EN 300 328 RF Test Report (BT-LE)

Report No.:	RE170816E06G-3
Test Model:	WLT674
Received Date:	Jan. 13, 2017
Test Date:	Mar. 05, 2017
Issued Date:	Oct. 04, 2018
Applicant:	Compex Systems Pte. Ltd.
Address:	No. 9 Harrison Road, #05-01 Singapore 369651
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

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Release Control Record

Issue No.	Description	Date Issued
RE170816E06G-3	Original release.	Oct. 04, 2018

1 Certificate of Conformity

Product:	Wireless M.2 Type A/E with BLE Module
Brand:	Compex
Test Model:	WLT674
Sample Status:	ENGINEERING SAMPLE
Applicant:	Compex Systems Pte. Ltd.
Test Date:	Mar. 05, 2017
Standards:	EN 300 328 V2.1.1 (2016-11)

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:** Oct. 04, 2018

Claire Kuan / Specialist

Approved by : _____ , **Date:** Oct. 04, 2018

May Chen / Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V2.1.1		
Clause	**Test Parameter**	**Results**
4.3.2.11	Receiver Blocking	Pass

2.1 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSW8	101497	Aug. 11, 2016	Aug. 10, 2017
ESG Vector signal generator Agilent	E4438C	MY47271330 506 602 UNJ	Sep. 26, 2016	Sep. 25, 2017
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010004	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/0 05 506 602 UK6 UNJ	Nov. 25, 2016	Nov. 24, 2017
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53052647	July 25, 2016	July 24, 2017
Direct Coupler EMCI	CS20-18-436/16	1139	NA	NA
Power Splitter/combiner Mini-Circuits	ZN4PD-642W-S +	408501327_0 3	Oct. 11, 2016	Oct. 10, 2017
Power Splitter/combiner Mini-Circuits	ZN4PD-642W-S +	408501327_0 4	Oct. 11, 2016	Oct. 10, 2017

NOTE: 1. The test was performed in Adaptivity room.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Mar. 05, 2017

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
Occupied Channel Bandwidth	±1.132x10^{-4} %
RF output power, conducted	±1.207dB
Power Spectral Density, conducted	±1.207dB
Unwanted Emissions, conducted	±3dB
All emissions, radiated	±4.925dB
Temperature	±0.6°C
Supply voltages	±0.04%
Time	±5 %

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated 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)). Principles for the calculation of measurement uncertainty are contained in ETSI TR 100 028-1, in particular in annex D of the ETSI TR 100 028-2.

Maximum measurement uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1,5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±3 °C
Supply voltages	±3 %
Time	±5 %

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-LE)

Product	Wireless M.2 Type A/E with BLE Module
Brand	Compex
Test Model	WLT674
Status of EUT	ENGINEERING SAMPLE
Nominal Voltage	3.3Vdc form host equipment
Voltage Operation Range	Vnom= 230Vac
Temperature Operating Range	-10℃ ~ 70℃
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Adaptive/Non-Adaptive	☐ non-adaptive Equipment ☒ adaptive Equipment without the possibility to switch to a non-adaptive mode ☐ adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power (Measured Max. Average)	8.15dBm
Antenna Type	See item 3.2
Antenna Connector	See item 3.2
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. This is a supplementary report of Report No: RE170816E06G-A-3. The differences between them are as below information:
   - ◆ Upgraded standard version to EN 300 328 V2.1.1.
2. According to above conditions, only Receiver Blocking test item need to be performed. And all data was verified to meet the requirements.
3. There are Bluetooth technology and WLAN technology used for the EUT.
4. WLAN/BT coexistence mode:
   - ◆ 2x2 WLAN + BT:
     - ➢ 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
     - ➢ 2.4GHz: timely shared coexistence.
5. The emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11n (HT20)) + Bluetooth (8DPSK)	36 to 140	140	OFDM
	0 to 78	78	FHSS

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

3.2 Description of Antenna

The antenna gain was declared by client; please refer to the following table:

Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
Chain (0)	WNC	81-EBJ15.005	PIFA	3.00	Band 1&2: 2.56	1.15	Band 1&2: 1.70	IPEX	300
					Band 3: 4.76		Band 3: 1.74		
					Band 4: 4.76		Band 4: 1.79		
Chain (1)	WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08	1.15	Band 1&2: 1.70	IPEX	300
					Band 3: 3.31		Band 3: 1.74		
					Band 4: 2.42		Band 4: 1.79		

Note: 1. Above antenna gains of antenna are Total (H+V).

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to	Description
	RB	
-	√	-

Where **RB:** Receiver Blocking

Receiver Blocking test:

☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 39	GFSK	1

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RB	23deg. C, 64%RH	230Vac, 50Hz	Gary Cheng

3.3 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 300 328 V2.1.1 (2016-11)

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

4 Test Procedure and Results
4.1 Receiver Blocking

4.1.1 Limit of Receiver Blocking

This requirement applies to all receiver categories.

Receiver Category		
☐Category 1	☒Category 2	☐Category 3
Minimum performance criterion	☒PER ≦10%	
	☐Alternative performance criteria (See note)	
Note: The manufacturer was declared performance criteria is x% for the intended use of the equipment.		

Receiver Category 1 Equipment			
Wanted signal mean power from companion device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (See note 2)**	**Type of blocking signal**
P_{min} + 6 dB	2 380 2 503.5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523.5 2 553.5 2 583.5 2 613.5 2 643.5 2 673.5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Receiver Category 2 Equipment			
Wanted signal mean power from companion device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (See note 2)**	**Type of blocking signal**
P_{min} + 6 dB	2 380 2 503.5	-57	CW
P_{min} + 6 dB	2 300 2 583.5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Receiver Category 3 Equipment			
Wanted signal mean power from companion device (dBm)	**Blocking Signal Frequency (MHz)**	**Blocking Signal Power (dBm) (See note 2)**	**Type of blocking signal**
P_{min} + 12 dB	2 380 2 503.5	-57	CW
P_{min} + 12 dB	2 300 2 583.5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

