



Entrust Corporation

LC Conversion Phase 2

FCC 15.225:2022

13.56 MHz Radio

Report: DTCD0090.1 Rev. 1, Issue Date: February 6, 2023



CERTIFICATE OF TEST



Last Date of Test: January 25, 2022
Entrust Corporation
EUT: LC Conversion Phase 2

Radio Equipment Testing

Standards

Specification	Method
FCC 15.207:2022	ANSI C63.10:2013
FCC 15.225:2022	

Results

Method Clause	Test Description	Applied	Results	Comments
6.2	Powerline Conducted Emissions	Yes	Pass	
6.4	Field Strength of Fundamental	Yes	Pass	
6.4	Field Strength of Spurious Emissions (Less Than 30 MHz)	Yes	Pass	
6.5	Field Strength of Spurious Emissions (Greater Than 30 MHz)	Yes	Pass	
6.8	Frequency Stability	No	N/A	Not required for a Class II Permissive Change to add a host to a limited modular approval.
6.9.2	Occupied Bandwidth	No	N/A	Not required to add a host to a limited modular approval. Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart.

Deviations From Test Standards

None

Approved By:

Eric Brandon, Department Manager

Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information. As indicated in the Statement of Work sent with the quotation, Element's standard process is to always use the latest published version of the test methods even when earlier versions are cited in the test specification. Issuance of a purchase order was de facto acceptance of this approach. Otherwise, the client would have advised Element in writing of the specific version of the test methods they wanted applied to the subject testing.

REVISION HISTORY

Revision Number	Description	Date (yyyy-mm-dd)	Page Number
01	Updated power settings table.	2023-02-06	11
	Added EUT serial number to all data sheets.	2023-02-06	15, 17, 20, 21, 22, 24, 26
	Fixed distance correction. Added note about worst case orientation	2023-02-06	24
	Updated polarity column to Horiz.	2023-02-06	26
	Added module information to configurations.	2023-02-06	12

ACCREDITATIONS AND AUTHORIZATIONS



United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Each laboratory is accredited by A2LA to ISO / IEC 17025, and as a product certifier to ISO / IEC 17065 which allows Element to certify transmitters to FCC and IC specifications.

Canada

ISED - Recognized by Innovation, Science and Economic Development Canada as a Certification Body (CB) and as a CAB for the acceptance of test data.

European Union

European Commission – Recognized as an EU Notified Body validated for the EMCD and RED Directives.

United Kingdom

BEIS – Recognized by the UK as an Approved Body under the UK Radio Equipment and UK EMC Regulations.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

MSIT / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Israel

MOC – Recognized by MOC as a CAB for the acceptance of test data.

Hong Kong

OFCA – Recognized by OFCA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

SCOPE

For details on the Scopes of our Accreditations, please visit:

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FACILITIES



California Labs OC01-17 41 Tesla Irvine, CA 92618 (949) 861-8918	Minnesota Labs MN01-11 9349 W Broadway Ave. Brooklyn Park, MN 55445 (612)-638-5136	Oregon Labs EV01-12 6775 NE Evergreen Pkwy #400 Hillsboro, OR 97124 (503) 844-4066	Texas Labs TX01-09 3801 E Plano Pkwy Plano, TX 75074 (469) 304-5255	Washington Labs NC01-05 19201 120 th Ave NE Bothell, WA 98011 (425)984-6600
A2LA				
Lab Code: 3310.04	Lab Code: 3310.05	Lab Code: 3310.02	Lab Code: 3310.03	Lab Code: 3310.06
Innovation, Science and Economic Development Canada				
2834B-1, 2834B-3	2834E-1, 2834E-3	2834D-1	2834G-1	2834F-1
BSMI				
SL2-IN-E-1154R	SL2-IN-E-1152R	SL2-IN-E-1017	SL2-IN-E-1158R	SL2-IN-E-1153R
VCCI				
A-0029	A-0109	A-0108	A-0201	A-0110
Recognized Phase I CAB for ISED, ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA				
US0158	US0175	US0017	US0191	US0157



MEASUREMENT UNCERTAINTY



Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document QM205.4.6. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found in the table below. A lab specific value may also be found in the applicable test description section. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

Test	+ MU	- MU
Frequency Accuracy	0.0007%	-0.0007%
Amplitude Accuracy (dB)	1.2 dB	-1.2 dB
Conducted Power (dB)	1.2 dB	-1.2 dB
Radiated Power via Substitution (dB)	0.7 dB	-0.7 dB
Temperature (degrees C)	0.7°C	-0.7°C
Humidity (% RH)	2.5% RH	-2.5% RH
Voltage (AC)	1.0%	-1.0%
Voltage (DC)	0.7%	-0.7%
Field Strength (dB)	5.2 dB	-5.2 dB
AC Powerline Conducted Emissions (dB)	3.2 dB	-3.2 dB

TEST SETUP BLOCK DIAGRAMS

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Unless otherwise stated, measurements were made using the bandwidths and detectors specified. No video filter was used.

Antenna Port Conducted Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

Near Field Test Fixture Measurements



Sample Calculation (logarithmic units)

Measured Value		Measured Level		Reference Level Offset
71.2	=	42.6	+	28.6

TEST SETUP BLOCK DIAGRAMS

Emissions Measurements



Sample Calculation (logarithmic units)

Radiated Emissions:

Measured Level (Amplitude)	Factor				Distance Adjustment Factor	External Attenuation	Field Strength
	Antenna Factor	Cable Factor	Amplifier Gain				
42.6	28.6	3.1	40.8	+	0.0	0.0	= 33.5

