVIRONMENTAL



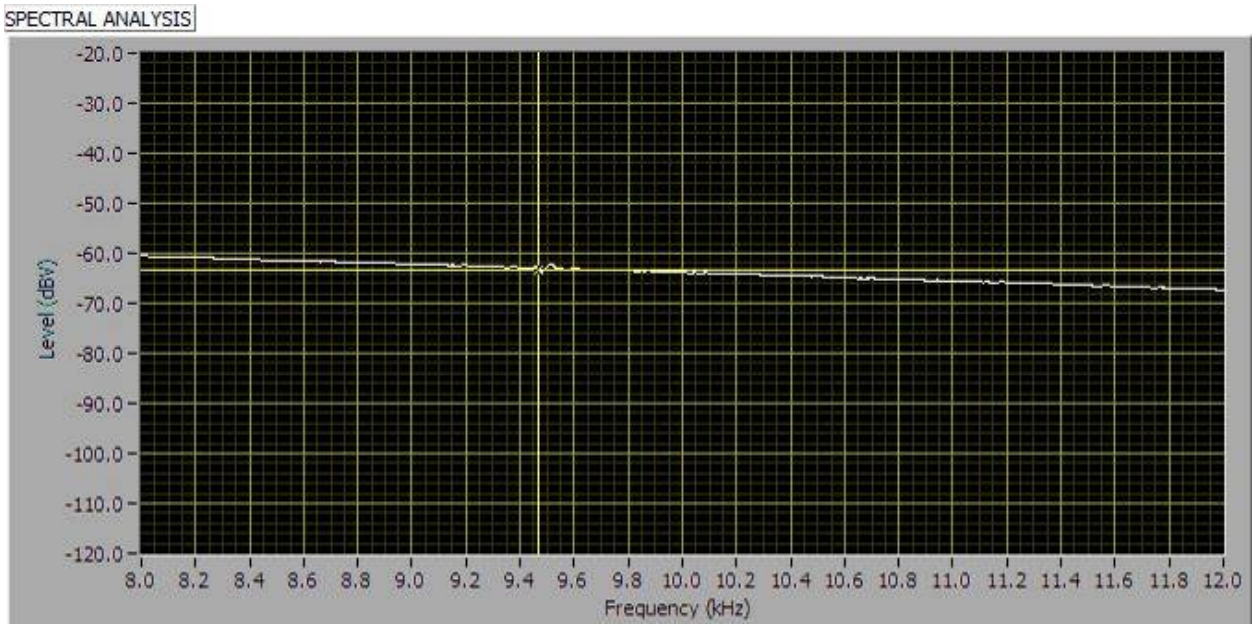
5.1.8.3 & 5.1.8.4 Longitudinal Voltage 4 kHz to 6 MHz