4.1.2 Test Procedure

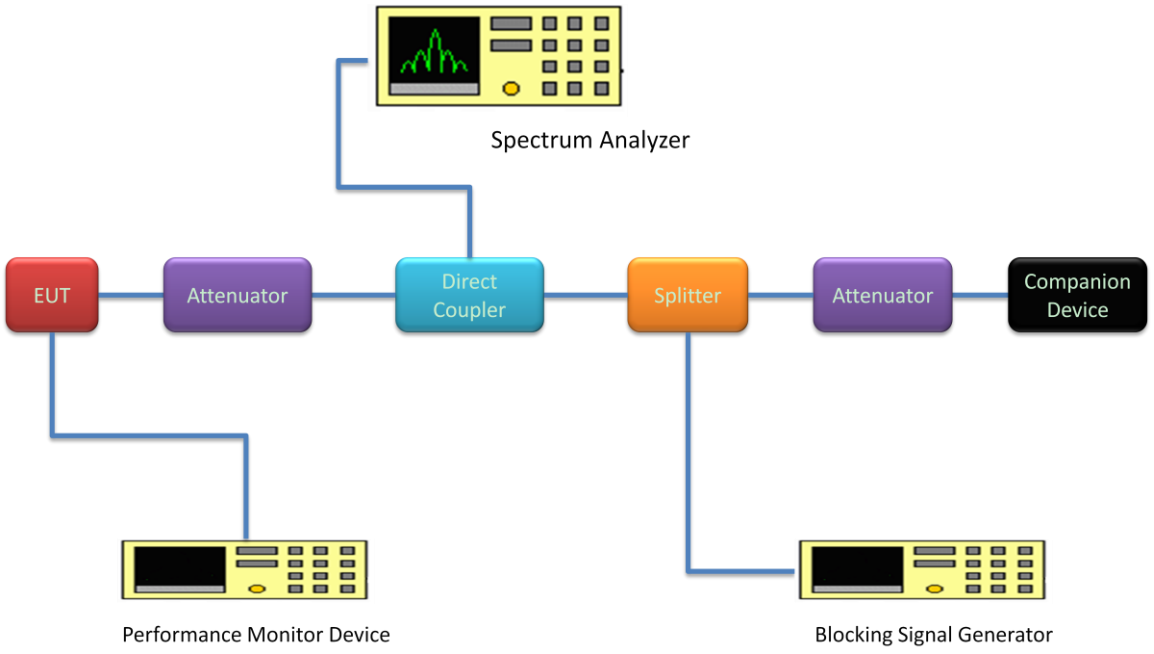
Refer to chapter 5.4.11 of EN 300 328 V2.1.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup Configuration



4.1.5 Test Results

Receiver Category 2 Equipment

Receiver blocking performance when operating at the lowest operating channel					
P_{min}: -90.18dBm				antenna gain(G) : 3.62 dBi	
The actual blocking signal power(Note1)				☒ at the antenna connector ☐ in front of the antenna	
Note1: For the conducted measurements , the level shall be corrected as follows: the actual blocking signal power = blocking signal power + G					
Operation Mode	**Channel**	**Wanted signal mean power from companion device (dBm)**	**Blocking signal frequency (MHz)**	**The actual blocking signal power (dBm)**	**Pass/Fail**
GFSK	0	-84.18	2380	-53.38	PASS
			2503.5	-53.38	PASS
			2300	-43.38	PASS
			2583.5	-43.38	PASS

Receiver blocking performance when operating at the Highest operating channel					
P_{min}: -89.6dBm				antenna gain(G) : 3.62 dBi	
The actual blocking signal power(Note1)				☒ at the antenna connector ☐ in front of the antenna	
Note1: For the conducted measurements , the level shall be corrected as follows: the actual blocking signal power = blocking signal power + G					
Operation Mode	**Channel**	**Wanted signal mean power from companion device (dBm)**	**Blocking signal frequency (MHz)**	**The actual blocking signal power (dBm)**	**Pass/Fail**
GFSK	39	-83.6	2380	-53.38	PASS
			2503.5	-53.38	PASS
			2300	-43.38	PASS
			2583.5	-43.38	PASS

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
Fax: 886-3-3270892

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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Appendix A – Original Report No.: RE170816E06G-A-3

EN 300 328 RF Test Report (BT-LE)

Report No.: RE170816E06G-A-3

Test Model: WLT674

Received Date: Jan. 07, 2015

Test Date: Jan. 20, 2015 ; July 12 to 13, 2016

Issued Date: Oct. 06, 2016

Applicant: Compex Systems Pte. Ltd.

Address: No. 9 Harrison Road, #05-01 Singapore 369651

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

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan R.O.C.

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Release Control Record

Issue No.	Description	Date Issued
RE170816E06G-A-3	Original release.	Oct. 06, 2016

1 Certificate of Conformity

Product:	Wireless M.2 Type A/E with BLE Module
Brand:	Compex
Test Model:	WLT674
Sample Status:	ENGINEERING SAMPLE
Applicant:	Compex Systems Pte. Ltd.
Test Date:	Jan. 20, 2015 ; July 12 to 13, 2016
Standards:	EN 300 328 V1.9.1 (2015-02)

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:** Oct. 06, 2016

Midoli Peng / Specialist

Approved by : _____ , **Date:** Oct. 06, 2016

May Chen / Manager

2 Summary of Test Results

The EUT has been tested according to the following specifications:

EN 300 328 V1.9.1		
Clause	**Test Parameter**	**Results**
	Transmitter Parameters	
4.3.2.2	RF Output Power	Pass
4.3.2.3	Power Spectral Density (Modulations other than FHSS equipment)	Pass
4.3.2.4	Duty cycle, Tx-sequence, Tx-gap (Non-adaptive equipment)	Not Applicable
4.3.2.5	Medium Utilisation (Non-Adaptive Equipment)	Not Applicable
4.3.2.6	Adaptivity (Adaptive Equipment)	Not Applicable (Note 1)
4.3.2.7	Occupied Channel Bandwidth	Pass
4.3.2.8	Transmitter Unwanted Emissions in the OOB Domain	Pass
4.3.2.9	Transmitter Unwanted Emissions in the Spurious Domain	Pass
4.3.2.12	Geo-location capability	Not Applicable
	Receiver Parameters	
4.3.2.10	Receiver Spurious Emissions	Pass
4.3.2.11	Receiver Blocking (Only for Adaptive equipment)	Not Applicable (Note 1)

Note: 1.These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm EIRP or for equipment when operating in a mode where the RF Output power is less than 10 dBm EIRP.

