EN 301 893 RF Test Report (Conducted Test)

Report No.:	RE160104C01-1
Test Model:	Type1GC
Received Date:	Jan. 04, 2016
Test Date:	Mar. 15 ~ Mar. 24, 2016
Issued Date:	Mar. 24, 2016
Applicant:	Murata Manufacturing Co., Ltd.
Address:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555, Japan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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Release Control Record

Issue No.	Description	Date Issued
RE160104C01-1	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:	Mar. 15 ~ Mar. 24, 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 : _____ , **Date:** Mar. 24, 2016

Polly Chien / Specialist

Approved by : _____ , **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	Pass
4.3	Occupied Channel Bandwidth	Pass
4.4	RF Output Power	Pass
4.4	Transmit Power Control (TPC)	See Note 1
4.4	Power Density	Pass
4.8	Adaptivity (Channel Access Mechanism)	Pass
4.9	User Access Restrictions	Pass
4.5.1	Transmitter unwanted emissions outside the HIPERLAN bands	Pass
4.5.2	Transmitter unwanted emissions within the HIPERLAN bands	See Note 3
4.7	Dynamic Frequency Selection	See Note 2
4.10	Geo-location capability	Not Applicable
	Receiver Parameters	
4.6	Spurious Emissions	See Note 3

Note:

1. The device has no TPC function.
2. The “Dynamic Frequency Selection measurement” was recorded in Report No.: RE160104C01-2.
3. For spurious emissions test was recorded in Report No.: RE160104C01-4.

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
26GHz ~ 40GHz Amplifier	EMC26400	815221	Oct. 18, 2015	Oct. 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	±3.294dB
Spurious emissions	±3.294dB
Humidity	±0.3%
Temperature	±0.23°C
Time	±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	±5 %
Temperature	±1 °C
Time	±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℃
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
EIRP Power (Measured Max. Average)	16.42dBm for 5180 ~ 5240MHz 16.16dBm for 5260 ~ 5320MHz 16.78dBm for 5500 ~ 5700MHz
Antenna Type	Monopole pattern antenna with 2.5dBi gain
Antenna Connecter	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
	FS	OB	ROP	TPC	PD	AD	SSM	
-	√	√	√	-	√	√	√	-

Where FS: Frequency Stability
OB: Occupied channel bandwidth measurement
ROP: RF output power
TPC: Transmit Power Control
PD: Power Density
AD: Adaptivity (Channel Access Mechanism)
SSM: Signal under Spectrum Mask

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

Carrier Frequencies and Channelization (Frequency Stability):

☒ 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, 64	OFDM	BPSK	6.0
		100 to 140	100, 140	OFDM	BPSK	6.0
-	802.11n (HT20)	36 to 64	36, 64	OFDM	BPSK	6.5
		100 to 140	100, 140	OFDM	BPSK	6.5
-	802.11n (HT40)	38 to 62	38, 62	OFDM	BPSK	13.5
		102 to 134	102, 134	OFDM	BPSK	13.5

Occupied Channel Bandwidth Measurement:

☒ 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, 64	OFDM	BPSK	6.0
		100 to 140	100, 140	OFDM	BPSK	6.0
-	802.11n (HT20)	36 to 64	36, 64	OFDM	BPSK	6.5
		100 to 140	100, 140	OFDM	BPSK	6.5
-	802.11n (HT40)	38 to 62	38, 62	OFDM	BPSK	13.5
		102 to 134	102, 134	OFDM	BPSK	13.5

RF Output Power:

☒ 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, 64	OFDM	BPSK	6.0
		100 to 140	100, 140	OFDM	BPSK	6.0
-	802.11n (HT20)	36 to 64	36, 64	OFDM	BPSK	6.5
		100 to 140	100, 140	OFDM	BPSK	6.5
-	802.11n (HT40)	38 to 62	38, 62	OFDM	BPSK	13.5
		102 to 134	102, 134	OFDM	BPSK	13.5

Power Density:

☒ 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, 64	OFDM	BPSK	6.0
		100 to 140	100, 140	OFDM	BPSK	6.0
-	802.11n (HT20)	36 to 64	36, 64	OFDM	BPSK	6.5
		100 to 140	100, 140	OFDM	BPSK	6.5
-	802.11n (HT40)	38 to 62	38, 62	OFDM	BPSK	13.5
		102 to 134	102, 134	OFDM	BPSK	13.5

Adaptivity Test:

☒ 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)
-	802.11n (HT40)	38 to 62	38	OFDM	BPSK	13.5
		102 to 134	102	OFDM	BPSK	13.5

Transmitter Unwanted Emissions within the Hiperlan Bands (Signal under Spectrum Mask):

☒ 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, 64	OFDM	BPSK	6.0
		100 to 140	100, 140	OFDM	BPSK	6.0
-	802.11n (HT20)	36 to 64	36, 64	OFDM	BPSK	6.5
		100 to 140	100, 140	OFDM	BPSK	6.5
-	802.11n (HT40)	38 to 62	38, 62	OFDM	BPSK	13.5
		102 to 134	102, 134	OFDM	BPSK	13.5

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
FS	25deg. C, 60%RH	230Vac, 50Hz	Antony Lee
OB	25deg. C, 60%RH	230Vac, 50Hz	Antony Lee
TPC	25deg. C, 60%RH	230Vac, 50Hz	Antony Lee
PD	25deg. C, 60%RH	230Vac, 50Hz	Antony Lee
AD	25deg. C, 60%RH	230Vac, 50Hz	Antony Lee
SSM	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

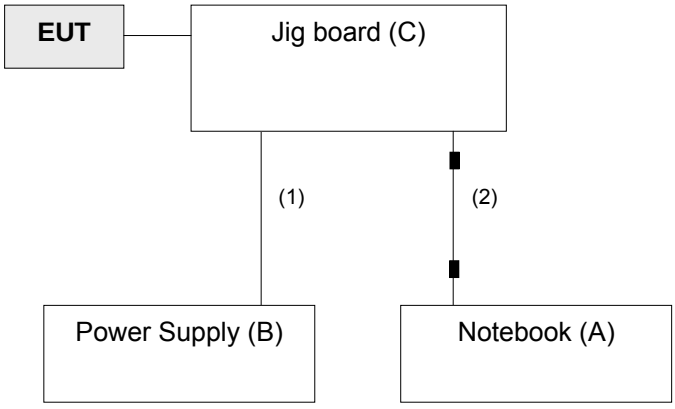
Note:

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 Carrier Frequencies and Channelization

4.1.1 Limits of Carrier Frequencies and Channelization

The actual centre frequency for any given channel declared by the manufacturer shall be maintained within the range fc ± 20 ppm.

4.1.2 Test Procedures

Refer to ETSI EN 301 893 V1.8.1 clause 5.3.2.2.

4.1.3 Deviation from Test Standard

No deviation

4.1.4 Test Setup

The test setup has been constructed as the normal use condition. The EUT shall be connected to spectrum analyzer.

