

# TEST REPORT

## No. AR18-0031790-01

Tests performed in accordance with  
ETSI EN 300 328 V2.1.1 (2016:11)

<b>PRODUCT</b>	Bluetooth Low Energy module
<b>MODEL(s) TESTED</b>	BLUENRG-M2SA
<b>TRADE MARK(s)</b>	STMICROELECTRONICS

<b>APPLICANT</b>	STMICROELECTRONICS S.r.l. Centro Direzionale Colleoni Palazzo Andromeda 3 ~ I-20864 Agrate Brianza
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Tested by	Robertino Torri <i>[Laboratory technician]</i>	
Approved by	Giovanni Di Turi <i>[Laboratory Manager]</i>	

### Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2018-10-26	First edition Digital sign - AR18-0031790-01_TR_EN 300 328 V2.1.1_STM - BLUENRG-M2SA

The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself.  
This Report shall not be reproduced partially the written approval of IMQ S.p.A..  
The authenticity of this Test Report and its contents can be verified by contacting IMQ S.p.A., responsible for this Test Report.

## 1. GENERAL DATA

SAMPLE		
Samples received on	2018-09-28	(Item(s) sampled and sent by applicant)
IMQ reference samples	BEM	92584
Samples tested No.	1	
Object under analysis recognition	<b>Not carried out</b> Except where stated, characteristics of products were taken from client description and were not verified by the laboratory	
Date of acceptance of test item	2018-10-05	
TEST LOCATION		
Testing dates	2018-10-05 ÷ 2018-10-11	
Testing laboratory.	IMQ S.p.A. - Via Quintiliano, 43 – I-20138 Milano	
Testing site	Viale Lombardia, 20 – I-20021 Bollate (MI)	
ENVIRONMENTAL CONDITIONING		
Parameter	Measured	
Ambient Temperature	24.0 ÷ 25.0 °C	
Relative Humidity	46 ÷ 58 %	
Atmospheric Pressure	1005 ÷ 1007 mbar	
The laboratory is monitored by a continuous environmental conditions measurements system. Temperature, humidity and pressure data are recorded on a weekly basis and stored in local archive.		
REMARKS		
Throughout this report a point is used as the decimal separator. The ability or reliability of this product to perform its intended function in a particular application has not been investigated. IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant.		

## 2. REFERENCE DOCUMENT

DOCUMENT	DATE	TITLE
ETSI EN 300 328 V2.1.1	2016-11	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

### 3. EQUIPMENT UNDER TEST (EUT) DETAILS

#### GENERAL DATA

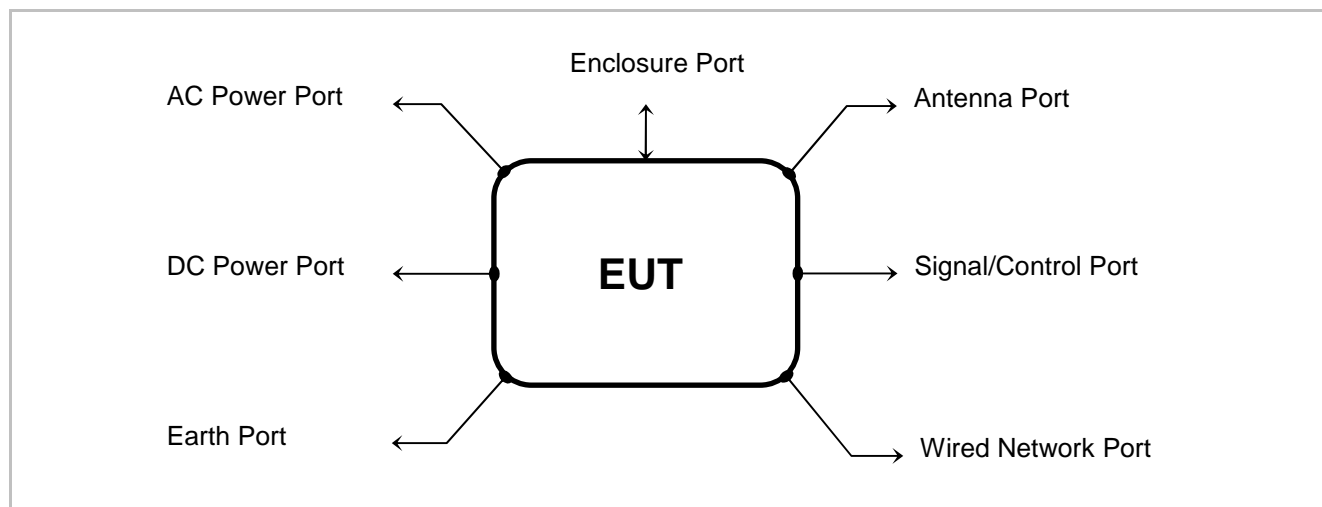
MODEL (basic)	Description
BLUENRG-M2SA	Bluetooth Low Energy module
VARIANTS (derived)	Description
/	/