a).Longitudinal 8kHz to 12kHz. Positive. 500 Ω. Max current

PRE-ENVIRONMENTAL

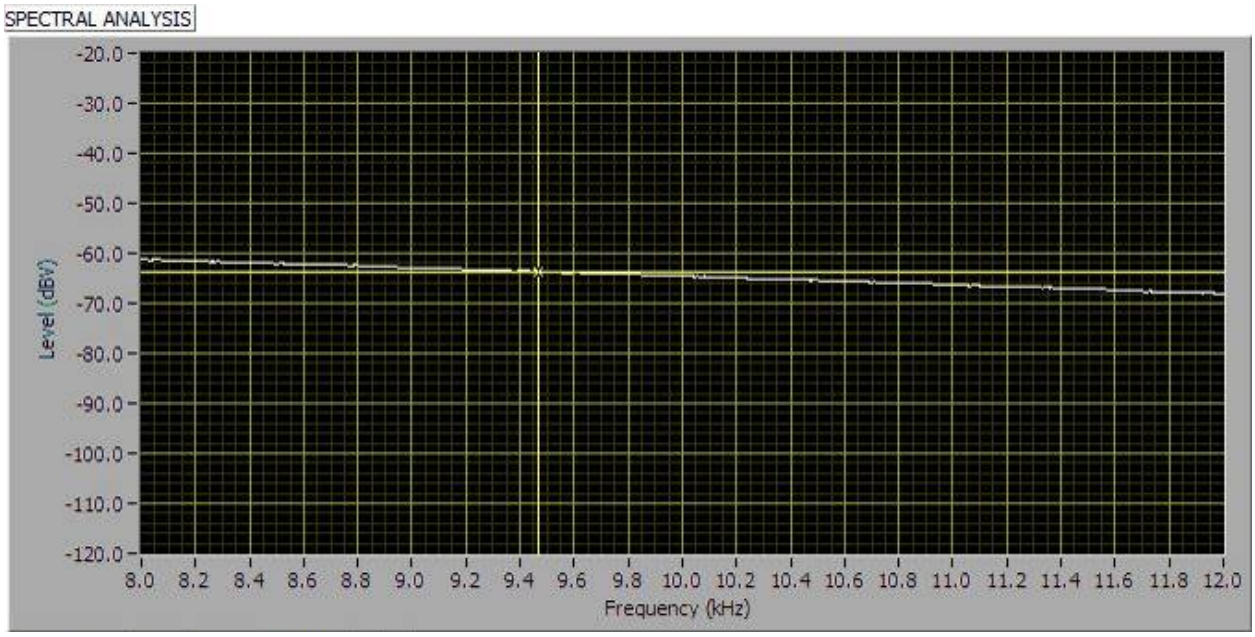


POST ENVIRONMENTAL

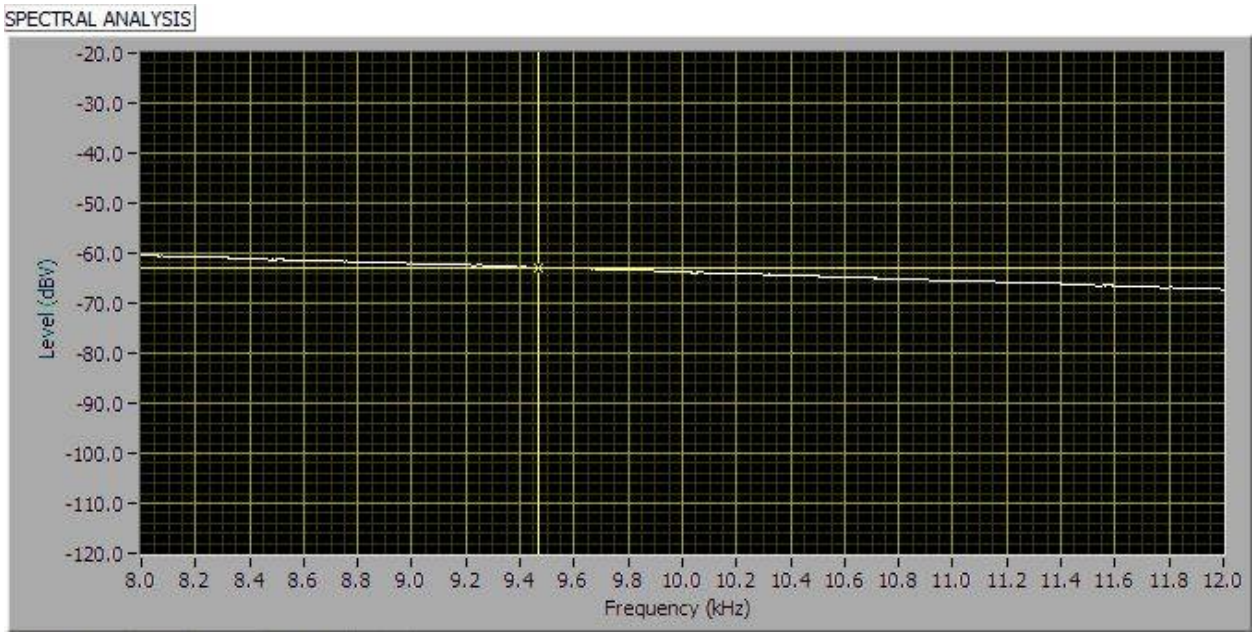


b). Longitudinal 8kHz to 12kHz. Negative. 500 Ω. Min current