4.1.5 Test Results

802.11a

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH36) 5180 MHz		(CH64) 5320 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	+25	V_{nom} (V)	5180.0163	3.1467	5320.0194	3.6466
T_{min}(℃)	-40	V_{min} (V)	5180.0108	2.0849	5320.0095	1.7857
		V_{max} (V)	5180.0061	1.1776	5320.011	2.0677
T_{max}(℃)	+85	V_{min} (V)	5179.9955	-0.8687	5319.9995	-0.094
		V_{max} (V)	5179.9993	-0.1351	5319.9946	-1.015

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH100) 5500 MHz		(CH140) 5700 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	+25	V_{nom} (V)	5500.0243	4.4182	5700.0254	4.4561
T_{min}(℃)	-40	V_{min} (V)	5500.008	1.4545	5700.0076	1.3333
		V_{max} (V)	5500.0113	2.0545	5700.009	1.5789
T_{max}(℃)	+85	V_{min} (V)	5500.0024	0.4364	5700.0038	0.6667
		V_{max} (V)	5499.9897	-1.8727	5699.9914	-1.5088

802.11n (HT20)

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH36) 5180 MHz		(CH64) 5320 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	+25	V_{nom} (V)	5180.0192	3.7066	5320.022	4.1353
T_{min}(℃)	-40	V_{min} (V)	5179.977	-4.4402	5319.9722	-5.2256
		V_{max} (V)	5179.9817	-3.5328	5319.9827	-3.2519
T_{max}(℃)	+85	V_{min} (V)	5179.993	-1.3514	5319.9927	-1.3722
		V_{max} (V)	5179.9933	-1.2934	5319.9912	-1.6541

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH100) 5500 MHz		(CH140) 5700 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	+25	V_{nom} (V)	5500.0233	4.2364	5700.027	4.7368
T_{min}(℃)	-40	V_{min} (V)	5499.9738	-4.7636	5699.9748	-4.4211
		V_{max} (V)	5499.9801	-3.6182	5699.9856	-2.5263
T_{max}(℃)	+85	V_{min} (V)	5499.9903	-1.7636	5699.995	-0.8772
		V_{max} (V)	5499.9948	-0.9455	5699.9917	-1.4561

802.11n (HT40)

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH38) 5190 MHz		(CH62) 5310 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	+25	V_{nom} (V)	5190.0193	3.7187	5310.0221	4.162
T_{min}(℃)	-40	V_{min} (V)	5189.977	-4.4316	5309.9723	-5.2166
		V_{max} (V)	5189.9817	-3.526	5309.9827	-3.258
T_{max}(℃)	+85	V_{min} (V)	5189.9929	-1.368	5309.9926	-1.3936
		V_{max} (V)	5189.9932	-1.3102	5309.9911	-1.6761

Test Condition			Carrier Centre Frequencies f_c (MHz)			
			(CH102) 5510 MHz		(CH134) 5670 MHz	
			Reading	ppm	Reading	ppm
T_{nom}(℃)	+25	V_{nom} (V)	5510.0235	4.265	5670.0272	4.7972
T_{min}(℃)	-40	V_{min} (V)	5509.9739	-4.7368	5669.9749	-4.4268
		V_{max} (V)	5509.9801	-3.6116	5669.9856	-2.5397
T_{max}(℃)	+85	V_{min} (V)	5509.9902	-1.7786	5669.9949	-0.8995
		V_{max} (V)	5509.9947	-0.9619	5669.9916	-1.4815

4.2 Nominal and Occupied Channel Bandwidth Measurement

4.2.1 Limit of Nominal and Occupied Channel Bandwidth Measurement

The Nominal Channel Bandwidth shall be at least 5 MHz at all times.
The Occupied Channel Bandwidth shall be between 80 % and 100 % of the declared Nominal Channel Bandwidth. In case of smart antenna systems (devices with multiple transmit chains) each of the transmit chains shall meet this requirement

During an established communication, the device is allowed to operate temporarily with an Occupied Channel Bandwidth below 80 % of its Nominal Channel Bandwidth with a minimum of 4 MHz.

4.2.2 Test Procedure

Refer to ETSI EN 301 893 V1.8.1 clause 5.3.3.2

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.2.3 Deviation from Test Standard

No deviation.

4.2.4 Test Setup

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

802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximum limit (MHz)	Pass / Fail
36	5180	16.46	16	20	Pass
64	5320	16.46	16	20	Pass
100	5500	16.41	16	20	Pass
140	5700	16.46	16	20	Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximum limit (MHz)	Pass / Fail
36	5180	17.68	16	20	Pass
64	5320	17.68	16	20	Pass
100	5500	17.68	16	20	Pass
140	5700	17.68	16	20	Pass

802.11n (HT40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Minimum limit (MHz)	Maximum limit (MHz)	Pass / Fail
38	5190	36.29	32	40	Pass
62	5310	36.29	32	40	Pass
102	5510	36.29	32	40	Pass
134	5670	36.29	32	40	Pass

4.3 RF Output Power and Transmit Power Control (TPC)

4.3.1 Limits of RF output power

Frequency Range (MHz)	Mean e.i.r.p. Limit (dBm)	
	With TPC	Without TPC
5150 to 5350	23	20 / 23 (see note 1)
5470 to 5725	30 (see note 2)	27 (see note 2)

Note 1: The applicable limit is 20 dBm, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 23 dBm.
Note 2: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.
Note 3: In case of multiple (adjacent or non-adjacent) channels within the same sub-band, the total RF output power of all channels in that sub-band shall not exceed the limits defined above table.
In case of multiple, non-adjacent channels operating in separate sub-bands, the total RF output power in each of the sub-bands shall not exceed the limits defined above table.

4.3.2 Limits of RF Output Power at Lowest Power Level

Frequency Range (MHz)	Average EIRP (dBm)
5250 to 5350	17
5470 to 5725	24(see note)

Note: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.

4.3.3 Test Procedure

Refer to ETSI EN 301 893 V1.8.1 clause 5.3.4.2

Measurement	
☒ Conducted measurement	☐ Radiated measurement
☒ Option 1: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment).	
☐ Option 2: For equipment without continuous transmission capability and operating (or with the capability to operate) in only one sub-band.	
☐ Option 3: For equipment without continuous transmission capability and having simultaneous transmissions in both sub-bands.	

4.3.4 Deviation from Test Standard

No deviation.

4.3.5 Test Setup

The test setup has been constructed as the normal and extreme test conditions. The RF power as defined in EN 301 893 clause 4.4.1.1 shall be measured and recorded. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

4.3.6 Test Results

802.11a

Test Condition			Transmitter Power (dBm)			
			(CH36) 5180 MHz	(CH64) 5320 MHz	(CH100) 5500 MHz	(CH140) 5700 MHz
T_{nom}(℃)	+25	V_{nom} (V)	15.70	15.44	15.48	15.57
T_{min}(℃)	-40	V_{min} (V)	16.40	16.15	16.38	**16.78**
		V_{max} (V)	**16.42**	**16.16**	16.36	16.73
T_{max}(℃)	+85	V_{min} (V)	15.75	15.64	15.70	15.66
		V_{max} (V)	15.75	15.62	15.73	15.69

802.11n (20MHz)

Test Condition			Transmitter Power (dBm)			
			(CH36) 5180 MHz	(CH64) 5320 MHz	(CH100) 5500 MHz	(CH140) 5700 MHz
T_{nom}(℃)	+25	V_{nom} (V)	14.70	14.51	14.55	14.90
T_{min}(℃)	-40	V_{min} (V)	14.81	14.55	14.60	14.98
		V_{max} (V)	14.84	14.50	14.64	14.97
T_{max}(℃)	+85	V_{min} (V)	14.32	14.12	14.16	14.78
		V_{max} (V)	14.34	14.11	14.19	14.83

