

EMC TEST REPORT

Report: EMC_SL17042801-DUS-002R1

Supersedes: N/A



Applicant Name:	Dust Networks
Product Name:	2.4 GHz Wireless Mote
Model Name:	M2510
Test Standard:	RED EN301-489-17 V3.2.0
Test Method:	RED EN301-489-17 V3.2.0, & EN 61000-4-3:2010
Date of Test:	May 2, 2017
Report Issue Date:	May 23, 2017

Test Result: ☒ Pass ☐ Fail

Equipment complied with the specifications: ☒

Equipment did not comply with the specifications: ☐

This test report is issued under the authority of:

			
Full Name:	John Plotner	Full Name:	Michael R. Gates
Title:	EMC Test Engineer	Title:	Quality Engineer

This test report may be reproduced in full only.

Test result presented in this test report is applicable to the tested sample only.

ISSUED BY:

SIEMIC Laboratories

775 Montague Expressway, Milpitas, CA 95035 USA



Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for conformity assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for conformity assessment

Country/Region	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1. Report revision history

Report No.	Version No.	Description	Issue Date
SL17042801-DUS-002R1	Original	Original	May 23, 2017

2. Executive summary

The purpose of this test program was to demonstrate compliance of following product:

Company: Linear Technology Corp.
Product: 2.4 GHz Wireless Mote
Model: M2510

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page. This Report was made in order to meet the new RED standards requirements. Please refer to the CKC Lab original CE EMC Test Reports No.: ETS07-043B and ETS07-043B1 for all other tests previously tested to the current revised standard for both models M2140 and M2510.

3. Customer information

Applicant Name:	Dust Networks
Applicant Address:	32990 Alvarado-Niles Rd, Suite 910 Union City, CA, 94587, Milpitas, CA 95035 U.S.A.
Manufacturer Name:	Dust Networks
Manufacturer Address:	32990 Alvarado-Niles Rd, Suite 910 Union City, CA, 94587, Milpitas, CA 95035 U.S.A.

4. Test site information

Lab Performing Tests:	SIEMIC Laboratories
Lab Address:	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No:	881796
IC Test Site No:	4842D-2
VCCI Test Site No:	A0133

5. Modification

Index	Item	Description	Note
None	N/A	N/A	N/A

6. Test software version

Test Item	Vendor	Software	Version
Radiated Immunity	EMISoft	EMISoft Vasona	V5.0



7. EUT Information

7.1. EUT Description

Product Name:	2.4 GHz Wireless Mote
Model No.:	M2510
Trade Name:	Dust Networks
Serial No.:	00-17-00-00-06-4A-97
Input Power:	Battery
Software version:	N/A
Date of EUT received:	05/02/2017
Equipment Class/ Category:	Class A / Radio Node
Highest frequency generated or used in the device or on which the device operates or tunes:	2.4 GHz
Port/Connectors:	Serial
Remark:	Only Model M2510 was tested for this report, as this was considered worse case of the two models M2140 and M2510. The other model contains exactly the same hardware.
AC Power Cord Type:	N/A – Power Supplied Battery Power
DC Power Cable Type:	N/A

