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Test Report on

Electromagnetic Emission Report

per

Japan: Radio Law: Article 2, Paragraph 1, Item 8 (Emissions)

ANT: PCB Antenna Specification (Performance)

are herein reported for

Vitesco Technologies GmbH HFA31

Test Report No.: 20250320-RPTWAC0100380A

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Date of Issue: March 20, 2025

Results of testing completed on or before March 19, 2025 are as follows.

AUT Performance: Antenna Under Test (AUT) measurements completed on or before March 19, 2025 are summarized in the following pages. Detailed measurement procedures employed in characterizing the AUT(s), followed by individual pages of data showing the key results of testing are included herein.

Emissions: The transmitter intentional emissions **COMPLY** with the regulatory limit(s) by no less than 17.7 dB. Transmit chain spurious or harmonic emissions **COMPLY** by no less than 26 dB. Unintentional spurious emissions from digital circuitry **COMPLY** with radiated emission limit(s) by at least 27.5 dB.

Revision History

Rev. No.	Date	Details	Revised By
r0	March 20, 2025	Initial Release.	J. Nantz
r1	March 27, 2025	Minor updates.	J. Brunett
r2	March 27, 2025	Antenna conf. section add.	J. Brunett

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1 Test Report Scope and Limitations

1.1 Laboratory Authorization

Test Facility description and attenuation characteristics are on file with the FCC Laboratory, Columbia, Maryland (FCC Reg. No: US5356) and with ISED Canada, Ottawa, ON (File Ref. No: 24249).

1.2 Report Retention

For equipment verified to comply with the regulations herein, the manufacturer is obliged to retain this report with the product records for the life of the product, and no less than ten years. A copy of this Report will remain on file with this laboratory until April 2035.

1.3 Subcontracted Testing

This report does not contain data produced under subcontract.

1.4 Limitation of Results

The test results contained in this report relate only to the item(s) tested. Any electrical or mechanical modification made to the test item subsequent to the test date shall invalidate the data presented in this report. Any electrical or mechanical modification made to the test item subsequent to this test date shall require reevaluation.

1.5 Copyright

This report shall not be reproduced, except in full, without the written approval of Willow Run (WR) Test Labs, Inc.

1.6 Endorsements

This report shall not be used to claim product endorsement by any accrediting, regulatory, or governmental agency.

1.7 Test Location

The EUT AUT was fully tested by **Willow Run (WR) Test Labs, Inc.**, headquartered at 7117 Fieldcrest Dr., Brighton, Michigan 48116 USA. Table 1.7.0 lists all sites employed herein. Specific test sites utilized are also listed in the test results sections of this report where needed.

Table 1.7.0 Test Site List.

Description	Location	Quality Num.
OATS (3 m)	3615 E Grand River Rd., Williamston, Michigan 48895	OATSD

1.8 Traceability and Equipment Used

Pertinent test equipment used for measurements at this facility is listed in Table 1.8.0. The quality system employed at Willow Run (WR) Test Labs, Inc. has been established to ensure all equipment has a clearly identifiable classification, calibration expiry date, and that all calibrations are traceable to the SI through NIST, other recognized national laboratories, accepted fundamental or natural physical constants, ratio type of calibration, or by comparison to consensus standards. All equipment is evaluated on a cycle no greater than 12 months following laboratory validation procedures and is calibrated following manufacturer recommended intervals.

Table 1.8.0 Equipment List.

Description	Manufacturer/Model	SN	Quality Num.	Cal/Ver By / Date Due
Spectrum Analyzer	R & S / FSW67	103233	RSFSW67	RS ^(ha) / Sept-2025
Spectrum Analyzer	R & S / FSV30	101660	RSFSV3001	RS ^(ha) / Apr-2025
Harmonic Mixer	VDI / SAX 108	A30316	MIX60TO9001	AHD ⁽ⁿⁱ⁾ / On-Use
Biconical	EMCO / 93110B	9802-3039	BICEMCO01	Keysight ^(ha) / Aug-2027
Log Periodic Antenna	EMCO / 3146	9305-3614	LOGEMCO01	Keysight ^(ha) / Aug-2027
Quad Ridge Horn	Singer / A6100	C35200	HQR1TO18S01	Keysight ^(ha) / Aug-2025
K-Band Horn	JEF / NRL Std.	001	HRNK01	AHD ⁽ⁿⁱ⁾ / On Use
Ka-Band Horn	JEF / NRL Std.	001	HRNKA001	AHD ⁽ⁿⁱ⁾ / On Use
U-Band Horn	Cust. Micro. / HO19R	-	HRNU01	Cust.M. ⁽ⁿⁱ⁾ / On-Use
E-Band Horn	Flann / 26240-25-1030B	250901	HRNE01	Flann ⁽ⁿⁱ⁾ / On-Use
W-Band Horn	Cust. Micro. / HO10R	-	HRNW01	Cust.M. ⁽ⁿⁱ⁾ / On-Use

As indicated above, all equipment calibrations align with the methods permitted under Article 24-2, Paragraph 4, Item 2 of the Japan Radio Law items:

(*ha*) use of an ISO 17025 / ILAC accredited laboratory outside of Japan, or

(*ni*) calibration via instruments that are calibrated at an ISO 17025 / ILAC accredited laboratory.

