

RF Test Report

Report No.: AGC08501161101EE10

TEST NAME : 1999/5/EC R&TTE Directive Art.3.2
PRODUCT DESIGNATION : Open-Source Sensor Beacon
BRAND NAME : Ruuvi
MODEL NAME : RuuviTag
CLIENT : Ruuvi Innovations Ltd.
DATE OF ISSUE : Nov.24, 2016
STANDARD(S) : EN 300 328 V1.9.1 2015-02
REPORT VERSION : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



CAUTION:

This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Nov.24, 2016	Valid	Original Report

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TABLE OF CONTENTS

TABLE OF CONTENTS	3
1. TEST RESULT CERTIFICATION	4
2. TECHNICAL INFORMATION	5
2.1 EUT DESCRIPTION	5
2.2 SUPPORT EQUIPMENT	6
2.3 DESCRIPTION OF TEST MODES	6
3 DETAILS OF TEST	8
3.1 IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION	8
3.2 LIST OF TEST EQUIPMENTS	8
3.3 ENVIRONMENTAL CONDITIONS	9
3.4 MEASUREMENT UNCERTAINTY	9
4. ETSI EN 300 328 REQUIREMENTS	10
4.1 RF OUTPUT POWER	10
4.2. POWER SPECTRAL DENSITY	13
4.3. ADAPTIVITY (CHANNEL ACCESS MECHANISM)	16
4.4. OCCUPIED CHANNEL BANDWIDTH	17
4.5. TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN	19
4.6. TRANSMITTER SPURIOUS EMISSIONS	24
4.7. RECEIVER SPURIOUS EMISSIONS	33
4.8. RECEIVER BLOCKING	40
APPENDIX A	41
PHOTOGRAPHS OF THE TEST SETUP	41
APPENDIX B	42
PHOTOGRAPHS OF THE EUT	42

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

1. TEST RESULT CERTIFICATION

Applicant	Ruuvii Innovations Ltd.
Address	c/o Solventia Rauhankatu 20B20, 06100 Porvoo, Finland
Manufacturer	Ruuvii Innovations Ltd.
Address	c/o Solventia Rauhankatu 20B20, 06100 Porvoo, Finland
Product Designation	Open-Source Sensor Beacon
Brand Name	Ruuvii
Test Model	RuuviiTag
Date of test	Nov.16, 2016 to Nov.18, 2016

We (AGC), Attestation of Global Compliance (Shenzhen) Co., Ltd has tested the product mentioned above in compliance with the requirements set forth in the European Standard ETSI EN 300 328 V1.9.1. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By Strive Liang
 Strive Liang(Liang Faqiang) Nov.18, 2016

Reviewed By Forrest Lei
 Forrest Lei(Lei Yonggang) Nov.24, 2016

Approved By Solger Zhang
 Solger Zhang(Zhang Hongyi) Nov.24, 2016
 Authorized Officer

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

2. TECHNICAL INFORMATION

2.1 EUT DESCRIPTION

Bluetooth Version	V4.2
Modulation	GFSK for BLE
Hardware Version	B4
Software Version	V1.0
Adaptive / non-adaptive equipment	Adaptive Equipment
The number of Hopping Frequencies	40
The maximum RF Output Power (e.i.r.p.)	2.88dBm
The different transmit operating modes	Operating mode 1: Single Antenna Equipment Equipment with only 1 antenna
Operating Frequency Range(s)	2402MHz~2480MHz
Type of Equipment	Stand-alone
Antenna designation	PCB Antenna
Antenna gain	0dBi
Nominal voltages	DC 3.0V by battery
The extreme operating conditions	Recommended Operating temperature range: -20°C~55°C

Note:

1. The above information was declared by the applicant.
2. The equipment submitted are representative production models.
3. The EUT provides Bluetooth wireless interface operating at 2.4G ISM band (2402MHz-2480MHz).
4. Only the Bluetooth was tested according the standard requirement.
5. The EUT is an adaptive equipment and hand-portable station according to ETSI EN 300 328 v1.9.1.
6. Please refer to Appendix I for the photographs of the EUT. For more details, please refer to the User's manual of the EUT.
7. The EUT didn't support BD/EDR.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

2.2 SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	PC	DELL	INSPIRON	A.E

2.3 DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Low channel (RX Mode)
5	Middle channel (RX Mode)
6	High channel (RX Mode)
7	Normal hopping
Note: 1. All modes have been tested and the worst mode test data recording in the test report, if no any other data.	

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

A) OBJECTIVE

Perform Radio Spectrum tests for CE Marking according to the provisions of article 3.2 of the R&TTE Directive (1999/5/EC) for the Bluetooth function of the EUT.

B) TEST STANDARDS AND RESULTS

The EUT has been tested according to ETSI EN 300 328 V1.9.1 (2015-02).

ETSI EN 300 328 V1.9.1 (2015-02)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
----------------------------------	---

TEST ITEMS AND THE RESULTS ARE AS BELOW:

No	Basic Standard	Test Type	The worst case operational mode	Result
1	ETSI EN 300 328 4.3.2.2	RF Output Power	Mode 1/2/3	Pass
2	ETSI EN 300 328 4.3.2.3	Power Spectral Density	Mode 1/2/3	Pass
3	ETSI EN 300 328 4.3.2.4	Duty Cycle, Tx-sequence, Tx-gap	N/A	N/A
4	ETSI EN 300 328 4.3.2.5	Medium Utilisation (MU) factor	N/A	N/A
5	ETSI EN 300 328 4.3.2.6	Adaptivity (adaptive equipment using modulations other than FHSS)	N/A	N/A
6	ETSI EN 300 328 4.3.2.7	Occupied Channel Bandwidth	Mode 1/3	Pass
7	ETSI EN 300 328 4.3.2.8	Transmitter unwanted emissions in the out-of-band domain	Mode 1/3	Pass
8	ETSI EN 300 328 4.3.2.9	Transmitter unwanted emissions in the spurious domain	Mode 1/3	Pass
9	ETSI EN 300 328 4.3.2.10	Receiver spurious emissions	Mode 4/6	Pass
10	ETSI EN 300 328 4.3.2.11	Receiver Blocking	N/A	N/A
11	ETSI EN 300 328 4.3.2.12	Geo-location capability	N/A	N/A

Note:

1. N/A means it's not applicable to this item.
2. Owing to the maximum declared RF Output power (e.i.r.p.) less than 10 dBm, so the item 3, 4, 5, 10 are not applicable.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

3 DETAILS OF TEST

3.1 IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

Company Name:	Attestation of Global Compliance (Shenzhen) Co., Ltd.
Address:	2/F., Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China

3.2 LIST OF TEST EQUIPMENTS

Description	Manufacturer	Model No.	S/N	Calibration Date	Calibration Due.
Signal Analyzer	AGILENT	N9020A	MY49100060	Nov.09, 2016	Nov.08, 2017
Signal Generator	AGILENT	N5182A	MY50140530	Oct.16, 2016	Oct.15, 2017
Signal Generator	AGILENT	E8257D	MY45141029	Oct.16, 2016	Oct.15, 2017
USB Wideband Power Sensor	AGILENT	U2021XA	MY54110007	Oct.16, 2016	Oct.15, 2017
USB Wideband Power Sensor	AGILENT	U2021XA	MY54110009	Oct.16, 2016	Oct.15, 2017
USB Wideband Power Sensor	AGILENT	U2021XA	MY54110014	Oct.16, 2016	Oct.15, 2017
USB Wideband Power Sensor	AGILENT	U2021XA	MY54110012	Oct.16, 2016	Oct.15, 2017
USB Simultaneous Sampling Multifunction DAQ	AGILENT	U2531A	MY5211038	Oct.16, 2016	Oct.15, 2017
2.4 GHz Filter	MICRO-TRONICS	BRM50702	017	Mar.01, 2016	Feb.28, 2017
Spectrum Analyzer	AGILENT	E4440A	US41421290	July 23, 2016	July 22, 2017
Wideband Frequency Antenna	SCHWARZBECK	VULB9168	VULB9168-494	Mar.12, 2016	Mar.11, 2017
Horn Antenna	EM	EM-AH-10180	67	Mar.01, 2016	Feb.28, 2017
Amplifier	EM	EM30180	060552	Feb.29, 2016	Feb.28, 2017