7.2. EUT Test modes / Configuration description

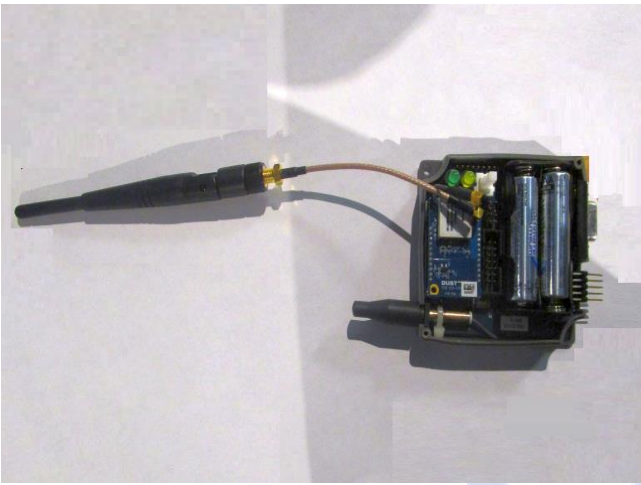

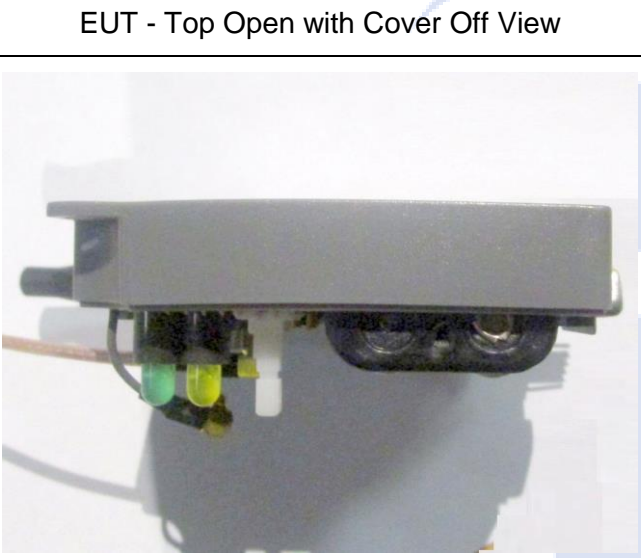

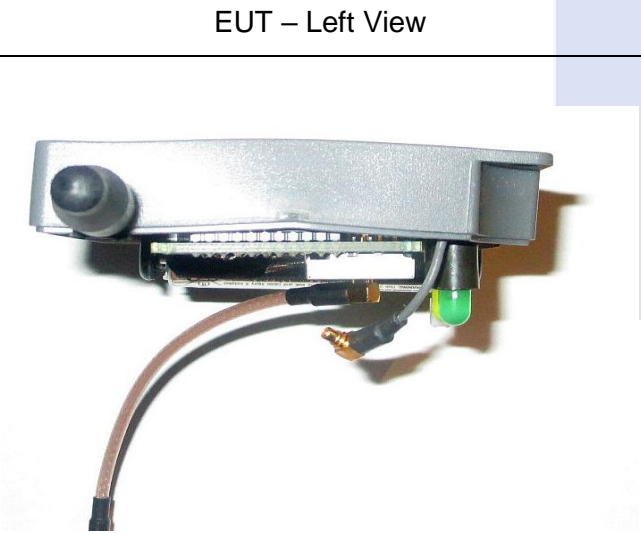
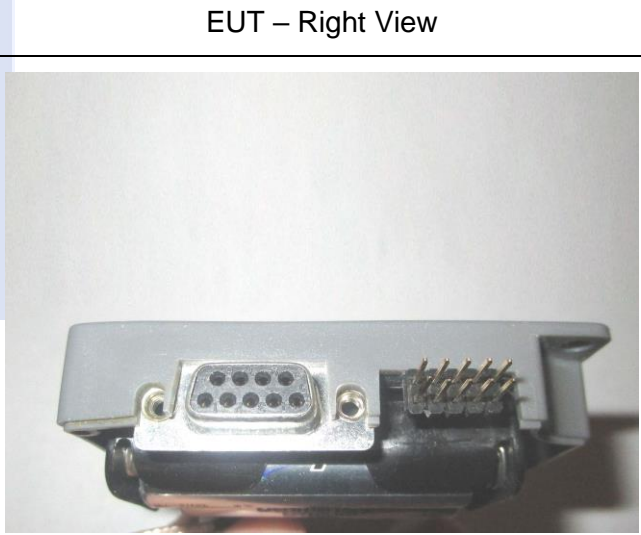
7.2.1.EUT Test modes: Pre-test mode

Prescan Test Mode		Notes
Pre-test Configuration 1	Manufacture Test Mode	The EUT was connected wirelessly to a laptop, and Network Manager with ping TX, and RX continuously transmitted.
Remark:		

7.2.2.EUT Test modes: Final test mode

Final Test Mode		Notes
Pre-test Configuration 1	Manufacture Test Mode	The EUT was connected wirelessly to a laptop, and Network Manager with ping TX, and RX continuously transmitted.
Remark:		

