

EN 301 893 RF Test Report (Radiated Test)

Report No.: RE160104C01-4

Test Model: Type1GC

Received Date: Jan. 04, 2016

Test Date: Feb. 23, 2016

Issued Date: Mar. 24, 2016

Applicant: Murata Manufacturing Co., Ltd.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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A D T

Release Control Record

Issue No.	Description	Date Issued
RE160104C01-4	Original release	Mar. 24, 2016

1 Certificate of Conformity

Product: Communication Module

Brand: MURATA

Test Model: Type1GC

Sample Status: Engineering Sample

Applicant: Murata Manufacturing Co., Ltd.

Test Date: Feb. 23, 2016

Standards: EN 301 893 V1.8.1 (2015-03)

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Polly Chien , **Date:** Mar. 24, 2016
Polly Chien / Specialist

Approved by : Ken Liu , **Date:** Mar. 24, 2016
Ken Liu / Senior Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 301 893 V1.8.1		
Clause	Test Parameter	Result
	Transmitter Parameters	
4.2	Carrier Frequencies	See Note 3
4.3	Occupied Channel Bandwidth	See Note 3
4.4	RF Output Power	See Note 3
4.4	Transmit Power Control (TPC)	See Note 1
4.4	Power Density	See Note 3
4.8	Adaptivity (Channel Access Mechanism)	See Note 3
4.9	User Access Restrictions	See Note 3
4.5.1	Transmitter unwanted emissions outside the HIPERLAN bands	See Note 3
4.5.2	Transmitter unwanted emissions within the HIPERLAN bands	Pass
4.7	Dynamic Frequency Selection	See Note 2
4.10	Geo-location capability	Not Applicable
	Receiver Parameters	
4.6	Spurious Emissions	Pass

Note:

1. The device has no TPC function.
2. The "Dynamic Frequency Selection measurement" was recorded in Report No.: RE160104C01-2.
3. For other test items were recorded in Report No.: RE160104C01-1.

2.1 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer Agilent	N9030A	MY54490617	Jul. 14, 2015	Jul. 13, 2016
Spectrum Analyzer Rohde & Schwarz	FSV40	101042	Sep. 23, 2015	Sep. 22, 2016
Vector signal generator Agilent	E4438C	MY47271120	Sep. 24, 2015	Sep. 23, 2016
Open Switch and Control Unit Rohde & Schwarz	OSP120	B157-100898	Jan. 08, 2016	Jan. 07, 2017
Vector Signal Generator Rohde & Schwarz	SMJ 100A	101943	Dec. 03, 2015	Dec. 02, 2016
RF and Microwave Signal Generator Rohde & Schwarz	SMB100A	177994	Dec. 25, 2015	Dec. 24, 2016
BILOG Antenna SCHWARZBECK	VULB 9168	9168-158	Jan. 18, 2016	Jan. 17, 2017
HORN Antenna ETS	3117	00034128	Jan. 20, 2016	Jan. 19, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170243	Jan. 20, 2016	Jan. 19, 2017
Preamplifier Agilent	8449B	3008A01963	Aug. 22, 2015	Aug. 21, 2016
Preamplifier Agilent	8447D	2944A10627	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-RF1-03 (274397-4)	Nov. 02, 2015	Nov. 01, 2016
RF signal cable HUBER+SUHNER	CA3501-3501-G.90 (3m) & CA3501-3501-F.90 (2m)	NF090 (3m)*2 & TCF427S (2m)*1	Apr. 07, 2015	Apr. 06, 2016
Software ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower Max-Full	MFA-440H	9707	NA	NA
Turn Table ADT	NA	SN40303	NA	NA
Controller Max-Full	MF-7802	MF7802093	NA	NA
Temperature & Humidity chamber TERCHY	MHU-225AU	920842	Jun. 18, 2015	Jun. 17, 2016

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa RF Chamber 1.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Parameter	Uncertainty
Radio frequency	$\pm 1.06 \times 10^{-8}$
RF power conducted	1.371 dB
RF power radiated	± 3.294 dB
Spurious emissions	± 3.294 dB
Humidity	$\pm 0.3\%$
Temperature	$\pm 0.23^\circ\text{C}$
Time	$\pm 2.53\%$