802.11n (HT40)

Test Condition			Transmitter Power (dBm)			
			(CH38) 5190 MHz	(CH62) 5310 MHz	(CH102) 5510 MHz	(CH134) 5670 MHz
T_{nom}(℃)	+25	V_{nom} (V)	14.72	14.38	14.88	14.58
T_{min}(℃)	-40	V_{min} (V)	15.02	14.69	15.32	14.91
		V_{max} (V)	15.05	14.64	15.36	14.90
T_{max}(℃)	+85	V_{min} (V)	14.58	14.20	14.53	14.41
		V_{max} (V)	14.60	14.19	14.56	14.46

4.4 Power Density

4.4.1 Limit of Power Density

Frequency Band (MHz)	Mean e.i.r.p. Density Limit (dBm/MHz)	
	With TPC	Without TPC
5150 to 5350	10	7 / 10 (see note 1)
5470 to 5725	17 (see note 2)	14 (see note 2)

Note 1: The applicable limit is 7 dBm/MHz, except for transmissions whose nominal bandwidth falls completely within the band 5 150 MHz to 5 250 MHz, in which case the applicable limit is 10 dBm/MHz.
Note 2: Slave devices without a Radar Interference Detection function shall comply with the limits for the band 5 250 MHz to 5 350 MHz.
Note 3: In case of multiple (adjacent or non-adjacent) channels within the same sub-band, the total RF output power of all channels in that sub-band shall not exceed the limits defined above table.
In case of multiple, non-adjacent channels operating in separate sub-bands, the total RF output power in each of the sub-bands shall not exceed the limits defined above table

4.4.2 Test Procedure

Refer to ETSI EN 301 893 V1.8.1 clause 5.3.4.2.1.3

Measurement	
☒ Conducted measurement	☐ Radiated measurement
☒ Option 1: For equipment with continuous transmission capability or for equipment operating (or with the capability to operate) with a constant duty cycle (e.g. Frame Based equipment)	
☐ Option 2: For equipment without continuous transmission capability and without the capability to transmit with a constant duty cycle	

4.4.3 Deviation from Test Standard

No deviation.

4.4.4 Test Setup

The transmitter shall be connected to the measuring equipment via a suitable attenuator and the power density value shall be measured and recorded.

4.4.5 Test Results

802.11a

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Without TPC Limit (dBm/1MHz) (EIRP)	Pass / Fail
36	5180	4.14	7	Pass
64	5320	3.63	7	Pass
100	5500	3.94	7	Pass
140	5700	4.11	7	Pass

802.11n (HT20)

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Without TPC Limit (dBm/1MHz) (EIRP)	Pass / Fail
36	5180	1.78	7	Pass
64	5320	0.91	7	Pass
100	5500	1.60	7	Pass
140	5700	2.10	7	Pass

802.11n (HT40)

Channel Number	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Without TPC Limit (dBm/1MHz) (EIRP)	Pass / Fail
38	5190	1.51	7	Pass
62	5310	1.52	7	Pass
102	5510	2.58	7	Pass
134	5670	2.99	7	Pass

4.5 Adaptive (Channel Access Mechanism)

This requirement applies to equipment, testing shall be performed using the highest nominal channel Bandwidth. The manufacturer shall state whether the UUT is capable of operating as a Frame Based Equipment or Load Based Equipment. See tables for the applicability of adaptive requirements and limit for each of the operational modes.

4.5.1 Limit of Adaptive

Applicability of adaptive requirements and limit

Requirement	Operational Mode			
	Frame Based Equipment	Load Based Equipment (CCA using 'energy detect')	Load Based Equipment (CCA not using any of the mechanisms referenced as IEEE spec.)	
			Option A	Option B
Minimum Clear Channel Assessment (CCA) Time	20us (see note 1)	(see note 2)	20us (see note 1)	20us (see note 1)
Maximum Channel Occupancy (COT) Time	1 ms to 10 ms	(see note 2)	10ms	(13/32)*q ms (see note 3)
Minimum Idle Period	5% COT	(see note 2)	CCA or extended CCA	CCA to q*CCA (see note 3)
Extended CCA check	NA	(see note 2)	q*18us	N*CCA (see note 3)
Short Control Signalling Transmissions	Maximum duty cycle of 5 % within an observation period of 50 ms (see note 5)			

Note 1: The CCA time used by the equipment shall be declared by the manufacturer.
Note 2: Minimum required of EN301 893 section 4.8.3.2 or LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using 'energy detect', as describedin IEEE 802.11™-2012 [8], clause 9, clause 10, clause 18 and clause 20 or as described in IEEE 802.11ac™-2013 [9], clause 8, clause 9, clause 10 and clause 22
Note 3: q is selected by the manufacturer in the range [4..32]
Note 4: The value of N shall be randomly selected in the range [1..q]
Note 5: Adaptive equipment may or may not have Short Control Signalling Transmissions.

Interference threshold level

Maximum transmit power (P_H) EIRP dBm	Threshold level (TL)
23	(see notes 1 and 2)

Note 1: For transmit power levels of 23 dBm e.i.r.p. or above, the CCA threshold level (TL), at the input to the receiver, shall be a minimum of -73 dBm/MHz assuming a 0 dBi receive antenna.
Note 2: For transmit power levels below 23 dBm e.i.r.p., the CCA threshold level (TL), at the input of the receiver, shall be proportional to the maximum transmit power (PH) according to the formula which assumes a 0 dBi receive antenna and PH to be specified in dBm e.i.r.p.
TL = -73 dBm / MHz + (23 dBm - PH) / (1 MHz)

4.5.2 Test Procedure

Refer to chapter 5.3.9.2 of ETSI EN 301 893 V1.8.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.5.3 Deviation from Test Standard

No deviation.

4.5.4 Test Setup Configuration

Companion Device information

Product	Brand	Model No.	Software/Firmware Version
Communication Module	MURATA	Type1GC	WLAN Firmware : wl0 Oct 20 2015 123035 Version : 7.15.168.5

4.5.5 List of Measurements

UUT Operational Mode	Applicable	Limit			
		The Maximum Channel Occupancy Time		The Minimum idle Period	
Frame Based Equipment		1ms to 10ms		5% of the channel occupancy time	
Load Based Equipment (CCA using 'energy detect')		Follow IEEE 802.11 Less than _____ms		Follow IEEE 802.11 More than _____ms	
	v	Max. COT< 13 ms [Max. COT=(13/32) x q ms.]		Between CCA =_32___us and q x CCA=__1024___us	
Load Based Equipment (CCA not using any of the mechanisms referenced)		Option A	10ms	Option A	CCA or extended CCA
		Option B	(13/32)*q ms	Option B	CCA to q*CCA