PRE-ENVIRONMENTAL

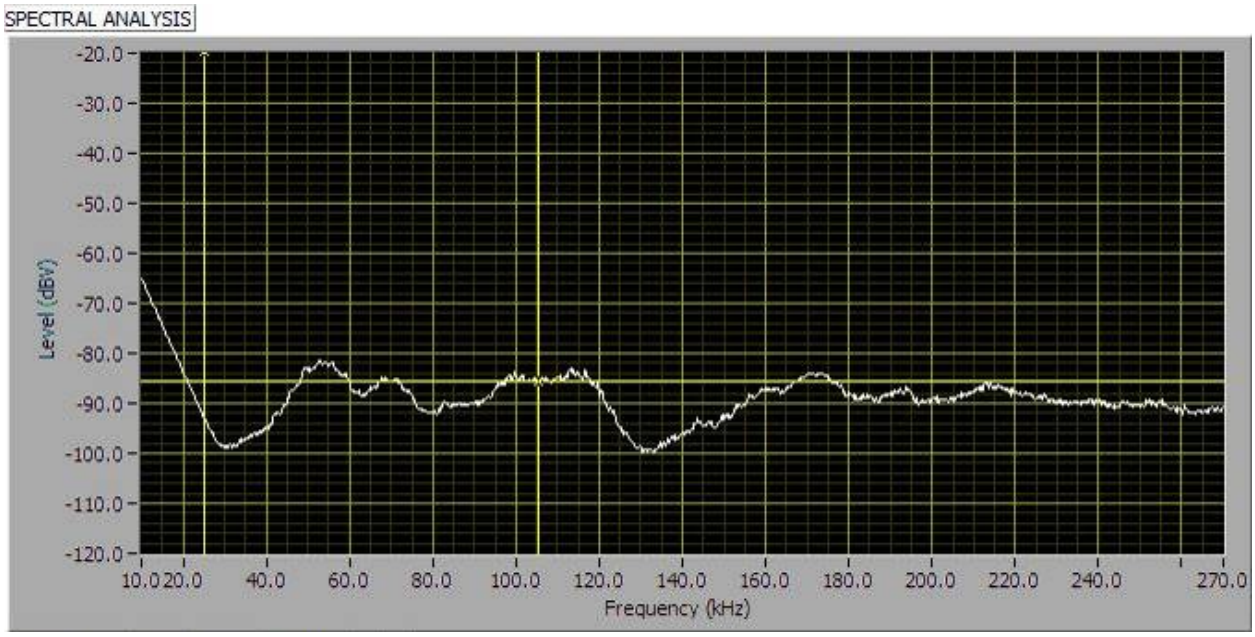


POST ENVIRONMENTAL

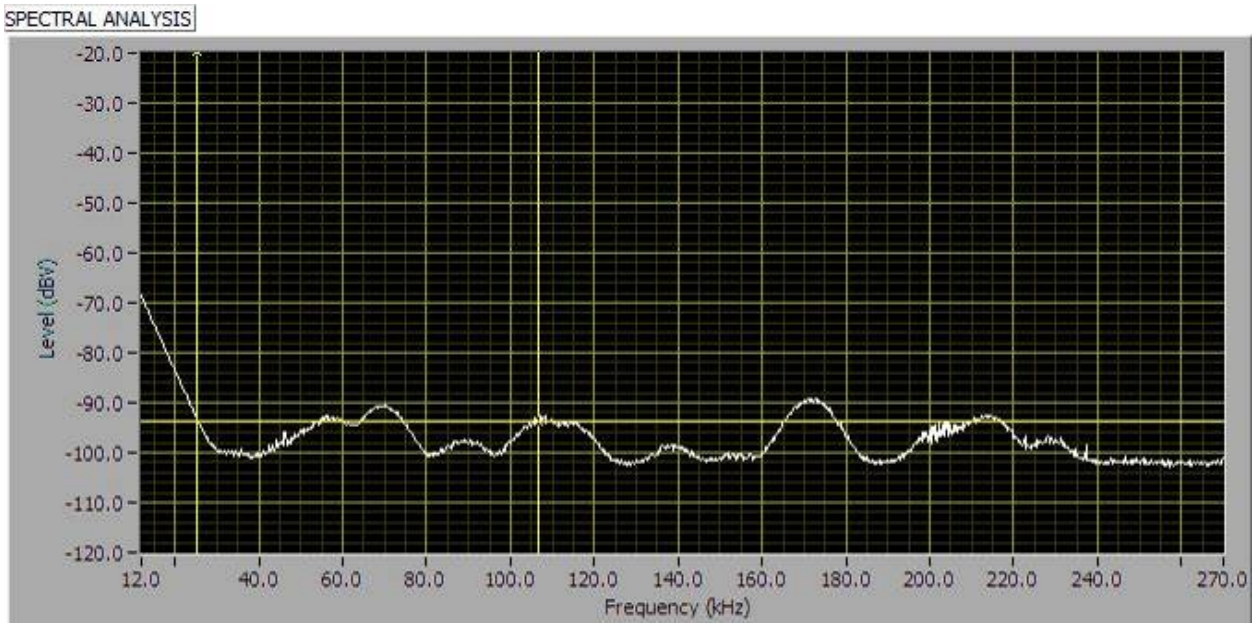


c). Longitudinal 12kHz to 270kHz. Positive. 90 Ω. Max current

PRE-ENVIRONMENTAL