2.1 Test Instruments

For spurious emissions test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Keysight	N9030A	MY54490679	July 26, 2015	July 25, 2016
Pre_Amplifier Agilent	8447D	2944A10626	Feb. 21, 2016	Feb. 20, 2017
Pre_Amplifier HP	8449B	3008A01281	Jan. 16, 2016	Jan. 15, 2017
Pre_Amplifier EMCI	EMC184045	980143	Jan. 15, 2016	Jan. 14, 2017
TRILOG Antenna SCHWARZBECK	VULB9168	9168-162	Jan. 20, 2016	Jan. 19, 2017
Horn_Antenna SCHWARZBECK	BBHA9120-D1	D124	Jan. 20, 2016	Jan. 19, 2017
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Jan. 19, 2016	Jan. 18, 2017
Software	ADT_Radiated _V7.6.15.9.4	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208411	NA	NA
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017
ESG Vector signal generator Agilent	E4438C	Y45094468/005 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016

NOTE: 1. The test was performed in RF Fully Chamber No. 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: July 12 to 13, 2016

For Transmitter Unwanted Emissions in the OOB Domain test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP40	100036	Jan. 27, 2016	Jan. 26, 2017
Spectrum Analyzer Keysight	N9030A	MY54490570	July 14, 2015	July 13, 2016
AC Power Source Extech Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 03, 2015	Dec. 02, 2016
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	Y45094468/005 506 602 UK6 UNJ	Dec. 01, 2015	Nov. 30, 2016
Power meter Anritsu	ML2495A	0824006	May 26, 2016	May 25, 2017
Power sensor Anritsu	MA2411B	0738172	May 26, 2016	May 25, 2017
Software	ADT_RF Test Software V6.6.5.3	NA	NA	NA
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2015	Nov. 09, 2016
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53051263	Aug. 10, 2015	Aug. 09, 2016
MIMO Powermeasurement Test set (4X4) Agilent	U2021XA	U2021XA_01	Aug. 08, 2015	Aug. 07, 2016
Switch Box Agilent	PS-X10-100	PS-X10-100_01	NA	NA
Test Receiver Agilent	N9038A	MY54450088	July 24, 2015	July 23, 2016

NOTE: 1. The test was performed in Oven room 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: July 13, 2016

For other test items:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSP 40	100037	Oct. 30, 2014	Oct. 29, 2015
Spectrum Analyzer Agilent	E4446A	MY48250253	Dec. 18, 2014	Dec. 17, 2015
AC Power Source EXTECH Electronics	6502	1140503	NA	NA
Temperature & Humidity Chamber TERCHY	MHU-225AU	911033	Dec. 08, 2014	Dec. 07, 2015
DC Power Supply GOOD WILL INSTRUMENT CO., LTD.	GPC - 3030D	7700087	NA	NA
ESG Vector signal generator Agilent	E4438C	MY47271330 506 602 UNJ	Apr. 28, 2014	Apr. 27, 2015
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010004	NA	NA
ESG Vector signal generator Agilent	E4438C	MY45094468/ 005 506 602 UK6 UNJ	Dec. 05, 2014	Dec. 04, 2015
Upgrade the software license on current E4438C ESG Agilent	E4438CK-403	ESG E4_010001	NA	NA
Power meter Anritsu	ML2495A	0824006	May 22, 2014	May 21, 2015
Power sensor Anritsu	MA2411B	0738172	May 22, 2014	May 21, 2015
Software	Total Power Measurement Tools V7.1	NA	NA	NA
Software	ADT_RF Test Software V6.6.5.3	NA	NA	NA
MXG X-Series RF Vector Signal Generator Agilent	N5182B	MY53051263	Sep. 17, 2014	Sep. 16, 2015
MIMO Powermeasurement Test set (4X4) Agilent	U2021XA	U2021XA_01	July 02, 2014	July 01, 2015
Switch Box Agilent	PS-X10-100	PS-X10-100_0 1	NA	NA
Test Receiver Agilent	N9038A	MY51210202	Dec. 12, 2014	Dec. 11, 2015

NOTE: 1. The test was performed in Oven room A.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: Jan. 20, 2015

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
Occupied Channel Bandwidth	±1.132x10^{-4} %
RF output power, conducted	±1.207dB
Power Spectral Density, conducted	±1.207dB
Unwanted Emissions, conducted	±3dB
All emissions, radiated	±4.925dB
Temperature	±0.6°C
Supply voltages	±0.04%
Time	±5 %

2.3 Maximum Measurement Uncertainty

For the test methods, according to ETSI EN 300 328 standard, the measurement uncertainty figures shall be calculated in accordance with ETSI TR 100 028-1 [1], ETSI TS 103 051 [2] and ETSI TS 103 052 [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
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1,5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±1 °C
Supply voltages	±3 %
Time	±5 %

2.4 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-LE)

Product	Wireless M.2 Type A/E with BLE Module
Brand	Compex
Test Model	WLT674
Status of EUT	ENGINEERING SAMPLE
Nominal Voltage	3.3Vdc form host equipment
Temperature Operating Range	-10℃ ~ 70℃
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Adaptive/Non-Adaptive	☐ non-adaptive Equipment ☒ adaptive Equipment without the possibility to switch to a non-adaptive mode ☐ adaptive Equipment which can also operate in a non-adaptive mode
EIRP Power (Measured Max. Average)	8.15dBm
Antenna Type	See item 3.2
Antenna Connector	See item 3.2
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. There are Bluetooth technology and WLAN technology used for the EUT.
2. The EUT support multiple function, therefore the WLAN OFDM will be cover BT OFDM (low power) scenario.
3. WLAN/BT coexistence mode:
   - ◆ 2x2 WLAN + BT:
     - ➢ 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.
     - ➢ 2.4GHz: timely shared coexistence.
4. The emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11n (HT20)) + Bluetooth (8DPSK)	36 to 140	140	OFDM
	0 to 78	78	FHSS

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

3.2 Description of Antenna

The antenna gain was declared by client; please refer to the following table:

Transmitter Circuit	Brand	Model	Ant. Type	2.4GHz Gain with cable loss (dBi)	5GHz Gain with cable loss (dBi)	2.4GHz Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
Chain (0)	WNC	81-EBJ15.005	PIFA	3.00	Band 1&2: 2.56	1.15	Band 1&2: 1.70	IPEX	300
					Band 3: 4.76		Band 3: 1.74		
					Band 4: 4.76		Band 4: 1.79		
Chain (1)	WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08	1.15	Band 1&2: 1.70	IPEX	300
					Band 3: 3.31		Band 3: 1.74		
					Band 4: 2.42		Band 4: 1.79		

Note: 1. Above antenna gains of antenna are Total (H+V).