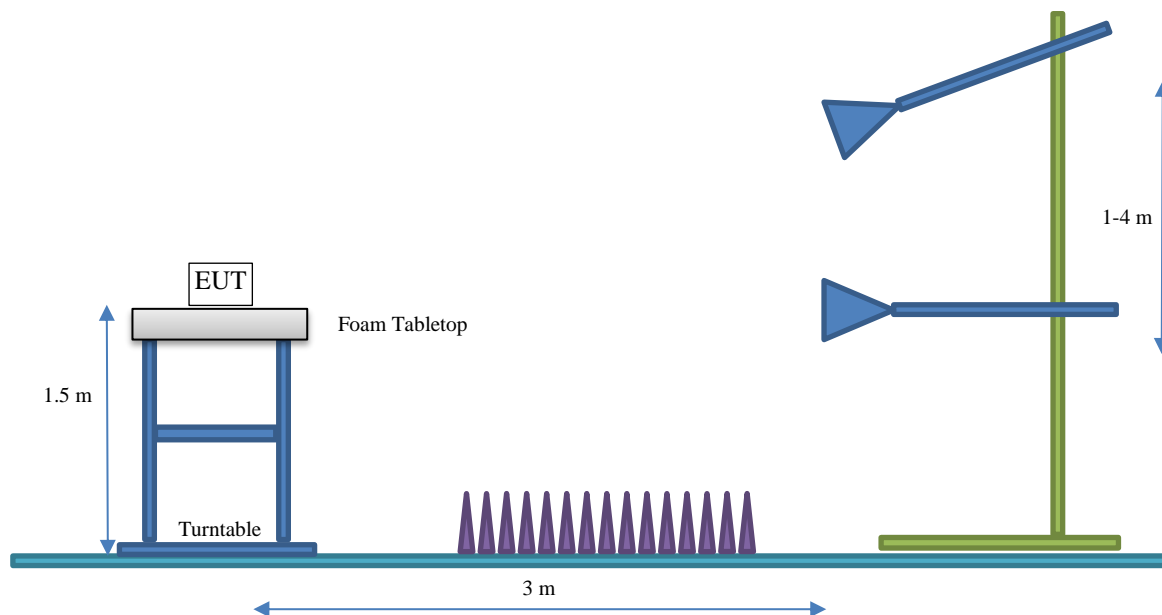
Conducted Emissions:

Measured Level (Amplitude)	Factor			External Attenuation	Adjusted Level
	Transducer Factor	Cable Factor			
26.7	0.3	0.1	+	20.0	= 47.1

TEST SETUP BLOCK DIAGRAMS

Bore Sighting (>1GHz)

The diameter of the illumination area is the dimension of the line tangent to the EUT formed by 3 dB beamwidth of the measurement antenna at the measurement distance. At a 3 meter test distance, the diameter of the illumination area was 3.8 meters at 1 GHz and greater than 2.1 meters up to 6 GHz. Above 1 GHz, when required by the measurement standard, the antenna is pointed for both azimuth and elevation to maintain the receive antenna within the cone of radiation from the EUT. The specified measurement detectors were used for comparison of the emissions to the peak and average specification limits.



PRODUCT DESCRIPTION



Client and Equipment Under Test (EUT) Information

Company Name:	Entrust Corporation
Address:	1187 Park Place
City, State, Zip:	Shakopee, MN 55379
Test Requested By:	Mike Greschner
EUT:	Card Machine
First Date of Test:	January 24, 2022
Last Date of Test:	January 25, 2022
Receipt Date of Samples:	January 24, 2022
Equipment Design Stage:	Prototype
Equipment Condition:	No Damage
Purchase Authorization:	Verified

Information Provided by the Party Requesting the Test

Functional Description of the EUT:

Card Machine with 12 electrically identical 13.56 MHz radios which transmit sequentially in a loop, as well as containing 1 separate RFID board. Contains the following radios with the following FCC IDs which are being integrated into the LC Conversion Phase 2 host:
Contactless card, GDI-50543001, quantity 12
Graphics supplies, GDI-SID004, quantity 1

Testing Objective:

To demonstrate compliance to FCC Part 15.225 specifications.

POWER SETTINGS AND ANTENNAS



The power settings, antenna gain value(s) and cable loss (if applicable) used for the testing contained in this report were provided by the customer and will affect the validity of the results. Element assumes no responsibility for the accuracy of this information.

ANTENNA GAIN

Name	Type	Provided by:	Frequency Range (MHz)	Antenna Description	Quantity
Graphics supplies	PCB Trace	Entrust Corporation	13.56	Circular, 4 turns, 46mm diameter	1
Contactless card	PCB Trace	Entrust Corporation	13.56	Rectangular, 2 turns, 68mm x 43 mm	12

No adjustable power settings were provided. The EUT was tested using power settings pre-defined by the manufacturer.

Radio	Modulation	Protocol	Data Rate	Frequency
Passive RFID	ASK	ISO 15693	26.48 kbps	13.56 MHz

CONFIGURATIONS



Configuration DTCD0090- 1

Software/Firmware Running During Test	
Description	Version
Firmware, Graphics	538874-001
Firmware, Contactless card	508166-701

EUT			
Description	Manufacturer	Model/Part Number	Serial Number
MX Card System	Entrust Datacard	MX Series, LC Conversion, Phase 2	MXX810182
RFID Radio Module w/ECS crystal	Entrust Datacard	534508-001-D	1981D201106687

Cables					
Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
AC Cable	No	2 m	No	MX Card System	AC Mains

MODIFICATIONS



Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	2022-01-24	Field Strength of Fundamental	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
2	2022-01-24	Field Strength of Spurious Emissions (Less than 30 MHz)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
3	2022-01-24	Field Strength of Spurious Emissions (Greater than 30 MHz)	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Element following the test.
4	2022-01-25	Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

POWERLINE CONDUCTED EMISSIONS

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Per the standard, an insulating material was also added to ground plane between the EUT's power and remote I/O cables. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Gauss Instruments	TDEMI 30M	ARK	2021-11-02	2022-11-02
LISN	Solar Electronics	9252-50-R-24-BNC	LIY	2021-03-15	2022-03-15
Cable - Conducted Cable Assembly	Northwest EMC	MNC, HGN, TYK	MNCA	2021-03-10	2022-03-10

MEASUREMENT UNCERTAINTY

Description		
Expanded k=2	3.2 dB	-3.2 dB

CONFIGURATIONS INVESTIGATED

DTCD0090-1

MODES INVESTIGATED

Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.