2 Test Specifications and Procedures

2.1 Test Specification and General Procedures

The goal of Vitesco Technologies GmbH is to demonstrate that the Equipment Under Test (EUT) complies with the Rules and/or Directives below. Detailed in this report are the results of testing the Vitesco Technologies GmbH HFA31 for compliance to:

Country/Region/Manu.	Rules or Directive	Referenced Section(s)
Japan	Japan Radio Law	Radio Law: Article 2, Paragraph 1, Item 8

It has been determined that the equipment under test is subject to the rules and directives above at the date of this testing. In conjunction with these rules and directives, the following specifications and procedures are followed herein to demonstrate compliance (in whole or in part) with these regulations.

Japan ORRE 1950	“Ordinance Regulating Radio Equipment, Radio Regulatory Commission Regulations No. 49”
Japan Radio Law	Art. 2, Par. 1, Item 8; 24.15 GHz
Radio Test Method	“MIC Notice No. 88, Annex 22-16”
ANSI C63.5:2017	“Radiated Emission Measurements in Electromagnetic Interference (EMI) Control — Calibration and Qualification of Antennas (9 kHz to 40 GHz)”

3 Configuration and Identification of the Equipment Under Test

3.1 Description and Declarations

The EUT is an automotive doppler kick sensor radar used for vehicle door access. The EUT is approximately 13 x 5 x 2 cm (approx.) in dimension, and is depicted in Figure 3.2.0 . It is powered by 13.4 VDC vehicle power system. In use, this device is permanently affixed in a motor vehicle. Table 3.1.0 outlines provider declared EUT specifications.

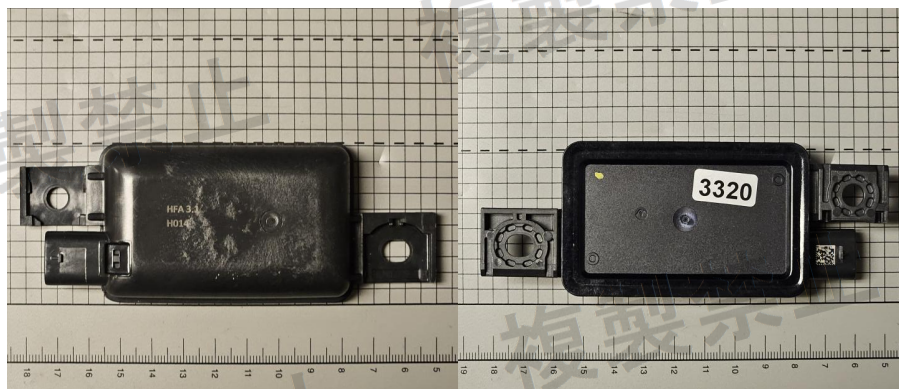


Figure 3.1.0 Photos of EUT.

Table 3.1.0 EUT Declarations.

General Declarations

Equipment Type:	24.2 GHz Doppler Sensor
Country of Origin:	Not Declared
Nominal Supply:	13.4 VDC
Oper. Temp Range:	-40° C to +85° C
Frequency Range:	24.15 – 24.25 GHz
Antenna Dimension:	Not Declared
Antenna Type:	integral monopole antennas
Antenna Gain:	6 dBi (verified) - See exhibit "HFA31 - Exh 10 - Antenna Design Specification - CONFIDENTIAL"
Number of Channels:	1
Channel Spacing:	Not Applicable
Alignment Range:	Not Declared
Type of Modulation:	CW Burst Radar

3.2 Description and Declarations

The EUT is an automotive doppler kick sensor radar used for vehicle door access. The EUT is approximately 13 x 5 x 2 cm (approx.) in dimension, and is depicted in Figure 3.2.0 . It is powered by 13.4 VDC vehicle power system. In use, this device is permanently affixed in a motor vehicle.

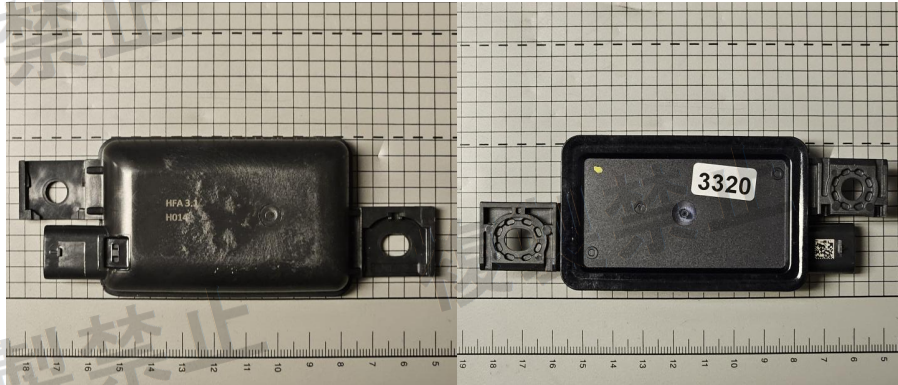


Figure 3.2.0 Photos of EUT.

3.2.1 AUT Configuration

The AUT is configured for testing as depicted in Figure 3.2.2 .



Figure 3.2.1 AUT Test Configuration Diagram.

3.2.2 EUT Configuration

The EUT is configured for testing as depicted in Figure 3.2.2 .

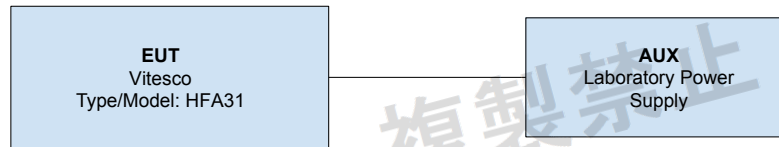


Figure 3.2.2 EUT Test Configuration Diagram.