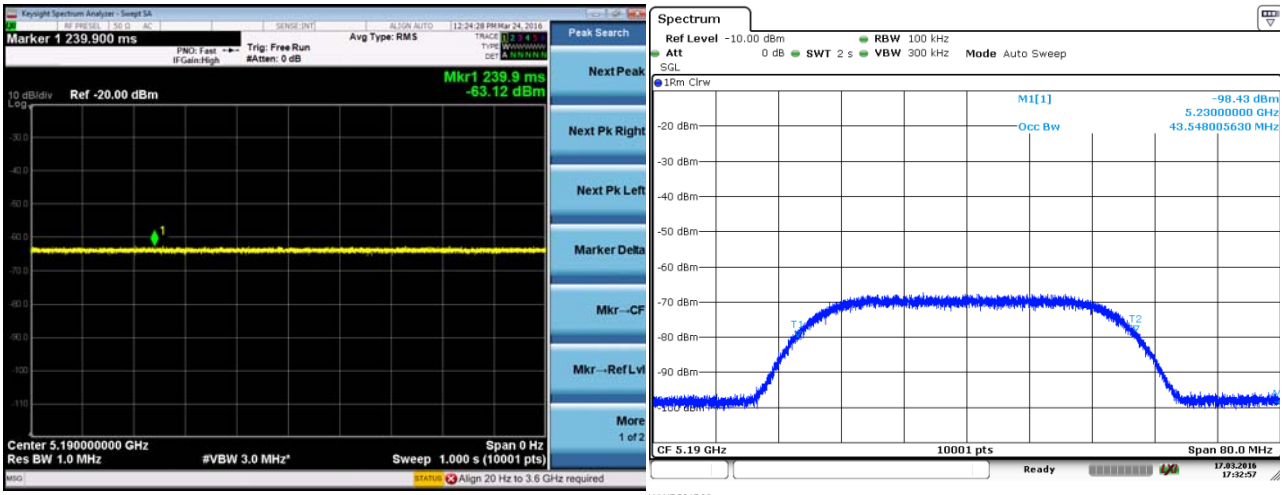
Note1: The value of q =32 is declared by the manufacture.
Note2: The value of CCA =32us is declared by the manufacture.

Clause	Test Parameter	Remarks	Pass/Fail
4.8.3.1	Adaptive (Frame Based Equipment)	Not Applicable	NA
4.8.3.2	Adaptive (Load Based Equipment)	Applicable	Pass
4.8.3.3	Short Control Signalling Transmissions	Applicable	Pass

4.5.6 Interference Threshold Level

Operating Frequency: 5190MHz

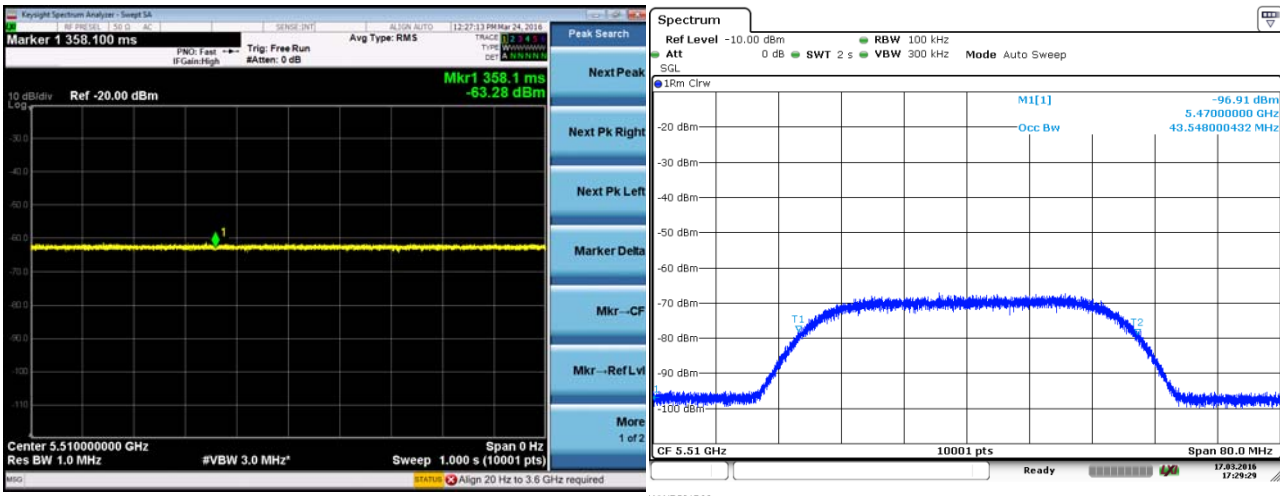
Detection Threshold Level
The maximum EIRP (Vnom) power is 14.72dBm and antenna gain is 2.5dBi. Detection Threshold level= -73dBm/MHz + (23dBm – P_H(14.72dBm)/MHz) + G (2.5dBi) = -62.22dBm/MHz . The interference signal level to the UUT is -62.22dBm/MHz.



WWP501B30
Date: 17.MAR.2016 17:32:57

Operating Frequency: 5510MHz

Detection Threshold Level
The maximum EIRP (Vnom) power is 14.88dBm and antenna gain is 2.5dBi. Detection Threshold level= -73dBm/MHz + (23dBm – PH(14.88dBm)/MHz) + G (2.5dBi) = -63.38dBm/MHz . The interference signal level to the UUT is -63.38dBm/MHz.



WWP501B30
Date: 17.MAR.2016 17:29:30

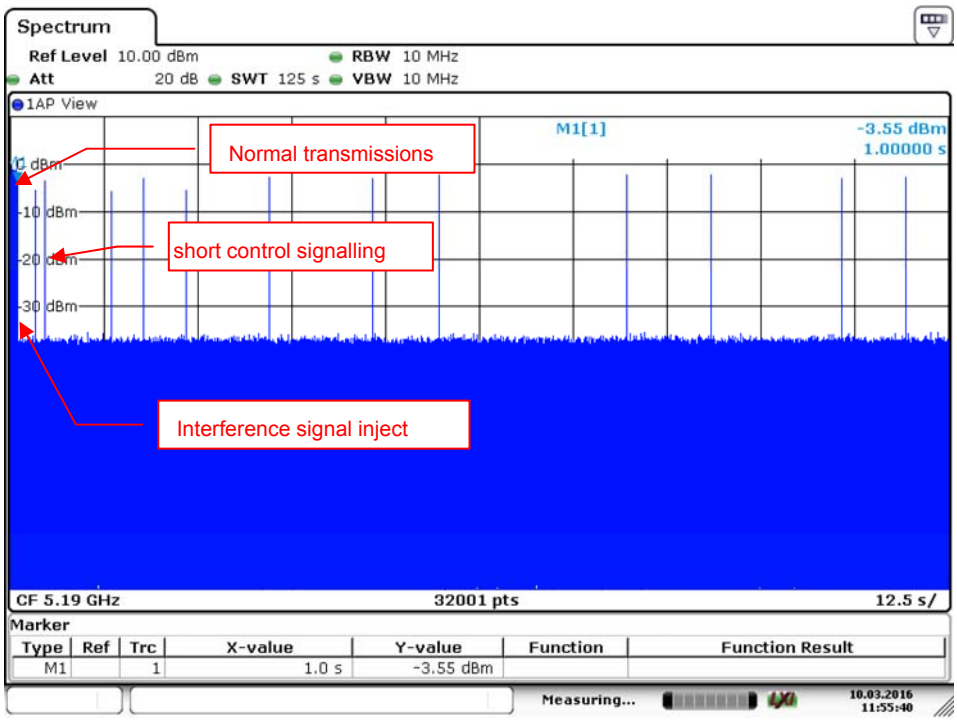
4.5.7 Test Result

4.5.7.1 Adaptive Result

Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	Test Result
802.11n (HT40)	5190	Pass
	5510	Pass