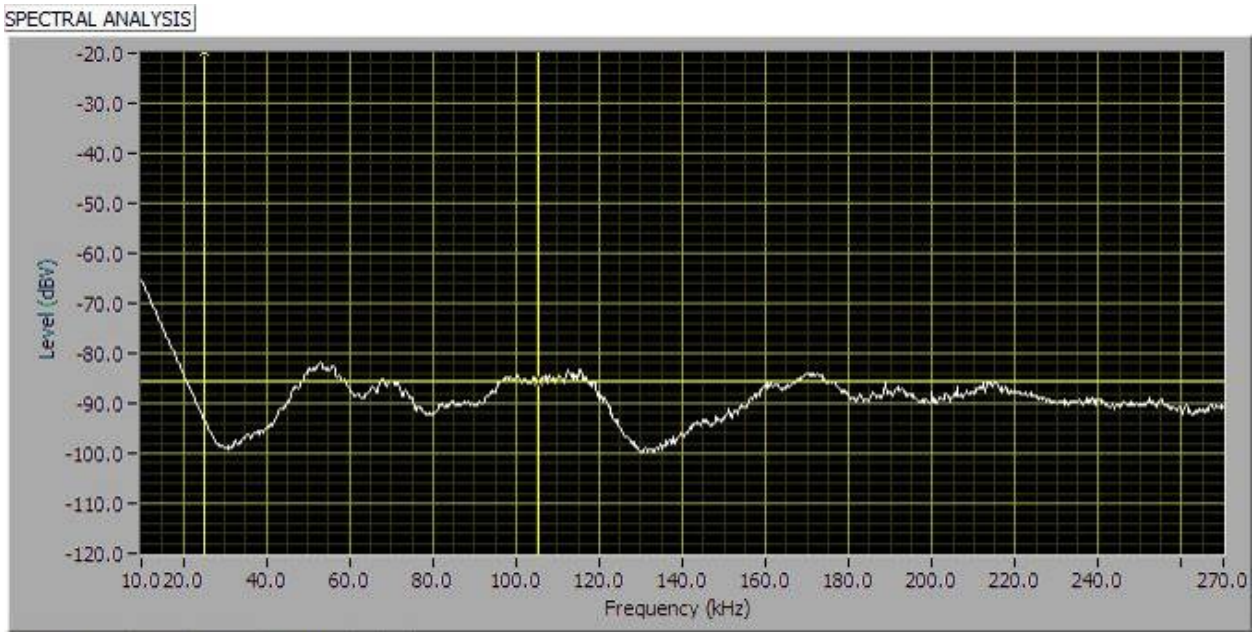


POST ENVIRONMENTAL

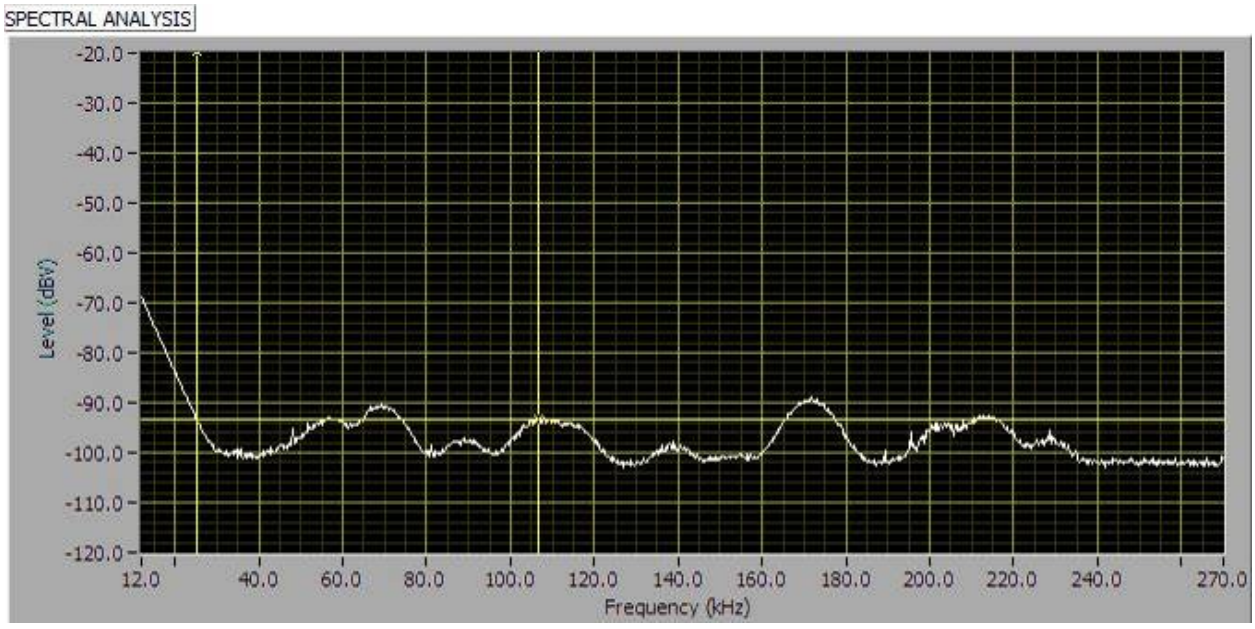


d) Longitudinal 12kHz to 270kHz. Negative. 90 Ω. Min current

PRE-ENVIRONMENTAL

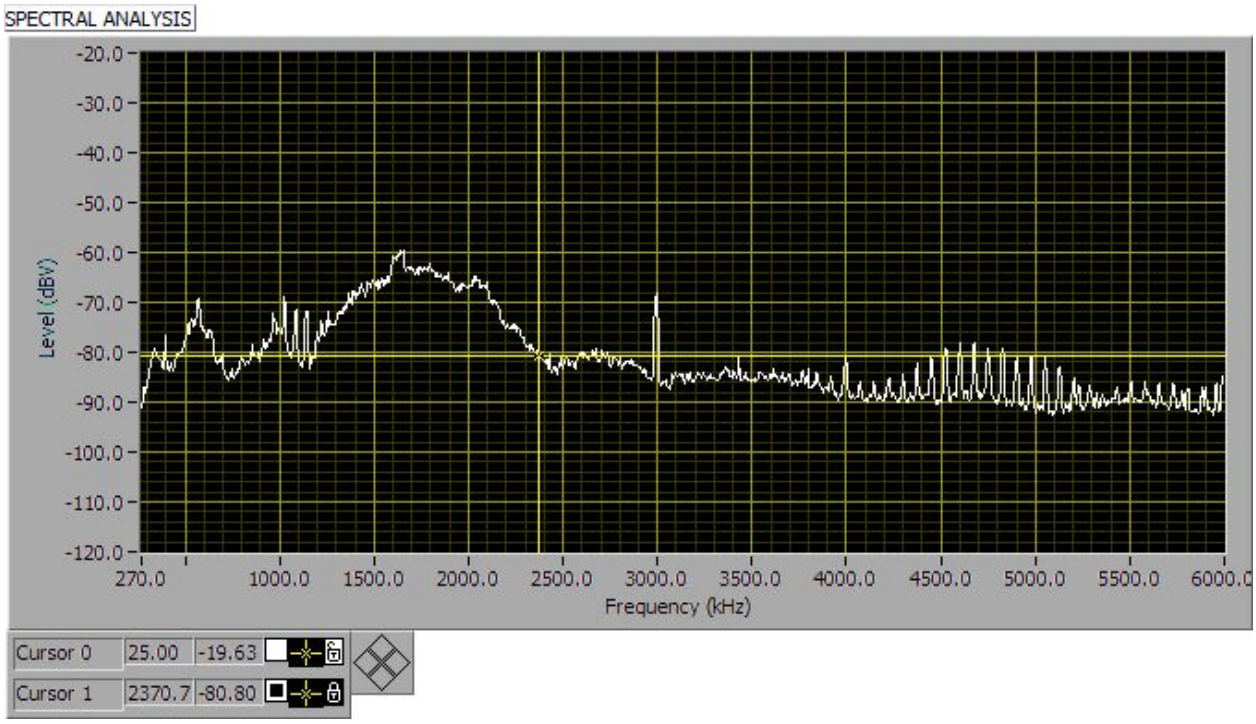