3.3 Description of Test Modes

40 channels are provided to this EUT:

Channel	FREQ. (MHz)	Channel	FREQ. (MHz)	Channel	FREQ. (MHz)	Channel	FREQ. (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

3.3.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to										Description
	ROP	PSD	DC/TS/TG	MU	AD	OCB	EOB	SE< 1G	SE≥ 1G	RB	
-	√	√	-	-	-	√	√	√	√	-	-

Where **ROP:** RF Output Power **PSD:** Power Spectral Density

DC/TS/TG: Duty Cycle/ Tx-Sequence / Tx-gap **MU:** Medium Utilization

AD: Adaptivity (Channel Access Mechanism) **OCB:** Occupied Channel Bandwidth

EOB: Transmitter unwanted emissions in the out-of-band domain **SE<1G:** Unwanted Emissions in the Spurious Domain below 1 GHz

SE≥1G: Unwanted Emissions in the Spurious Domain above 1 GHz **RB:** Receiver Blocking

RF Output Power 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.

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 19, 39	GFSK	1

Power Spectral Density 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.

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 19, 39	GFSK	1

Occupied Channel Bandwidth 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.

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 39	GFSK	1

Transmitter Unwanted Emissions in the Out-of-band Domain 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.

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 39	GFSK	1

Unwanted Emissions in the Spurious Domain 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.

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	39	GFSK	1
0 to 39 Receiver	39	-	-

Unwanted Emissions in the Spurious Domain 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.

Available Channel	Tested Channel	Modulation Type	Data Rate (Mbps)
0 to 39	0, 39	GFSK	1
0 to 39 Receiver	0, 39	-	-

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
ROP	25deg. C, 60%RH	230Vac, 50Hz	James Chan
PSD	25deg. C, 60%RH	230Vac, 50Hz	James Chan
OCB	25deg. C, 60%RH	230Vac, 50Hz	James Chan
EOB	25deg. C, 60%RH	230Vac, 50Hz	Look Huang
SE<1G	25deg. C, 65%RH	230Vac, 50Hz	Nelson Tseng Louis Tseng
SE≥1G	25deg. C, 65%RH	230Vac, 50Hz	Nelson Tseng Louis Tseng

3.4 Description of Support Units

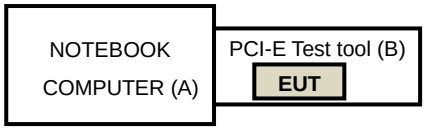
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	GM1SKV1	FCC DoC	Provided by Lab
B	PCI-E Test tool	Compex	NA	NA	NA	Supplied by Client

NOTE:

1. All power cords of the above support units are non-shielded (1.8 m).

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

EN 300 328 V1.9.1 (2015-02)

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

4 Test Procedure and Results

Transmitter Parameters

4.1 RF Output Power

4.1.1 Limits of RF Output Power

Condition	Frequency Band	Limit (e.i.r.p)
Under all test conditions	2400 ~ 2483.5 MHz	AV: 20dBm

4.1.2 Test Procedures

Refer to chapter 5.3.2.2 of EN 300 328 V1.9.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.1.3 Deviation from Test Standard

No deviation.

4.1.4 Test Setup

The measurements for RF output power was performed at both normal environmental conditions and at the extremes of the operating temperature. Controlling software (QCARCT Version: 3.0.33.0) has been activated to set the EUT on specific channel and power level.

4.1.5 Test Results

Test Condition			EIRP Power (dBm)		
			(CH0) 2402 MHz	(CH19) 2440 MHz	(CH39) 2480 MHz
Tnom(℃)	25	Vnom(v)	6.62	7.02	7.22
Tmin(℃)	-10	Vnom(v)	7.75	8.04	8.15
Tmax(℃)	70	Vnom(v)	7.09	7.39	7.77

4.2 Power Spectral Density

4.2.1 Limit of Power Spectral Density

Condition	Frequency Band	Limit (e.i.r.p.)
Under normal conditions	2400 ~ 2483.5 MHz	10dBm / 1MHz

4.2.2 Test Procedures

Refer to chapter 5.3.3.2 of EN 300 328 V1.9.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.2.3 Deviation of Test Standard

No deviation.

4.2.4 Test Setup

The test setup has been constructed as the normal test condition. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The power spectral density as defined in EN 300 328 clause 4.3.2.3 shall be measured and recorded. Controlling software (QCARCT Version: 3.0.33.0) has been activated to set the EUT on specific status.

4.2.5 Test Results

Channel	Channel Frequency (MHz)	Power Density (dBm/1MHz) (EIRP)	Limit (dBm/1MHz) (EIRP)	Pass/Fail
0	2402	6.52	10	Pass
19	2440	6.92	10	Pass
39	2480	7.11	10	Pass

4.4 Occupied Channel Bandwidth

4.4.1 Limit of Occupied Channel Bandwidth

Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz.
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and e.i.r.p >10dBm.	Less than 20MHz
	For non-adaptive Frequency Hopping system and e.i.r.p >10dBm.	Less than 5MHz

4.4.2 Test Procedure

Refer to chapter 5.3.8.2 of EN 300 328 V1.9.1.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

4.4.3 Deviation from Test Standard

No deviation.

4.4.4 Test Setup

These measurements only were performed at normal test conditions. The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software (QCARCT Version: 3.0.33.0) has been activated to set the EUT on specific status.

4.4.5 Test Results

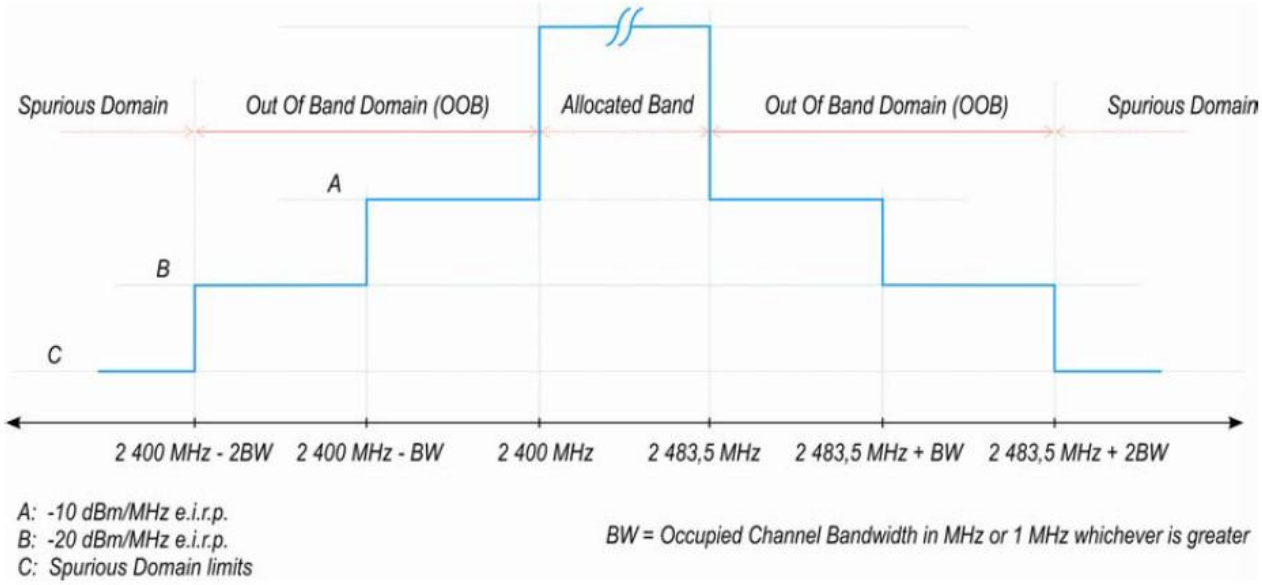
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies		Limit	Pass/Fail
			F_L (MHz)	F_H (MHz)		
0	2402	1.36	2401.36	2402.72	F_L > 2400 MHz and F_H < 2483.5 MHz	Pass
39	2480	1.36	2479.36	2480.72		Pass