MANUFACTURER	STMICROELECTRONICS
ASSEMBLY PLANT(s)	/

#### EUT IDENTIFICATION

UUT type	Bluetooth Low Energy module		
UUT use	<input type="checkbox"/> Portable <input type="checkbox"/> Mobile <input type="checkbox"/> Fixed <input checked="" type="checkbox"/> Other		
UUT single or system	<input type="checkbox"/> Single <input type="checkbox"/> System <input checked="" type="checkbox"/> Other		
EUT standing	To be integrated into final application		
Supply voltage	3.0 V (2 x AAA alkaline battery) by evaluation board		
<b>Radio Data (necessary only for EUT with radio module)</b>			
Radio module(s) model	BLUENRG-M2SA		
Radio module(s) type	<input checked="" type="checkbox"/> Bluetooth <input type="checkbox"/> IEEE802.11 <input type="checkbox"/> 802.15.4 <input type="checkbox"/> Proprietary <input type="checkbox"/> Other		
Adaptive / non-adaptive	<input checked="" type="checkbox"/> Adaptive <input type="checkbox"/> Non-Adaptive <input type="checkbox"/> Adaptive operate in non-Adaptive mode		
Receiver category	<input checked="" type="checkbox"/> Category 1 <input type="checkbox"/> Category 2 <input type="checkbox"/> Category 3		
Modulation Type	<input type="checkbox"/> FHSS <input checked="" type="checkbox"/> DSSS, OFDM, etc.		
Number of channels	40	Channel bandwidth/spacing	2 MHz
Operating frequency	2400 ÷ 2483.5 MHz		
Antenna	Model/Gain:	2450AT18A100E of JOHANSON TECHNOLOGY / +0.5 dBi max peak	
	Type:	<input type="checkbox"/> Integral <input checked="" type="checkbox"/> Dedicated <input type="checkbox"/> External <input type="checkbox"/> Smart antenna systems*	
	Number*	<input checked="" type="checkbox"/> single antenna <input type="checkbox"/> multiple, no beamforming <input type="checkbox"/> multiple, with beamforming	
Transmission protocol	/		

## EUT PORTS



Port	Description	Cable >3 m	Cable Shielded
Enclosure	Open frame		
AC power	/	/	/
DC power	3.0 V (2 x AAA alkaline battery) by evaluation board	/	/
Earth	/	/	/
Wired network	/	/	/
Signal/ Control	/	/	/
Antenna	Dedicated	/	/

## STATE OF THE EUT DURING TESTS

Ref.	Mode	Description
#1	Operating	Data transmission.

## SUPPORT EQUIPMENT

Defined as equipment needed for correct operation or loading of the EUT, but not considered as tested:

Equipment	Manufacturer	Model
PC with dedicated software for RF transmission management	/	/
Evaluation board	STM	STEVAL-IDB007V1M

**ELECTROMAGNETICALLY RELEVANT COMPONENTS**

Component	No.	Manufacturer	Model
Bluetooth Low Energy module	1	STMICROELECTRONICS	PC87B V01

**RFI SUPPRESSION DEVICES**

Component	No.	Manufacturer	Model
/	/	/	/

**EMI PROTECTION DEVICES**

Component	No.	Manufacturer	Model
/	/	/	/

**EUT TECHNICAL DOCUMENTATION**

Document	Reference
/	/

## 4. SUMMARY OF TEST RESULTS

POSSIBLE TEST CASE VERDICTS:	
Test object meets the requirement	PASS
Test object does not meet the requirement	FAIL
Test case does not apply to the test object	N.A.
Test not performed	N.P.