POST ENVIRONMENTAL

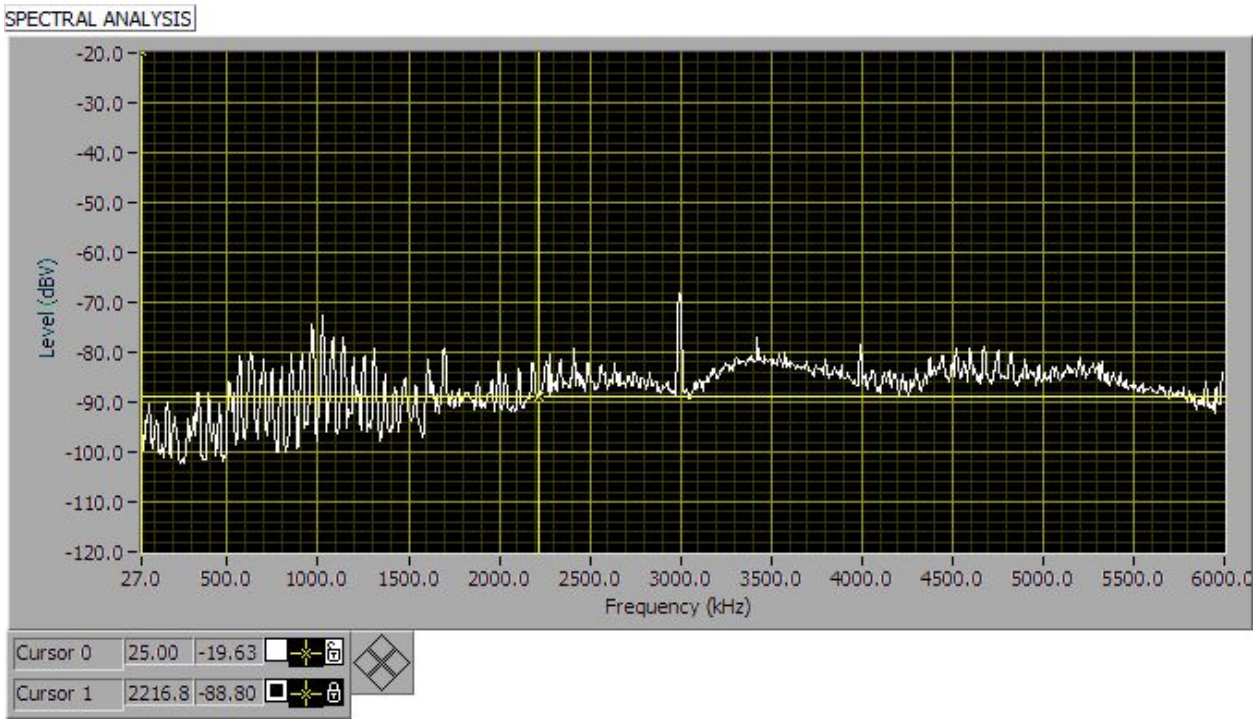


e). Longitudinal 270kHz to 6MHz. Positive. 90 Ω. Max current

PRE-ENVIRONMENTAL

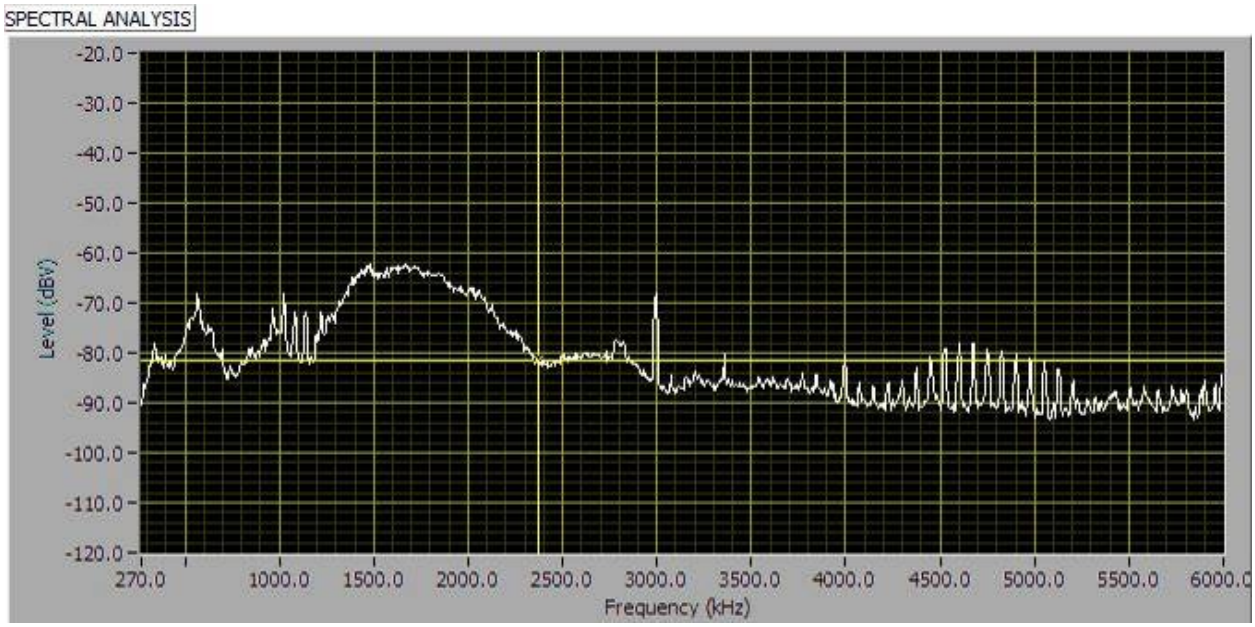


POST ENVIRONMENTAL