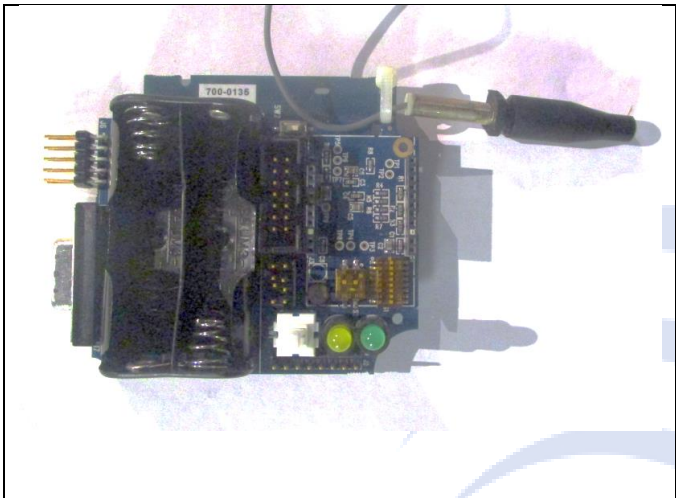
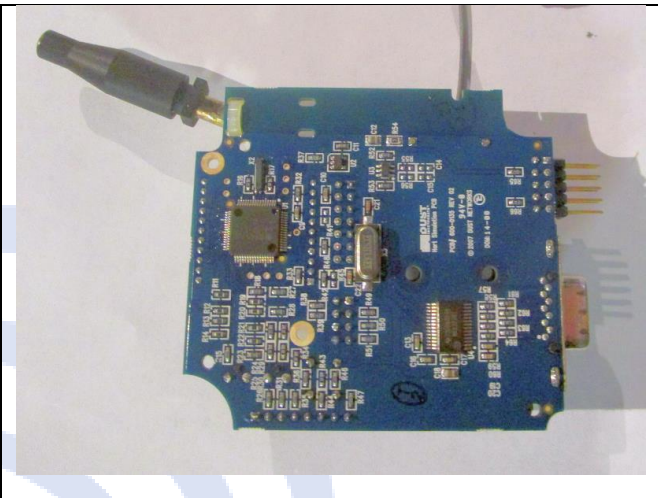


7.3. EUT Photos | External

	
	
	
<p>EUT - Top Open with Cover Off View</p>	<p>EUT Top Open with Cover Off Close Up</p>
<p>EUT - Left View</p>	<p>EUT - Right View</p>
<p>EUT - Top View</p>	<p>EUT - Bottom View</p>



EUT – Back View

7.4. EUT Photos | Internal

	
<p>EUT Mother Board Top</p>	<p>EUT Mother Board Bottom</p>
	
<p>Daughter Card – Top View</p>	<p>Main Daughter Card Bottom View</p>

7.5. EUT Photos | Test setup



Radiated Immunity Above 1GHz – Front View



Radiated Immunity Above 1GHz – Rear View

8. Supporting equipment / Software / Cabling information

8.1. Support equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	7675 X61 Thinkpad	LV-L6N2 08/06	Lenovo	Not Directly Connected to EUT. Used for Wireless Communications only.
3	Network Manager	Smartmesh-XD D2511	DCM2650	Dust Networks	Not Directly Connected to EUT. Used for Wireless Communications only.