Note: F_L is the lowest frequency of the 99% occupied bandwidth of power envelope.
F_H is the highest frequency of the 99% occupied bandwidth of power envelope.

4.5 Transmitter Unwanted Emissions in the Out-of-band Domain

4.5.1 Limits of Transmitter Unwanted Emissions in the Out-of-band Domain

Condition	Limit
Under normal conditions	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in below figure.



4.5.2 Test Procedure

Refer to chapter 5.3.9.2 of EN 300 328 V1.9.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

4.5.3 Deviation from Test Standard

No deviation

4.5.4 Test Setup

The measurements were performed at normal environmental conditions. The measurement was performed at the lowest and the highest channel on which the equipment can operate. The equipment was configured to operate under its worst case situation with respect to output power. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The frequency has to be recorded for the right and left end above threshold of highest and lowest channel respectively.

4.5.5 Test Results

Channel Frequency		2402MHz				2480MHz			
Test Condition		OOB Emission (MHz)				OOB Emission (MHz)			
		2398.64 ~ 2400		2397.28 ~ 2398.64		2483.5 ~ 2484.86		2484.86 ~ 2486.22	
		Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)	Freq. (MHz)	Power (dBm/ MHz)
T_{nom} 25℃	V_{nom}(v)	2399.50	-35.78	2398.14	-39.31	2484.00	-38.56	2485.36	-39.49
Limit (dBm/MHz)		-10.00		-20.00		-10.00		-20.00	
Pass/Fail		Pass		Pass		Pass		Pass	

4.6 Transmitter Spurious Emissions

4.6.1 Limits of Transmitter Spurious Emissions

Frequency Range	Maximum Power Limit	Bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87,5 MHz	-36dBm	100kHz
87,5 MHz to 118 MHz	-54dBm	100kHz
118 MHz to 174 MHz	-36dBm	100kHz
174 MHz to 230 MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 862 MHz	-54dBm	100kHz
862 MHz to 1 GHz	-36dBm	100kHz
1GHz ~ 12.75GHz	-30dBm	1MHz

4.6.2 Test Procedure

Refer to chapter 5.3.10.2 of EN 300 328 V1.9.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement

For Conducted measurement:

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).

Conducted measurement (For equipment with multiple transmit chains):

☐ Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits.

☐ 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 x log (N) (number of active transmit chains)

4.6.3 Deviation from Test Standard

No deviation.

4.6.4 Test Setup

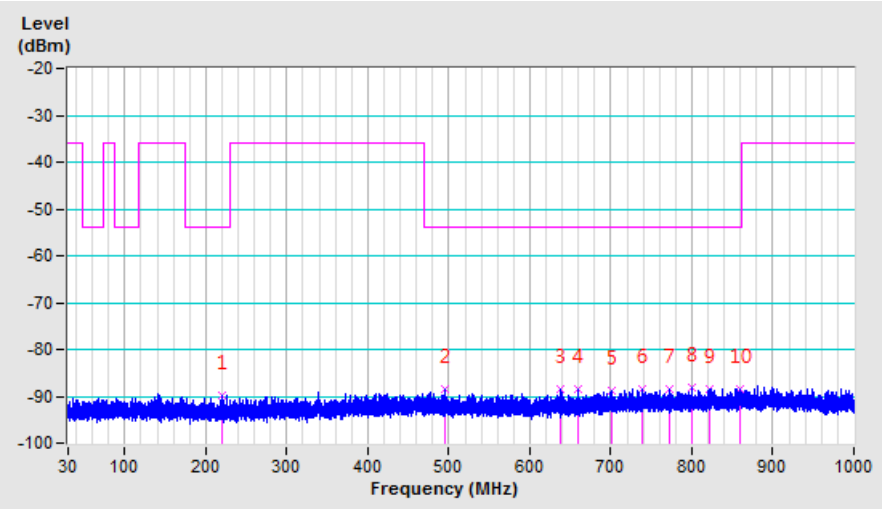
1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The equipment was configured to operate under its worst case situation with respect to output power.
3. The test setup has been constructed as the normal use condition. Controlling software (QCARCT Version: 3.0.33.0)has been activated to set the EUT on specific status.