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

3.3 ENVIRONMENTAL CONDITIONS

During the measurement the environmental conditions were within the listed ranges:

- Temperature: 15-35°C
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

3.4 MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

- Uncertainty of Radio Frequency, $U_c = \pm 1 \times 10^{-5}$
- Uncertainty of total RF power, conducted, $U_c = \pm 1.5\text{dB}$
- Uncertainty of RF power density, conducted, $U_c = \pm 3\text{dB}$
- Uncertainty of spurious emissions, conducted, $U_c = \pm 3\text{dB}$
- Uncertainty of all emissions, radiated, $U_c = \pm 6\text{dB}$
- Uncertainty of Temperature: $\pm 1^\circ\text{C}$
- Uncertainty of Humidity: $\pm 5\%$
- Uncertainty of DC and low frequency voltages: $\pm 3\%$

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4. ETSI EN 300 328 REQUIREMENTS

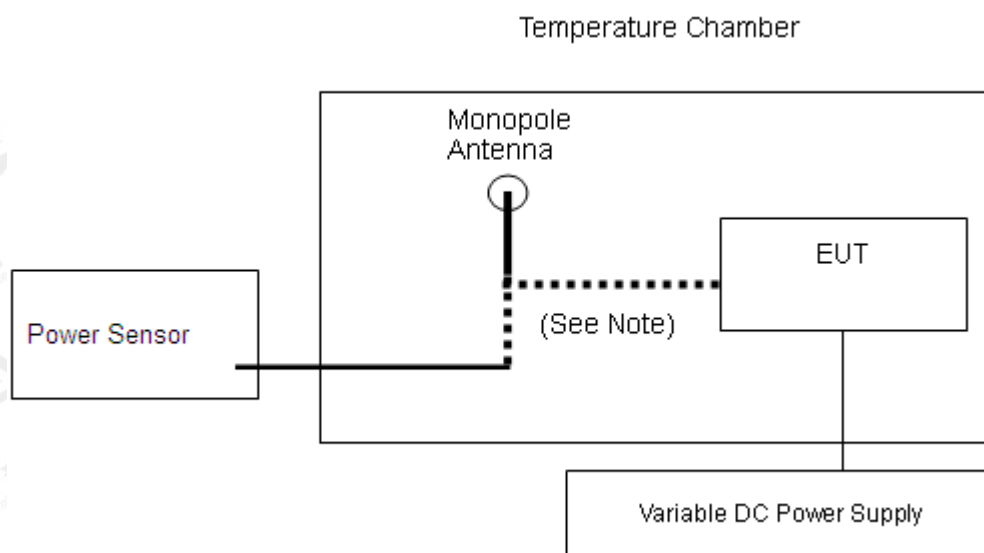
4.1 RF OUTPUT POWER

EN 300 328 Clause 4.3.2.3

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.

The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. See clause 5.3.1 m). For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier. This limit shall apply for any combination of power level and intended antenna assembly.

Test Configuration



Remarks:

EUT was direct connected to test equipment through coupling device.

TEST PROCEDURE

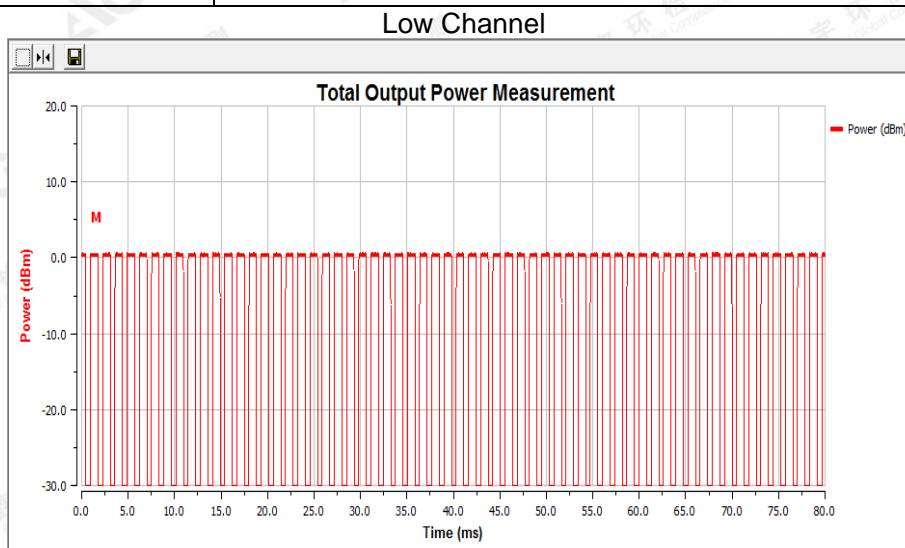
1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.2.1 for the measurement method.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST RESULTS

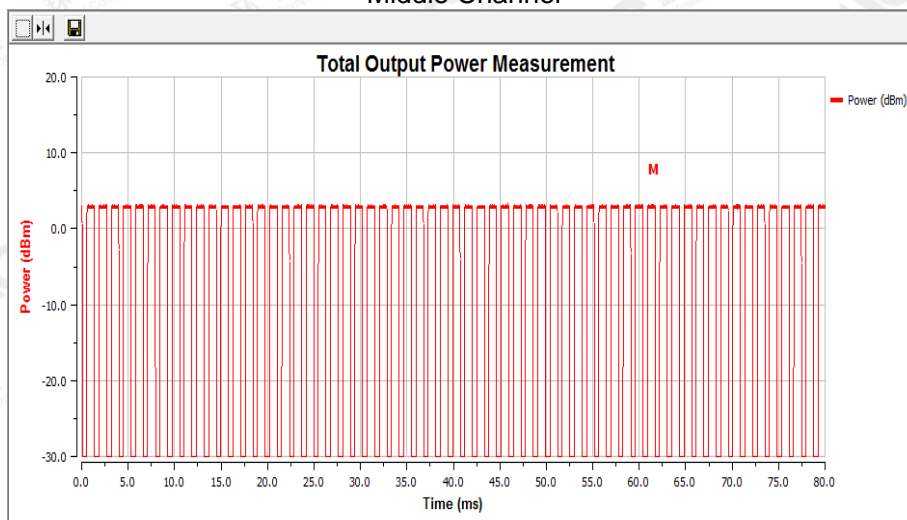
Temperature: 25°C Tested by: Strive Liang
Humidity: 55 % RH Detector: RMS
Number of Burst = 10
Measurement Time = 45.53ms

TEST CONDITIONS	GFSK MODULATION RF OUTPUT POWER (dBm)		
	Temp (25)°C	Temp (-20)°C	Temp (55)°C
Result	DC 3.0V	DC 3.0V	DC 3.0V
Low Channel TX	1.17	1.14	1.13
Middle Channel TX	2.88	2.87	2.83
High Channel TX	2.00	1.97	1.99
Limit	20dBm		

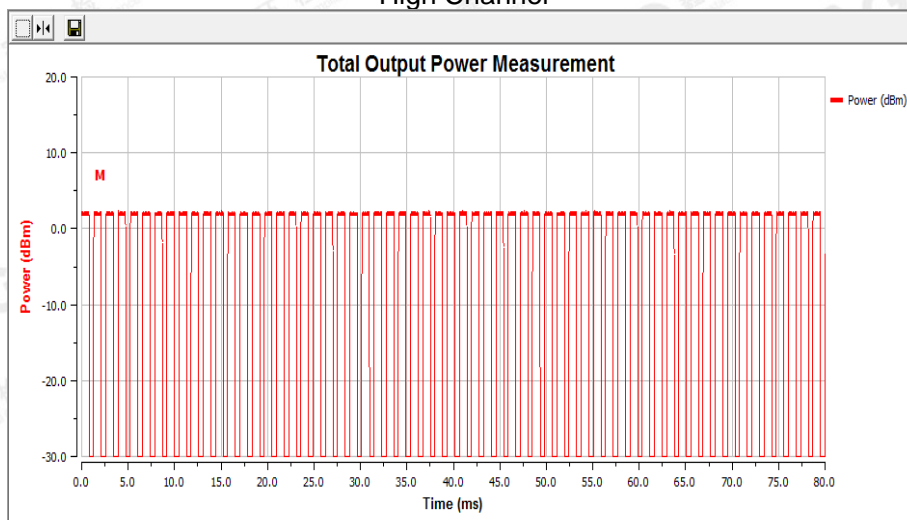


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Middle Channel



High Channel



Note: Result=Reading+ Ant. Gain

The reading value included cable loss.