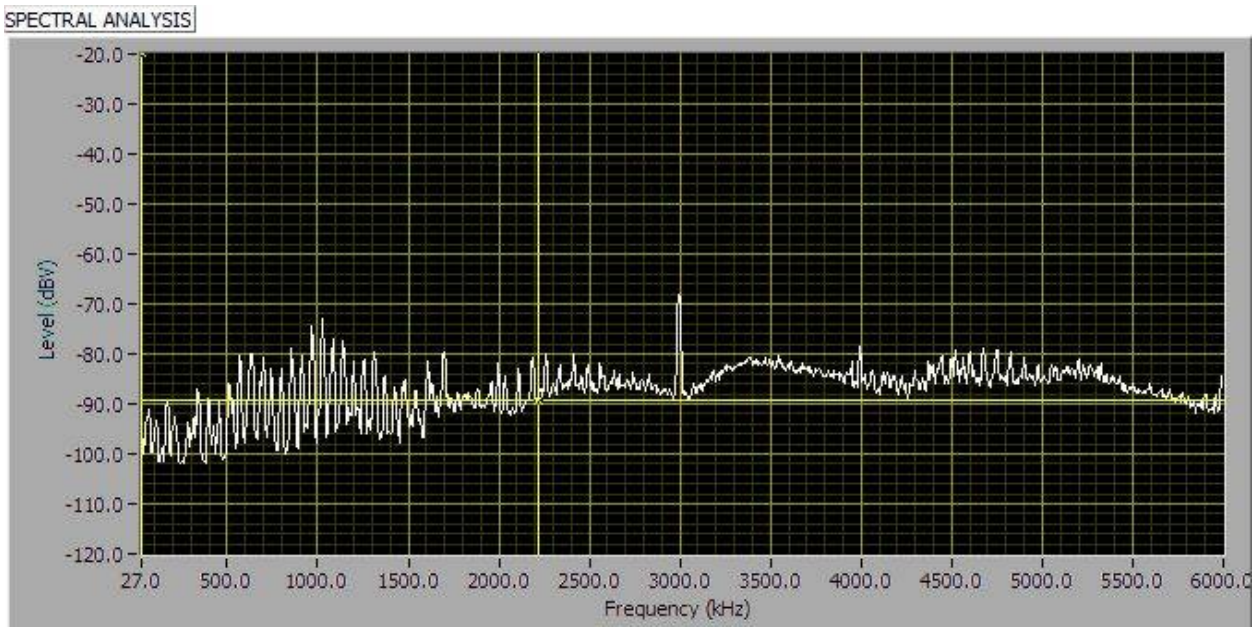


f) Longitudinal 270kHz to 6MHz. Negative. 90 Ω. Min current

PRE-ENVIRONMENTAL



POST ENVIRONMENTAL



5.1.11.2 Loop start Equipment Limitations

5.1.11.2.1 and 5.1.11.2.2. On-Hook resistance (MΩ)