4.6.5 Test Results (Operating - Conducted)

Below 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

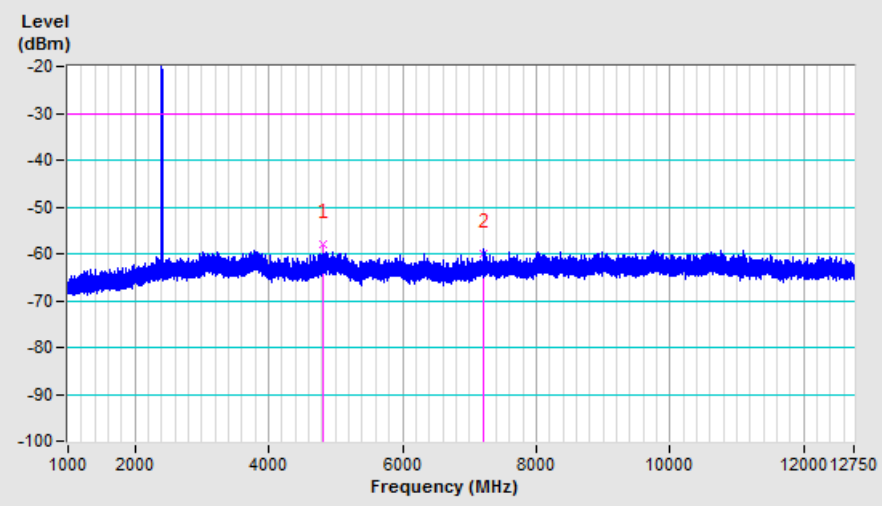
SPURIOUS EMISSION LEVEL			
Frequency (MHz)	**Level (dBm)**	**Limit (dBm)**	**Margin**
220.78	-89.86	-54.00	-35.86
494.38	-88.38	-54.00	-34.38
638.00	-88.56	-54.00	-34.56
660.08	-88.55	-54.00	-34.55
700.23	-88.97	-54.00	-34.97
738.58	-88.45	-54.00	-34.45
772.16	-88.37	-54.00	-34.37
800.32	-88.16	-54.00	-34.16
820.86	-88.39	-54.00	-34.39
858.62	-88.33	-54.00	-34.33



Above 1GHz Worst-case Data

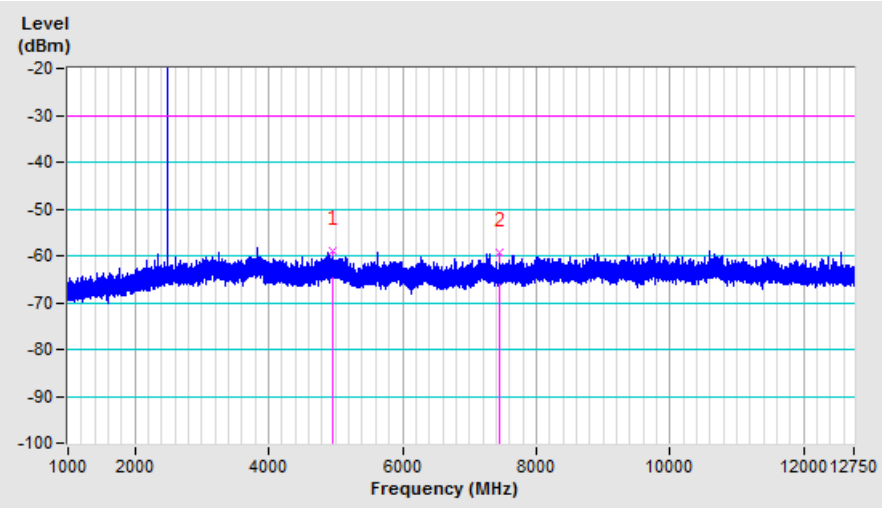
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	**Level (dBm)**	**Limit (dBm)**	**Margin**
4803.96	-57.90	-30.00	-27.90
7206.50	-60.06	-30.00	-30.06



SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	39

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	**Level (dBm)**	**Limit (dBm)**	**Margin**
4960.01	-58.90	-30.00	-28.90
7441.14	-59.43	-30.00	-29.43



4.6.6 Test Results (Operating - Radiated)

Below 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
39.90	V	-73.28	-36.00	-37.28
64.40	H	-73.86	-54.00	-19.86
99.90	H	-61.28	-54.00	-7.28
105.25	V	-69.28	-54.00	-15.28
144.21	V	-63.18	-36.00	-27.18
180.06	V	-63.16	-54.00	-9.16
398.67	H	-69.26	-36.00	-33.26
456.32	H	-69.43	-36.00	-33.43
480.27	H	-66.00	-54.00	-12.00
492.32	V	-71.20	-54.00	-17.20
516.33	H	-63.67	-54.00	-9.67
516.33	V	-69.82	-54.00	-15.82
533.28	V	-68.71	-54.00	-14.71
576.23	H	-63.08	-54.00	-9.08
648.13	V	-67.82	-54.00	-13.82
648.33	H	-63.60	-54.00	-9.60
720.04	H	-63.58	-54.00	-9.58
759.19	V	-70.79	-54.00	-16.79
826.74	V	-68.00	-54.00	-14.00
863.59	H	-67.81	-36.00	-31.81

Above 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0, 39

SPURIOUS EMISSION LEVEL					
Channel	**Frequency (MHz)**	**Antenna Polarization**	**Level (dBm)**	**Limit (dBm)**	**Margin (dB)**
0	4803.51	V	-56.28	-30.00	-26.28
	4804.00	H	-57.59	-30.00	-27.59
	7206.00	H	-51.30	-30.00	-21.30
	7206.00	V	-52.89	-30.00	-22.89
	9608.00	H	-48.60	-30.00	-18.60
	9608.00	V	-49.27	-30.00	-19.27
39	4960.00	H	-55.62	-30.00	-25.62
	4960.00	V	-53.80	-30.00	-23.80
	7440.00	H	-51.42	-30.00	-21.42
	7440.00	V	-51.95	-30.00	-21.95
	9920.00	H	-48.72	-30.00	-18.72
	9920.00	V	-48.01	-30.00	-18.01

Receiver Parameters

4.7 Receiver Spurious Radiation

4.7.1 Limit of Receiver Spurious Radiation

Frequency Range	Maximum Power Limit
30 MHz ~ 1 GHz	-57dBm
1 GHz ~ 12.75 GHz	-47dBm

4.7.2 Test Procedure

Refer to chapter 5.3.11.2 of EN 300 328 V1.9.1.

Measurement Method	
☒ Conducted measurement	☐ Radiated measurement
For Conducted measurement: 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).	
Conducted measurement (For equipment with multiple transmit chains): ☐ Option 1: The results for each of the transmit chains for the corresponding 1MHz segments shall be added and compared with the limits. ☐ 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 x log (N) (number of active transmit chains)	

4.7.3 Deviation from Test Standard

No deviation.