3.2.3 Modes of Operation

The EUT is capable of a low duty cycle SLEEP mode where it sends CW burst transmissions infrequently looking for motion. Once motion is detected, the EUT switches into ACTIVE mode where it transmits the same short CW bursts more frequently. Every CW burst transmission is a single 11us transmission simultaneously emanating from both integral transmit antennas. Both SLEEP and ACTIVE modes are detailed and tested herein.

3.2.4 Variants

There is only a single variant of the EUT, as tested.

3.2.5 Test Samples

Two samples were provided, one capable of normal (sleep) mode (SN: 3361) and one capable of active mode (SN: 3320) all of which were tested herein.

3.2.6 Functional Exerciser

Normal operating EUT functionality was verified by observation transmitted signal.

3.2.7 Modifications Made

There were no modifications made to the EUT by this laboratory.

3.2.8 Production Intent

The EUT appears to be a production ready sample.

3.2.9 Declared Exemptions and Additional Product Notes

Spurious emissions in section 4.3.1 of this report include Out Of Band, Spurious Domain and Receiver Emissions.

receiver / analyzer are converted to $\text{dB}\mu\text{V}/\text{m}$ at the regulatory distance, using

$$E_{\text{dist}} = 107 + P_R + K_A - K_G + K_E - C_F$$

where P_R is the power recorded on spectrum analyzer, in dBm, K_A is the test antenna factor in dB/m, K_G is the combined pre-amplifier gain and cable loss in dB, K_E is duty correction factor (when applicable) in dB, and C_F is a distance conversion (employed only if limits are specified at alternate distance) in dB. This field strength value is then compared with the regulatory limit. If effective isotropic radiated power (EIRP) is computed, it is computed as

$$\text{EIRP}(\text{dBm}) = E_{3\text{m}}(\text{dB}\mu\text{V}/\text{m}) - 95.2.$$

When presenting data at each frequency, the highest measured emission under all possible EUT orientations (3-axes) is reported.

Where regulations call for substitution method measurements, the EUT is replaced by a substitution antenna if field strength measurements indicate the emission is close to the regulatory limit. This antenna is co-polarized with the test antenna and tuned (when necessary) to the emission frequency, after which the test antenna height is again optimized. The substitution antenna's signal level is adjusted such that its emission is equal to the level measured from the EUT. The signal level applied to the substitution antenna is then recorded. Effective isotropic radiated power (EIRP) and effective radiated power (ERP) in dBm are formulated from

$$\text{EIRP} = P_T - G_A = \text{ERP} + 2.16, \quad (1)$$

where P_T is the power applied to substitution antenna in dBm, including correction for cable loss, and G_A is the substitution antenna gain, in dBi.

When microwave measurements are made at a range different than the regulatory distance or made at close-range to improve receiver sensitivity, the reading is corrected back to the regulatory distance. This is done using a 20 dB/decade field behavior as dictated by the test procedures. When measurements are made in the near-field, the near-field/far-field boundary (N/F) is reported. It is computed as

$$N/F = 2D^2/\lambda$$

where D is the maximum dimension of the transmitter or receive antenna, and λ is the wavelength at the measurement frequency. Typically for high frequency measurements the receive antenna is connected to test receiver / analyzer through an external mixer. In this case, cable loss, IF amplifier gain, and mixer conversion losses are corrected for in the data table, or directly in the spectrum analyzer.



Figure 5.1.1 Radiated Emissions Test Setup Photograph(s).

5.1.2 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

5.1.3 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report. The provider has declared that the EUT is designed for operation over the temperature range -40°C to $+85^{\circ}\text{C}$. Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber, temperature and humidity are recorded, and thermal balance is verified via a thermocouple-based probe.

5.2 Intentional Emissions

5.2.1 Duty and Transmission Cycle, Pulsed Operation

The details and results of testing the EUT for pulsed operation are summarized in Table 5.2.1 . Plots showing the measurements made to obtain these values are provided in Figure 5.2.1 .

Table 5.2.1 Pulsed Emission Characteristics (Duty Cycle).