a). Between terminal a1 and earth. Positive. On-Hook

Conditions	Pre-Surge	Post-surge	limit	Verdict
1 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
10 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
20 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
30 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
40 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
50 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
80 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
100 V	>5GΩ	> 10MΩ	>= 5 MΩ	P
125 V	>5GΩ	> 10MΩ	>= .03 MΩ	P
150 V	>5GΩ	> 10MΩ	>= .03 MΩ	P
175 V	>5GΩ	> 10MΩ	>= .03 MΩ	P
200 V	>5GΩ	> 10MΩ	>= .03 MΩ	P

b). Between terminal a1 and earth. Negative. On-Hook

Conditions	Pre-Surge	Post-surge	limit	Verdict
1 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
10 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
20 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
30 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
40 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
50 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
80 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
100 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
125 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
150 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
175 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
200 V	>5GΩ	> 20MΩ	>= .03 MΩ	P

c). Between terminal b1 and earth. Positive. On-Hook

Conditions	Pre-Surge	Post-surge	limit	Verdict
1 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
10 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
20 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
30 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
40 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
50 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
80 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
100 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
125 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
150 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
175 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
200 V	>5GΩ	> 20MΩ	>= .03 MΩ	P

d). between terminal b1 and earth. Negative. On-Hook

Conditions	Pre-Surge	Post-surge	limit	Verdict
1 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
10 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
20 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
30 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
40 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
50 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
80 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
100 V	>5GΩ	> 20MΩ	>= 5 MΩ	P
125 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
150 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
175 V	>5GΩ	> 20MΩ	>= .03 MΩ	P
200 V	>5GΩ	> 20MΩ	>= .03 MΩ	P

e). Between terminals a1 and b1. Positive. On-Hook

Conditions	Pre-Surge	Post-surge	limit	Verdict
1 V	>100MΩ	>40MΩ	>= 5 MΩ	P
10 V	>100MΩ	>40MΩ	>= 5 MΩ	P
20 V	>100MΩ	>40MΩ	>= 5 MΩ	P
30 V	>100MΩ	>40MΩ	>= 5 MΩ	P
40 V	>100MΩ	>40MΩ	>= 5 MΩ	P
50 V	>100MΩ	>40MΩ	>= 5 MΩ	P
80 V	>100MΩ	>40MΩ	>= 5 MΩ	P
100 V	>100MΩ	>40MΩ	>= 5 MΩ	P
125 V	>100MΩ	>40MΩ	>= .03 MΩ	P
150 V	>100MΩ	>40MΩ	>= .03 MΩ	P
175 V	>100MΩ	>40MΩ	>= .03 MΩ	P
200 V	>100MΩ	>40MΩ	>= .03 MΩ	P

f). Between terminals a1 and b1. Negative. On-Hook

Conditions	Pre-Surge	Post-surge	limit	Verdict
1 V	>100MΩ	>40MΩ	>= 5 MΩ	P
10 V	>100MΩ	>40MΩ	>= 5 MΩ	P
20 V	>100MΩ	>40MΩ	>= 5 MΩ	P
30 V	>100MΩ	>40MΩ	>= 5 MΩ	P
40 V	>100MΩ	>40MΩ	>= 5 MΩ	P
50 V	>100MΩ	>40MΩ	>= 5 MΩ	P
80 V	>100MΩ	>40MΩ	>= 5 MΩ	P
100 V	>100MΩ	>40MΩ	>= 5 MΩ	P
125 V	>100MΩ	>40MΩ	>= .03 MΩ	P
150 V	>100MΩ	>40MΩ	>= .03 MΩ	P
175 V	>100MΩ	>40MΩ	>= .03 MΩ	P
200 V	>100MΩ	>40MΩ	>= .03 MΩ	P

5.1.11.2.3 DC Current During Ringing (mA)

a). Normal, Type A

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 20Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 20Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
40 Vrms, 30Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 30Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P

b). Reversal. Type A

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 20Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 20Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
40 Vrms, 30Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 30Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P

c). Normal, Type B

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 15.3Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 15.3Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
62 Vrms, 35Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 35Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
62 Vrms, 50Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
150 Vrms, 50Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
62 Vrms, 68Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
150 Vrms, 68Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P

d). Reversal. Type B

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 15.3Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 15.3Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
62 Vrms, 35Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
130 Vrms, 35Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
62 Vrms, 50Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
150 Vrms, 50Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
62 Vrms, 68Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P
150 Vrms, 68Hz, 56.5 Vdc	< 50 µA	< 50 µA	<= 3 mA	P