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 301 893 standard, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [2] and TR 100 028-2 [3] and shall correspond to an expansion factor (coverage factor) $k = 1.96$ or $k = 2$ (which provide confidence levels of respectively 95 % and 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Maximum measurement uncertainty

Parameter	Uncertainty
Radio frequency	$\pm 1 \times 10^{-5}$
RF power conducted	± 1.5 dB
RF power radiated	± 6 dB
Spurious emissions	± 6 dB
Humidity	$\pm 5\%$
Temperature	$\pm 1^\circ\text{C}$
Time	$\pm 10\%$

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Communication Module
Brand	MURATA
Test Model	Type1GC
Regulatory Type	Engineering sample
Nominal Voltage	3.6Vdc (host)
Voltage Operation Range	$V_{nom} = 3.6$ $V_{min} = 3.0$ $V_{max} = 4.8$
Temperature Operating Range	-40~85°C
Modulation Type	64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 135Mbps
Operating Frequency	5180 ~ 5320MHz, 5500 ~ 5700MHz
Number of Channel	For 5180 ~ 5320MHz: 802.11a, 802.11n (HT20): 8 802.11n (HT40): 4 For 5500 ~ 5700MHz: 802.11a, 802.11n (HT20): 11 802.11n (HT40): 5
Antenna Type	Monopole pattern antenna with 2.5dBi gain
Antenna Connector	NA
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The EUT provides one completed transmitter and one receiver.

Modulation Mode	TX Function
802.11a	1TX
802.11n (HT20)	1TX
802.11n (HT40)	1TX

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

For 5180 ~ 5320MHz

8 channels are provided for 802.11a, 802.11n (HT20):

Channel	Frequency	Channel	Frequency
36	5180MHz	52	5260MHz
40	5200MHz	56	5280MHz
44	5220MHz	60	5300MHz
48	5240MHz	64	5320MHz

4 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
38	5190MHz	54	5270MHz
46	5230MHz	62	5310MHz

For 5500 ~ 5700MHz

11 channels are provided for 802.11a, 802.11n (HT20):

Channel	Frequency	Channel	Frequency
100	5500MHz	124	5620MHz
104	5520MHz	128	5640MHz
108	5540MHz	132	5660MHz
112	5560MHz	136	5680MHz
116	5580MHz	140	5700MHz
120	5600MHz		

5 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
102	5510MHz	126	5630MHz
110	5550MHz	134	5670MHz
118	5590MHz		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to		Description
	SE< 1G	SE≥ 1G	
-	√	√	-

Where SE<1G: Unwanted Emissions in the Spurious Domain below 1 GHz SE≥1G: Unwanted Emissions in the Spurious Domain above 1 GHz

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Spurious Emissions Test (Below 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11a	36 to 64	36	OFDM	BPSK	6.0
		100 to 140		OFDM	BPSK	6.0

Spurious Emissions Test (Above 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11a	36 to 64	36, 140	OFDM	BPSK	6.0
		100 to 140		OFDM	BPSK	6.0

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
SE<1G	22deg. C, 70%RH	230Vac, 50Hz	Kevin Kuo
SE≥1G	22deg. C, 70%RH	230Vac, 50Hz	Kevin Kuo

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5430	FKKCYW1	FCC DoC Approved	-
B.	Power Supply	TOPWARD	6303D	802236	NA	-
C.	Jig board	NA	NA	NA	NA	Provided by manufacturer

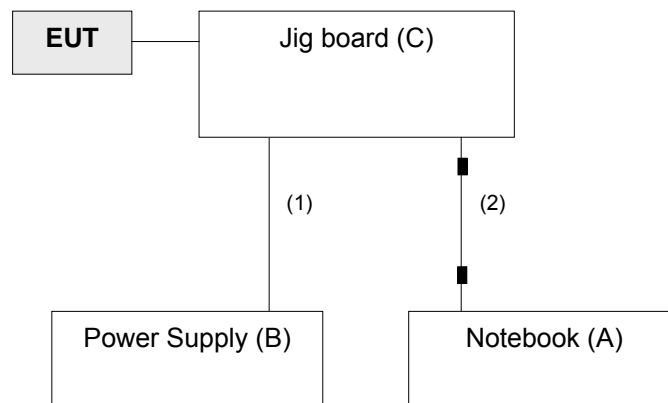
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Items A, B acted as communication partners to transfer data and under test table during test.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC power cable	4	1.8	-	0	-
2.	USB cable	1	1.8	Y	2	Provided by manufacturer

NOTE: The core(s) is(are) originally attached to the cable(s).