POWERLINE CONDUCTED EMISSIONS

EUT:	LC Conversion Phase 2	Work Order:	DTCD0090
Serial Number:	MXX810182	Date:	2022-01-25
Customer:	Entrust Corporation	Temperature:	21.8°C
Attendees:	Craig Jacobsen	Relative Humidity:	16.3%
Customer Project:	None	Bar. Pressure (PMSL):	1031 mb
Tested By:	Chris Patterson	Job Site:	MN03
Power:	220VAC/60Hz	Configuration:	DTCD0090-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013

TEST PARAMETERS

Run #:	1	Line:	Neutral	Add. Ext. Attenuation (dB):	0
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COMMENTS

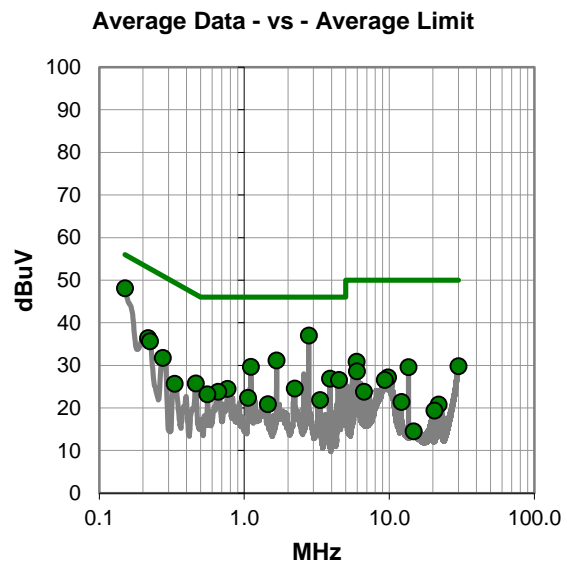
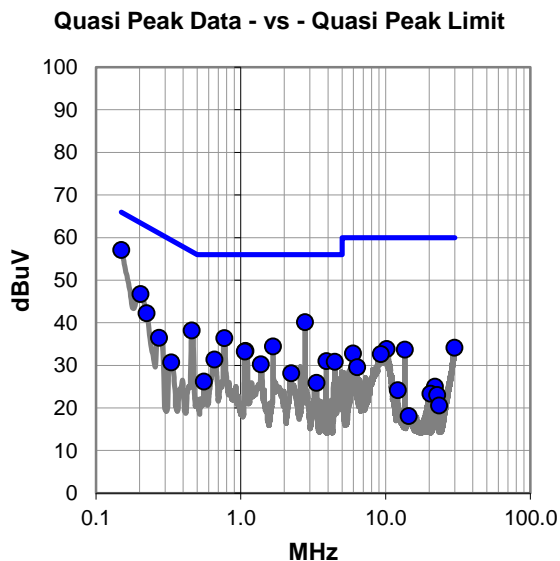
Graphics Materials Unit active, adding contactless card unit

EUT OPERATING MODES

Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #1

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (I)	Spec. Limit (I)	Margin (dB)
0.150	36.1	21.0	57.1	66.0	-8.9
2.784	19.6	20.6	40.2	56.0	-15.8
0.203	26.1	20.7	46.8	63.5	-16.7
0.459	17.7	20.5	38.2	56.7	-18.5
0.769	15.9	20.5	36.4	56.0	-19.6
0.224	21.7	20.6	42.3	62.7	-20.4
1.670	14.0	20.5	34.5	56.0	-21.5
1.078	12.9	20.5	33.4	56.0	-22.6
1.069	12.8	20.5	33.3	56.0	-22.7
0.272	16.0	20.5	36.5	61.0	-24.5
0.658	11.0	20.4	31.4	56.0	-24.6
3.896	10.4	20.6	31.0	56.0	-25.0
4.457	10.3	20.6	30.9	56.0	-25.1
1.377	9.8	20.5	30.3	56.0	-25.7
29.934	12.6	21.6	34.2	60.0	-25.8
10.140	13.0	20.9	33.9	60.0	-26.1
13.560	12.8	20.9	33.7	60.0	-26.3
5.943	12.2	20.6	32.8	60.0	-27.2
9.296	11.9	20.8	32.7	60.0	-27.3
2.228	7.7	20.5	28.2	56.0	-27.8
0.331	10.2	20.5	30.7	59.4	-28.7
0.556	5.7	20.5	26.2	56.0	-29.8
3.339	5.3	20.6	25.9	56.0	-30.1
6.362	8.9	20.7	29.6	60.0	-30.4
21.924	3.7	21.3	25.0	60.0	-35.0

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (I)	Spec. Limit (I)	Margin (dB)
0.150	27.1	21.0	48.1	56.0	-7.9
2.784	16.4	20.6	37.0	46.0	-9.0
1.670	10.7	20.5	31.2	46.0	-14.8
1.111	9.2	20.5	29.7	46.0	-16.3
0.217	15.8	20.6	36.4	52.9	-16.5
0.224	15.1	20.6	35.7	52.7	-17.0
3.896	6.3	20.6	26.9	46.0	-19.1
5.949	10.3	20.6	30.9	50.0	-19.1
0.274	11.3	20.5	31.8	51.0	-19.2
4.507	6.0	20.6	26.6	46.0	-19.4
29.934	8.2	21.6	29.8	50.0	-20.2
13.560	8.7	20.9	29.6	50.0	-20.4
0.462	5.3	20.5	25.8	46.7	-20.9
5.978	8.0	20.6	28.6	50.0	-21.4
2.226	4.1	20.5	24.6	46.0	-21.4
0.767	4.0	20.5	24.5	46.0	-21.5
0.659	3.4	20.4	23.8	46.0	-22.2
9.783	6.4	20.8	27.2	50.0	-22.8
0.556	2.7	20.5	23.2	46.0	-22.8
9.304	5.8	20.8	26.6	50.0	-23.4
1.058	1.9	20.5	22.4	46.0	-23.6
0.331	5.2	20.5	25.7	49.4	-23.7
3.339	1.3	20.6	21.9	46.0	-24.1
1.454	0.4	20.5	20.9	46.0	-25.1
6.682	3.0	20.8	23.8	50.0	-26.2

CONCLUSION

Pass



Tested By

POWERLINE CONDUCTED EMISSIONS

EUT:	LC Conversion Phase 2	Work Order:	DTCD0090
Serial Number:	MXX810182	Date:	2022-01-25
Customer:	Entrust Corporation	Temperature:	21.8°C
Attendees:	Craig Jacobsen	Relative Humidity:	16.3%
Customer Project:	None	Bar. Pressure (PMSL):	1031 mb
Tested By:	Chris Patterson	Job Site:	MN03
Power:	220VAC/60Hz	Configuration:	DTCD0090-1

TEST SPECIFICATIONS

Specification:	Method:
FCC 15.207:2022	ANSI C63.10:2013

TEST PARAMETERS

Run #:	2	Line:	High Line	Add. Ext. Attenuation (dB):	0
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COMMENTS