5.1.11.2.4 AC Impedance (Metallic) During Ringing (kΩ)

a). Normal, Type A

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 20Hz, 56.5 Vdc	51k	50k	>= 1.4 k	P
130 Vrms, 20Hz, 56.5 Vdc	13k	13k	>= 1.4 k	P
40 Vrms, 30Hz, 56.5 Vdc	39k	39k	>= 1 k	P
130 Vrms, 30Hz, 56.5 Vdc	13k	12k	>= 1 k	P

b). Reversal, Type A

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 20Hz, 56.5 Vdc	50k	51k	>= 1.4 k	P
130 Vrms, 20Hz, 56.5 Vdc	14k	11.2k	>= 1.4 k	P
40 Vrms, 30Hz, 56.5 Vdc	38k	39k	>= 1 k	P
130 Vrms, 30Hz, 56.5 Vdc	14k	12k	>= 1 k	P

c). Normal, Type B

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 15.3Hz, 56.5 Vdc	62k	62k	>= 1.6 k	P
130 Vrms, 15.3Hz, 56.5 Vdc	13k	14k	>= 1.6 k	P
62 Vrms, 35Hz, 56.5 Vdc	31k	31k	>= 1.6 k	P
130 Vrms, 35Hz, 56.5 Vdc	14k	14k	>= 1.6 k	P
62 Vrms, 50Hz, 56.5 Vdc	26k	25k	>= 1.6 k	P
150 Vrms, 50Hz, 56.5 Vdc	13k	13k	>= 1.6 k	P
62 Vrms, 68Hz, 56.5 Vdc	24k	24k	>= 1.6 k	P
150 Vrms, 68Hz, 56.5 Vdc	7.3k	7.3k	>= 1.6 k	P

d). Reversal, Type B

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 15.3Hz, 56.5 Vdc	62k	62k	>= 1.6 k	P
130 Vrms, 15.3Hz, 56.5 Vdc	12k	12k	>= 1.6 k	P
62 Vrms, 35Hz, 56.5 Vdc	31k	31k	>= 1.6 k	P
130 Vrms, 35Hz, 56.5 Vdc	14k	14k	>= 1.6 k	P
62 Vrms, 50Hz, 56.5 Vdc	24k	25k	>= 1.6 k	P
150 Vrms, 50Hz, 56.5 Vdc	13k	13k	>= 1.6 k	P
62 Vrms, 68Hz, 56.5 Vdc	24k	23k	>= 1.6 k	P
150 Vrms, 68Hz, 56.5 Vdc	7.2k	7.3k	>= 1.6 k	P

5.1.11.2.5 AC Impedance (Longitudinal) During Ringing (kΩ)

a). Tip, Type A

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 20Hz, 56.5 Vdc	13MΩ	11 MΩ	>100 k	P
130 Vrms, 20Hz, 56.5 Vdc	12 MΩ	11 MΩ	>100 k	P
40 Vrms, 30Hz, 56.5 Vdc	11 MΩ	9 MΩ	>100 k	P
130 Vrms, 30Hz, 56.5 Vdc	10 MΩ	9 MΩ	>100 k	P

b). Ring, Type A

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 20Hz, 56.5 Vdc	13 MΩ	11 MΩ	>100 k	P
130 Vrms, 20Hz, 56.5 Vdc	13 MΩ	12 MΩ	>100 k	P
40 Vrms, 30Hz, 56.5 Vdc	11 MΩ	9 MΩ	>100 k	P
130 Vrms, 30Hz, 56.5 Vdc	10 MΩ	10 MΩ	>100 k	P

c). Tip, Type B

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 15.3Hz, 56.5 Vdc	15 MΩ	11 MΩ	>100 k	P
130 Vrms, 15.3Hz, 56.5 Vdc	12 MΩ	13 MΩ	>100 k	P
62 Vrms, 68Hz, 56.5 Vdc	9 MΩ	5 MΩ	>100 k	P
150 Vrms, 68Hz, 56.5 Vdc	5 MΩ	5 MΩ	>100 k	P

d). Ring, Type B

Conditions	Pre-surge	Post-surge	Limit	Verdict
40 Vrms, 15.3Hz, 56.5 Vdc	15 MΩ	11 MΩ	>100 k	P
130 Vrms, 15.3Hz, 56.5 Vdc	12 MΩ	13 MΩ	>100 k	P
62 Vrms, 68Hz, 56.5 Vdc	9 MΩ	5 MΩ	>100 k	P
150 Vrms, 68Hz, 56.5 Vdc	5 MΩ	5 MΩ	>100 k	P

5.1.11.2.6. REN Calculation

Conditions	Pre-surge	Post-surge	Limit	Verdict
REN (ac) Type A	0.4A	0.4A	<= 5	P
REN (ac) Type B	1.1B	1.1B	<= 5	P

5.1.11.4 Loop Current Requirements