TEST FOR OTHER TYPES OF WIDE BAND MODULATION		
EUT PART	ENVIRONMENTAL PHENOMENON	RESULT
Transmitter	RF output power	PASS
	Power Spectral Density	PASS
	Duty Cycle, Tx-sequence, Tx-gap	N.A. <sup>1</sup>
	Medium Utilisation (MU) factor	N.A. <sup>2</sup>
	Adaptivity (adaptive equipment using modulations other than FHSS) – Non-LBT based Detect and Avoid	N.A. <sup>3</sup>
	Adaptivity (adaptive equipment using modulations other than FHSS) – LBT based Detect and Avoid	N.A. <sup>3</sup>
	Occupied Channel Bandwidth	PASS
	Transmitter unwanted emissions in the out-of-band domain	PASS
	Transmitter unwanted emissions in the spurious domain	PASS
Receiver	Receiver spurious emissions	PASS
	Receiver Blocking	PASS
	Geo-location capability	N.A. <sup>4</sup>

Note 1	These requirements apply to non-adaptive equipment or to adaptive equipment operating in a non-adaptive mode. These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10dBm e.i.r.p.
Note 2	This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode. In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.
Note 3	This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment. In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.
Note 4	This requirement only applies to equipment with geo-location capability

## 5. TEST RESULTS

### 5.1 RF OUTPUT POWER

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.2
Test set-up	§ 5.4.2.2
Test method	<input type="checkbox"/> Conducted (§ 5.4.2.2.1) <input checked="" type="checkbox"/> Radiated (§ 5.4.2.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input type="checkbox"/> Hopping equipment (§ 4.3.1.2.3) <input checked="" type="checkbox"/> Wide Band (§ 4.3.2.2.3)
Deviation to test procedure	None
EUT operating condition	#1
Testing dates	2018-10-05

Test conditions		Channel			Limits (dBm)	Results
		CH Low 2.402 GHz	CH Middle 2.440 GHz	CH High 2.480 GHz		
Temperature	Voltage	Measured equivalent isotropic power (dBm)				
T <sub>nom</sub> +25°C	V <sub>nom</sub> 3 V	4.30	4.57	2.90	20	PASS
T <sub>min</sub> -40 °C	V <sub>min</sub> 2.55 V	4.33	4.60	2.93	20	PASS
	V <sub>max</sub> 3 V	4.32	4.59	2.92	20	PASS
T <sub>max</sub> +85 °C	V <sub>min</sub> 2.55 V	3.38	3.65	1.98	20	PASS
	V <sub>max</sub> 3 V	3.38	3.65	1.98	20	PASS

## 5.2 POWER SPECTRAL DENSITY

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.3
Test set-up	§ 5.4.3.2
Test method	<input type="checkbox"/> Conducted (§ 5.4.3.2.1) <input checked="" type="checkbox"/> Radiated (§ 5.4.3.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input checked="" type="checkbox"/> Wide Band § 4.3.2.3.3
Deviation to test procedure	None
EUT operating condition	#1
Testing dates	2018-10-08

Test conditions		CH Low 2.402 GHz	CH Middle 2.440 GHz	CH High 2.480 GHz	Limits (dBm/MHz)	Results
Temperature	Voltage	Maximum e.i.r.p. spectral density (dBm/MHz)				
T <sub>nom</sub> +25°C	V <sub>nom</sub> 3 V	1.54	1.83	0.30	10	PASS

### 5.3 OCCUPIED CHANNEL BANDWIDTH

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.7
Test set-up	§ 5.4.7.2
Test method	<input type="checkbox"/> Conducted (§ 5.4.7.2.1) <input checked="" type="checkbox"/> Radiated (§ 5.4.7.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input type="checkbox"/> Hopping equipment (§ 4.3.1.8.3) <input checked="" type="checkbox"/> Wide Band § (4.3.2.7.3)
Deviation to test procedure	None
EUT operating condition	#1
Testing dates	2018-10-08