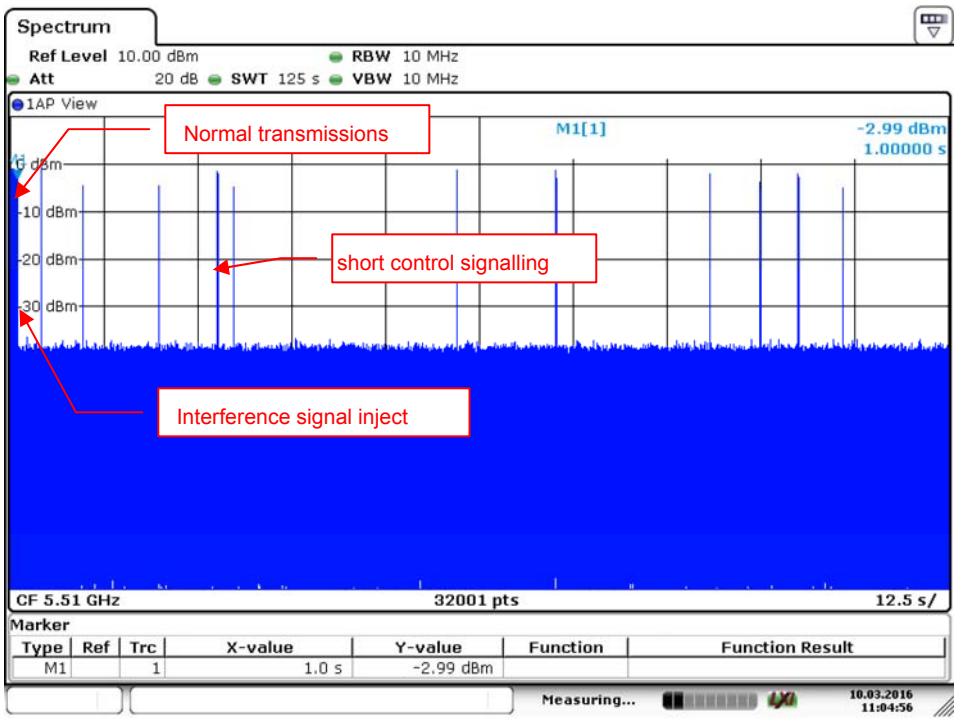
5190MHz



WWP501B30

Date: 10.MAR.2016 11:55:40

5510MHz



WWP501B30

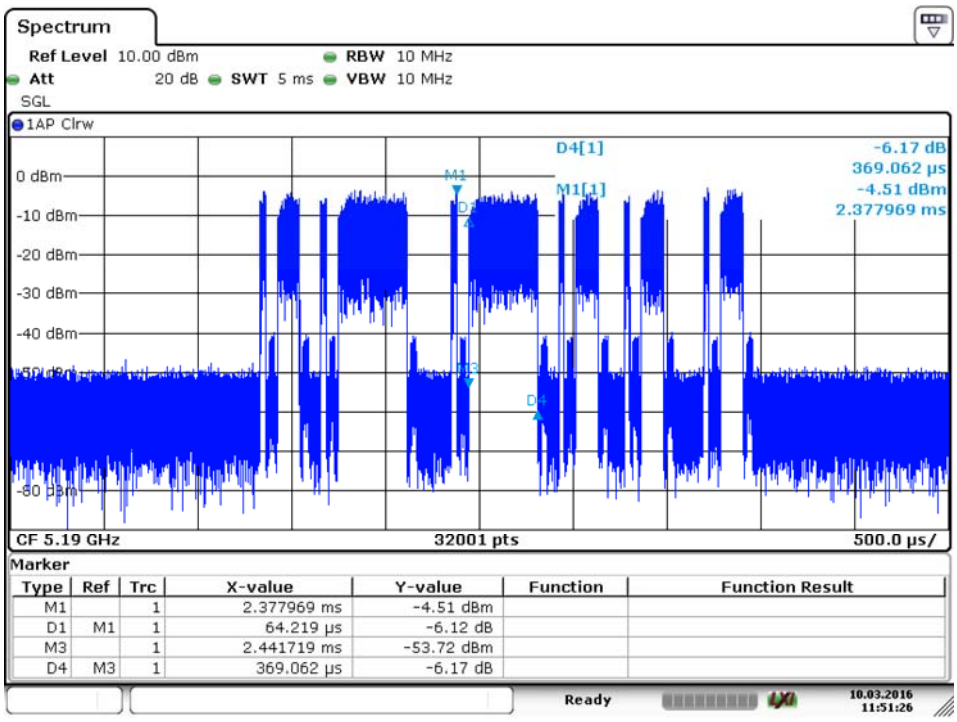
Date: 10.MAR.2016 11:04:56

4.5.7.2 The Channel Occupancy Time Result

Operating Frequency Bands and Mode of EUT

Operational Mode	Operating Frequency (MHz)	The Channel Occupancy Time (ms)	Minimum Idle Period (ms)	Test Result
802.11n (HT40)	5190	0.369062	0.064219	Pass
	5510	0.367813	0.06375	Pass