The diagrams are for normal temperature.

Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.2. POWER SPECTRAL DENSITY EN 300 328 Clause 4.3.2.3

For wide band modulations other than the FHSS, The maximum E.I.R.P Power density is limited to 10mW Per MHz

TEST PROCEDURE

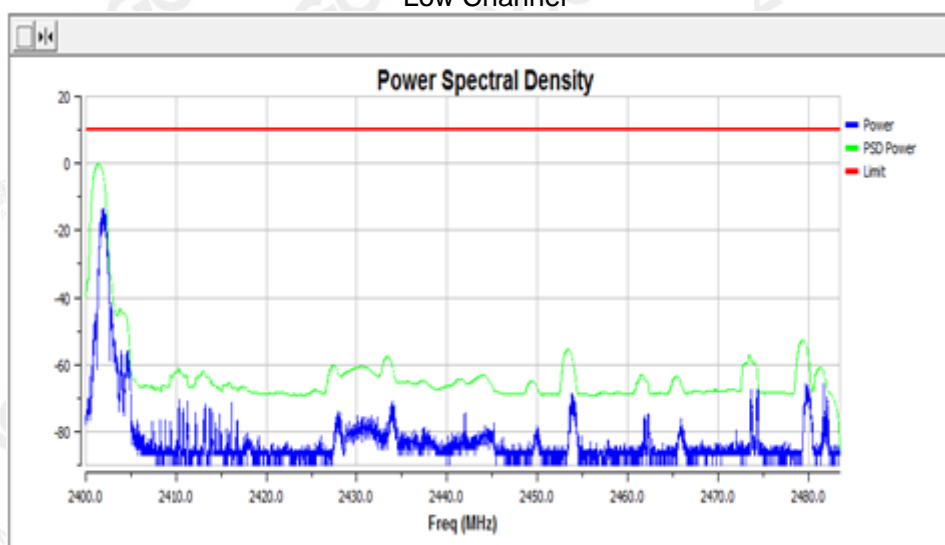
1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.3.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.3.2.1 for the measurement method.
- 3 The equipment setting as following
 - Start Frequency: 2 400 MHz
 - Stop Frequency: 2 483.5 MHz
 - Resolution BW: 10 kHz
 - Video BW: 30 kHz
 - Sweep Points: >8350
 - Detector: RMS
 - Trace Mode: Max Hold
 - Sweep time: Auto

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST RESULTS

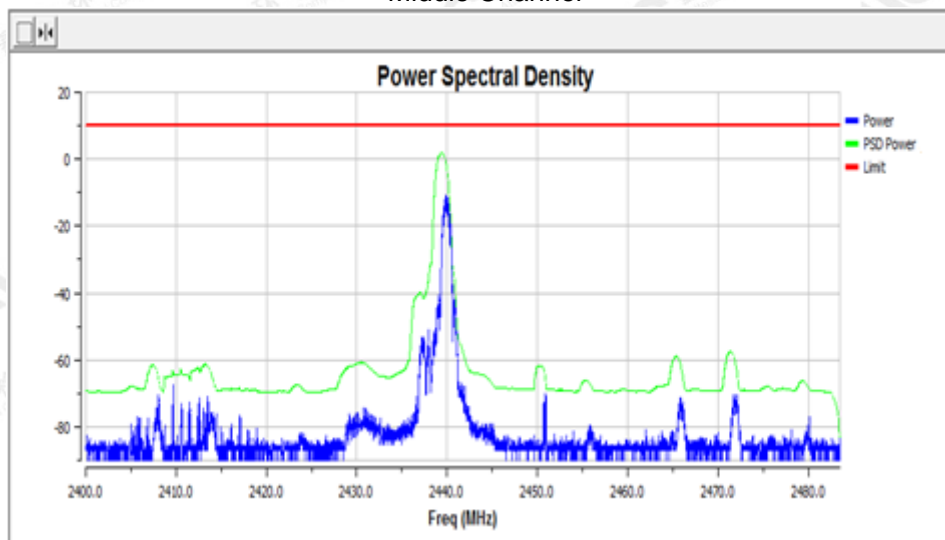
PEAK POWER DENSITY			
Channel Tested	Power Density (dBm/MHz)	Test Limit (dBm/MHz)	Pass / Fail
Low Channel TX	-1.04	10	Pass
Middle Channel TX	1.82	10	Pass
High Channel TX	1.26	10	Pass

Low Channel

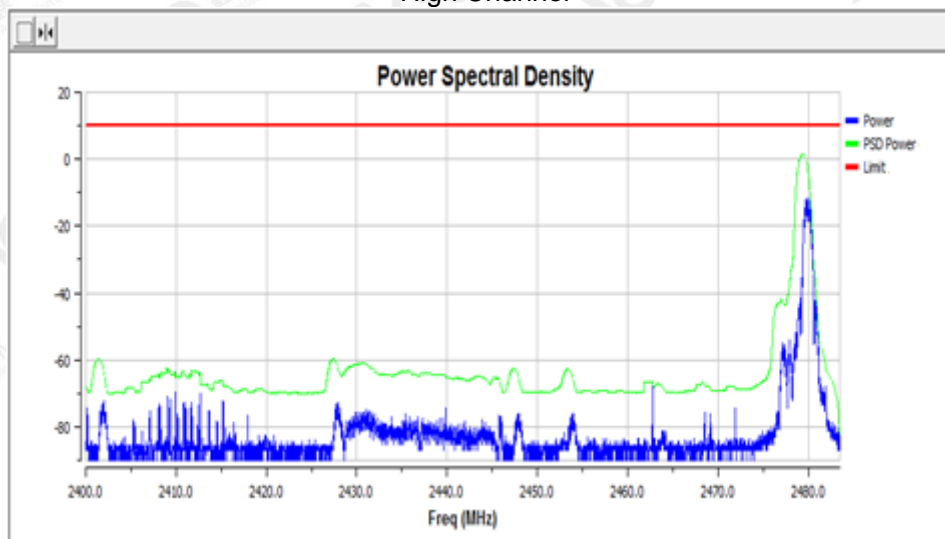


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Middle Channel



High Channel



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.3. ADAPTIVITY (CHANNEL ACCESS MECHANISM)

ETSI EN 300 328 SUBCLAUSE 4.3.2.6

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.

