Application Note

EMC Compliance Report: CISPR and IEC Test Results for Isolators With Integrated Power

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ABSTRACT

This application note provides EMC results achieved with TI's signal isolators with integrated power, the ISOW64xx, ISOW308x, and ISOW1050 devices. The document covers CISPR and IEC EMC standard emissions tests, such as radiated emission, radiated immunity, conducted emissions, conducted immunity, magnetic immunity, ESD, and CMTI for both industrial and automotive devices, and also gives details on how these tests are done.

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1 Introduction

Current isolated systems in industrial automation, motor drives, grid infrastructure, and medical equipment face formidable design challenges when implementing isolated power with isolated communication. The conventional approach of combining a discrete isolation transformer, driver ICs, rectification stages, feedback networks, and separate digital isolators result in a complex, potentially expensive design prone to EMI, which demands lengthy development cycles and multiple safety certifications.

The Texas Instruments' ISOW64xx, ISOW308x, and ISOW1050 family of devices helps solve these challenges by integrating both an isolated DC-DC converter and signal isolators (digital, RS485, and CAN) into a single 16-pin wide-body SOIC package. This integrated architecture is specifically engineered with excellent EMC performance as a primary design objective. Refer to the *Enhance Design Performance using Integrated Power and Digital Isolation Design* application brief for more details on the benefits of using this family of devices.

2 EMC Test Overview

Electromagnetic compatibility (EMC) encompasses the ability of a device to operate correctly in an electromagnetic environment without degrading that environment. For an isolator with an integrated power converter, EMC is doubly critical since the switching converter is a potential source of radiated and conducted emissions, while the individual isolator must remain immune to the harsh electromagnetic environments found in industrial, automotive, and medical applications.

The ISOW644x, ISOW308x, and ISOW1050 family of devices is designed from inception to address both sides of EMC with minimal effort on the PCB design. All tests performed on the ISOW6441DWEEVM, ISOW3080DWEEVM, and ISOW1050DWEEVM evaluation module (EVM) used a standard two-layer PCB layout. The results of the tests demonstrate compliance to EMC with minimal costs to the PCB—no four-layer board or expensive EMC workarounds are required. To get better EMC performance, follow the schematic and layout guidelines provided in the EVMs mentioned earlier.

For more details, refer to the Optimizing EMC in Isolated Designs: 10 PCB Techniques for CISPR and IEC Compliance application note.

2.1 Summary of Coverage for the EMC Standards on the ISOW64xx, ISOW308x, and ISOW1050 Devices

Table 2-1. Summary of Coverage for the EMC Standards

Test Type	Standard	Parameter	Level | Class	Result
Radiated Emission	CISPR 32	Industrial Radiated Emissions	Class B	PASS
	CISPR 25	Automotive Radiated Emissions	Class 5	PASS
Radiated Immunity	IEC 61000-4-3	Industrial Radiated Immunity	20V/m	PASS
	ISO11452-2	Automotive Radiated Immunity	100V/m	PASS
Conducted Immunity	IEC 61000-4-6	Conducted Immunity	15Vrms	PASS
Conducted Emission	CISPR 32	Conducted Emission	Class B	PASS
Magnetic Immunity	IEC 61000-4-8	Magnetic Field	100A/m (Level 5)	PASS
ESD	AEC Q100-002	HBM ESD	2kV	PASS
	AEC Q100-011	CDM ESD	1.5kV	PASS
	IEC 62368-1	Surge Isolation	10.4kV	PASS
CMTI	VDE 0884-17	Common Mode Transient Immunity	100kV/µs (Minimum); 200kV/µs (Typical)	PASS

2.2 Special Coverage for the EMC Standards on the RS485 Bus in the ISOW308x Device

Table 2-2. Special Coverage for the EMC Standards on the RS485 Bus

Test Type	Standard	Parameter	Level | Class	Result
ESD: RS485 Bus to GND (same side)	IEC 61000-4-2	Contact ESD	8kV	PASS
	AEC Q100-002	HBM ESD	16kV	PASS