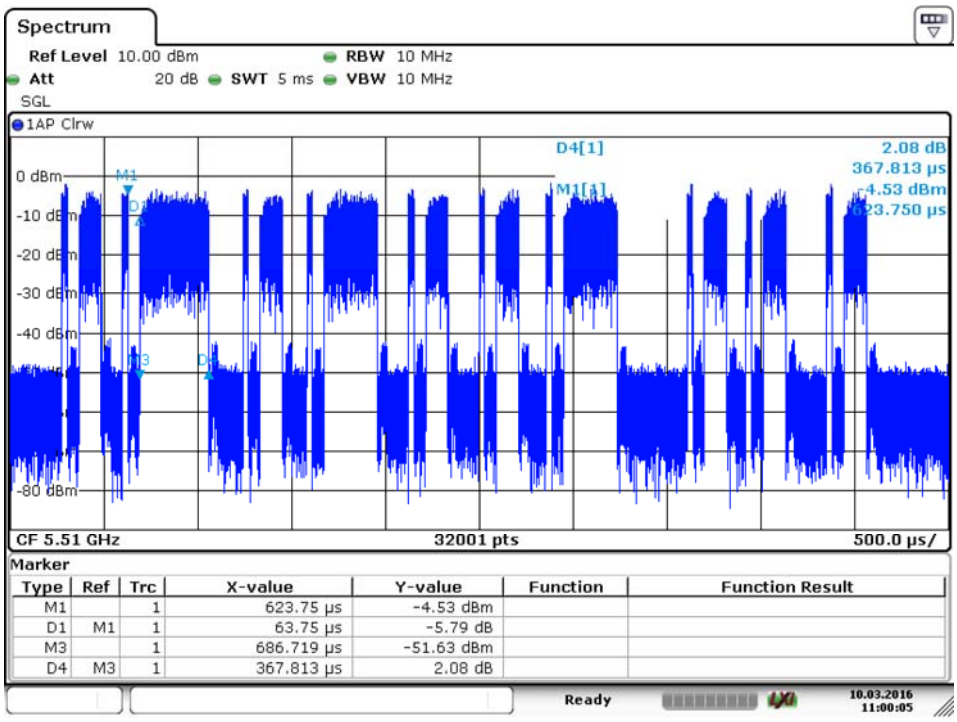
5190MHz



WWP501B30

Date: 10.MAR.2016 11:51:26

5510MHz



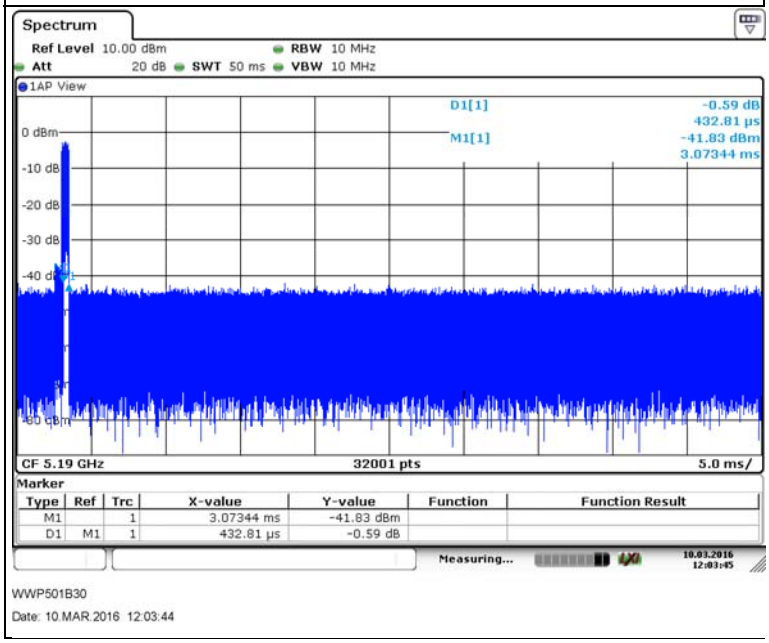
WWP501B30

Date: 10.MAR.2016 11:00:05

4.5.7.3 Short Control Signalling Transmissions Result

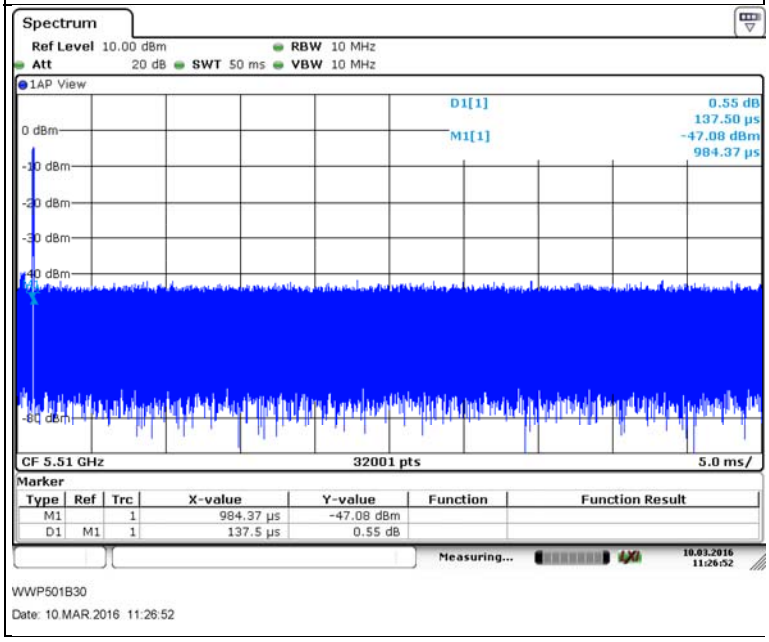
5190MHz

Short Control Signalling Transmission Result
The SCST on time is 0.43281ms
The SCST Duty cycle = 0.43281ms / 50ms = 0.87% < 5%



5510MHz

Short Control Signalling Transmission Result
The SCST on time is 0.98437ms
The SCST Duty cycle = 0.98437ms / 50ms = 1.97% < 5%



4.6 User Access Restrictions

4.6.1 Definition

User Access Restrictions are constraints implemented in the RLAN device to restrict access of the user to any hardware and/or software settings of the equipment, including software replacement(s), which may impact (directly or indirectly) the compliance of the equipment with the requirements in the present document.

NOTE: The user should be understood as the end user, the operator or any person not responsible for the compliance of the equipment against the requirements in the present document.

4.6.2 Requirement

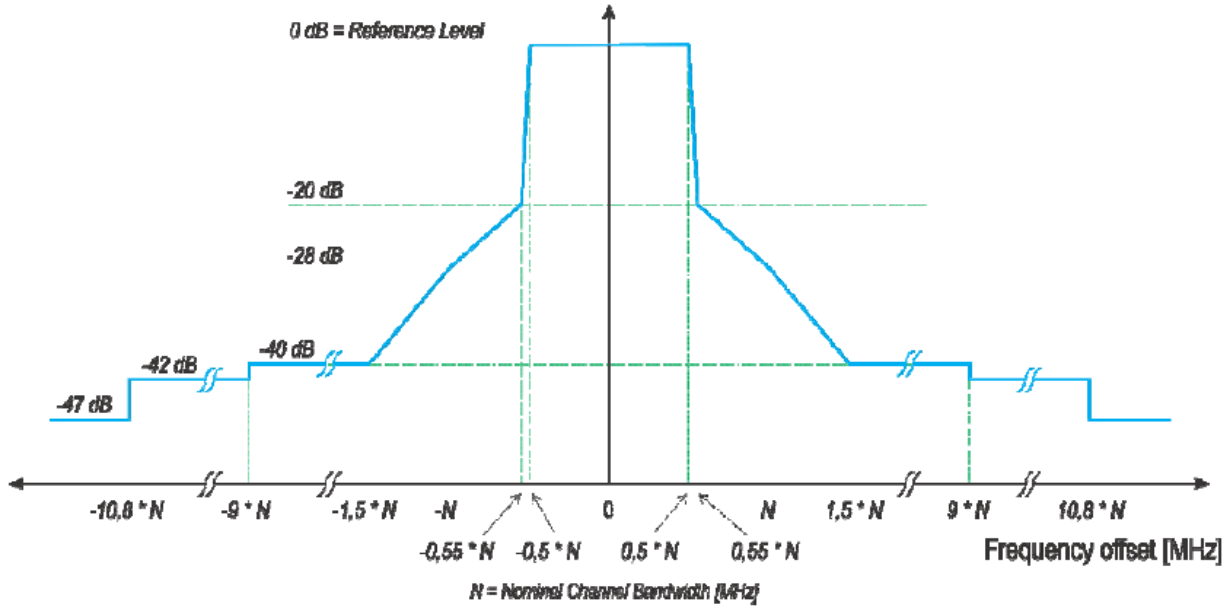
The equipment shall be so constructed that settings (hardware and/or software) related to DFS shall not be accessible to the user if changing those settings result in the equipment no longer being compliant with the DFS requirements in clause 4.7.
The above requirement includes the prevention of indirect access to any setting that impacts DFS.