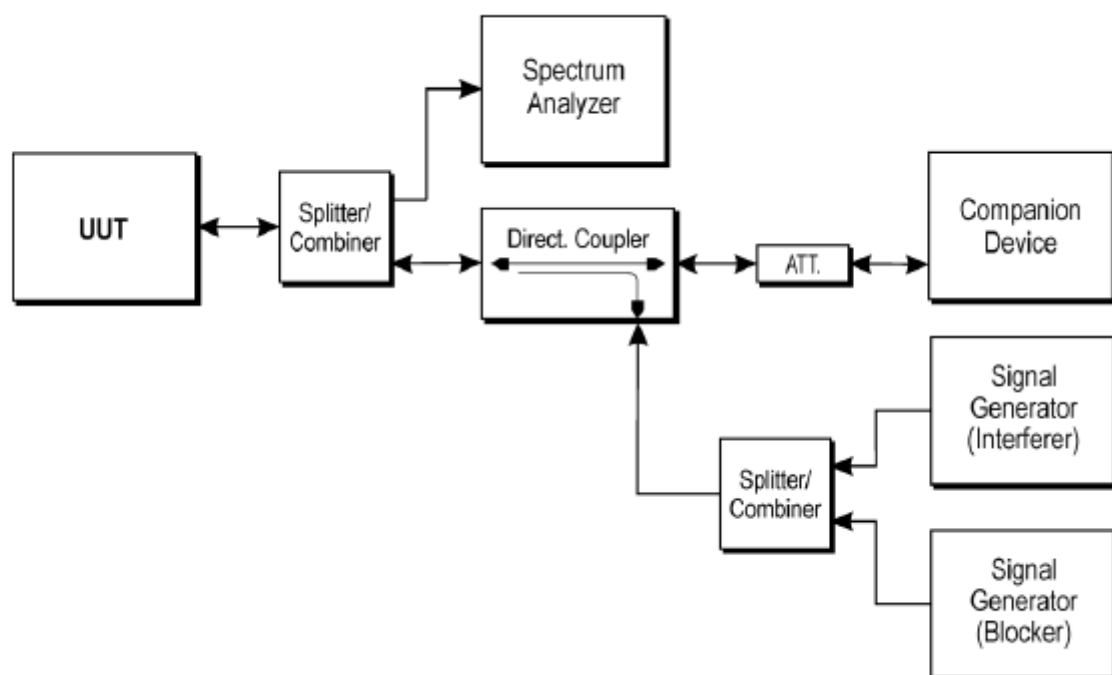
In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

Adaptive equipment using modulations other than FHSS is allowed to operate in a non-adaptive mode providing it complies with the requirements applicable to non-adaptive equipment.

An adaptive equipment using modulations other than FHSS is equipment that uses a mechanism by which it can adapt to its environment by identifying other transmissions present within its Occupied Channel Bandwidth. Adaptive equipment using modulations other than FHSS shall implement either of the Detect and Avoid mechanisms provided in clauses 4.3.2.5.1 or 4.3.2.5.2.

Adaptive systems are allowed to switch dynamically between different adaptive modes.

TEST CONFIGURATION



TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.2.1 the measurement method.

TEST RESULT

N/A

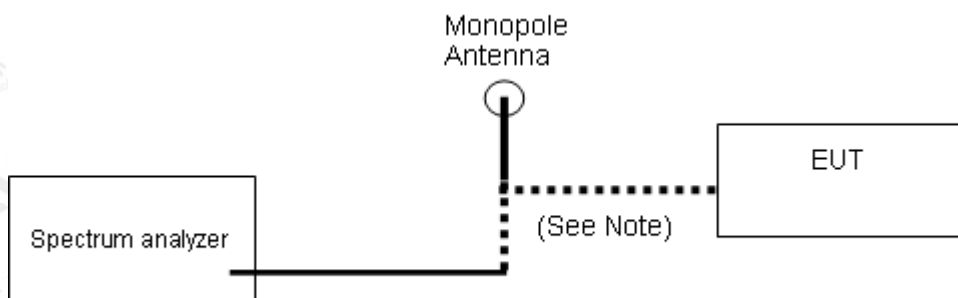
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.4. OCCUPIED CHANNEL BANDWIDTH

ETSI EN 300328 SUBCLAUSE 4.3.2.7

The Occupied Channel Bandwidth shall fall completely within the band given in clause 1.
In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

CONFIGURATION



TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.8.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.8.2.1 the measurement method.
3. The Test equipment information as following
Centre frequency: 2402MHz,2480MHz
Resolution bandwidth: 20kHz
Video bandwidth: 62kHz
Detector mode :RMS
Trace mode :Max Hold

TEST RESULT

TEST ITEM	OCCUPIED CHANNEL BANDWIDTH
TEST MODE	GFSK MODULATION

MEASUREMENT RESULT		
Test Data (MHz)		Result
Low Channel	1.026	PASS
High Channel	1.025	PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Low Channel



High Channel



Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.5. TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN

ETSI EN300328 SUBCLAUSE 4.3.2.8

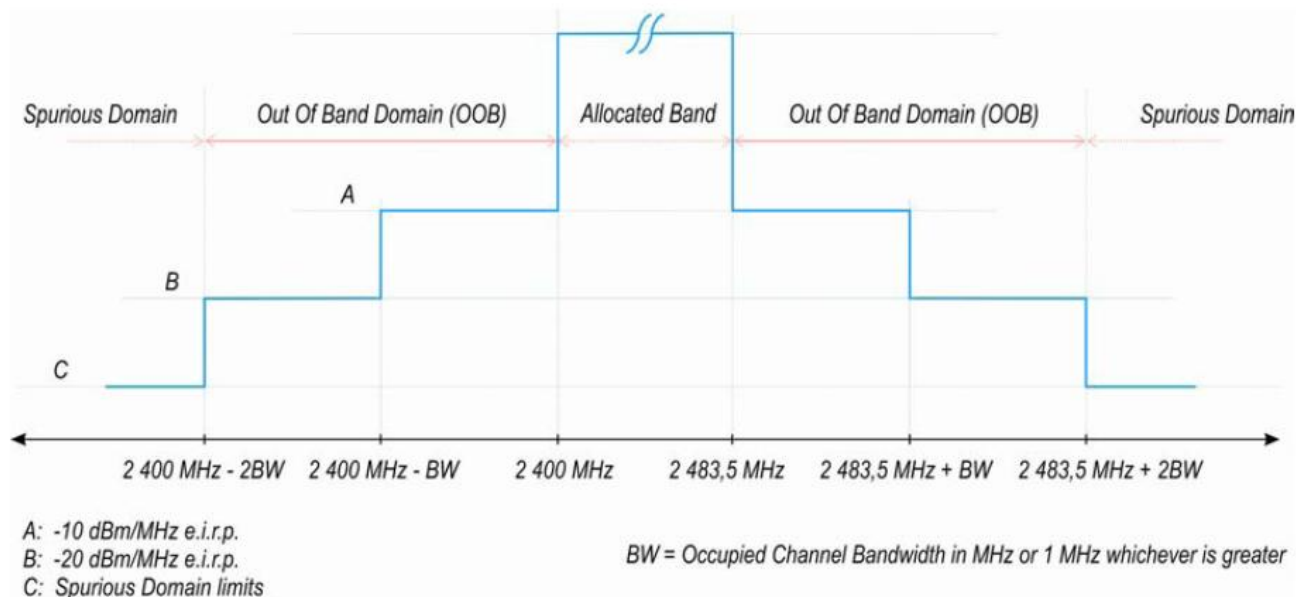
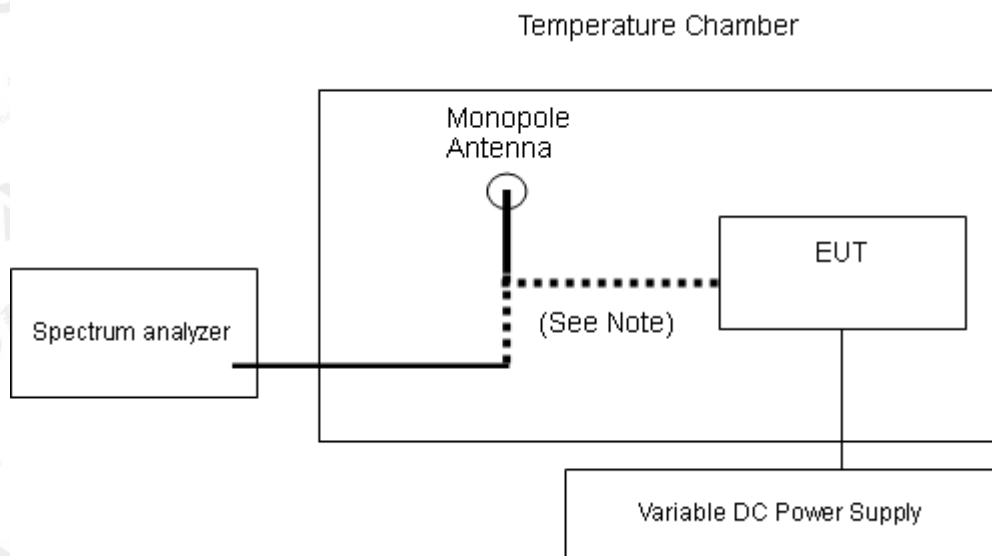