Test Engineer: J. Nantz

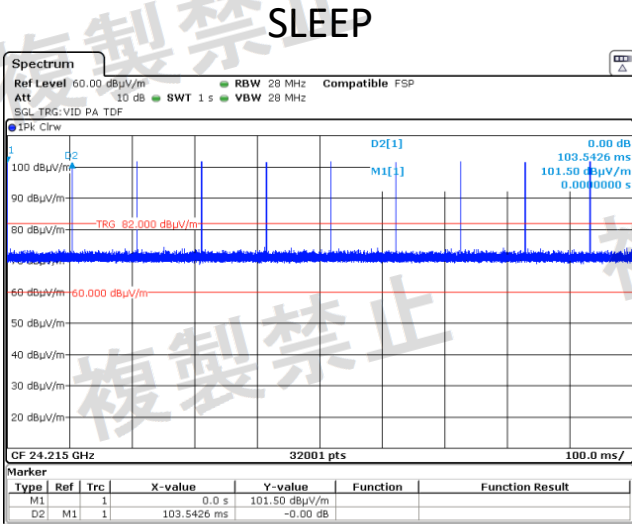
Test Date: 01/14/25

EUT Modes: a1 No Motion
a2 Continuous Motion

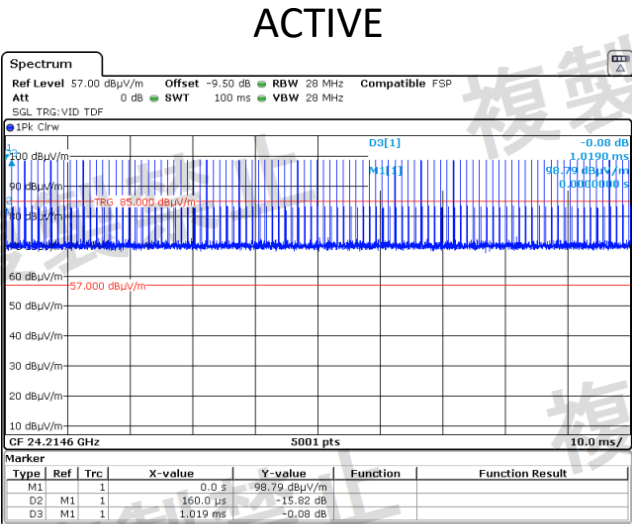
R0	Frequency		Site						EUT			Test Antenna			Cable	Receiver		Measured		Computed	
	Start	Stop	T	RH	MR	DR	N/F	CF	Mode	Volt.	Dim	Pol.	Dim.	Ka	Kg	RBW	VBW	Frame	Max Frame	Duty Factor	
	GHz	GHz	C	%		m		dB	above	V	cm	H/V	cm	dB/m	dB	MHz		Period	Length	%	dB
R1	SETUP:		TAPERED CHAMBER						HFA31			HRNK01				RSFSV30001		NOTES:			
R2	24.1500	24.2500	20	65	0.6	3.0	0.6	14.0	a1	13.4	6.0	H/V	10.2	33.2		28.00	28.00	103.555	0.011	0.01	-39.6
R3	24.1500	24.2500	20	65	0.6	3.0	0.6	14.0	a2	13.4	6.0	H/V	10.2	33.2		28.00	28.00	1.039	0.011	1.08	-19.7
R4																					
R5																					
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21

(ROW) (COLUMN) NOTE:

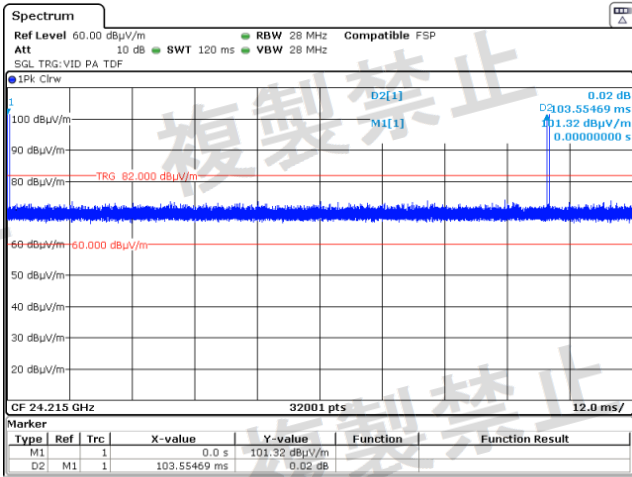
- R0 C3 T is Temperature
R0 C4 RH is Relative Humidity
R0 C5 MR is Measurement Range, which is reduced from DR to achieve necessary SNR.
R0 C6 DR is the regulatory Desired Range measurement distance.
R0 C7 N/F is Near-Field / Far-Field distance computed for max of EUT Antenna Dimension and Test Antenna dimension where applicable.
R0 C8 CF is Distance Correction Factor is computed using a 20 dB/decade field decay rate.
R0 C18 CW burst period
R0 C19 Carrier on time for each burst period
R0 C20 Percentage on-time per each burst event
R0 C26 Duty Factor = $10 \cdot \log_{10}(\text{Max frame length per burst/burst period}) = 10 \cdot \log_{10}(0.0113\text{ms}/1.04\text{ms}) = -19.7$