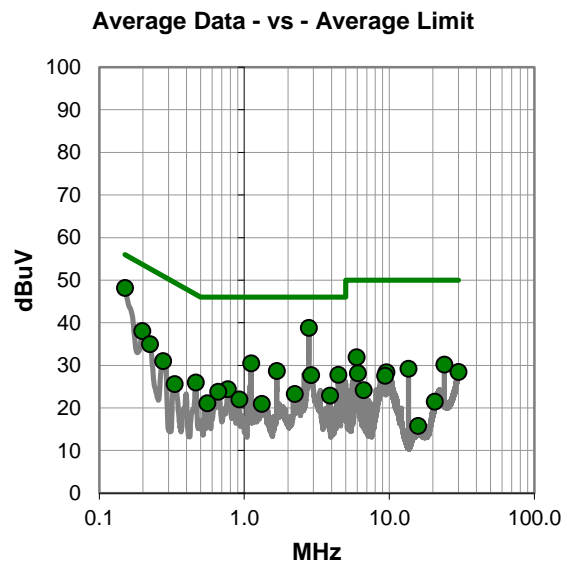
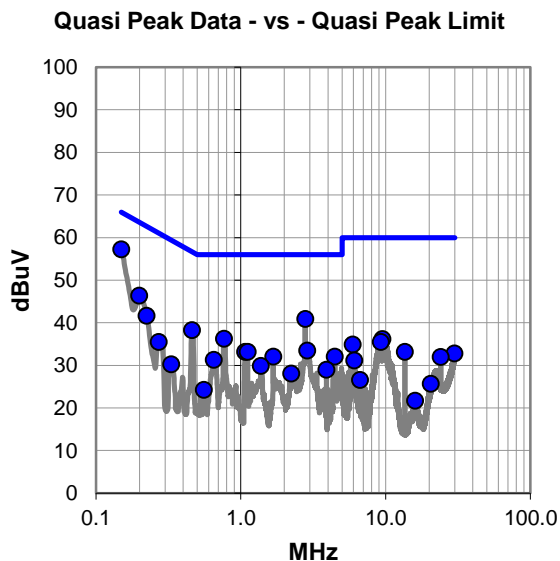
Graphics Materials Unit active, adding contactless card unit

EUT OPERATING MODES

Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.

DEVIATIONS FROM TEST STANDARD

None



POWERLINE CONDUCTED EMISSIONS

RESULTS - Run #2

Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (I)	Spec. Limit (I)	Margin (dB)
0.150	36.3	21.0	57.3	66.0	-8.7
2.787	20.3	20.6	40.9	56.0	-15.1
0.199	25.7	20.7	46.4	63.7	-17.3
0.460	17.8	20.5	38.3	56.7	-18.4
0.767	15.8	20.5	36.3	56.0	-19.7
0.224	21.1	20.6	41.7	62.7	-21.0
2.881	12.9	20.6	33.5	56.0	-22.5
1.073	12.7	20.5	33.2	56.0	-22.8
1.115	12.7	20.5	33.2	56.0	-22.8
9.505	15.4	20.8	36.2	60.0	-23.8
4.460	11.5	20.6	32.1	56.0	-23.9
1.676	11.6	20.5	32.1	56.0	-23.9
9.279	14.7	20.8	35.5	60.0	-24.5
0.652	10.9	20.4	31.3	56.0	-24.7
5.938	14.3	20.6	34.9	60.0	-25.1
0.271	15.0	20.5	35.5	61.1	-25.6
1.379	9.4	20.5	29.9	56.0	-26.1
13.560	12.3	20.9	33.2	60.0	-26.8
3.902	8.4	20.6	29.0	56.0	-27.0
29.939	11.2	21.6	32.8	60.0	-27.2
2.229	7.6	20.5	28.1	56.0	-27.9
23.985	10.7	21.3	32.0	60.0	-28.0
6.074	10.5	20.7	31.2	60.0	-28.8
0.331	9.8	20.5	30.3	59.4	-29.1
0.557	3.8	20.5	24.3	56.0	-31.7

Average Data - vs - Average Limit

Freq (MHz)	Amp. (dBuV)	Factor (dB)	Adjusted (I)	Spec. Limit (I)	Margin (dB)
2.787	18.2	20.6	38.8	46.0	-7.2
0.150	27.2	21.0	48.2	56.0	-7.8
1.115	10.0	20.5	30.5	46.0	-15.5
0.197	17.4	20.7	38.1	53.7	-15.6
1.676	8.2	20.5	28.7	46.0	-17.3
0.224	14.4	20.6	35.0	52.7	-17.7
5.938	11.3	20.6	31.9	50.0	-18.1
4.455	7.2	20.6	27.8	46.0	-18.2
2.883	7.1	20.6	27.7	46.0	-18.3
23.985	8.9	21.3	30.2	50.0	-19.8
0.275	10.5	20.5	31.0	51.0	-20.0
0.462	5.5	20.5	26.0	46.7	-20.7
13.561	8.3	20.9	29.2	50.0	-20.8
29.937	6.9	21.6	28.5	50.0	-21.5
9.560	7.6	20.8	28.4	50.0	-21.6
0.769	3.9	20.5	24.4	46.0	-21.6
6.074	7.5	20.7	28.2	50.0	-21.8
0.659	3.4	20.4	23.8	46.0	-22.2
9.336	6.8	20.8	27.6	50.0	-22.4
2.229	2.8	20.5	23.3	46.0	-22.7
3.902	2.3	20.6	22.9	46.0	-23.1
0.331	5.1	20.5	25.6	49.4	-23.8
0.925	1.5	20.5	22.0	46.0	-24.0
0.555	0.6	20.5	21.1	46.0	-24.9
1.322	0.5	20.5	21.0	46.0	-25.0

CONCLUSION

Pass



Tested By

FIELD STRENGTH OF FUNDAMENTAL



PSA-ESCI 2021.12.10.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.
Transmitting at 13.56 MHz on the Graphics Materials RFID

POWER SETTINGS INVESTIGATED

220VAC/60Hz

CONFIGURATIONS INVESTIGATED

DTCD0090 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	490 MHz	Stop Frequency	30 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR26	ARP	2021-04-08	2022-04-08
Cable	ESM Cable Corp.	Antenna Loop Cable	MNE	2021-02-17	2022-02-17
Antenna - Loop	ETS Lindgren	6502	AOB	2021-06-01	2023-06-01