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specification of the EUT declared by the manufacturer, it must comply with the requirements of the following standards:

EN 301 893 V1.8.1 (2015-03)

All test items have been performed and recorded as per the above standard.

4 Test Procedure and Results

Transmitter Parameters

4.1 Transmitter Unwanted Emissions outside the 5 GHz RLAN Bands

4.1.1 Limits of Transmitter Unwanted Emission outside the 5 GHz RLAN Bands

Frequency Range (MHz)	Maximum power, ERP (dBm)	Bandwidth (kHz)
30 to 47	-36	100
47 to 74	-54	100
74 to 87.5	-36	100
87.5 to 118	-54	100
118 to 174	-36	100
174 to 230	-54	100
230 to 470	-36	100
470 to 862	-54	100
862 to 1000	-36	100
Frequency Range (GHz)	Maximum power, EIRP (dBm)	Bandwidth (MHz)
1 to 5.15	-30	1
5.35 to 5.47	-30	1
5.725 to 26	-30	1

4.1.2 Test Procedure

Refer to chapter 5.3.5.2 of ETSI EN 301 893 V1.8.1.

Measurement	
<input type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u> The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p> <p><u>Conducted measurement (For equipment with multiple transmit chains):</u> <input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1 MHz segments shall be added and compared with the limits. <input type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log_{10}(T_{CH})$ (number of active transmit chains).</p>	

4.1.3 Deviation from Test Standard

No deviation

4.1.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The test setup has been constructed as the normal use condition. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

4.1.5 Test Results

Below 1GHz worst-Case Data: 802.11a

Frequency Range	30MHz ~ 1GHz	Operating Channel	36
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Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
94.37	H	-70.00	-54.00	-16.00
96.67	V	-64.39	-54.00	-10.39
165.99	H	-65.15	-36.00	-29.15
165.99	V	-60.48	-36.00	-24.48
240.00	H	-62.72	-36.00	-26.72
345.01	H	-59.56	-36.00	-23.56
345.01	V	-61.07	-36.00	-25.07
480.01	H	-65.35	-54.00	-11.35
528.03	V	-67.69	-54.00	-13.69
625.00	H	-66.78	-54.00	-12.78
625.00	V	-64.80	-54.00	-10.80
729.08	V	-61.71	-54.00	-7.71

Above 1GHz worst-Case Data:

802.11a

Frequency Range	1GHz ~ 1500GHz	Operating Channel	36, 140
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Spurious Emission Level					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
36	5150.00	H	-46.07	-30.00	-16.07
	5150.00	V	-54.65	-30.00	-24.65
	6906.14	H	-55.31	-30.00	-25.31
	6906.42	V	-55.02	-30.00	-25.02
	10359.87	H	-50.75	-30.00	-20.75
	10363.73	V	-51.88	-30.00	-21.88
140	5725.00	H	-37.34	-30.00	-7.34
	5725.00	V	-46.98	-30.00	-16.98
	7599.55	H	-54.97	-30.00	-24.97
	7600.47	V	-54.97	-30.00	-24.97
	11399.44	H	-51.12	-30.00	-21.12
	11399.73	V	-51.47	-30.00	-21.47

Receiver Parameters

4.2 Receiver Spurious Radiation

4.2.1 Limit of Receiver Spurious Radiation

Frequency Range	Maximum Power Limit
30 MHz ~ 1 GHz	-57dBm
1 GHz ~ 26 GHz	-47dBm

4.2.2 Test Procedure

Refer to chapter 5.3.7.2 of ETSI EN 301 893 V1.8.1.

Measurement Method	
<input type="checkbox"/> Conducted measurement	<input checked="" type="checkbox"/> Radiated measurement
<p><u>For Conducted measurement:</u> The level of unwanted emissions shall be measured as their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment with the antenna connector(s) terminated by a specified load (cabinet radiation).</p>	
<p><u>Conducted measurement (For equipment with multiple transmit chains):</u> <input type="checkbox"/> Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits. <input type="checkbox"/> Option 2: The results for each of the transmit chains shall be individually compared with the limits after these limits have been reduced by $10 \times \log(N)$ (number of active transmit chains)</p>	

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The test setup has been constructed as the normal use condition. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