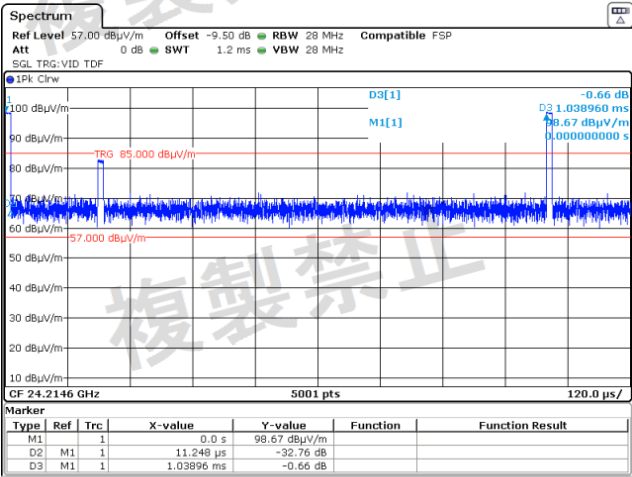
Date: 14 JAN 2025 17:52:22



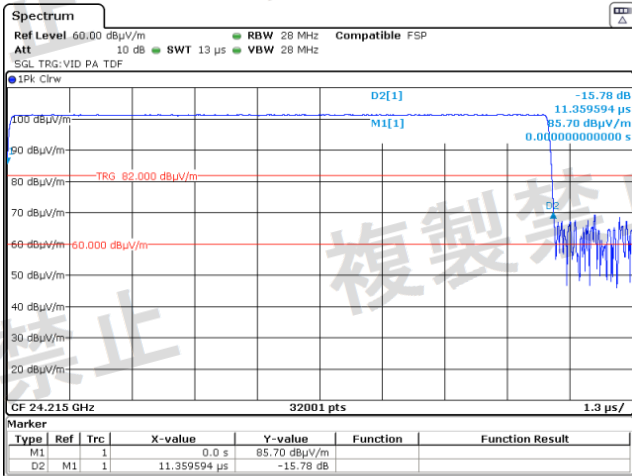
Date: 13 JAN 2025 16:38:35



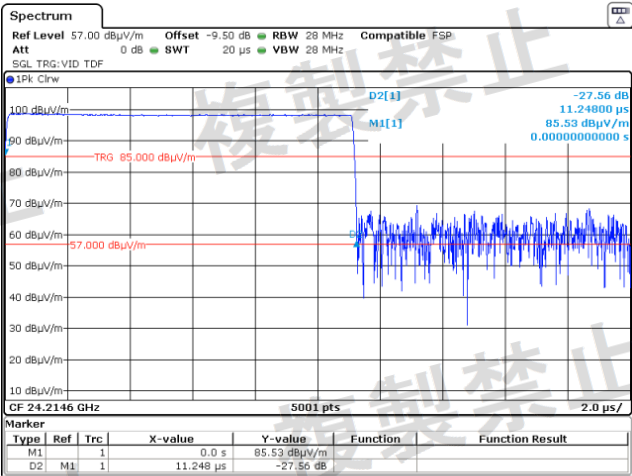
Date: 14 JAN 2025 17:48:20



Date: 13 JAN 2025 16:37:07



Date: 14 JAN 2025 17:51:19



Date: 13 JAN 2025 16:36:05

Figure 5.2.1 Pulsed Emission Characteristics (Duty Cycle).

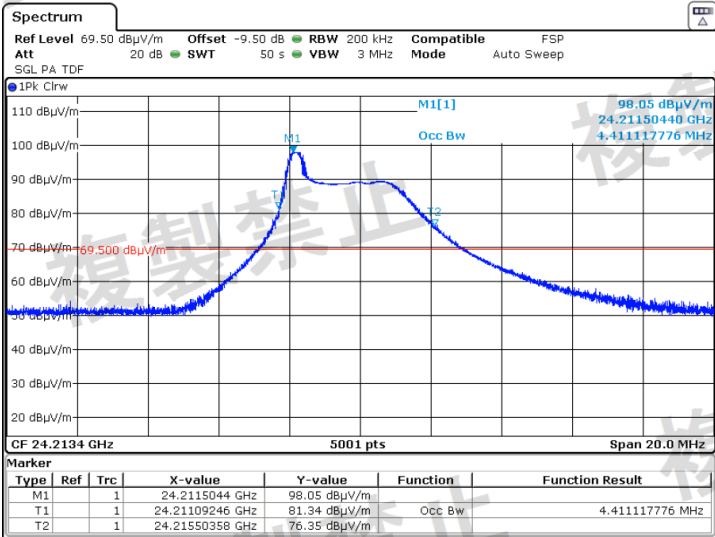
5.2.2 Frequency Error and Occupied Bandwidth

The occupied bandwidth (OBW) of the EUT is measured with the device placed in the test worst case test modes employed. Emissions are recorded following the test procedures listed in Section 2.1. The OBW (the 99% power bandwidth) is measured across the range environmental factors required by the test standard. The results of this testing are summarized in Table 5.2.2 . Plots showing examples of the measurements employed to obtain the emission bandwidths reported are provided in Figure 5.2.2 .

Table 5.2.2 Intentional Emission Bandwidth.

Frequency Range Freq > 1 GHz					Det Pk	IFBW 300 kHz	VBW 3 MHz	Span 20 MHz	Test Date: 14-Jan-25 Test Engineer: J. Nantz EUT Vitesco HFA31 EUT Mode: Cont. Motion (worst case) Meas. Distance: 30 cm				
Occupied Bandwidth (Temperature & Voltage Test)													
R0	RH (%)	Vib Freq. Min (Hz)	Vib Freq. Max (Hz)	Vib. Displacement (mm)	Temperature (C)	Voltage (V)	99% OBW (MHz)	99% OBW Limit (MHz)	fL (GHz)	fL Limit (GHz)	fH (GHz)	fH Limit (GHz)	Pass/Fail
R1	65				85.0	16.0	6.136	200.0	24.21363	24.050	24.21977	24.250	Pass
R2	65					9.0	6.262	200.0	24.21426	24.050	24.22052	24.250	Pass
R3	65					16.0	4.322	200.0	24.21415	24.050	24.21847	24.250	Pass
R4	65				20.0	13.5	4.295	200.0	24.21504	24.050	24.21934	24.250	Pass
R5	65					9.0	4.296	200.0	24.21439	24.050	24.21869	24.250	Pass
R6	65					16.0	3.396	200.0	24.21430	24.050	24.21770	24.250	Pass
R7	65				-40.0	9.0	3.427	200.0	24.21506	24.050	24.21849	24.250	Pass
R8	Occupied Bandwidth (Humidity Test – 4 HRS)												
R9	RH	Vib Freq. Min	Vib Freq. Max	Vib. Displacement	Temperature	Voltage	99% OBW	99% OBW Limit	fL	fL Limit	fH	fH Limit	Pass/Fail
R10	(%)	(Hz)	(Hz)	(mm)	(C)	(V)	(MHz)	(MHz)	(GHz)	(GHz)	(GHz)	(GHz)	
R11	95				35.0	13.5	4.405	200.0	24.21493	24.050	24.2193	24.250	Pass
R12	Occupied Bandwidth (Vibration Test – 2 x 45 mins)												
R13	RH	Vib Freq. Min	Vib Freq. Max	Total Displacement	Temperature	Voltage	99% OBW	99% OBW Limit	fL	fL Limit	fH	fH Limit	Pass/Fail
R14	(%)	(Hz)	(Hz)	(mm)	(C)	(V)	(MHz)	(MHz)	(GHz)	(GHz)	(GHz)	(GHz)	
R15	65	1.0	8.3	3mm	20.0	13.5	4.465	200.0	24.21527	24.050	24.2197	24.250	Pass
R16	65	8.3	30.0	1mm	20.0	13.5							
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	(ROW)	(COLUMN)		NOTE:									
	R0	C3		T is Temperature									
	R0	C4		RH is Relative Humidity									
	R0	C8, C9, C11		Test Method MIC Notification No. 88 of 2004, Annex 22-16									
	R0	C8, C9, C11		Limit per Item 8, Article 2-1									