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

The fundamental carrier of the EUT was maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A calibrated active loop antenna was used for this test in order to provide sufficient measurement sensitivity. The reference point of the loop antenna was maintained at 1m above the ground plane during the testing.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector


As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.5, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

FIELD STRENGTH OF FUNDAMENTAL



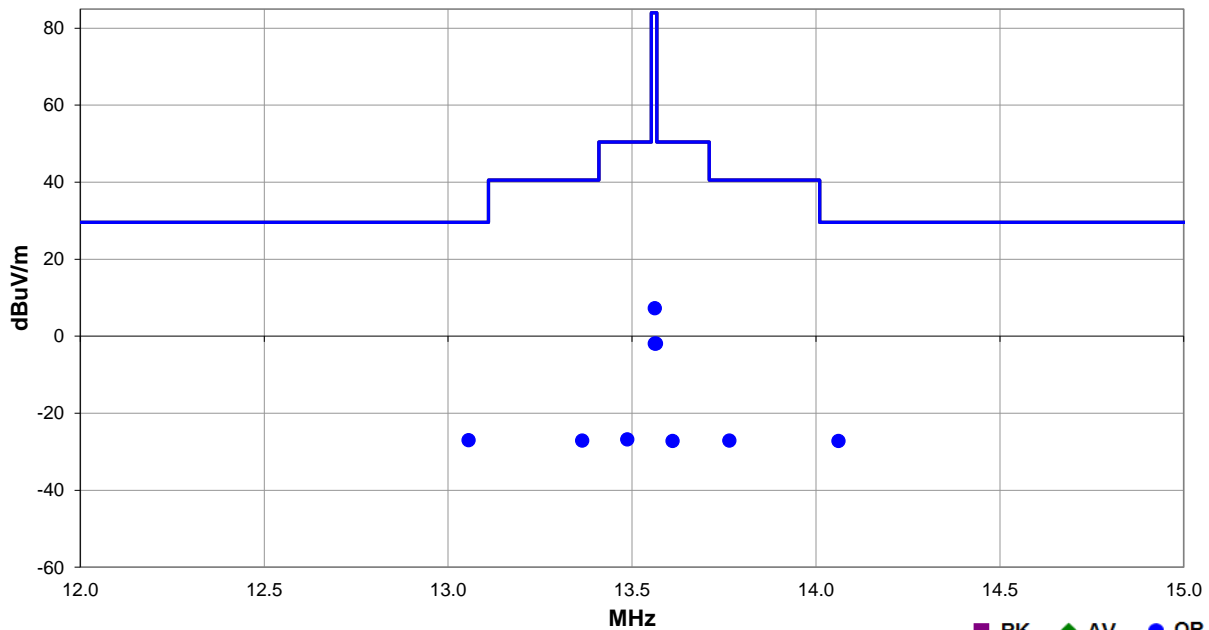
EmiRS 2021.09.09.0

PSA-ESCI 2021.12.10.0

Work Order:	DTCD0090	Date:	2022-01-24	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	16.5% RH	
Serial Number:	MXX810182	Barometric Pres.:	1016 mbar	
EUT:		LC Conversion Phase 2		
Configuration:	1			
Customer:	Entrust Corporation			
Attendees:	Craig Jacobsen			
EUT Power:	220VAC/60Hz			
Operating Mode:	Transmitting at 13.56 MHz on the Graphics Materials RFID			
Deviations:	None			
Comments:	Graphics Materials Unit active.			

Test Specifications	Test Method
FCC 15.225:2022	ANSI C63.10:2013

Run #	2	Test Distance (m)	3	Antenna Height(s)	1(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
13.056	1.9	11.1	1.0	82.0	3.0	0.0	Para to GND	QP	-40.0	-27.0	29.5	-56.5
14.061	1.8	11.0	1.0	43.0	3.0	0.0	Para to GND	QP	-40.0	-27.2	29.5	-56.7
13.365	1.8	11.1	1.0	360.0	3.0	0.0	Para to GND	QP	-40.0	-27.1	40.5	-67.6
13.765	1.9	11.0	1.0	360.0	3.0	0.0	Para to GND	QP	-40.0	-27.1	40.5	-67.6
13.562	36.3	11.0	1.0	0.0	3.0	0.0	Para to GND	QP	-40.0	7.3	84.0	-76.7
13.487	2.1	11.1	1.0	0.0	3.0	0.0	Para to GND	QP	-40.0	-26.8	50.5	-77.3
13.610	1.8	11.0	1.0	82.0	3.0	0.0	Para to GND	QP	-40.0	-27.2	50.5	-77.7
13.565	27.1	11.0	1.0	5.0	3.0	0.0	Para to EUT	QP	-40.0	-1.9	84.0	-85.9
13.562	27.1	11.0	1.0	64.0	3.0	0.0	Perp to EUT	QP	-40.0	-1.9	84.0	-85.9