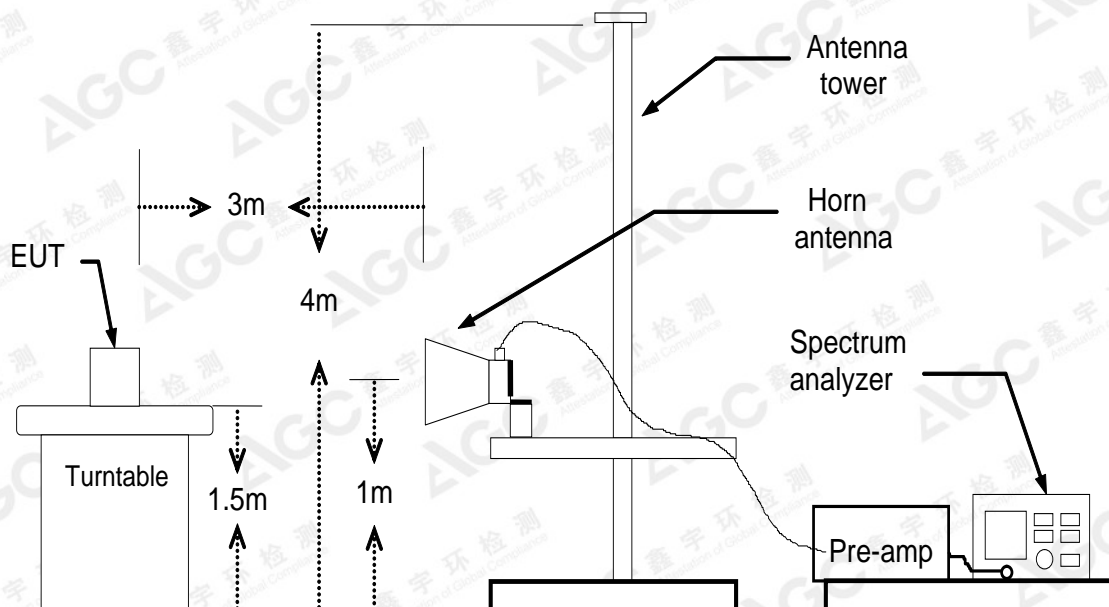
Figure 1: Transmit mask

TEST CONFIGURATION



For have temporary antenna connector product

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.



For have no temporary antenna product

TEST PROCEDURE

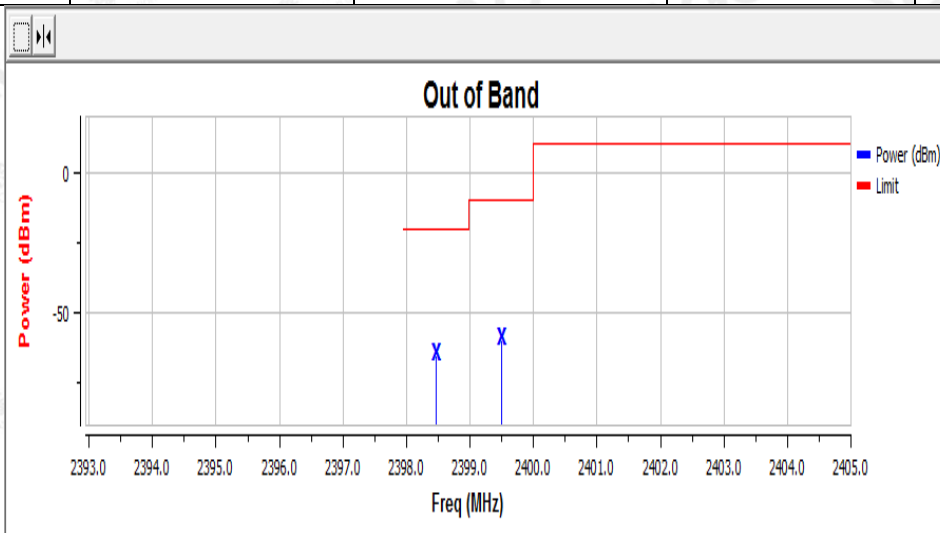
1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.9.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.9.2.1 the measurement method.

TEST RESULT

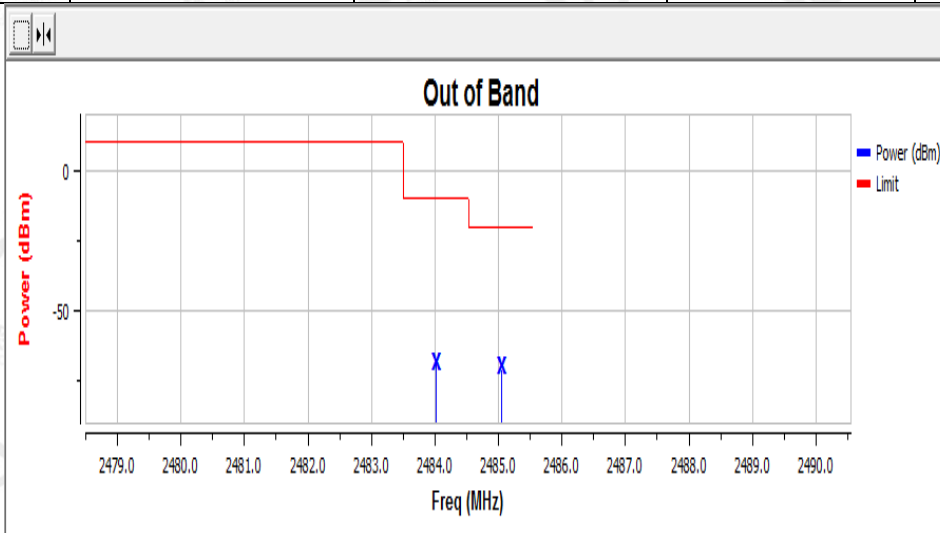
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

NORMAL TEMPERATURE NORMAL VOLTAGE

Channel	Antenna	Freq(MHz)	Level	Limit
CH Low-2402	Antenna 1	2399.5	-60.23	-10
CH Low-2402	Antenna 1	2398.474	-65.92	-20



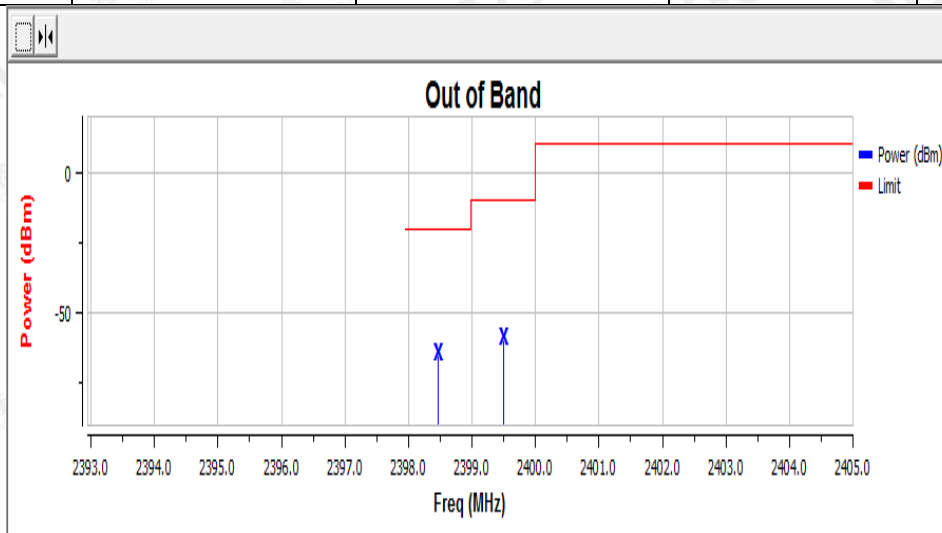
Channel	Antenna	Freq(MHz)	Level	Limit
CH High-2480	Antenna 1	2484.025	-69.58	-10
CH High-2480	Antenna 1	2485.05	-71.47	-20