NOTE:
T is Temperature
RH is Relative Humidity
Test Method MIC Notification No. 88 of 2004, Annex 22-16
Limit per Item 8, Article 2-1



Date: 13 JAN 2025 13:26:25

Figure 5.2.2 Intentional Emission Bandwidth Example Plot.

5.2.3 Antenna Power, Gain, EIRP, and Power Tolerance

Pursuant to the regulations, antenna power measurements are made on the EUT under normal and extreme test conditions. Table 5.2.3 outlines the resulting Antenna Power ratings for all tested mode(s) of the EUT.

Table 5.2.3 Antenna Power and EIRP

Test Engineer: J. Nantz										Test Date: 01/14/25					EUT Modes: a1					Continuous Motion (Tx & Rx)							
Declared Antenna Power - DAP (mW): 0.7										a2																	
R0	Frequency		Site						EUT		Test Antenna			Cable	Receiver		Measured		Computed			Limits			Details		
	Start	Stop	T	RH	MR	DR	N/F	CF	Mode	Volt.	Dim	Pol.	Dim.	Ka	Kg	RBW	VBW	EIRP Pk	AG	EIRP Avg	AP Avg	Deviation DAP	AG	AP Avg	Deviation In DAP	Pass Fail	
	GHz	GHz	C	%	m		dB		above	V	cm	H/V	cm	dB/m	dB	MHz		dBm	dB	dBm	mW	%	dB	mW	Min	Max	dB
R1	SETUP:		OATSC/TAPERED CHAMBER						HFA31		HRNK01				RSFSV30001		NOTES:										
R2	24.05	24.25	85	65	3.0	3.0	0.6		a1	16	6.0	H/V	10.2	33.2		10.00	28.00	2.9	6.0	2.9	0.5	-30.0	24.0	20.0	-50.0	50.0	19.5
R3	24.05	24.25	85	65	3.0	3.0	0.6		a1	9.0	6.0	H/V	10.2	33.2		10.00	28.00	2.8	6.0	2.8	0.5	-31.6	24.0	20.0	-50.0	50.0	19.5
R4	24.05	24.25	20	65	3.0	3.0	0.6		a1	16	6.0	H/V	10.2	33.2		10.00	28.00	3.6	6.0	3.6	0.6	-17.8	24.0	20.0	-50.0	50.0	19.4
R5	24.05	24.25	20	65	3.0	3.0	0.6		a1	13.5	6.0	H/V	10.2	33.2		10.00	28.00	3.6	6.0	3.6	0.6	-17.8	24.0	20.0	-50.0	50.0	19.4
R6	24.05	24.25	20	65	3.0	3.0	0.6		a1	9.0	6.0	H/V	10.2	33.2		10.00	28.00	3.5	6.0	3.5	0.6	-19.7	24.0	20.0	-50.0	50.0	19.4
R7	24.05	24.25	-40	65	3.0	3.0	0.6		a1	16.0	6.0	H/V	10.2	33.2		10.00	28.00	5.6	6.0	5.6	0.9	30.3	24.0	20.0	-50.0	50.0	19.0
R8	24.05	24.25	-40	65	3.0	3.0	0.6		a1	9	6.0	H/V	10.2	33.2		10.00	28.00	5.5	6.0	5.5	0.9	27.3	24.0	20.0	-50.0	50.0	19.1
R9																											
R10																											
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27
(ROW)	(COLUMN) NOTE:																										
R0	C3		T is Temperature (Reported temperature is inside temperature when verifying OATS EIRP in our inside chamber)																								
R0	C4		RH is Relative Humidity (Reported humidity is inside humidity when verifying OATS EIRP in our inside chamber)																								
R0	C5		MR is Measurement Range, which is reduced from DR to achieve necessary SNR.																								
R0	C6		DR is the regulatory Desired Range measurement distance.																								
R0	C7		N/F is Near-Field / Far-Field distance computed for max of EUT Antenna Dimension (C10) and Test Antenna dimension (C12), where applicable.																								
R0	C8		CF is Distance Correction Factor is computed using a 20 dB/decade field decay rate.																								
R0	C18		EIRP computed from Substitution Method measurements at MR distance.																								
R0	C19		AG is Antenna Gain (as declared by the manufacturer). See exhibit "HFA31 - Exh 10 - Antenna Design Specification - CONFIDENTIAL"																								
R0	C20		EIRP Pk is used to demonstrate compliance																								
R0	C21		AP is Antenna Power = EIRP Pk (C18) – AG (C19)																								
R0	C23, C24		Method following MIC Notice 88, Annex 22-16																								

5.3 Unintentional Emissions

5.3.1 Transmit Chain Spurious Emissions

The results for the measurement of transmit chain spurious emissions at the nominal voltage and temperature for all modes of operation are provided in Figure-Table 5.3.1 .