Fall of occupied channel bandwidth			
Channel	Value measured (MHz)	Limit (MHz)	Results
Lowest	2401.5	> 2400	PASS
Highest	2480.6	< 2483.5	PASS

Wide Band equipment - 99 % Occupied channel bandwidth				
Channel	Value measured (MHz)	Limit (MHz)		Results
		Adaptive	Non Adaptive	
Lowest	1.034	/	< 20*	PASS
Highest	1.034	/	< 20*	PASS

\*: only for equipment with e.i.r.p. greater than 10dBm.

## 5.4 TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.8
Test set-up	§ 5.4.8.2
Test method	<input type="checkbox"/> Conducted (§ 5.4.8.2.1) <input checked="" type="checkbox"/> Radiated (§ 5.4.8.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input type="checkbox"/> Hopping equipment (§ 4.3.1.9.3) <input checked="" type="checkbox"/> Wide Band (§ 4.3.2.8.3)
Deviation to test procedure	None
EUT operating condition	#1
Testing dates	2018-10-08

Allocated band (MHz)	Bandwidth (MHz)	Out of band domain (MHz)			
2400 ÷ 2483.5	1	-2BW	-BW	+BW	+2BW
		2398 ÷ 2399	2399 ÷ 2400	2483.5 ÷ 2484.5	2484.5 ÷ 2485.5

Test conditions		-2BW	-BW	+BW	+2BW	Results
Temperature	Voltage	(dBm/MHz e.i.r.p.)				
T <sub>nom</sub> +25°C	V <sub>nom</sub> 3 V	-35.49	-31.18	-34.22	-38.01	PASS
Limit		-20	-10	-10	-20	

## 5.5 TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.9
Test set-up	§ 5.4.9.2
Test method	<input type="checkbox"/> Conducted (§ 5.4.9.2.1) <input checked="" type="checkbox"/> Radiated (§ 5.4.9.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input type="checkbox"/> Hopping equipment (§ 4.3.1.10.3) <input checked="" type="checkbox"/> Wide Band (§ 4.3.2.9.3)
Deviation to test procedure	None
EUT operating condition	#1
Testing dates	2018-10-05 ÷ 2018-10-11

Frequency (MHz)	RBW / VBW (kHz)	Level (dBm)	Limit (dBm)	Result
47 ÷ 74 87.5 ÷ 118 174 ÷ 230 470 ÷ 862	100/300	< -70	-54	PASS
30 ÷ 47 74 ÷ 87.5 118 ÷ 174 230 ÷ 470 862 ÷ 1000	100/300	< -60	-36	PASS
110.83	100/300	-71.98	-54	PASS
754.39	100/300	-67.04	-54	PASS
4959.53	1000/3000	-43.54	-30	PASS
7205.20	1000/3000	-36.88	-30	PASS
9759.06	1000/3000	-40.87	-30	PASS
12198.87	1000/3000	-37.75	-30	PASS
up to 12750	1000/3000	< -40	-30	PASS

## 5.6 RECEIVER SPURIOUS EMISSIONS

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.10
Test set-up	§ 5.4.10.2
Test method	<input type="checkbox"/> Conducted (§ 5.4.10.2.1) <input checked="" type="checkbox"/> Radiated (§ 5.4.10.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input type="checkbox"/> Hopping equipment (§ 4.3.1.11.3) <input checked="" type="checkbox"/> Wide Band (§ 4.3.2.10.3)
Deviation to test procedure	None
EUT operating condition	#2
Testing dates	2018-10-05 ÷ 2018-10-11

### EUT operating condition: Receive mode

Frequency (MHz)	RBW / VBW (kHz)	Level (dBm)	Limit (dBm)	Result
30 ÷ 1000	100 / 300	< -65	-57	PASS
1000 ÷ 12750	1000 / 3000	< -60	-47	PASS
2930.00	1000 / 3000	-50.66	-47	PASS
4877.37	1000 / 3000	-47.63	-47	PASS