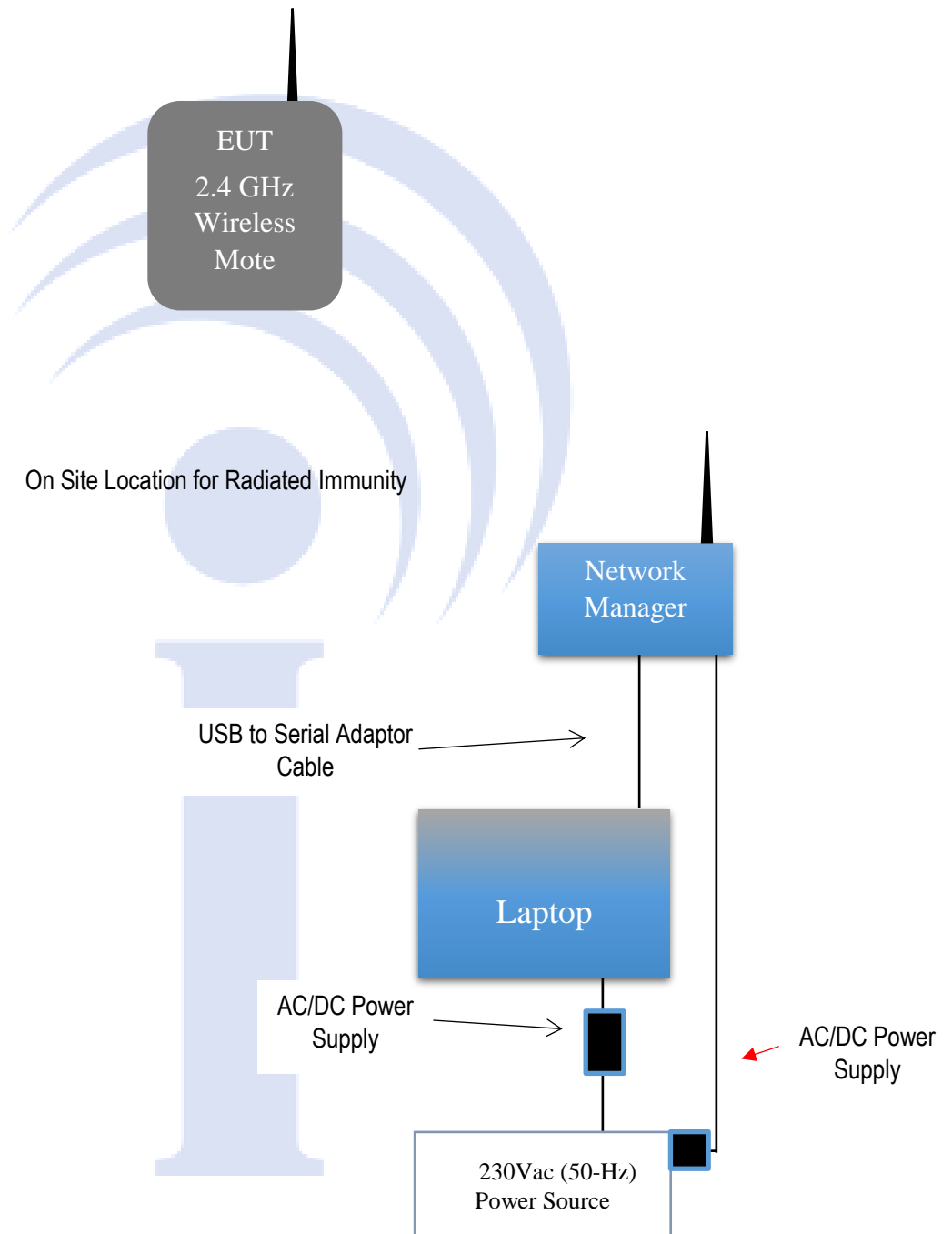
8.2. I/O Ports

Item	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
1	Laptop	USB	Network Manager	9pin Serial	0.3	Shielded	Not connected to EUT directly.
2	EUT	Serial	N/A	N/A	N/A	N/A	Maintenance Port Only

8.3. Test software description

Test Item	Software	Description
1	Command Prompt	Program used to RX and TX ping to the EUT from the laptop and network manager.

8.4. System setup block diagram



9. Test summary

Immunity			
Test Item	Test Standard	Test Method / Procedure	Pass / Fail
Electrostatic Discharge Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-2:2009	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A
Radiated RF Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-3:2010	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Electrical Fast Transients/Bust Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-4:2012	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A
Voltage Surge Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-5:2014	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A
Conducted Disturbances Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-6:2014	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A
Power Frequency Magnetic Field Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-8:2010	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A
Voltage Dips and Short Interruptions Immunity	EN55024 EN 301 489-50 V2.1.1, EN 301 489-1, & RED EN 301 489-1 V2.1.1/-52 V1.1.1 1	EN 61000-4-11:2004	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A
Remark	<ol style="list-style-type: none"> 1. All measurement uncertainties are not taken into consideration for all presented test result. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. 3. N/A: Refer these test items to the CKC Lab original CE EMC Test Report No.: ETS07-043B and ETS07-043B1." 		