4.7.4 Test Setup

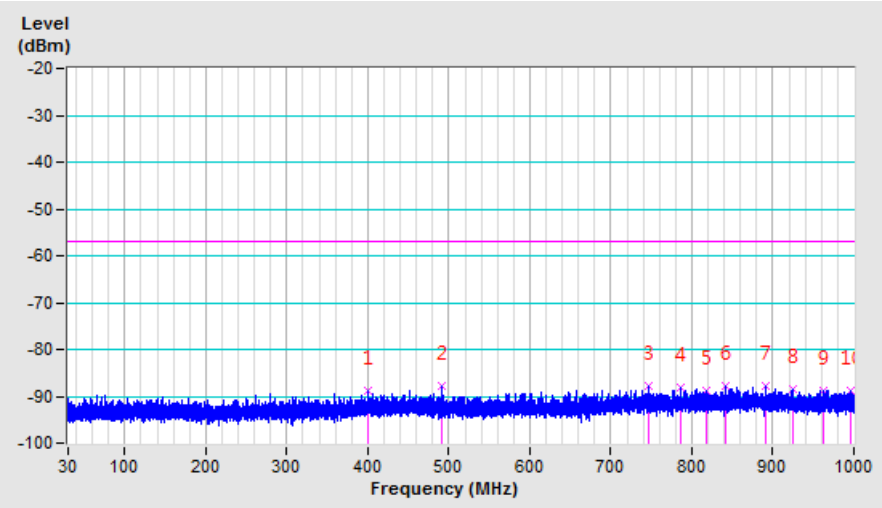
1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. Testing was performed when the equipment was in a receive-only mode.
3. The test setup has been constructed as the normal use condition. Controlling software (QCARCT Version: 3.0.33.0) has been activated to set the EUT on specific status.

4.7.5 Test Results (Operating - Conducted)

RX Below 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

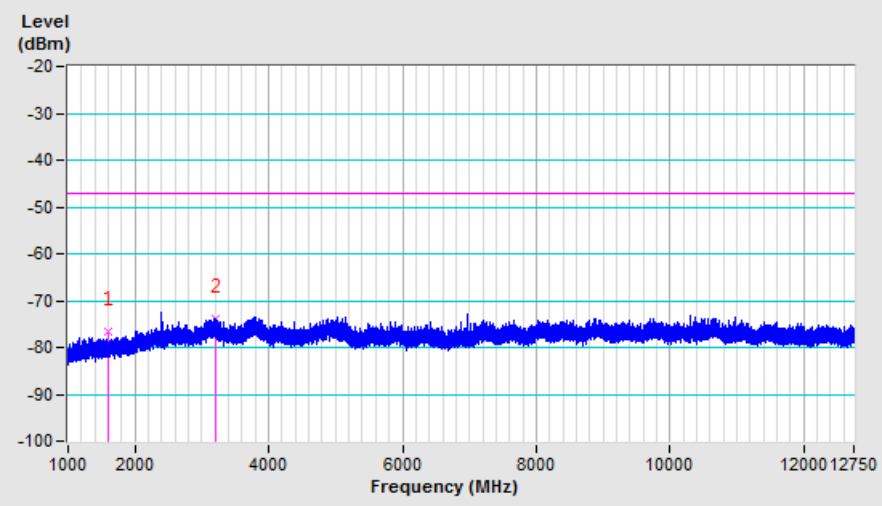
SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
401.11	-88.89	-57.00	-31.89
491.79	-87.94	-57.00	-30.94
747.19	-87.95	-57.00	-30.95
786.24	-88.29	-57.00	-31.29
817.88	-88.84	-57.00	-31.84
840.81	-87.80	-57.00	-30.80
890.66	-87.80	-57.00	-30.80
925.58	-88.38	-57.00	-31.38
963.09	-88.66	-57.00	-31.66
996.02	-88.78	-57.00	-31.78



RX Above 1GHz Worst-case Data

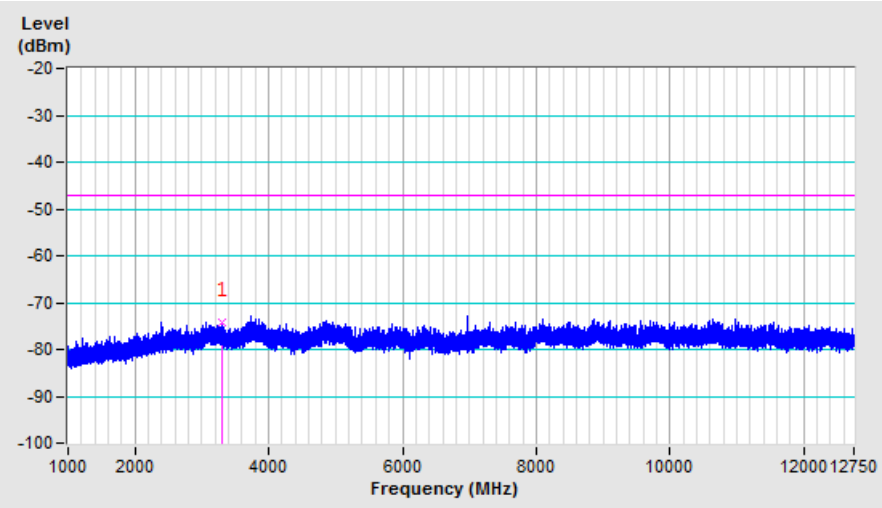
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
1599.25	-76.58	-47.00	-29.58
3205.11	-74.03	-47.00	-27.03



SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	39

SPURIOUS EMISSION LEVEL			
Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin
3307.66	-74.26	-47.00	-27.26



4.7.8 Test Results (Operating - Radiated)

RX Below 1GHz Worst-case Data

SPURIOUS EMISSION FREQUENCY RANGE	30MHz ~ 1GHz	OPERATING CHANNEL	39

SPURIOUS EMISSION LEVEL				
Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
37.45	H	-72.81	-57.00	-15.81
43.05	V	-71.73	-57.00	-14.73
56.65	V	-72.11	-57.00	-15.11
107.95	V	-68.11	-57.00	-11.11
143.76	H	-63.84	-57.00	-6.84
144.21	V	-60.21	-57.00	-3.21
200.16	V	-61.30	-57.00	-4.30
269.41	V	-66.56	-57.00	-9.56
299.66	V	-66.10	-57.00	-9.10
398.67	H	-69.53	-57.00	-12.53
430.62	H	-70.18	-57.00	-13.18
430.67	V	-68.67	-57.00	-11.67
480.32	H	-64.46	-57.00	-7.46
516.33	H	-63.45	-57.00	-6.45
533.18	V	-68.62	-57.00	-11.62
576.08	H	-63.77	-57.00	-6.77
672.28	H	-64.08	-57.00	-7.08
720.09	H	-63.12	-57.00	-6.12
744.34	H	-65.54	-57.00	-8.54
789.19	V	-67.84	-57.00	-10.84