FIELD STRENGTH OF FUNDAMENTAL



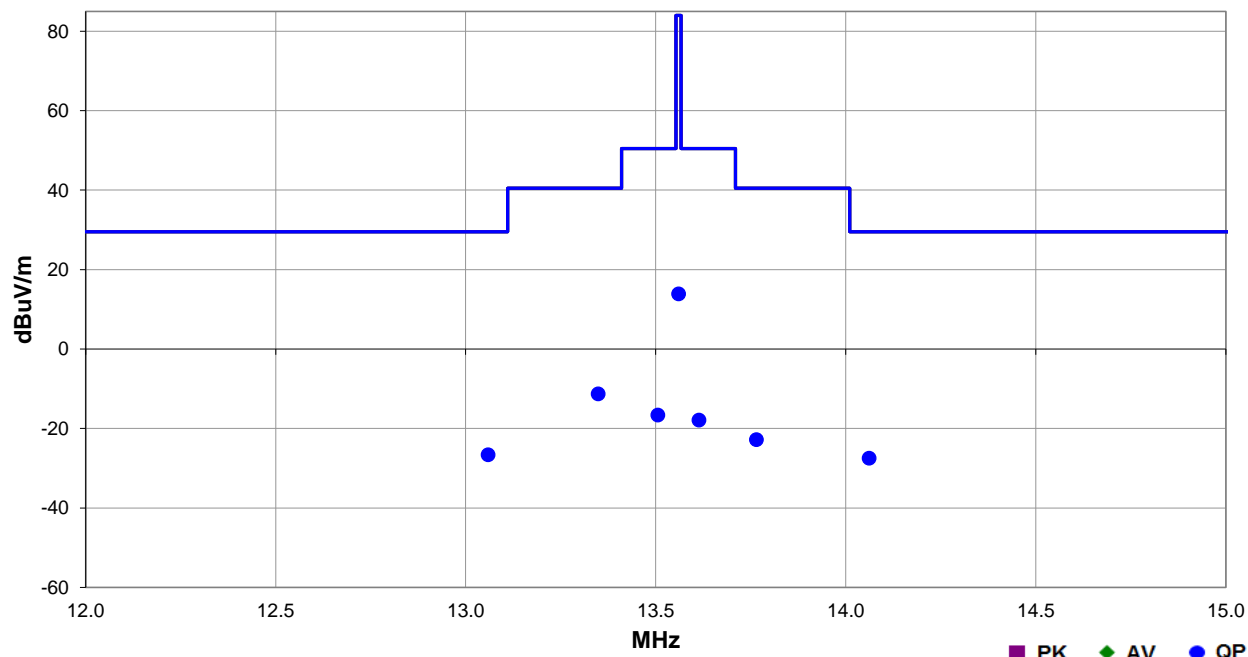
EmR5 2021.09.09.0

PSA-ESCI 2021.12.10.0

Work Order:	DTCD0090	Date:	2022-01-24	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	16.5% RH	
Serial Number:	MX810182	Barometric Pres.:	1016 mbar	Tested by: Chris Patterson
EUT:	LC Conversion Phase 2			
Configuration:	1			
Customer:	Entrust Corporation			
Attendees:	Craig Jacobsen			
EUT Power:	220VAC/60Hz			
Operating Mode:	Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.			
Deviations:	None			
Comments:	Graphics Materials Unit, and contactless card unit active			

Test Specifications	Test Method
FCC 15.225:2022	ANSI C63.10:2013

Run #	3	Test Distance (m)	3	Antenna Height(s)	1(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
13.349	17.6	11.1	1.0	332.0	3.0	0.0	Para to GND	QP	-40.0	-11.3	40.5	-51.8
13.059	2.3	11.1	1.0	0.0	3.0	0.0	Para to GND	QP	-40.0	-26.6	29.5	-56.1
14.062	1.5	11.0	1.0	41.0	3.0	0.0	Para to GND	QP	-40.0	-27.5	29.5	-57.0
13.765	6.2	11.0	1.0	309.0	3.0	0.0	Para to GND	QP	-40.0	-22.8	40.5	-63.3
13.505	12.4	11.0	1.0	311.0	3.0	0.0	Para to GND	QP	-40.0	-16.6	50.5	-67.1
13.614	11.1	11.0	1.0	305.0	3.0	0.0	Para to GND	QP	-40.0	-17.9	50.5	-68.4
13.560	42.9	11.0	1.0	328.0	3.0	0.0	Para to GND	QP	-40.0	13.9	84.0	-70.1

FIELD STRENGTH OF FUNDAMENTAL

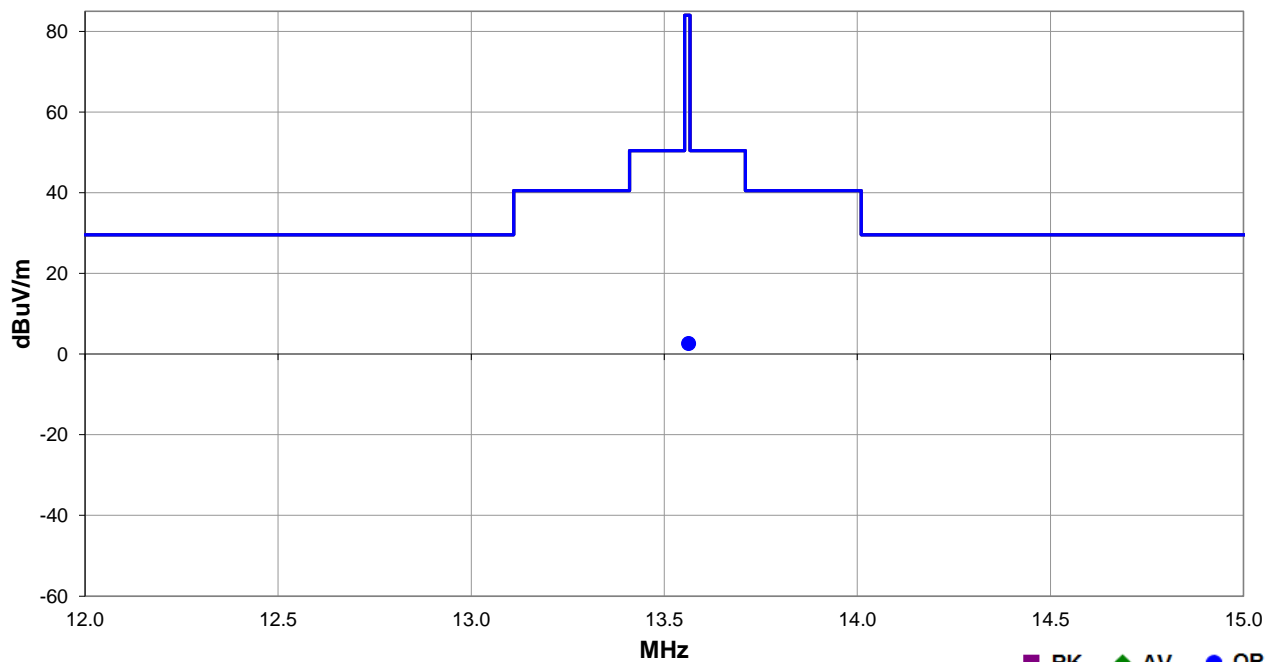


EmiR5 2021.09.09.0

PSA-ESCI 2021.12.10.0

Work Order:	DTCD0090	Date:	2022-01-24	
Project:	None	Temperature:	21.5 °C	
Job Site:	MN04	Humidity:	16.5% RH	
Serial Number:	MXX810182	Barometric Pres.:	1016 mbar	
EUT: LC Conversion Phase 2				Tested by: Chris Patterson
Configuration:	1			
Customer:	Entrust Corporation			
Attendees:	Craig Jacobsen			
EUT Power:	220VAC/60Hz			
Operating Mode:	Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.			
Deviations:	None			
Comments:	Graphics Materials Unit, and contactless card unit active			

Test Specifications					Test Method		
FCC 15.225:2022					ANSI C63.10:2013		
Run #	4	Test Distance (m)	10	Antenna Height(s)	1(m)	Results	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
13.563	10.7	11.0	1.0	67.0	10.0	0.0	Para to GND	QP	-19.1	2.6	84.0	-81.4

TRANSMITTER SPURIOUS EMISSIONS < 30 MHz



PSA-ESCI 2021.12.10.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.