10. Performance Criteria Per EN 301 489-1 V2.1.1 (2017-02)

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

Performance table

Table 1: Performance criteria

Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (see note 1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2).
<p>NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.</p> <p>If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p>		

Performance criteria for Continuous phenomena applied to Transmitters (CT)

The performance criteria A shall apply.

Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance criteria for Transient phenomena applied to Transmitters (TT)

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance criteria for Continuous phenomena applied to Receivers (CR)

The performance criteria A shall apply.

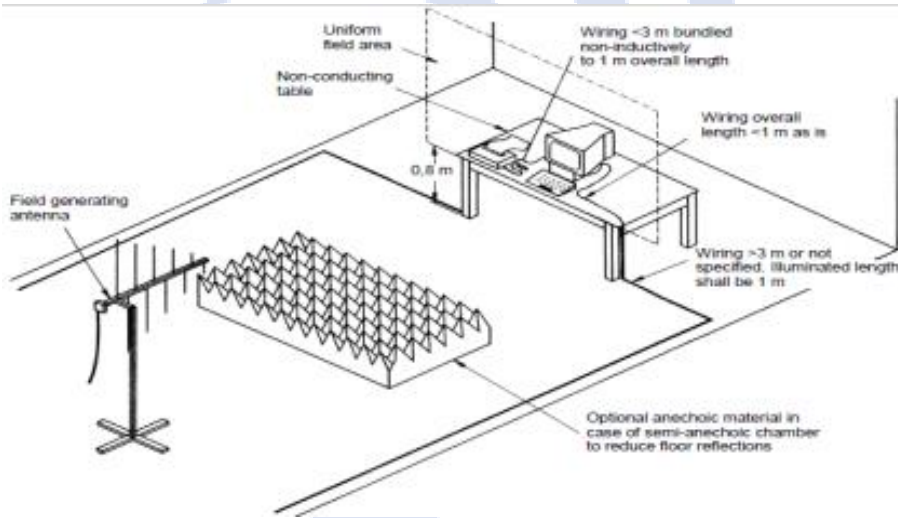
Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Performance criteria for Transient phenomena applied to Receivers (TR)

The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply.

Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

10.1. Radiated Susceptibility (RS)

Spec	Requirement	Applicable																		
RED EN301-489-17 V3.2.0 EN 61000-4-3:2010	<p>For ETSI EN 301 489 testing will be done in accordance to the EN 61000-4-3 test method will be used for the following tests. The frequency range for the Radiated RF Immunity test is 80MHz to 6000MHz. The test levels are given in the following table.</p> <table><thead><tr><th>Level</th><th>Test field strength (V/m)</th></tr></thead><tbody><tr><td>1</td><td>1</td></tr><tr><td>2</td><td>3</td></tr><tr><td>3</td><td>10</td></tr><tr><td>x</td><td>Special</td></tr></tbody></table> <p>Note: "x" is an open test level and the associated field strength may be any value. This level may be given in the product standard.</p>	Level	Test field strength (V/m)	1	1	2	3	3	10	x	Special	<div>☒</div>								
Level	Test field strength (V/m)																			
1	1																			
2	3																			
3	10																			
x	Special																			
Test Setup																				
Test Condition	<table><tbody><tr><td>Antenna position:</td><td>Horizon & verticality</td></tr><tr><td>Antenna distance:</td><td>1 meter</td></tr><tr><td>Magnetic field strength:</td><td>3 V/m</td></tr><tr><td>Frequency ranges:</td><td>1000MHz to 6000MHz</td></tr><tr><td>Modulation:</td><td>AM, 80 %, 1 kHz sine wave</td></tr><tr><td>Sweep rates:</td><td>1.5 x 10⁻³ decades/sec</td></tr><tr><td>Frequency steps:</td><td>1 % step</td></tr><tr><td>Injection position:</td><td>4 sections</td></tr><tr><td>Performance evaluation standard:</td><td>A</td></tr></tbody></table>	Antenna position:	Horizon & verticality	Antenna distance:	1 meter	Magnetic field strength:	3 V/m	Frequency ranges:	1000MHz to 6000MHz	Modulation:	AM, 80 %, 1 kHz sine wave	Sweep rates:	1.5 x 10 ⁻³ decades/sec	Frequency steps:	1 % step	Injection position:	4 sections	Performance evaluation standard:	A	
Antenna position:	Horizon & verticality																			
Antenna distance:	1 meter																			
Magnetic field strength:	3 V/m																			
Frequency ranges:	1000MHz to 6000MHz																			
Modulation:	AM, 80 %, 1 kHz sine wave																			
Sweep rates:	1.5 x 10 ⁻³ decades/sec																			
Frequency steps:	1 % step																			
Injection position:	4 sections																			
Performance evaluation standard:	A																			
Procedure	<div><div><div>1. The EUT was setup inside a semi-anechoic chamber in accordance with the standard.</div><div>2. The EUT was placed on top of a 0.8m high, non-metallic table in a typical configuration.</div><div>3. An isotropic field probe was placed adjacent to the EUT.</div><div>4. The EUT was switched on and allowed to warm up to its normal operating condition.</div><div>5. The EUT was exercised and monitored in the manner specified by the customer.</div><div>6. All test instruments were PC controlled, via their IEEE 488.2 bus interfaces, and the test was conducted in the following manner:<div><div>a. The testing frequencies were swept over the required frequency range, with a step frequency equal to 1% of fundamental. The sweep rate was 1.0 x 10⁻³ decades/s.</div></div></div></div></div>																			