There were no emission found above system measuring level (at least 10 dB below the limit)

## 5.7 RECEIVER BLOCKING

TEST REQUIREMENT	
Reference standard	ETSI EN 300 328 § 5.4.11
Test set-up	§ 5.4.11.2
Test method	<input checked="" type="checkbox"/> Conducted (§ 5.4.11.2.1) <input type="checkbox"/> Radiated (§ 5.4.11.2.2)
Test condition	<input checked="" type="checkbox"/> Normal (§ 5.1.2) <input checked="" type="checkbox"/> Extreme (§ 5.1.3)
Limit	<input type="checkbox"/> Hopping equipment (§ 4.3.1.12.4) <input checked="" type="checkbox"/> Wide Band (§ 4.3.2.11.4)
Deviation to test procedure	None
EUT operating condition	#2
Testing dates	2018-10-09

Receiver category	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal value (dBm)	PER measured		Max. PER Limit	Result
				CH Lowest	CH Highest		
1	Pmin + 6dB	2380	-53	0.01%	0%	10%	PASS
1	Pmin + 6dB	2503.5		0.01%	0%	10%	PASS
1	Pmin + 6dB	2300	-47	0%	0%	10%	PASS
1	Pmin + 6dB	2330		0.01%	0%	10%	PASS
1	Pmin + 6dB	2360		0%	0.01%	10%	PASS
1	Pmin + 6dB	2523.5	-47	0%	0%	10%	PASS
1	Pmin + 6dB	2553.5		0%	0.01%	10%	PASS
1	Pmin + 6dB	2583.5		0.01%	0%	10%	PASS
1	Pmin + 6dB	2613.5		0%	0.01%	10%	PASS
1	Pmin + 6dB	2643.5		0%	0%	10%	PASS
1	Pmin + 6dB	2673.5		0.01%	0%	10%	PASS
Pmin = -70 dBm CH Lowest; -68 dBm CH Highest							

## 6. TESTS UNCERTAINTY

Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001 and IO-LAB-004.

The expanded uncertainty was calculated for all measurements and tests listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainty in EMC Measurements", with UKAS document LAB 34 and is documented in the quality system accordance to ISO/IEC 17025.

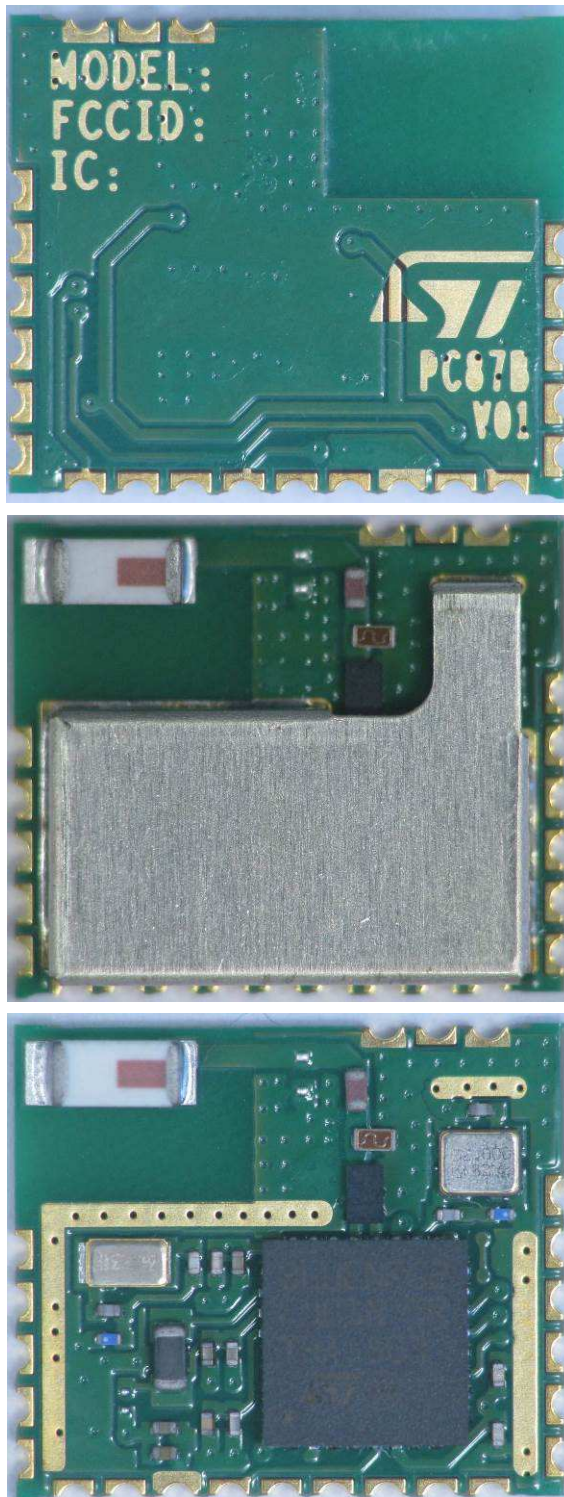
Internal Procedure PG-037 ensures that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.