2.3 Special Coverage for the EMC Standards on the CAN Bus in the ISOW1050 Device

Table 2-3. Special Coverage for the EMC Standards on the CAN Bus

Test Type	Standard	Parameter	Level | Class	Result
ESD: CAN Bus to GND (same side)	IEC 61000-4-2	Contact ESD with TVS Diode	15kV	PASS
	IEC 61000-4-2	Contact ESD without TVS Diode	7kV	PASS
	AEC Q100-002	HBM ESD	12kV	PASS

3 Details of the EMC Tests

3.1 Industrial Radiated Emissions (CISPR 32 Class B)

3.1.1 Standard Overview

CISPR 32 (EN 55032) is the international emissions standard for multimedia equipment. The standard replaces the older CISPR 22 standard and covers both conducted and radiated emissions from 9kHz to 6GHz. Class B is the most stringent classification, applying to equipment intended for use in residential environments—where sensitive radio reception must be protected from interference generated by electronics in the home or light-commercial space. The following CISPR 32 radiated emissions data was collected for a 5V input and a 3.3V output with 140mA load.

For more details on industrial RE refer to the Passing CISPR 32 Class-B Radiated Emissions With Ease Using ISOW6441 application note.

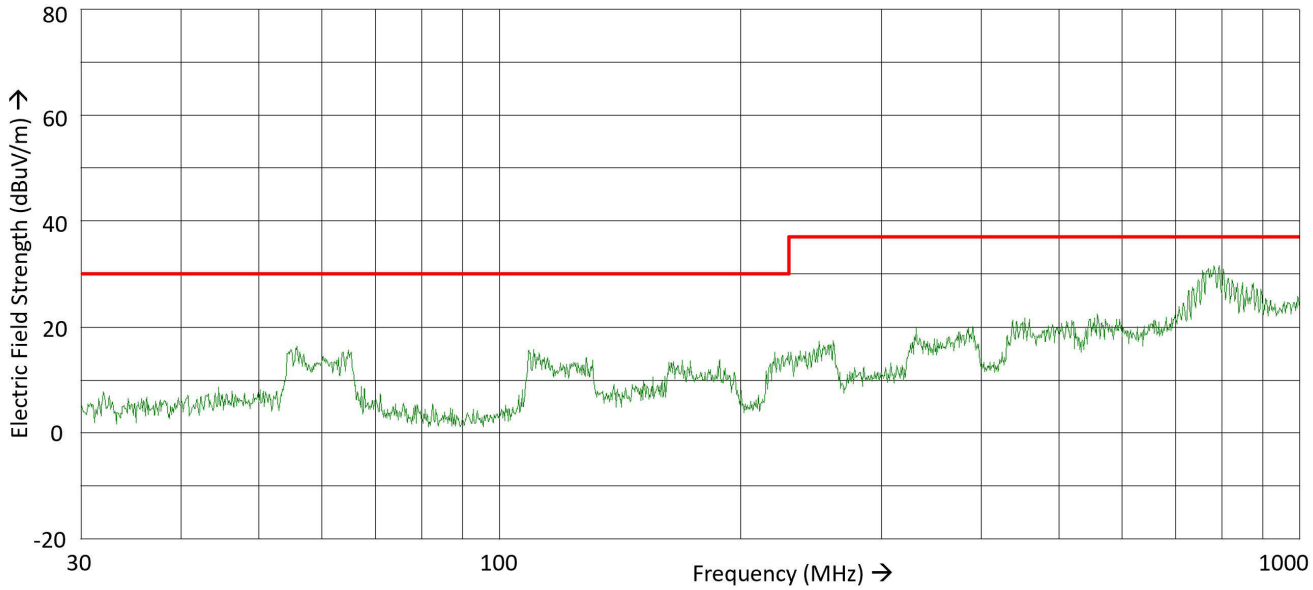

Figure 3-1. CISPR 32 Class B Radiated Emissions Data for the ISOW64xx Device in 5V3 Mode (140mA Load)