Manufacturer provides declaration form to meet this requirement.

4.7 Transmitter Unwanted Emissions within the 5 GHz RLAN Bands

4.7.1 Limits of Transmitter Unwanted Emissions within the 5 GHz RLAN Bands

The average level of the transmitted spectrum shall not exceed the limits given in the following figure:



NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

4.7.2 Test Procedure

Refer to chapter 5.3.6.2 of ETSI EN 301 893 V1.8.1.

Measurement Method	
☐ Conducted measurement	☒ Radiated measurement
☒ Option 1: For equipment with continuous transmission capability	
☐ Option 2: For equipment without continuous transmission capability	

4.7.3 Deviation from Test Standard

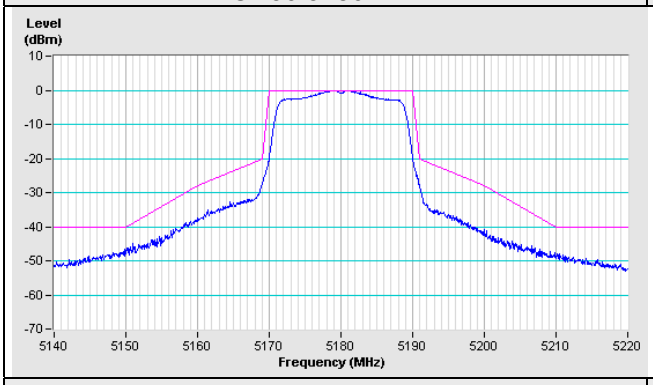
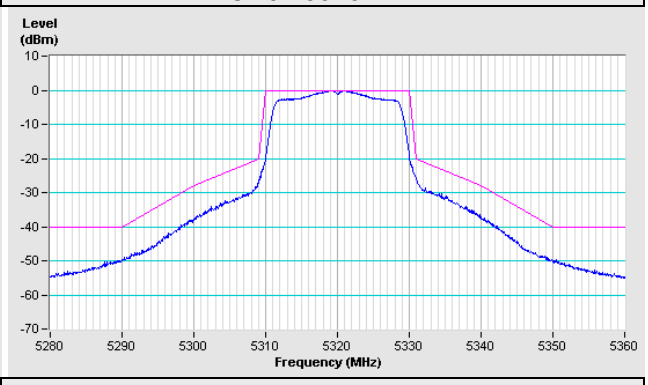
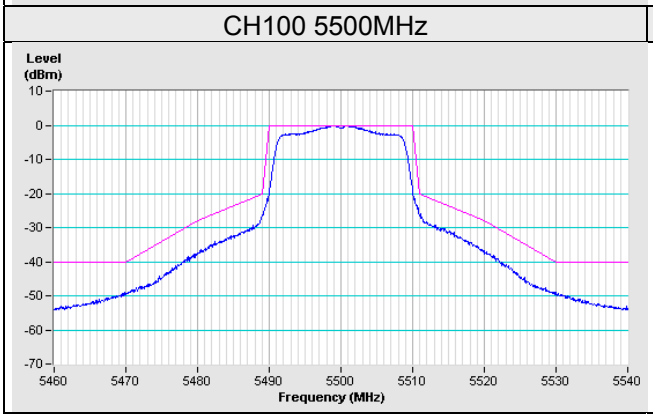
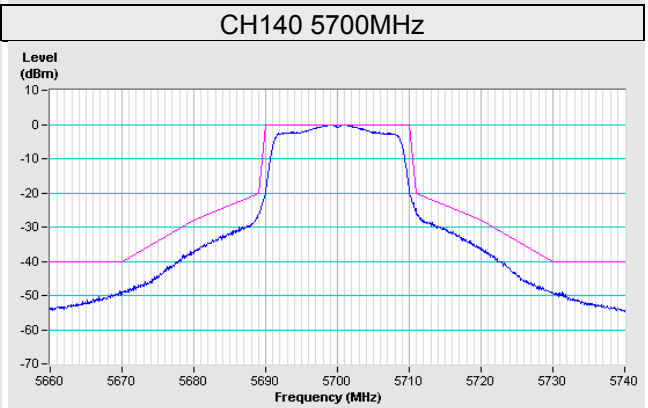
No deviation.

4.7.4 Test Setup

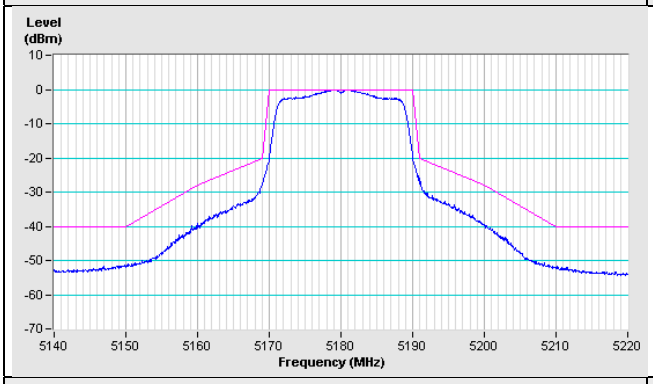
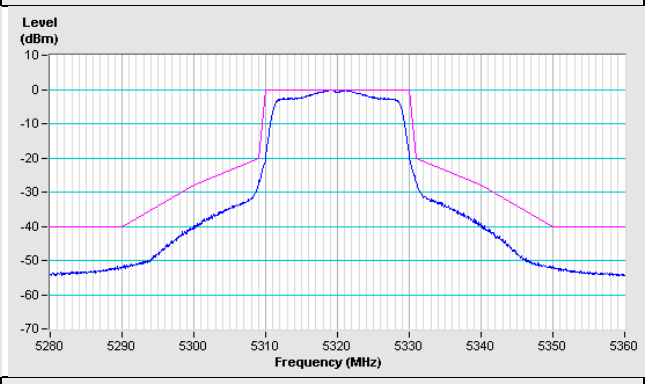
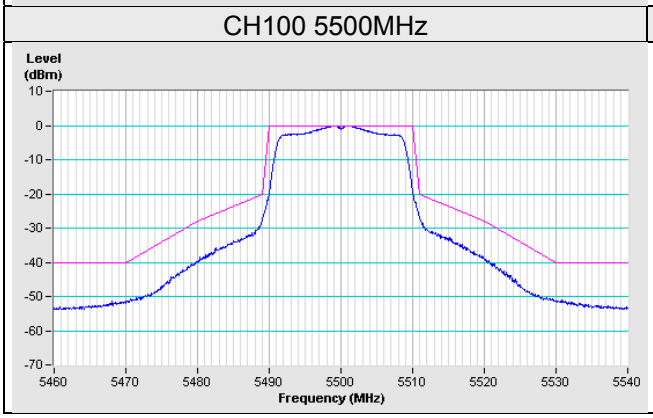
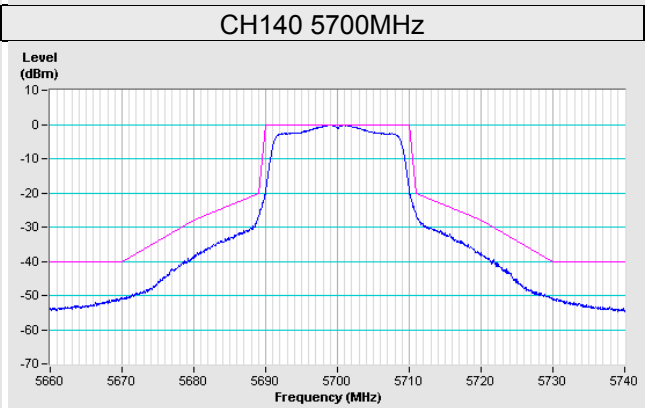
The test setup has been constructed as the normal use condition. Controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