Table 5.3.1 Transmit Chain Spurious Emissions.

Test Engineer: J. Nantz

Test Date: 01/14/25

EUT Modes: a1 Continuous Motion (Tx & Rx)
a2

R0	Frequency		Site						EUT			Test Antenna			Cable	Receiver		Measured		Computed		Limits	Details
	Start	Stop	T	RH	MR	DR	N/F	CF	Mode	Volt.	Dim	Pol.	Dim.	Ka	Kg	RBW	VBW	E-field @ DR		EIRP		EIRP	Pass
	GHz	GHz	C	%	m			dB	above	V	cm	H/V	cm	dB/m	dB	MHz		dBuV/m		dBm		dBm	Fail
																		Pk	Avg	Pk	Avg		
R1	SETUP:		OATSA						HFA31			HQR1TO18S01				RSFSV30001		NOTES:					
R2	1000.0	6000.0	21	61	3.0	3.0	1.9		a1	13.4	6.0	H/V	22.0	33.0	-0.2	1.00	3.00	49.3		-45.9		-26	19.9
R3	6000.0	18000.0	21	61	3.0	3.0	2.7		a1	13.4	6.0	H/V	15.0	34.3	-0.6	1.00	3.00	51.1		-44.1		-26	18.1
R4	SETUP:		OATSC						HFA31			HRNK01				RSFSV30001		NOTES:					
R5	18000.0	24000.0	21	61	0.6	3.0	1.7	14.0	a1	13.4	6.0	H/V	10.2	33.2		1.00	3.00	44.0		-51.2		-26	25.2
R6	24050.0	24050.0	21	61	0.6	3.0	1.7	14.0	a1	13.4	6.0	H/V	10.2	33.2		1.00	3.00	50.0		-45.2		-26	19.2
R7	24250.0	24250.0	21	61	0.6	3.0	1.7	14.0	a1	13.4	6.0	H/V	10.2	33.2		1.00	3.00	59.7		-35.5		-26	9.5
R8	24250.0	26500.0	21	61	0.6	3.0	1.8	14.0	a1	13.4	6.0	H/V	10.2	33.7		1.00	3.00	47.3		-47.9		-26	21.9
R9	SETUP:		OATSC						HFA31			HRNKA01				RSFSV30001		NOTES:					
R10	26500.0	40000.0	21	61	0.6	3.0	2.3	14.0	a1	13.4	6.0	H/V	9.2	35.4	36.5	1.00	3.00	47.1		-48.1		-26	22.1
R11	SETUP:		OATSC						HFA31			HRNU001				RSFSV30001		NOTES:					
R12	40000.0	70000.0	21	61	0.6	3.0	1.9	14.0	a1	13.4	6.0	H/V	6.3	39.1		1.00	3.00	50.2		-45.0		-26	19.0
R13	48430.0	48430.0	21	61	0.6	3.0	1.3	14.0	a1	13.4	6.0	H/V	6.3	39.1		1.00	3.00	63.2	43.2	-52.0		-26	26.0
R14																							
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23

(ROW) (COLUMN) NOTE:

- R0 C3 T is Temperature (Reported temperature is inside temperature when verifying OATS EIRP in our inside chamber)
- R0 C4 RH is Relative Humidity (Reported humidity is inside humidity when verifying OATS EIRP in our inside chamber)
- R0 C5 MR is Measurement Range, which is reduced from DR to achieve necessary SNR.
- R0 C6 DR is the regulatory Desired Range measurement distance.
- R0 C7 N/F is Near / Far-Field distance computed for max of EUT Antenna Dimension (C10) and Test Antenna dimension (C12), where applicable.
- R0 C8 CF is Distance Correction Factor is computed using a 20 dB/decade field decay rate.
- R0 C18 Peak values are used to show compliance.
- R0 C18 EUT is in continuous motion mode therefore receiver emissions are included.
- R0 C20,C21 EIRP = E-field @ 3m – 95.2 dB
- R0 C22 Limit is -26dBm (2.5 uW) for out of band, spurious and receiver emissions, Method MIC Notice No.88 Annex 22-16

5.3.2 General Radiated and Cabinet Spurious

The results for the measurement of general spurious emissions (emissions arising from digital circuitry) at the nominal voltage and temperature are provided in Table 5.3.2. Radiation from digital components are measured up to 1000 MHz or to the highest frequency required by the applied standards, whichever is greater.

Table 5.3.2 Radiated Spurious Emissions.