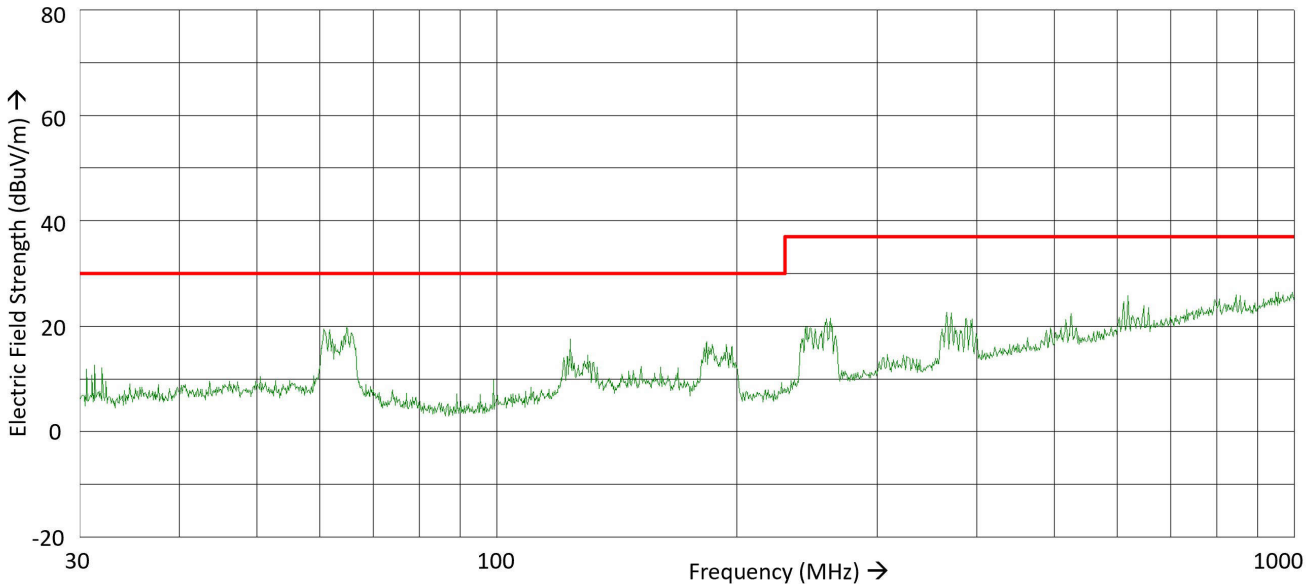

Figure 3-2. CISPR 32 Class B Radiated Emissions Data for the ISOW308x Device With 54Ω Load