	<p>b. For each frequency tested, the signal generator output level was adjusted automatically until the unmodulated field strength registered by the field monitor reached the desired level. This level was held constant for the specified dwell time.</p> <p>7. The EUT was continuously monitored during the test in accordance with the Pass / Fail criteria declared by the customer.</p> <p>8. The test was done in both horizontal and vertical antenna polarizations and for all necessary sides of the EUT.</p>
Remarks	The EUT model M2140 considered worse case of the two models. It was tested from 1 to 6GHz at 3 V/m to meet the new Directive Specifications. For the lower frequency testing rang of 80MHz to 1GHz please refer to the CKC Lab original CE EMC Test Reports No.: ETS07-043B and ETS07-043B1."
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A

Test Data ☒ Yes ☐ N/A

Test Plot ☐ Yes (See below) ☒ N/A














Test specification:	Radiated RF Immunity			
Environmental Conditions:	Temp(°C):	26	Result:	
	Humidity (%):	48		X Pass
	Atmospheric(mbar):	1010		
Mains Power:	230Vac, 50Hz			
Tested by:	John Plotner			Fail
Test Date:	May 2, 2017			
Remarks:	No changes were observed during the duration of these tests.			






Test Results						
Sides Tested	Frequency Range (MHz)	Test Severity Level	Antenna	Standard	Tested	Result
Front	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Rear	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Right	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Left	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Vertical	A	A	PASS
Front	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS
Rear	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS
Right	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS
Left	1000 – 6000 MHz	3V/m, 80% AM (1kHz)	Horizontal	A	A	PASS

11. Annex A | Test instruments and method

Instrument	Model	Serial #	Cal Cycle	Cal Due	In use
Radiated RF Immunity					
High Power Solid State Amplifier (80 - 1000MHz)	CMC150	M631-0408	N/A	-	NO
RF Power Amplifier (700-6000 MHz, 50 Watts)	5293RE	1035	N/A	-	YES
Antenna - Biconlog (26MHz – 2GHz)	3141	1203	N/A	-	NO
Horn Antenna (700MHz - 18GHz)	SAS-571	411	1 Year	5/13/2017	YES
Dual Channel Arbitrary Waveform Generator	WW1072	207593	1 Year	8/3/2017	YES
EMC Field Probe	HI-6005	156327	1 Year	7/5/2017	YES
3 Meters SAC	3M	N/A	1 Year	6/9/2017	YES

12. Annex B | SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		Radio & Telecommunications Terminal Equipment: EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		(Phase II) OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		Radio: Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII
Japan Recognized Certification Body Designation		Radio: A1. Terminal equipment for purpose of calling Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI
		EMS: KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EM, KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68

		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06, AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016, AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2