POWER SETTINGS INVESTIGATED

220VAC/60Hz

CONFIGURATIONS INVESTIGATED

DTCD0090 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	490 MHz	Stop Frequency	30 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR26	ARP	2021-04-08	2022-04-08
Cable	ESM Cable Corp.	Antenna Loop Cable	MNE	2021-02-17	2022-02-17
Antenna - Loop	ETS Lindgren	6502	AOB	2021-06-01	2023-06-01

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was continuously transmitting while set to the channel specified.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis if required, and adjusting the measurement antenna height and polarization (per ANSI C63.10). An active loop antenna was used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector
PK = Peak Detector
AV = RMS Detector

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.


As outlined in 15.209(e), 15.31(f)(2), and RSS-GEN, 6.5, measurements may be performed at a distance closer than what is specified with the limit. The limit at the specified distance is shown on the data sheet. Measurements are made at a closer distance and the data is adjusted using a distance correction factor of 40dB/decade for comparison to the limit.

TRANSMITTER SPURIOUS EMISSIONS < 30 MHz



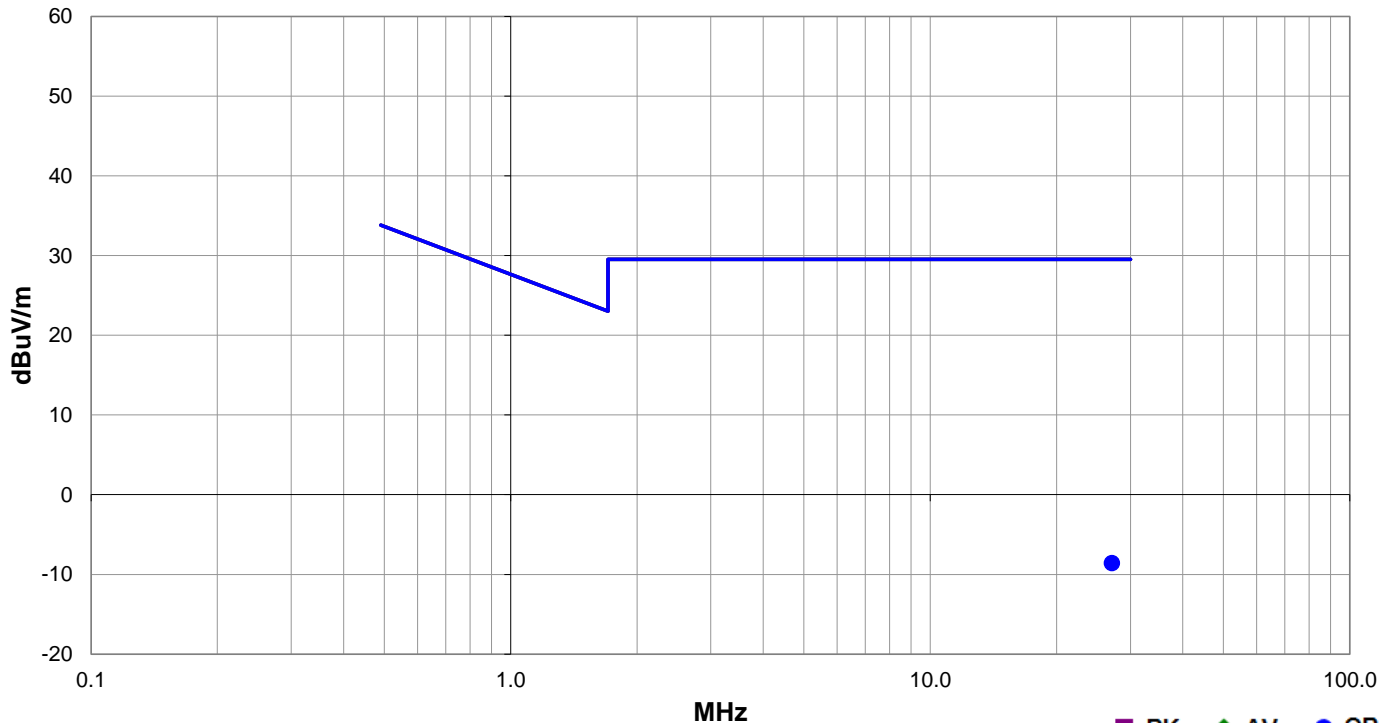
EmiR5 2021.09.09.0

PSA-ESCI 2021.12.10.0

Work Order:	DTCD0090	Date:	2022-01-24		
Project:	None	Temperature:	22.3 °C		
Job Site:	MN04	Humidity:	17.4% RH		
Serial Number:	MXX810182	Barometric Pres.:	1016 mbar	Tested by:	Chris Patterson
EUT:	LC Conversion Phase 2				
Configuration:	1				
Customer:	Entrust Corporation				
Attendees:	Craig Jacobsen				
EUT Power:	220VAC/60Hz				
Operating Mode:	Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.				
Deviations:	None				
Comments:	Graphics Materials Unit active, adding contactless card unit. Only worst case orientation from previous data measured.				

Test Specifications	Test Method
FCC 15.225:2022	ANSI C63.10:2013

Run #	5	Test Distance (m)	10	Antenna Height(s)	1(m)	Results	Pass
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Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
27.092	1.0	9.5	1.0	286.0	10.0	0.0	Para to GND	QP	-19.1	-8.6	29.5	-38.1

FIELD STRENGTH OF SPURIOUS EMISSIONS

> 30 MHz



PSA-ESCI 2021.12.10.0

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.