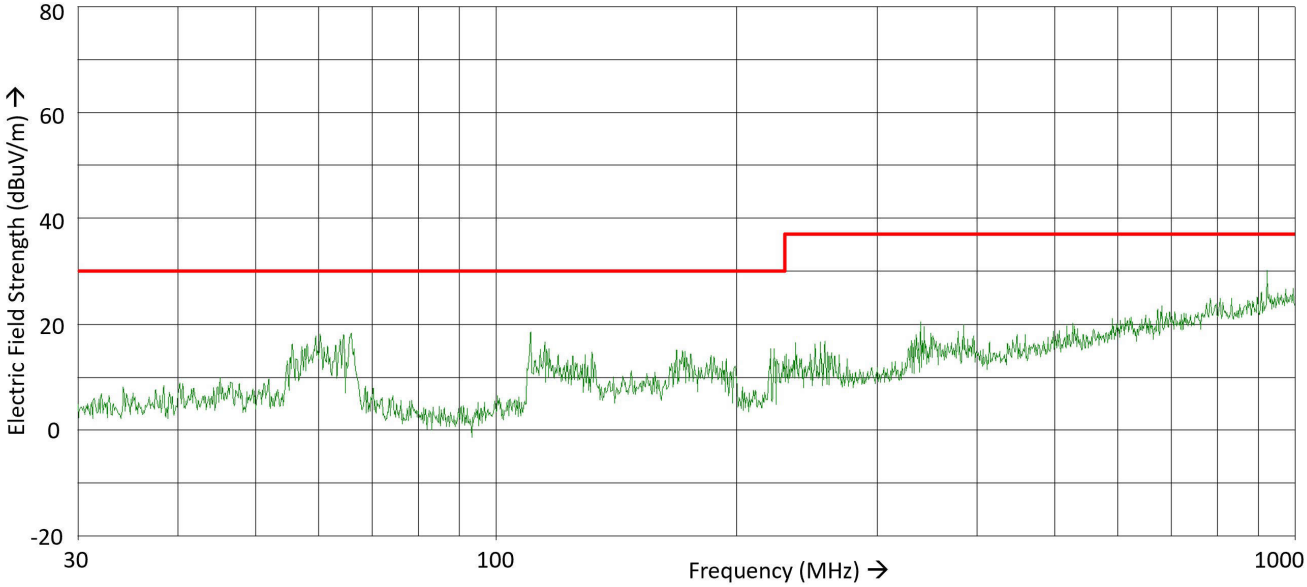

Figure 3-3. CISPR 32 Class B Radiated Emissions Data for the ISOW1050 Device With 60Ω Load

3.2 Automotive Radiated Emissions (CISPR 25 Class 5)

3.2.1 Standard Overview

The CISPR 25 standard specifies radio disturbance limits for electronic components and systems intended for installation in vehicles, boats, and internal combustion engines. The standard protects onboard radio receivers (AM, FM, DAB, GPS, LTE, and so forth) from interference generated by other vehicle electronics. The standard defines five limit classes from Class 1 (least stringent) to Class 5 (most stringent). Class 5 represents the highest level of emissions cleanliness and is typically required by premium automotive original equipment manufacturers (OEMs). The following CISPR 25 radiated emissions data was collected for a 5V input and a 3.3V output with 70mA load.

For more details on automotive RE, refer to the *Passing CISPR 25 Class-5 Automotive Radiated Emissions Using ISOW6441* application note.