4.2.5 Test Results

Below 1GHz worst-Case Data: 802.11a

Frequency Range	30MHz ~ 1GHz	Operating Channel	36
-----------------	--------------	-------------------	----

Spurious Emission Level				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
74.87	V	-61.61	-57.00	-4.61
99.59	H	-65.55	-57.00	-8.55
166.58	V	-58.55	-57.00	-1.55
240.00	H	-62.84	-57.00	-5.84
240.00	V	-64.51	-57.00	-7.51
335.99	H	-64.50	-57.00	-7.50
335.99	V	-63.41	-57.00	-6.41
479.96	H	-65.52	-57.00	-8.52
633.63	V	-65.65	-57.00	-8.65
666.53	H	-68.64	-57.00	-11.64
844.82	V	-65.07	-57.00	-8.07
945.35	H	-64.62	-57.00	-7.62

Above 1GHz worst-Case Data:

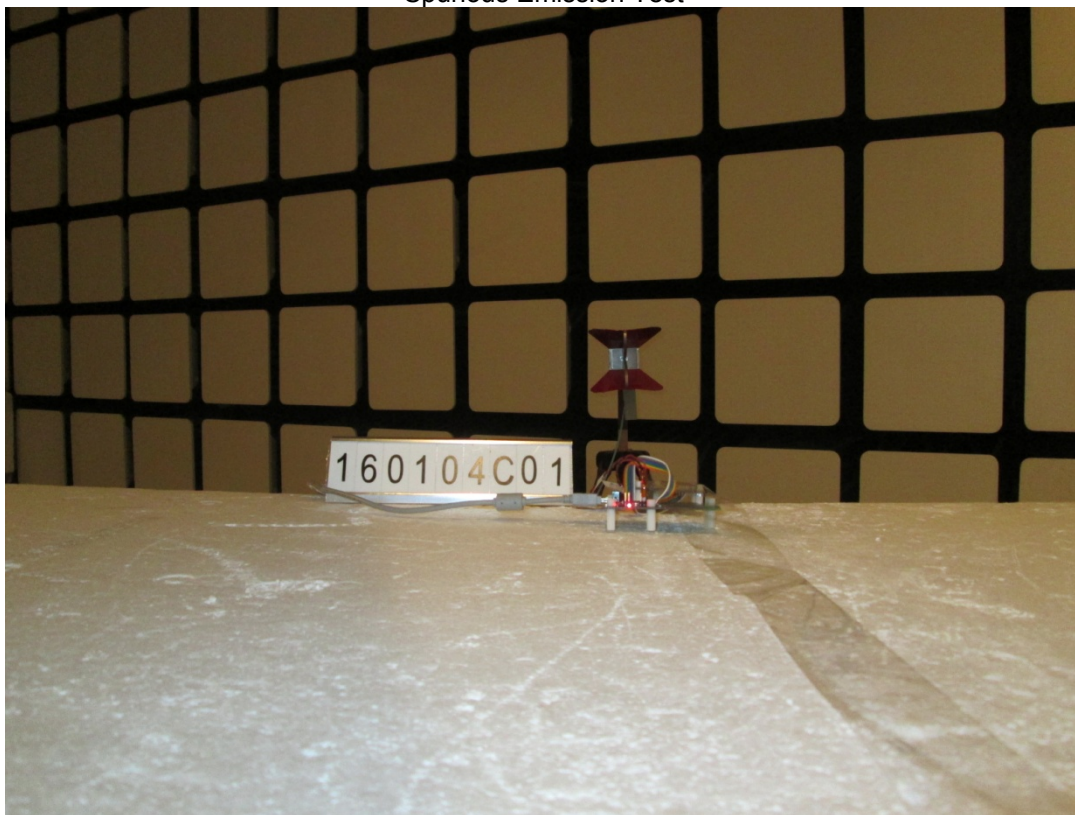
802.11a

Frequency Range	1GHz ~ 26.5GHz	Operating Channel	36, 140
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SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
36	10359.51	V	-52.17	-47.00	-5.17
	10359.92	H	-52.11	-47.00	-5.11
140	11400.01	H	-51.24	-47.00	-4.24
	11400.81	V	-51.19	-47.00	-4.19

5 Photographs of the Test Configuration

Spurious Emission Test





Appendix - Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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The address and road map of all our labs can be found in our web site also.

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