POWER SETTINGS INVESTIGATED

220VAC/60Hz

CONFIGURATIONS INVESTIGATED

DTCD0090 - 1

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	1000 MHz
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SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Cal. Due
Receiver	Rohde & Schwarz	ESR26	ARP	2021-04-08	2022-04-08
Filter - Low Pass	Micro-Tronics	LPM50004	HGW	2021-09-12	2022-09-12
Amplifier - Pre-Amplifier	Miteq	AM-1551	PAC	2021-06-17	2022-06-17
Cable	ESM Cable Corp.	MN04 Bilog Cables	MND	2021-02-02	2022-02-02
Antenna - Biconilog	ETS Lindgren	3142D	AXN	2021-12-08	2023-12-08

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

TEST DESCRIPTION

The antennas to be used with the EUT were tested. The EUT was transmitting while set at the operating channel.

For each configuration, the spectrum was scanned throughout the specified range as part of the exploratory investigation of the emissions. These "pre-scans" are not included in the report. Final measurements on individual emissions were then made and included in this test report.

The individual emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.10). A preamp and high pass filter (and notch filter) were used for this test in order to provide sufficient measurement sensitivity.

Measurements were made with the required detectors and annotated on the data for each individual point using the following annotation:

QP = Quasi-Peak Detector

PK = Peak Detector

AV = RMS Detector

Measurements were made to satisfy the specific requirements of the test specification for out of band emissions as well as the restricted band requirements.

If there are no detectable emissions above the noise floor, the data included may show noise floor measurements for reference only.

FIELD STRENGTH OF SPURIOUS EMISSIONS > 30 MHz

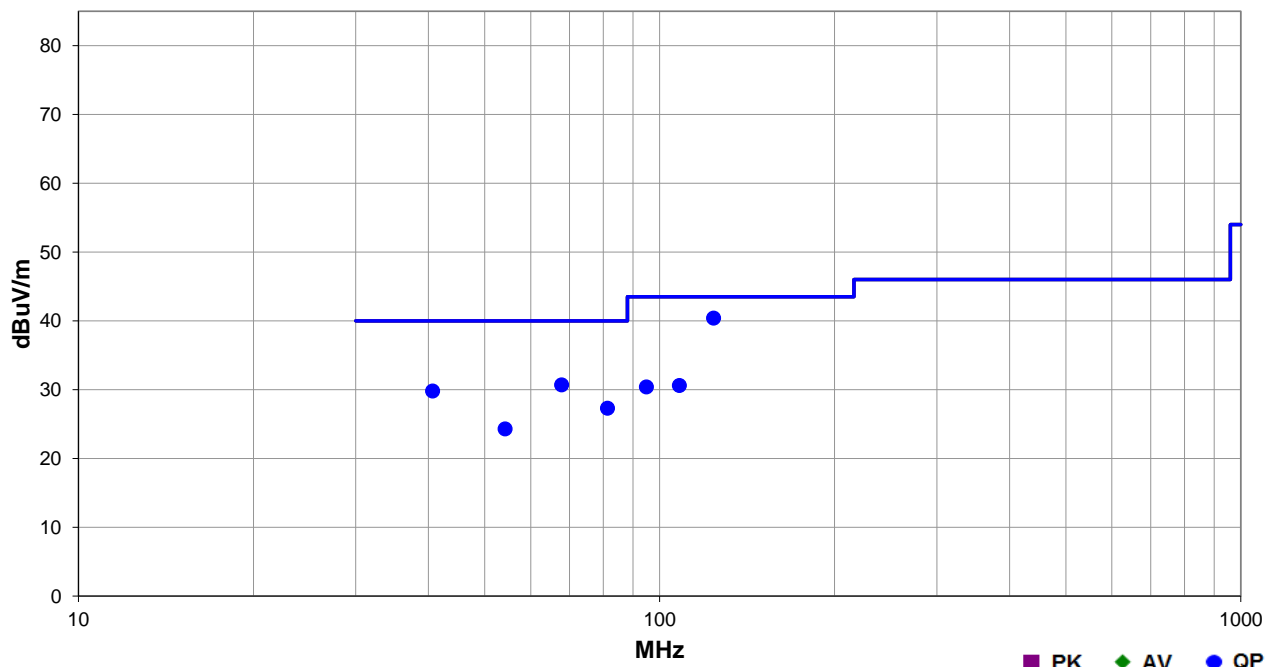


EmiR5 2021.09.09.0

PSA-ESCI 2021.12.10.0

Work Order:	DTCD0090	Date:	2022-01-24	
Project:	None	Temperature:	22.3 °C	
Job Site:	MN04	Humidity:	17.4% RH	
Serial Number:	MXX810182	Barometric Pres.:	1016 mbar	
EUT: MX Series, LC Conversion, Phase 2				Tested by: Chris Patterson
Configuration:	1			
Customer:	Entrust Corporation			
Attendees:	Craig Jacobsen			
EUT Power:	220VAC/60Hz			
Operating Mode:	Transmitting at 13.56 MHz on the Graphics supplies RFID and contactless card unit. Graphics supplies RFID transmitting continuously. Contactless card unit transmitting sequentially through the 12 RFID radios on the unit as it would in the field.			
Deviations:	None			
Comments:	Graphics Materials Unit and contactless card unit, active			

Test Specifications				Test Method			
FCC 15.225:2022				ANSI C63.10:2013			
Run #	8	Test Distance (m)	10	Antenna Height(s)	1 to 4(m)	Results	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB/m)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)
123.784	61.4	-31.5	4.0	81.0	10.0	0.0	Horz	QP	10.5	40.4	43.5	-3.1
67.800	52.3	-32.1	3.88	9.0	10.0	0.0	Horz	QP	10.5	30.7	40.0	-9.3
40.678	47.3	-28.0	3.77	266.0	10.0	0.0	Horz	QP	10.5	29.8	40.0	-10.2
81.330	49.2	-32.4	3.93	24.0	10.0	0.0	Horz	QP	10.5	27.3	40.0	-12.7
108.159	50.7	-30.6	4.0	31.0	10.0	0.0	Horz	QP	10.5	30.6	43.5	-12.9
94.922	50.9	-31.0	3.89	317.0	10.0	0.0	Horz	QP	10.5	30.4	43.5	-13.1
54.233	45.6	-31.8	3.87	156.0	10.0	0.0	Horz	QP	10.5	24.3	40.0	-15.7

End of Test Report