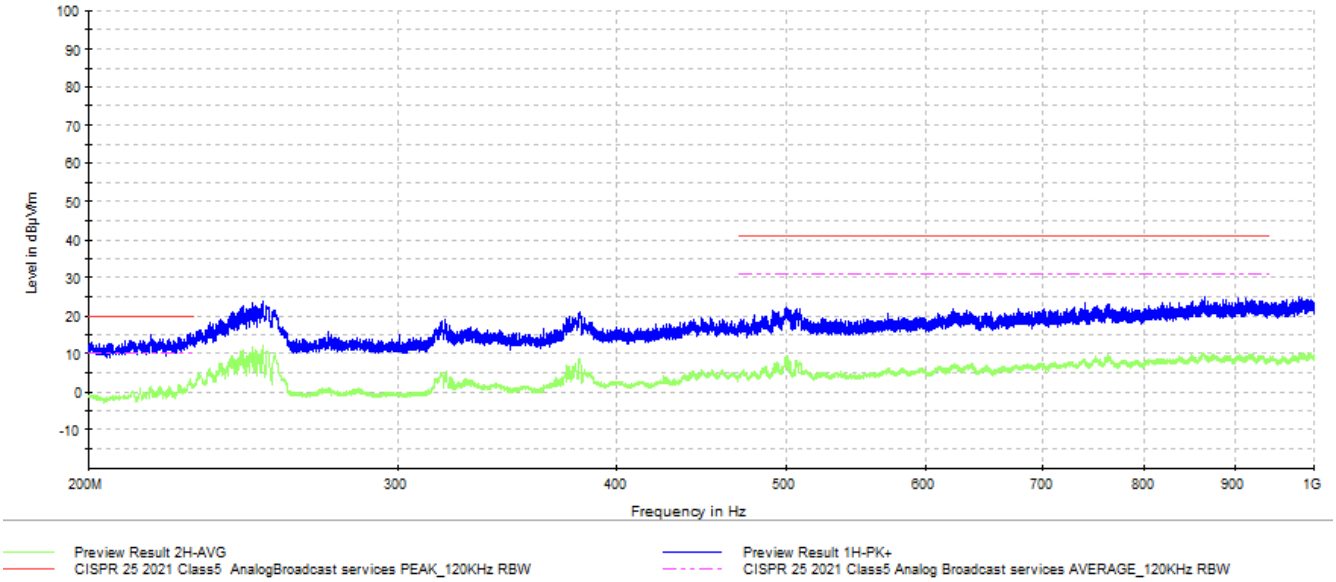

Figure 3-4. CISPR 25 Class 5 Radiated Emissions Data for the ISOW64xx Device from 200MHz to 1GHz

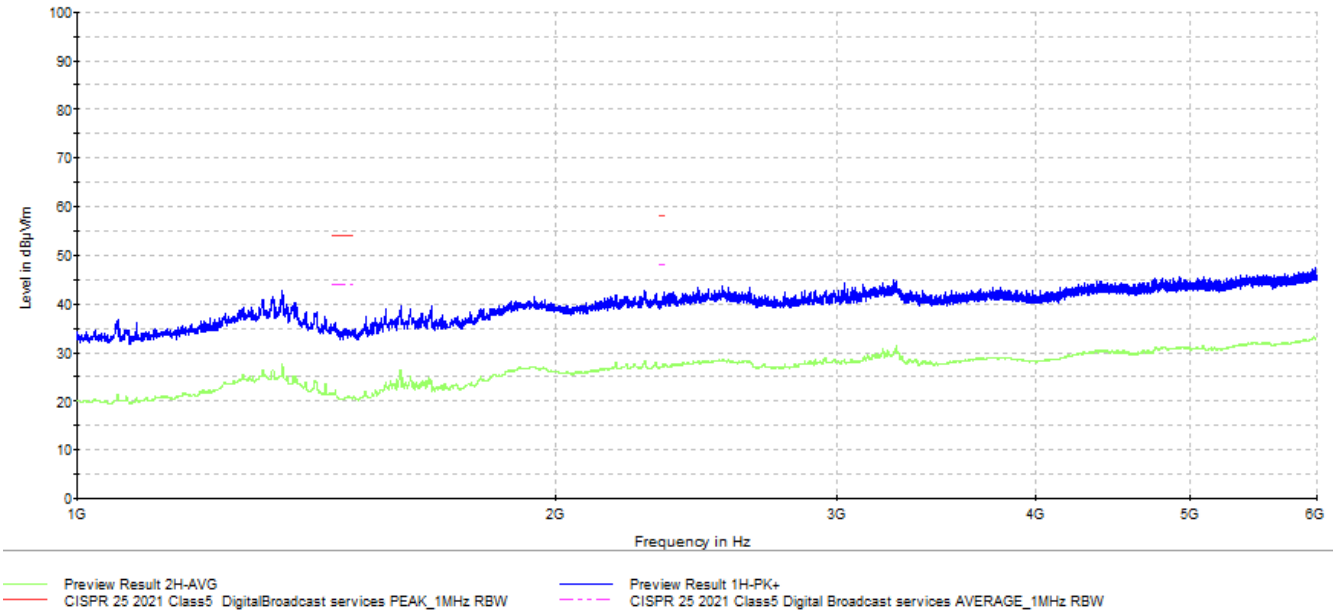

Figure 3-5. CISPR 25 Class 5 Radiated Emissions Data for the ISOW64xx Device from 1GHz to 6GHz

3.3 Industrial Radiated Immunity (IEC 61000-4-3)

3.3.1 Standard Overview

The IEC 61000-4-3 standard defines test methods and levels for the immunity of electrical and electronic equipment to radiated electromagnetic fields from radio transmitters and other intentional or unintentional RF sources. The standard covers the frequency range 80MHz to 6GHz, with the test field generated by an antenna inside a shielded anechoic chamber.