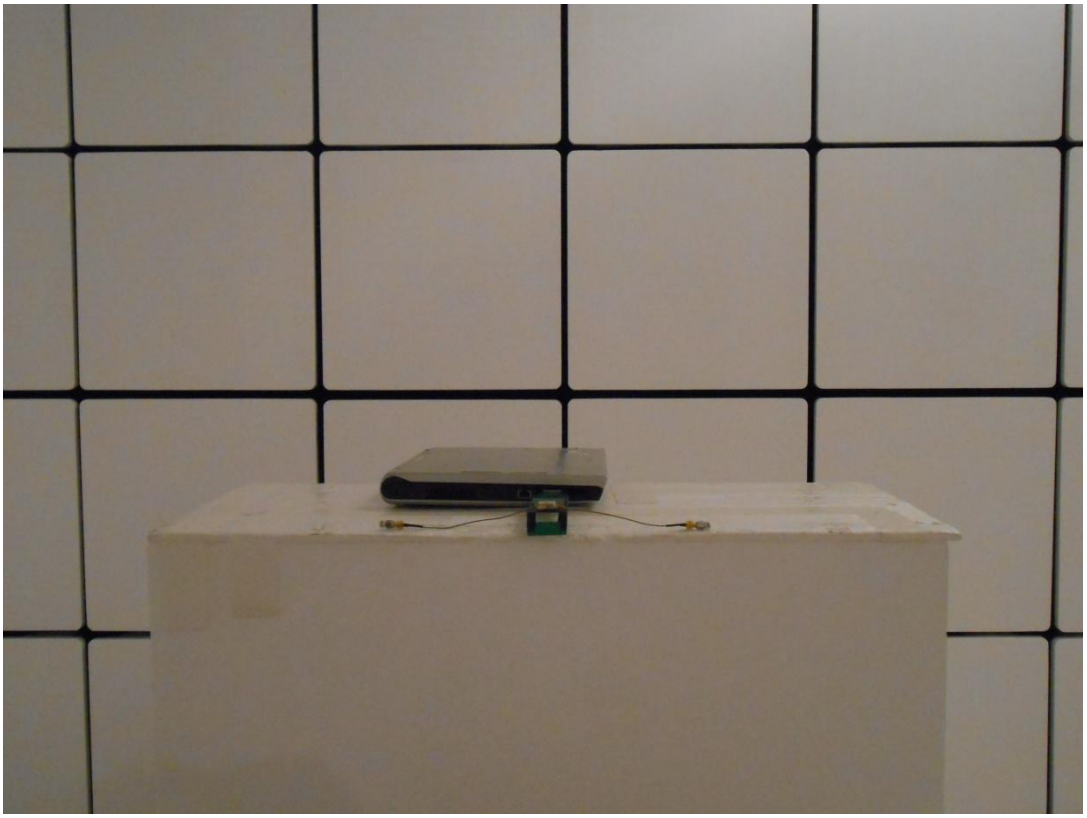
RX Above 1GHz Worst-case Data

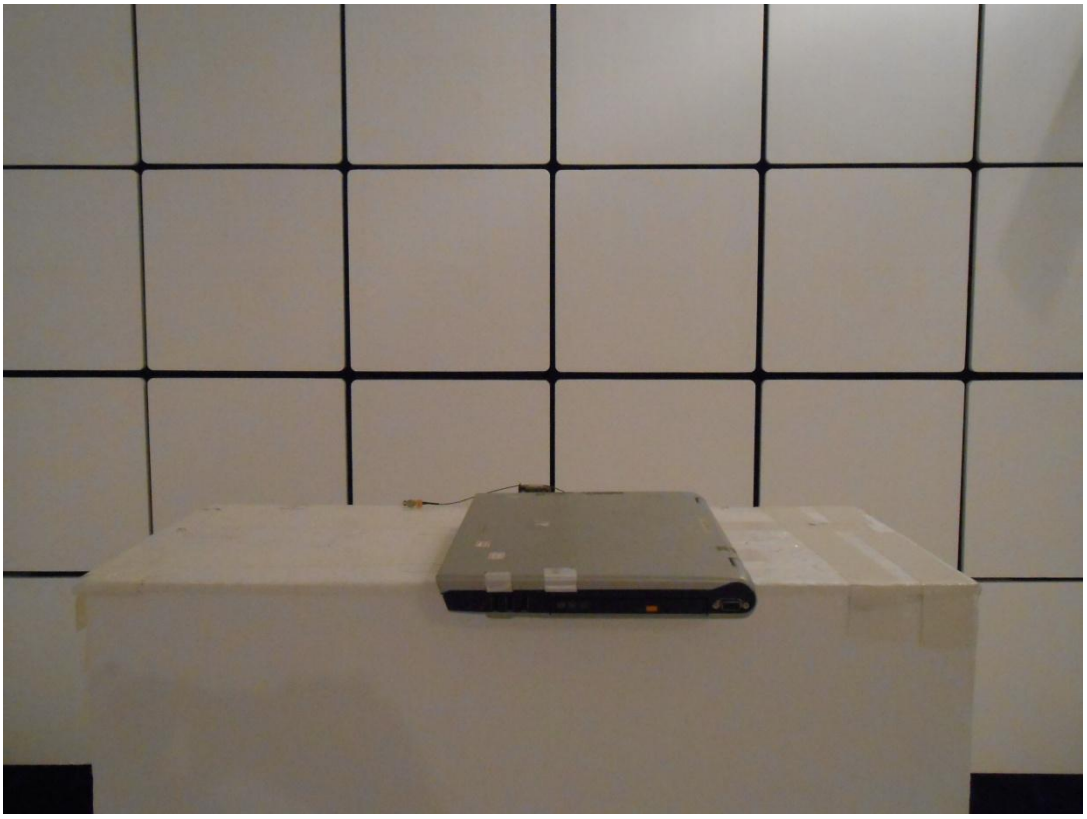
SPURIOUS EMISSION FREQUENCY RANGE	1GHz ~ 12.75GHz	OPERATING CHANNEL	0, 39

SPURIOUS EMISSION LEVEL					
Channel	Frequency (MHz)	Antenna Polarization	Level (dBm)	Limit (dBm)	Margin (dB)
0	3202.66	H	-60.03	-47.00	-13.03
	3202.66	V	-61.05	-47.00	-14.05
	4803.99	H	-59.11	-47.00	-12.11
	4803.99	V	-58.17	-47.00	-11.17
39	3306.66	H	-60.79	-47.00	-13.79
	3306.66	V	-60.15	-47.00	-13.15
	4959.99	H	-57.42	-47.00	-10.42
	4959.99	V	-55.05	-47.00	-8.05

5 Photographs of the Test Configuration

TX / RX 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:

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
Fax: 886-3-3270892

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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