4.7.5 Test Results for unwanted emissions within the 5 GHz RLAN bands

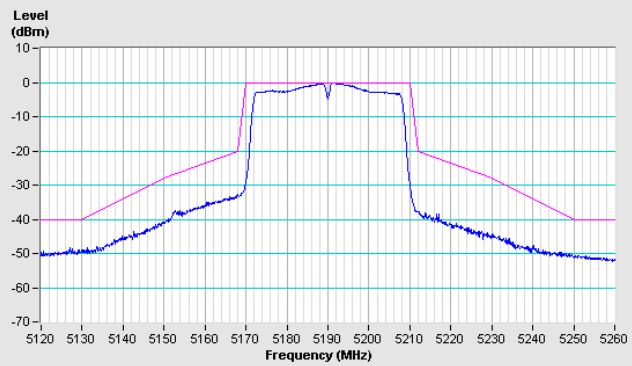
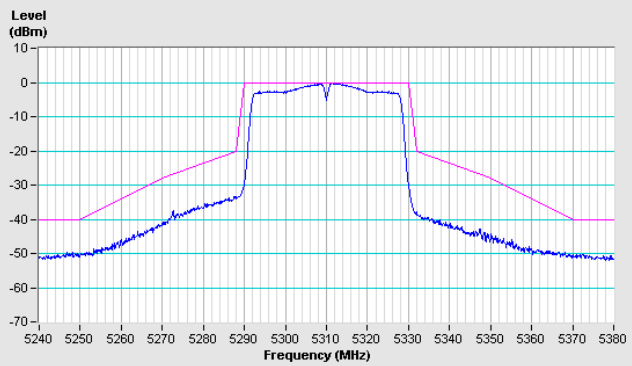
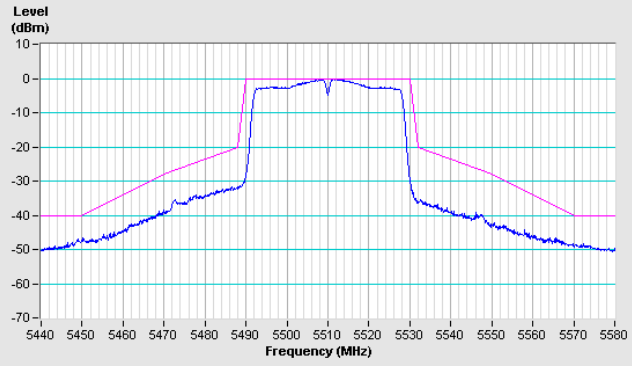
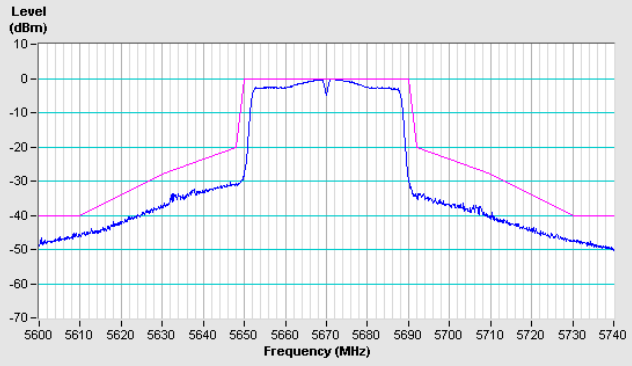
802.11a

CH36 5180MHz	CH64 5320MHz
	
CH100 5500MHz	**CH140 5700MHz**
	

802.11n (HT20)

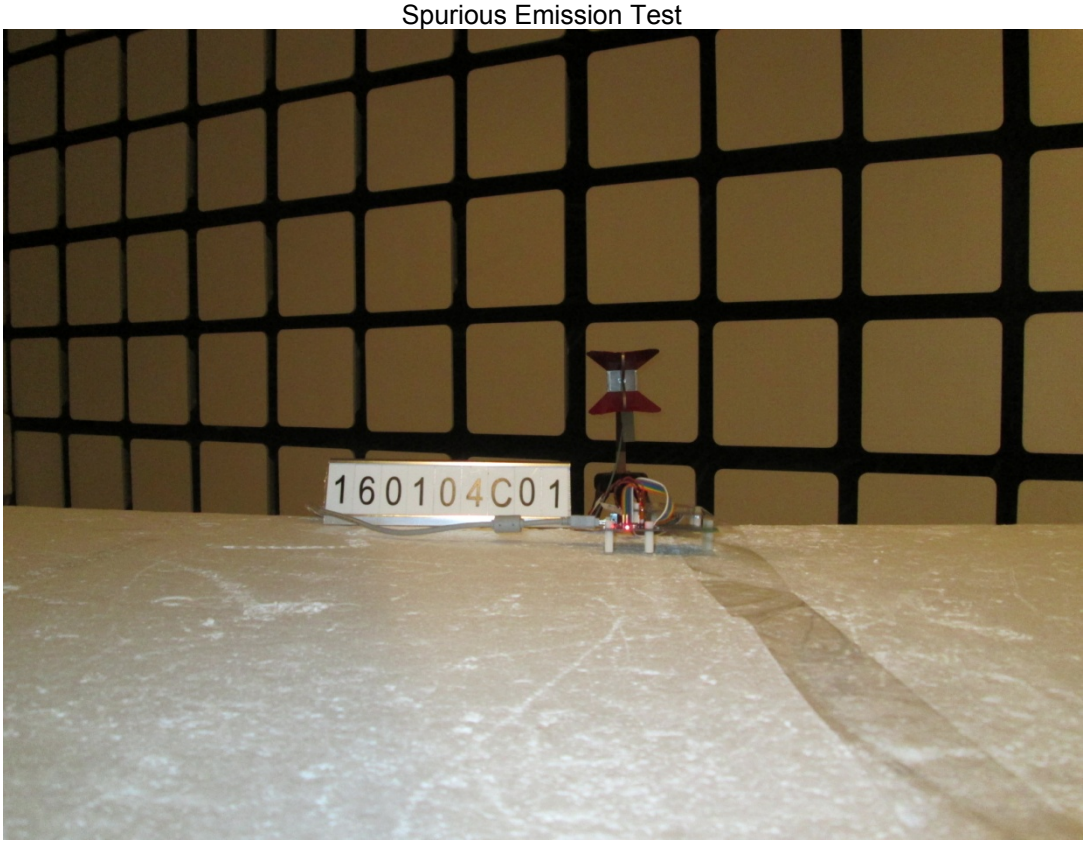
CH36 5180MHz	CH64 5320MHz
	
CH100 5500MHz	**CH140 5700MHz**
	

802.11n (HT40)

CH38 5190MHz	CH62 5310MHz
	
CH102 5510MHz	**CH134 5670MHz**
	

5 Photographs of the Test Configuration

Spurious Emission Test

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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:

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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