3.3.2 Industrial Test Configuration and Results

Table 3-1. Industrial Test Configuration and Results IEC 61000-4-3 Standard

Parameter	Value | Details
Frequency Range	80MHz – 6GHz
Field Strength	20V/m

Table 3-1. Industrial Test Configuration and Results IEC 61000-4-3 Standard (continued)

Parameter	Value | Details
Result	PASS — No data errors

3.4 Automotive Radiated Immunity (ISO11452-2)

3.4.1 Standard Overview

The ISO 11452-2 standard specifies test methods for evaluating the immunity of automotive electronic components to narrowband radiated electromagnetic interference (EMI). Testing is conducted inside a shielded anechoic chamber, which provides a controlled, reflection-minimized RF environment. The standard defines the test setup, frequency range (typically 80MHz to 6GHz), field strength levels, and pass and fail criteria for components under test.

3.4.2 Automotive Test Configuration and Results

Table 3-2. Automotive Test Configuration and Results – ISO1145-2 Standard

Parameter	Value | Details
Frequency Range	80MHz – 6GHz
Field Strength	100V/m
Result	PASS — No data errors

3.5 Conducted Immunity (IEC 61000-4-6)

3.5.1 Standard Overview

The IEC 61000-4-6 standard addresses immunity to conducted disturbances induced by electromagnetic fields. Where the IEC 61000-4-3 standard tests immunity to RF waves through air, the IEC 61000-4-6 standard tests immunity to RF currents that are coupled directly into power supply lines, signal cables, and I/O ports.

3.5.2 Test Configuration and Results

Table 3-3. Test Configuration and Results – IEC 61000-4-6 Standard

Parameter	Value | Details
Frequency Range	150kHz – 80MHz
Injection Method	CDN (Coupling/Decoupling Network)
Test Level	15Vrms
Result	PASS — No data errors across full frequency range.

3.6 Conducted Emissions (CISPR 32)

3.6.1 Standard Overview

The CISPR 32 standard also defines conducted emission limits for the power supply ports of multimedia and industrial electronic equipment. Conducted emissions are high-frequency currents that travel back through the power supply lines and can interfere with other equipment connected to the same mains. Limits are specified in the frequency range 150kHz to 30MHz. The ISOW6441, ISOW3080, and ISOW1050 devices pass Class B limits with margin. The following CISPR 32 conducted emissions data was collected for a 5V input and a 5V output with 110mA load.