Test Engineer: J. Nantz

Test Date: 01/14/25

EUT Modes: a1 Continuous Motion (Tx & Rx)
a2

R0	Frequency		T	Site				CF	EUT			Test Antenna			Cable Kg	Receiver		Measured		Computed		Limits EIRP Avg	Details Pass Fail
	Start	Stop		MR	DR	N/F	Mode		Volt.	Dim	Pol.	Dim.	Ka	RBW		VBW	E-field @ DR	EIRP					
	GHz	GHz	C	%	m	dB	above	V	cm	H/V	cm	dB/m	dB	MHz	Pk	Qpk	Pk	Qpk	dBm	dB			
	GHz	GHz	C	%	m	dB	above	V	cm	H/V	cm	dB/m	dB	MHz	Pk	Qpk	Pk	Qpk	dBm	dB			
R1	SETUP:		OATSC						HFA31			BICEMCO01			RSFSV30001		NOTES:						
R2	30.0	47.0	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	13.3	25.8	0.12	0.30	37.4		-57.8		-26	31.8
R3	47.0	74.0	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	9.5	24.6	0.12	0.30	37.6		-57.6		-26	31.6
R4	74.0	87.5	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	7.6	24.5	0.12	0.30	38.1		-57.1		-26	31.1
R5	87.5	118.0	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	7.8	24.4	0.12	0.30	40.9		-54.3		-26	28.3
R6	118.0	174.0	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	9.8	24.3	0.12	0.30	41.3		-53.9		-26	27.9
R7	174.0	230.0	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	13.9	24.2	0.12	0.30	41.7		-53.5		-26	27.5
R8	230.0	250.0	21	67	3.0	3.0			a1	13.4	6.0	H/V	150.0	14.7	24.1	0.12	0.30	39.8		-55.4		-26	29.4
R9	SETUP:		OATSC						HFA31			LOGEMCO01			RSFSV30001		NOTES:						
R10	250.0	470.0	21	67	3.0	3.0			a1	13.4	6.0	H	100.0	16.9	23.6	0.12	0.30	38.7		-56.5		-26	30.5
R11	470.0	862.0	21	67	3.0	3.0			a1	13.4	6.0	H	100.0	22.1	21.9	0.12	0.30	39.3		-55.9		-26	29.9
R12	862.0	1000.0	21	67	3.0	3.0			a1	13.4	6.0	H	100.0	24.1	24.5	0.12	0.30	40.3		-54.9		-26	28.9
#	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21	C22	C23

(ROW)

(COLUMN)

NOTE:

- R0 C3 T is Temperature (Reported temperature is inside temperature when verifying OATS EIRP in our inside chamber)
- R0 C4 RH is Relative Humidity (Reported humidity is inside humidity when verifying OATS EIRP in our inside chamber)
- R0 C5 MR is Measurement Range, which is reduced from DR to achieve necessary SNR.
- R0 C6 DR is the regulatory Desired Range measurement distance.
- R0 C7 N/F is Near / Far-Field distance computed for max of EUT Antenna Dimension (C11) and Test Antenna dimension (C13), where applicable.
- R0 C8 CF is Distance Correction Factor is computed using a 20 dB/decade field decay rate.
- R0 C18 Reported values are the max of EUT or background noise, whichever is greater.
- R0 C20 Peak values are used to show compliance
- R0 C20,C21 EIRP = E-field @ 3m – 95.2 dB

6 Functionality

6.1 Interference Prevention Function

6.1.1 Test Setup and Procedures

Test Parameters In order to demonstrate compliance with the JRL interference prevention requirements, the EUT is verified to confirm this product employs one of the three acceptable means of interference prevention detailed in RL Article 6-2 (3), (4), or (5).

Setup EUT is setup for normal operation, radar transmission modulation and manufacturer details are reviewed to confirm one of the three acceptable methods of interference prevention are present.

6.1.2 Test Results

It is determined that the EUT satisfies the requirement of RL Article 6-2 (5), as the EUT uses Coherent Detection and Integration and the radar's transmit energy is time spread, both methods accepted for discriminating desired signals from interference under this article.

6.2 RF Accessibility Prevention Function

6.2.1 Test Setup and Procedures

Test Parameters To demonstrate compliance with the JRL limited RF accessibility requirement, the EUT is reviewed to ensure the manufacturer implements a means to prevent the end user from accessing the RF circuitry in line with Notice 88, Annex 22-16, Appendix 43, 44, and 45.

6.2.2 Test Results

It is determined that the EUT satisfies the requirement of Notice 88, Annex 22-16, Appendix 43, 44, and 45, as the EUT is fully enclosed in a laser welded plastic housing and all radio components are manufactured via surface mount technology. Thus the product RF circuit is inaccessible and not adjustable.

7 Measurement Uncertainty

The maximum values of measurement uncertainty for the laboratory test equipment and facilities associated with each test are given in the table below. This uncertainty is computed for a 95.45% confidence level based on a coverage factor of $k = 2$.

Table 7.0.0 Measurement Uncertainty.

Measured Parameter	Measurement Uncertainty [†]
Radio Frequency	$\pm(f_{Mkr}/10^7 + RBW/10 + (SPN/(PTS - 1))/2 + 1 \text{ Hz})$
Conducted Emm. Amplitude	$\pm 1.59 \text{ dB}$
3-axis Exp. Amplitude (9 kHz – 30 MHz)	$\pm 0.8 \text{ dB}$
Radiated Emm. Amplitude (30 – 200 MHz)	$\pm 3.27 \text{ dB}$
Radiated Emm. Amplitude (200 – 1000 MHz)	$\pm 3.58 \text{ dB}$
Radiated Emm. Amplitude ($f > 1000 \text{ MHz}$)	$\pm 3.22 \text{ dB}$
Conducted Imm. Amplitude (0.15 - 400 MHz)	$\pm 2.7 \text{ dB}$
Radiated Imm. Amplitude (80 - 6000 MHz)	$\pm 2.6 \text{ dB}$
Electrostatic Discharge	ISO 10605 Compliant
DC and Low Frequency Voltages	$\pm 2\%$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 5\%$

[†]Ref: CISPR 16-4-2:2011+A1:2014