## 7. MEASUREMENT EQUIPMENT AND INSTRUMENTATION

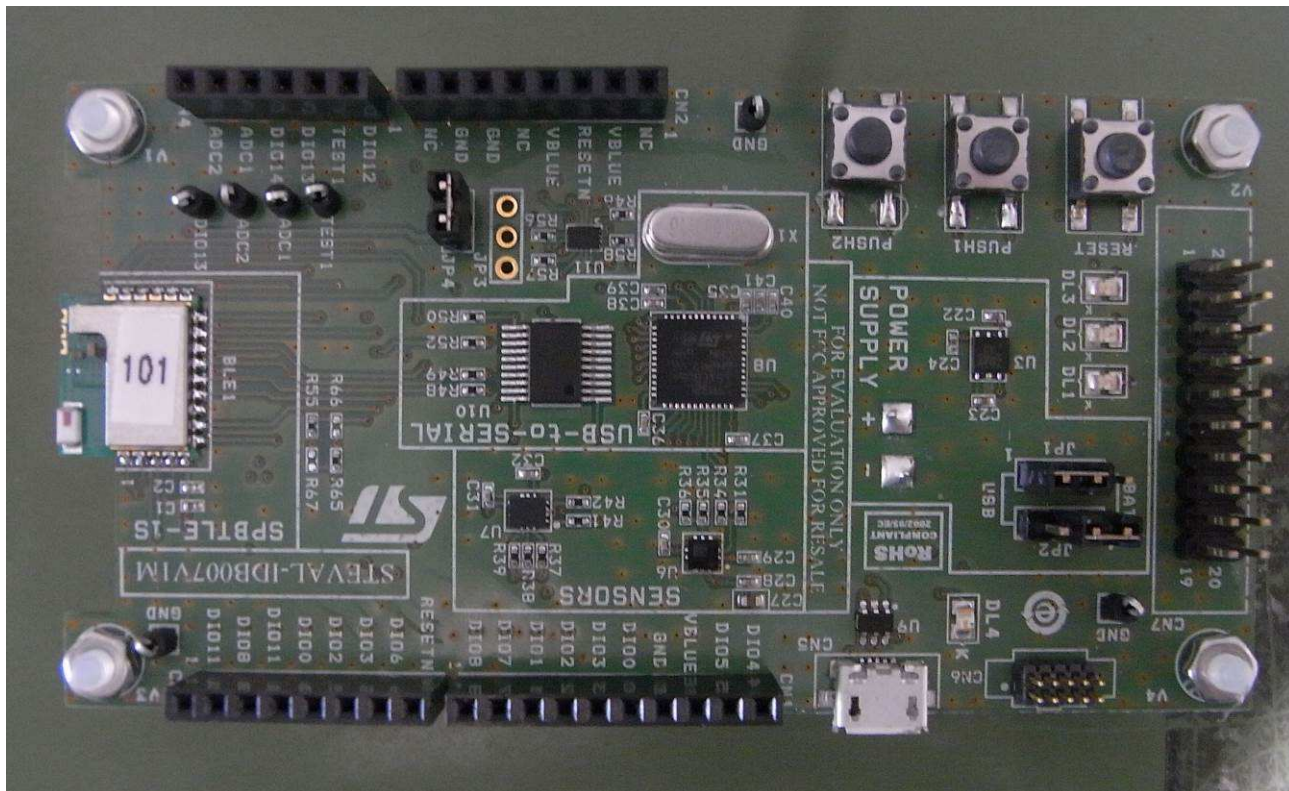
Instrument	Manufacturer	Model	IMQ Ref.
Climatic chamber	ANGELANTONI	UY 300	P-00484
Shielded chamber	/	/	P-02386
Spectrum analyzer	ROHDE & SCHWARZ	FSP40	S-03629
EMI Receiver	ROHDE & SCHWARZ	ESU 8	S-05562
Signal generator	ROHDE & SCHWARZ	SMR20	S-03707
Log antenna	ARA	LPB-2513	S-02385
Horn antenna	SCHWARZBECK	BBHA 9120D	S-03463
Fast power sensor	ROHDE & SCHWARZ	NRP-Z81	S-06704
Pre-amplifier	HEWLETT PACKARD	HP 8449B	S-03542
Pre-amplifier	BONN ELEKTRONIK	BLNA 0110-15C35	S-04193
Band reject filter	WAINWRIGHT INSTRUMENT	WRCG2400/2483	S-04308
High pass filter	WAINWRIGHT INSTRUMENT	WHK3.4/18G-10EE	S-04309
Power splitter	WEINSCHEL	1870A	S-04937
Attenuator 110dB + 11dB	HEWLETT PACKARD	8496B + 8494B	S-06533
Shielded box	JRE TEST	JRE2525	S-03477