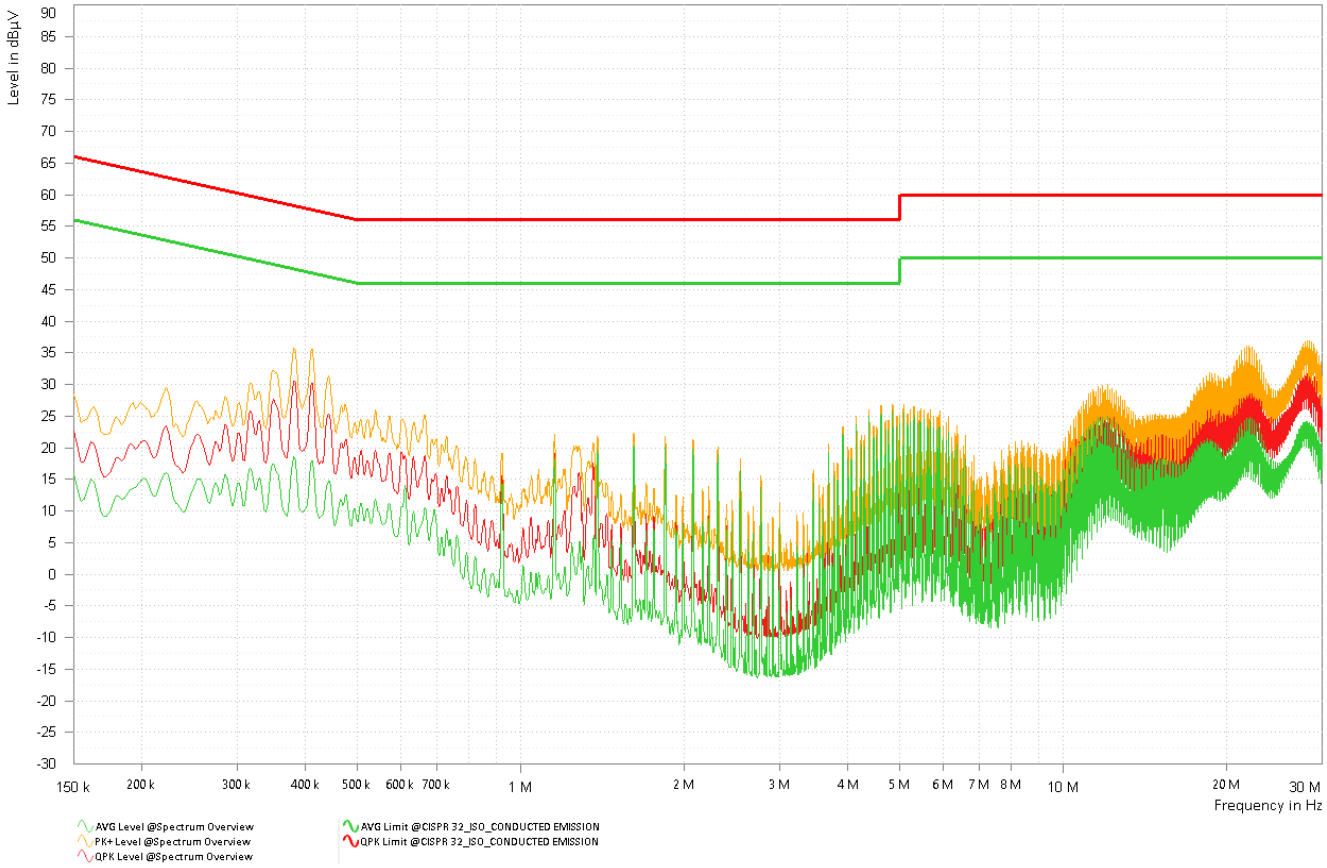

Figure 3-6. CISPR 32 Class B Conducted Emissions Data on VDD (Pin1)

3.7 ESD Immunity

3.7.1 Standard Overview

The AEC Q100-002 human body model electrostatic discharge (HBM ESD) standard simulates a charged human body discharging through an IC pin using a 100pF or 1.5kΩ model, serving as a key automotive IC qualification requirement. The AEC Q100-011 charged-device model electrostatic discharge (CDM ESD) standard replicates scenarios where a charged IC discharges upon grounding contact, reflecting manufacturing handling risks such as pick-and-place assembly operations. The IEC 62368-1 standard addresses surge isolation by requiring insulation and isolation barriers in audio and video, IT, and communication equipment to be capable of withstanding transient overvoltages from lightning or power switching events. Together, these standards form a comprehensive framework for validating the ESD and surge robustness of electronic components and systems across both automotive and consumer applications.