## 8. PHOTOGRAPHIC DOCUMENTATION

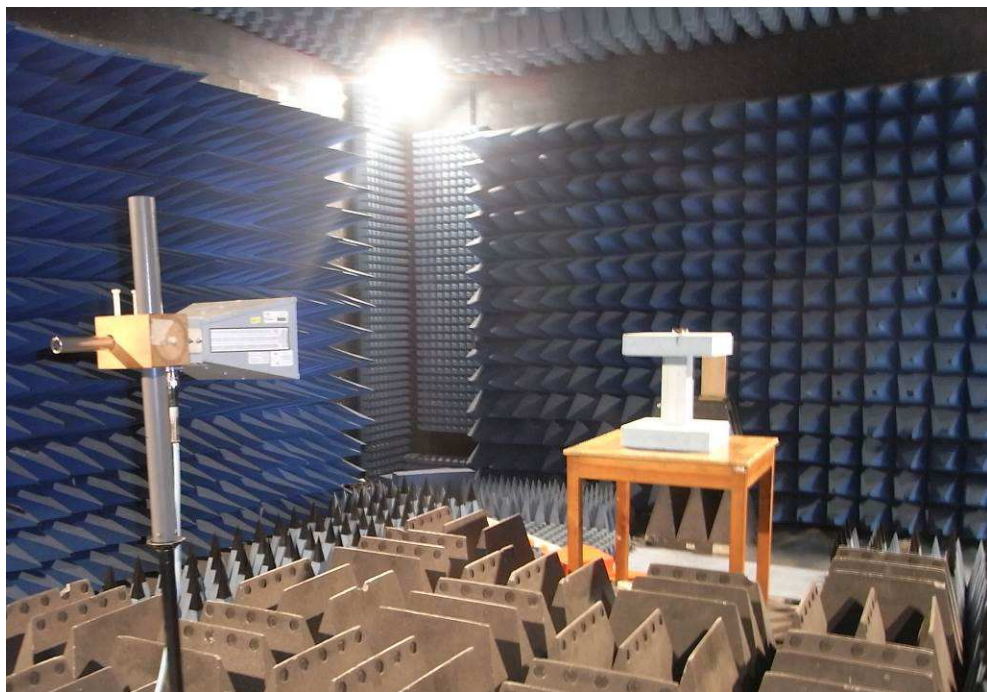
### EUT IDENTIFICATION – External views



**EVALUATION BOARD with radio module**



## SET-UP



**END OF TEST REPORT**