3.7.2 Test Configuration and Results

Table 3-4. ESD Test Configuration and Results

Parameter	Value | Details
HBM ESD (AEC Q100-002)	±2kV
CDM ESD (AEC Q100-011)	±1.5kV
Surge Isolation (IEC 62368-1)	10.4kV$_{PK}$ (1.2/50µs, tested in oil)

3.7.3 Special ESD Test Results of the RS485 Bus of the ISOW308x Device

Table 3-5. Special ESD Test Results of the RS485 Bus

Parameter	Value | Details
Contact Discharge (IEC 61000-4-2)	±8kV

Table 3-5. Special ESD Test Results of the RS485 Bus (continued)

Parameter	Value | Details
HBM ESD (AEC Q100-002)	±16kV

3.7.4 Special ESD Test Results of the CAN Bus of the ISOW1050 Device

Table 3-6. Special ESD Test Results of the CAN Bus

Parameter	Value | Details
Contact ESD With TVS Diode (IEC 61000-4-2)	±15kV
Contact ESD Without TVS Diode (IEC 61000-4-2)	±7kV
HBM ESD (AEC Q100-002)	±12kV

3.8 Magnetic Immunity (IEC 61000-4-8)

3.8.1 Standard Overview

The IEC 61000-4-8 standard specifies tests for immunity to power-frequency (50/60Hz) magnetic fields. This addresses the magnetic fields generated by power cables, busbars, transformers, and motors in industrial environments. The field is applied using a Helmholtz coil arrangement that generates a uniform magnetic field around the equipment under test.

3.8.2 Test Configuration and Results

Table 3-7. Test Configuration and Results – IEC 61000-4-8

Parameter	Value | Details
Frequency	50/60Hz power frequency
Applied Field (Continuous)	100A/m
Result	PASS — No data errors

3.9 Common Mode Transient Immunity (VDE 0884-17)

3.9.1 Overview

Common mode transient immunity (CMTI) quantifies the ability of the isolator to reject fast, large-amplitude voltage transients that appear simultaneously on both the input and output ground references. In systems, such as motor drives and inverters, the switching of high-voltage transistors causes rapid dV/dt events on the floating side. This transient appears as a common-mode signal across the isolation barrier. If not rejected, these events can cause spurious transitions at the output of the isolator, corrupting control signals or triggering false switching events in gate drivers.

3.9.2 Test Configuration and Results

Table 3-8. CMTI Test Configuration and Results

Parameter	Value | Details
Test Method	Per VDE 0884-17; common-mode voltage ramp applied to isolated side
Common-mode Swing (VCM)	1000V peak-to-peak across isolation barrier
Result – Minimum CMTI	100kV/µs
Result – Typical CMTI	200kV/µs

4 Summary

This application note provides the details of electromagnetic compatibility (EMC) results for the Texas Instruments' ISOW64xx, ISOW308x, and ISOW1050 families of integrated signal isolators and power converters. These devices combine isolated DC-DC conversion and signal isolation into a single package, addressing the complexities of traditional discrete implementations.

For more details, refer to the Optimizing EMC in Isolated Designs: 10 PCB Techniques for CISPR and IEC Compliance application note.

5 References

1. Texas Instruments, *Enhance Design Performance Using Integrated Power and Digital Isolation Design*, application brief.
2. Texas Instruments, *ISOW644x Robust-EMC, Reinforced, Quad-Channel Digital Isolator With Integrated DCDC Converter*, datasheet.
3. Texas Instruments, *ISOW308x Robust-EMC, Isolated RS-485/RS-422 Transceiver With Integrated DC-DC Converter*, datasheet.
4. Texas Instruments, *ISOW1050 Robust-EMC, Isolated CAN FD Transceiver With Integrated DC-DC Converter*, datasheet.
5. Texas Instruments, *ISOW644x EVM Datasheet for Layout Guidance*, evaluation module.
6. Texas Instruments, *ISOW308x EVM Datasheet for Layout Guidance*, evaluation module.
7. Texas Instruments, *ISOW1050 EVM Datasheet for Layout Guidance*, evaluation module.
8. Texas Instruments, *Optimizing EMC in Isolated Designs: 10 PCB Techniques for CISPR and IEC Compliance*, application note.
9. Texas Instruments, *Passing CISPR 25 Class-5 Automotive Radiated Emissions Using ISOW6441*, application note.
10. Texas Instruments, *Passing CISPR 32 Class-B Radiated Emissions With Ease Using ISOW6441*, application note.

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