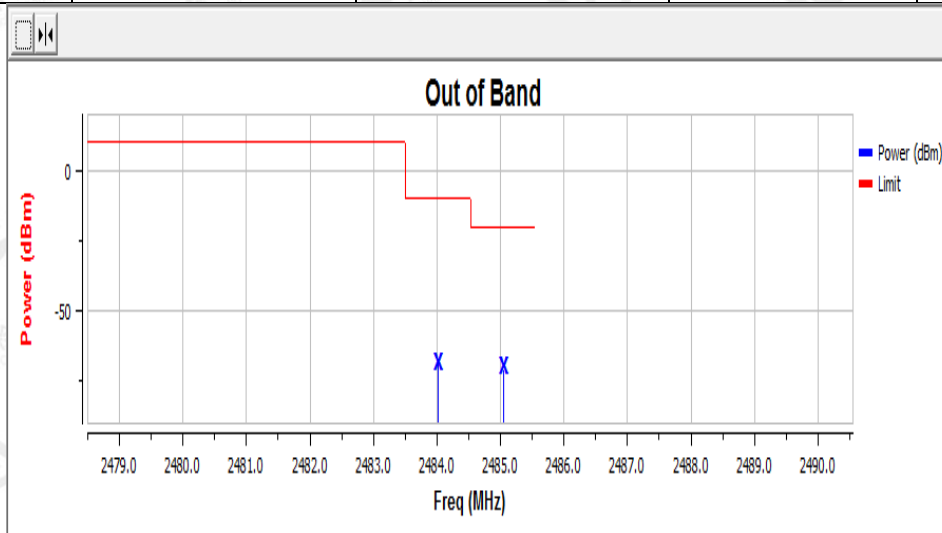
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

LOW TEMPERATURE NORMAL VOLTAGE

Channel	Antenna	Freq(MHz)	Level	Limit
CH Low-2402	Antenna 1	2399.5	-60.24	-10
CH Low-2402	Antenna 1	2398.475	-65.94	-20



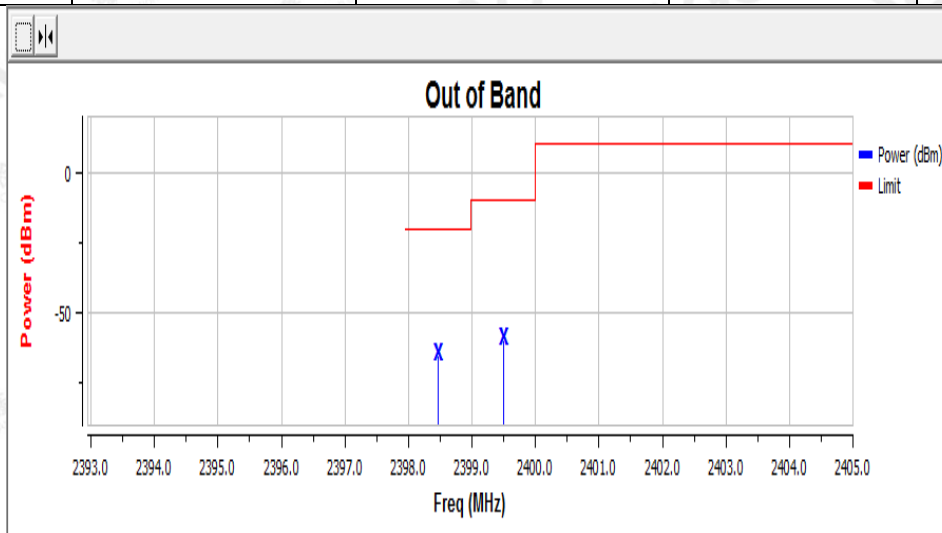
Channel	Antenna	Freq(MHz)	Level	Limit
CH High-2480	Antenna 1	2484.025	-69.56	-10
CH High-2480	Antenna 1	2485.05	-71.46	-20



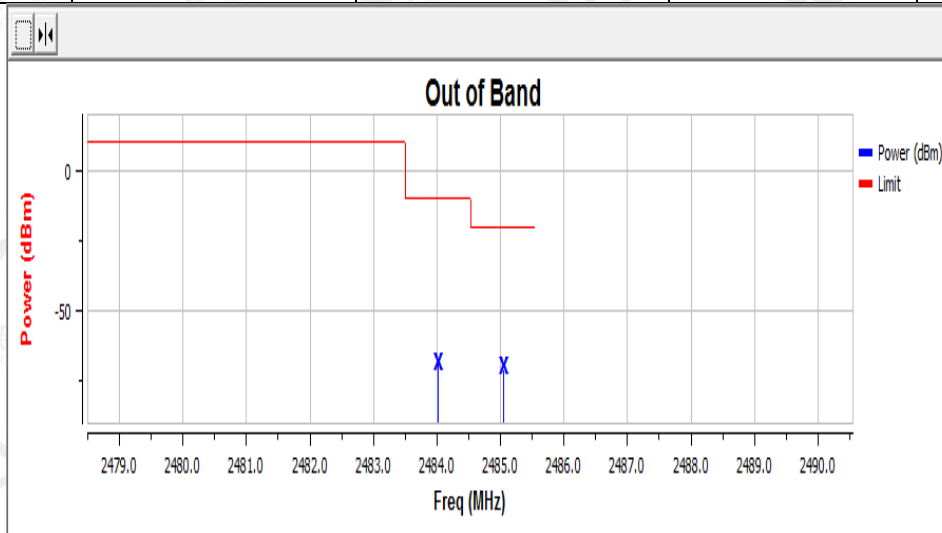
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

HIGH TEMPERATURE NORMAL VOLTAGE

Channel	Antenna	Freq(MHz)	Level	Limit
CH Low-2402	Antenna 1	2399.5	-60.18	-10
CH Low-2402	Antenna 1	2398.475	-65.92	-20



Channel	Antenna	Freq(MHz)	Level	Limit
CH High-2480	Antenna 1	2484.025	-69.59	-10
CH High-2480	Antenna 1	2485.05	-71.46	-20



Note: The worst modulation used during test is GFSK.

Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.6. TRANSMITTER SPURIOUS EMISSIONS

ETSI EN300328 SUBCLAUSE 4.3.2.9

Spurious emissions are emissions outside the frequency range(s) of the equipment as defined in Clause 4.3.1.9.

Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain as indicated in figure 1 when the equipment is in Transmit mode.

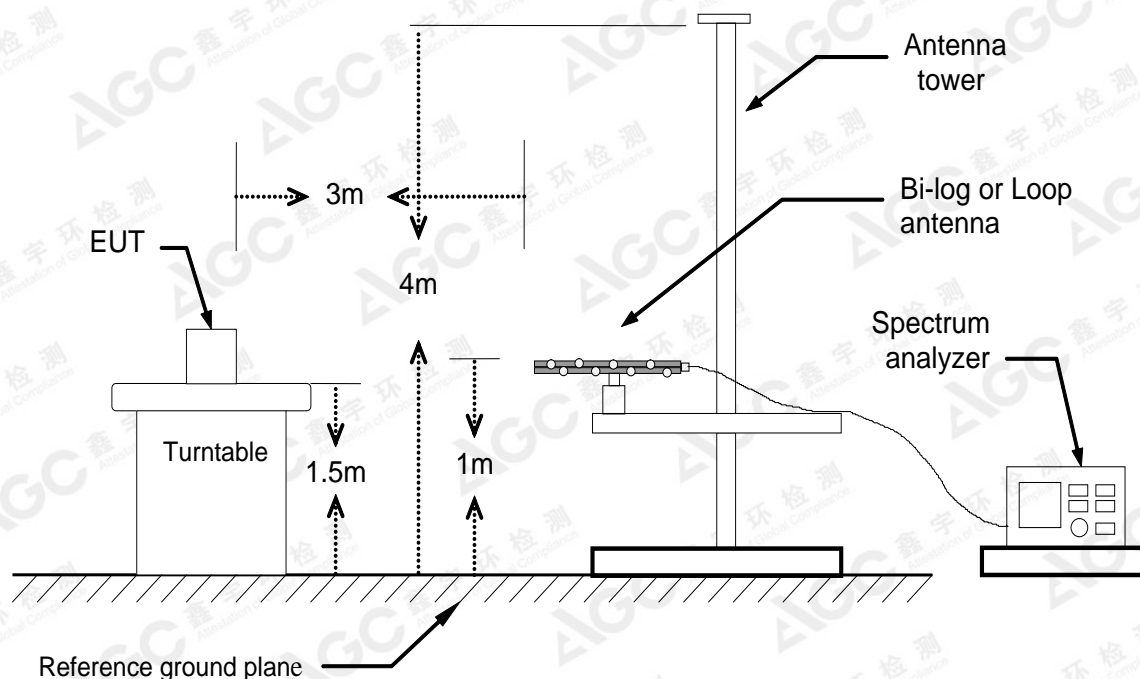
The spurious emissions of the transmitter shall not exceed the values in tables in the indicated bands:

Frequency Range	Maximum Power e.r.p(<=1GHz)/e.i.r.p(>1GHz)	Bandwidth
30MHz to 47MHz	-36dBm	100kHz
47MHz to 74MHz	-54dBm	100kHz
74MHz to 87.5MHz	-36dBm	100kHz
87.5MHz to 118MHz	-54dBm	100kHz
118MHz to 174MHz	-36dBm	100kHz
174MHz to 230MHz	-54dBm	100kHz
230MHz to 470MHz	-36dBm	100kHz
470MHz to 862MHz	-54dBm	100kHz
862 MHz to 1GHz	-36dBm	100kHz
1 GHz to 12.75GHz	-30dBm	1MHz

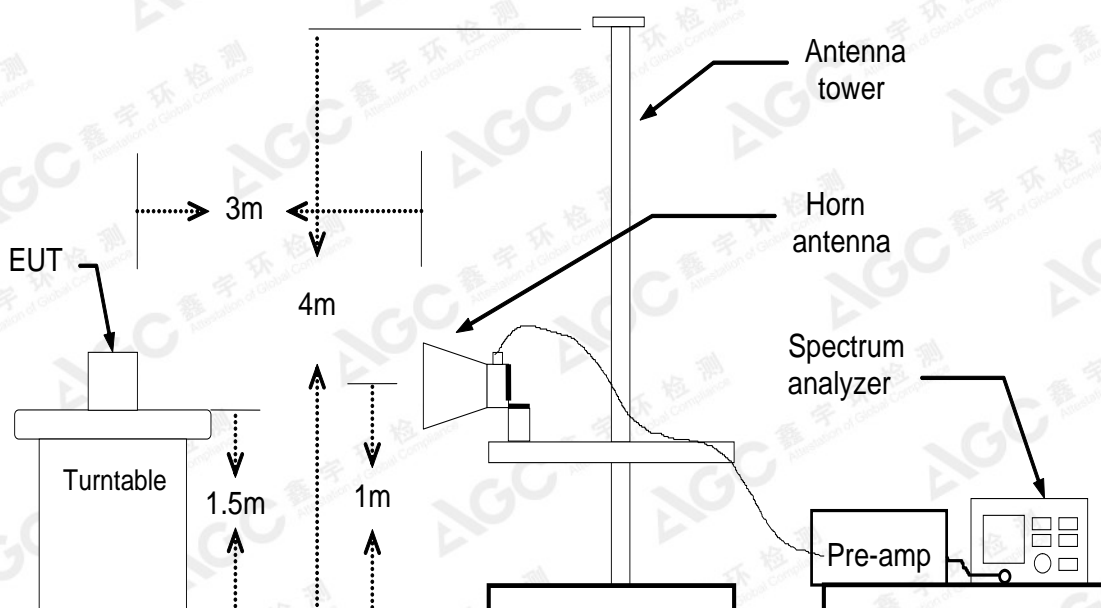
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Test Configuration

Below 1GHz

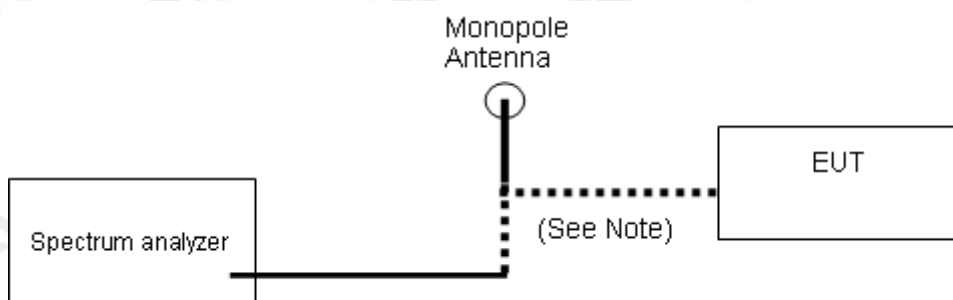


Above 1GHz



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Radiated Method



Conducted Method

TEST PROCEDURE

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10.2.1 for the conducted method.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10.2.2 for the radiated method.

TEST SETTING

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyzer settings:

- Resolution bandwidth: 100 kHz
- Video bandwidth: 300 kHz
- Detector mode: Peak
- Trace Mode: Max Hold
- Sweep Points: $\geq 9\,970$

The emissions over the range 1 GHz to 12.75 GHz shall be identified.

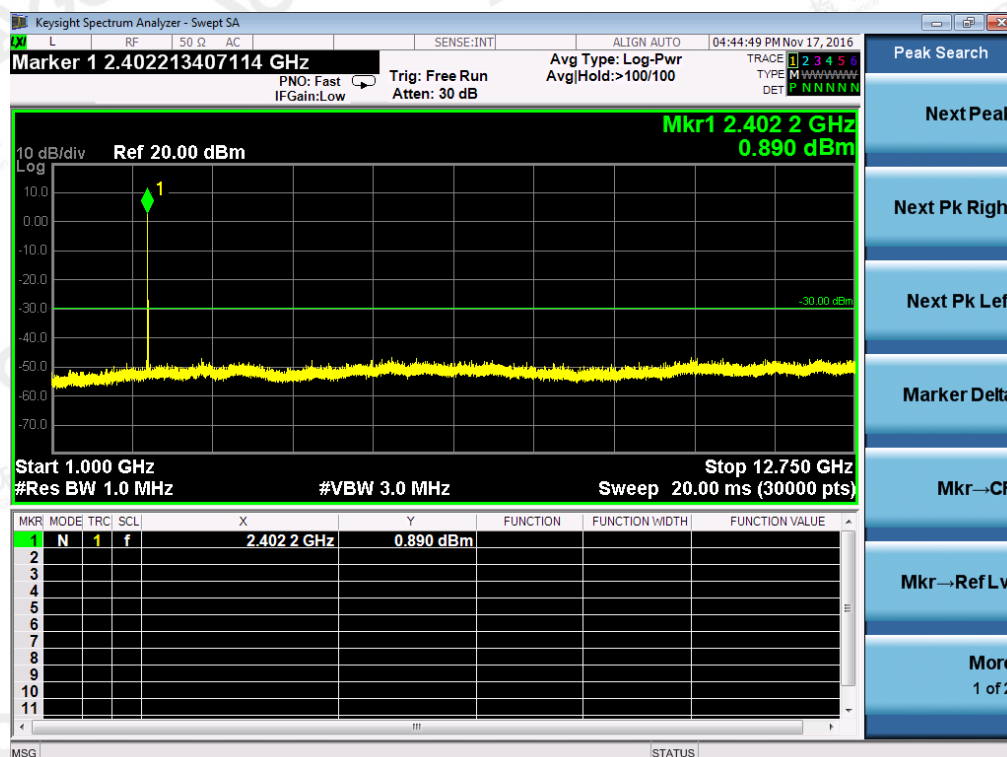
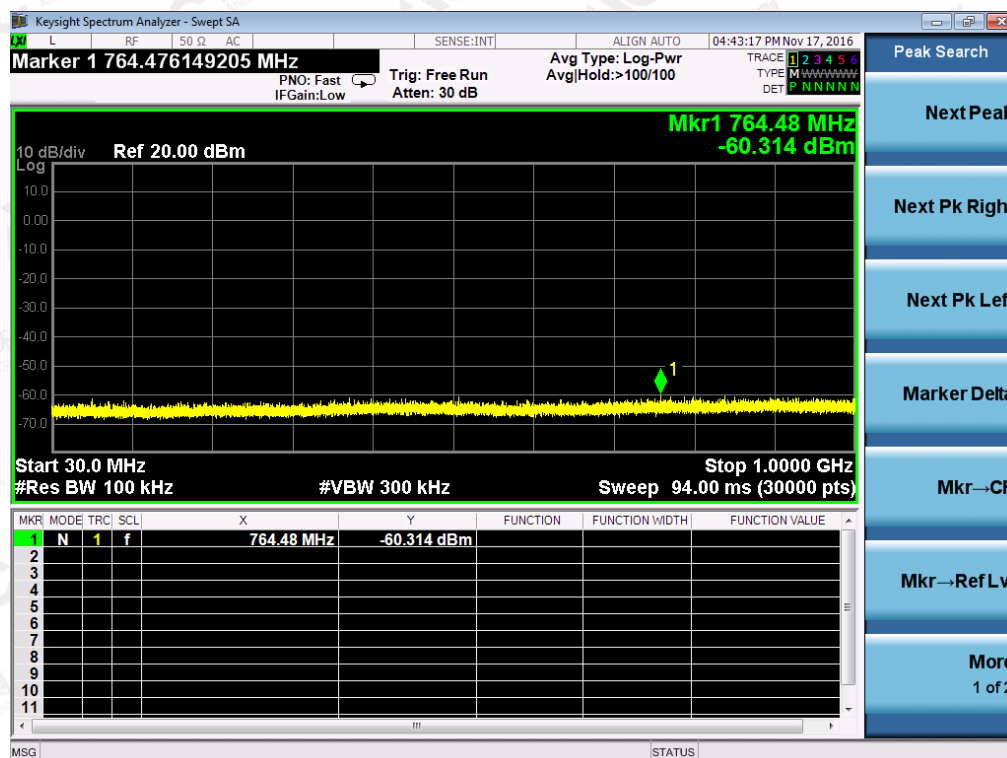
Spectrum analyzer settings:

- Resolution bandwidth: 1 MHz
- Video bandwidth: 3 MHz
- Detector mode: Peak
- Trace Mode: Max Hold
- Sweep Points: Sweep time $[\mu\text{s}] / (1\,\mu\text{s})$ with a maximum of 30 000

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

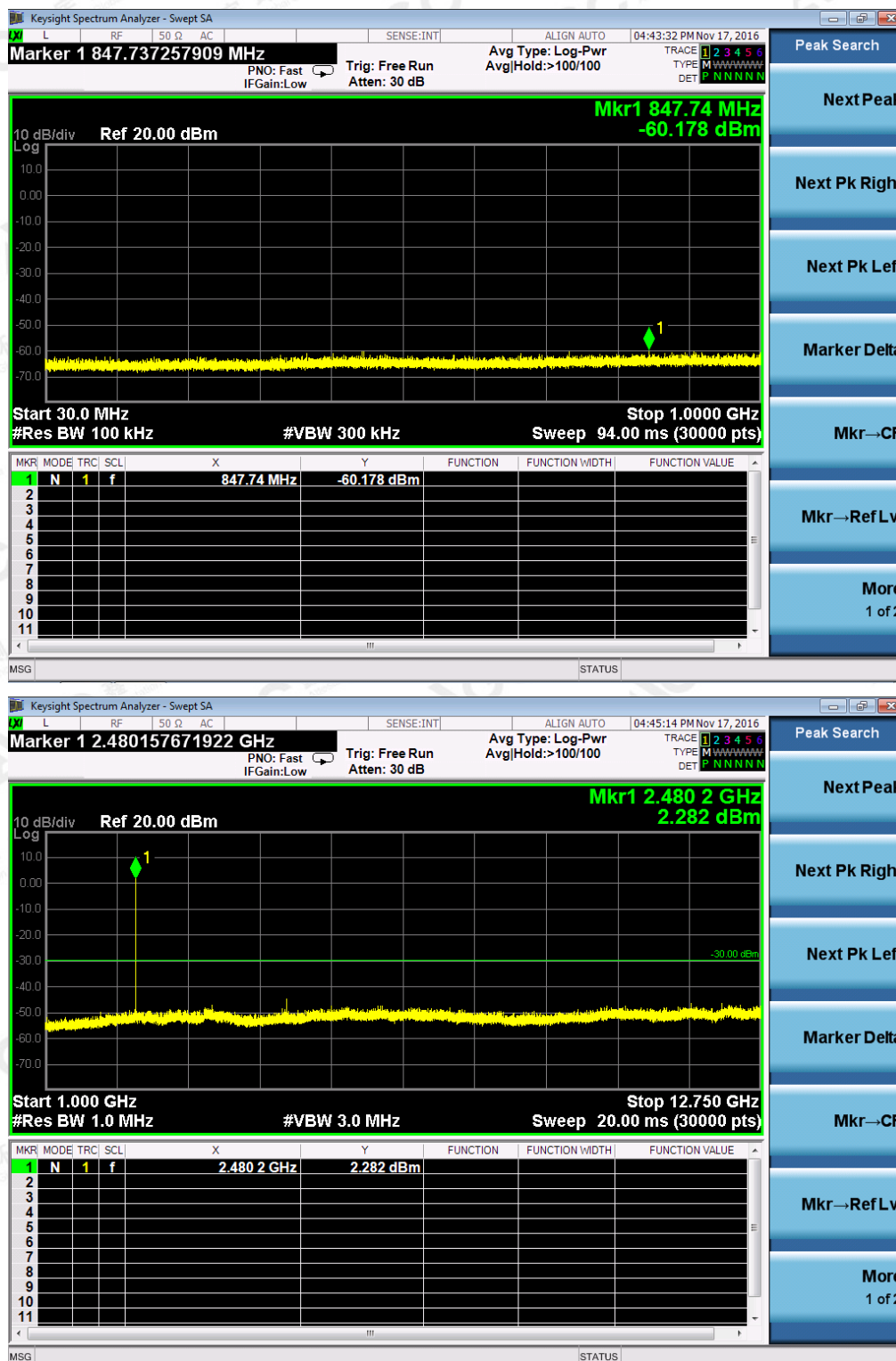
TEST RESULTS

CONDUCTED RESULTS: (Low channel)



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

(High channel)



Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Attestation of Global Compliance

Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com 400 089 2118
Add: 2F., Building 2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Baoan District, Shenzhen, Guangdong China

No.16 E

TEST RESULTS FOR RADIATED METHOD
Low Channel: Transmitter Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
97.33	31.98	V	-59.73	0.04	1.60	-58.17	-54.00	4.17
154.42	27.53	V	-65.17	0.06	0.70	-64.53	-36.00	28.53
249.19	31.24	V	-68.78	0.13	7.06	-61.85	-36.00	25.85
352.15	31.62	V	-64.00	0.25	5.76	-58.49	-36.00	22.49
447.63	29.45	V	-63.39	0.36	6.34	-57.41	-36.00	21.41
853.29	29.19	V	-67.10	0.67	6.64	-61.13	-54.00	7.13
93.19	29.69	H	-61.85	0.04	1.64	-60.25	-54.00	6.25
148.24	28.43	H	-62.99	0.05	0.54	-62.50	-36.00	26.50
268.32	28.63	H	-69.82	0.15	6.96	-63.01	-36.00	27.01
496.96	29.49	H	-67.34	0.42	7.04	-60.71	-54.00	6.71
542.43	26.49	H	-72.67	0.45	7.10	-66.02	-54.00	12.02
669.68	31.46	H	-66.63	0.54	6.83	-60.34	-54.00	6.34

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

High Channel: Transmitter Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
97.59	29.46	V	-61.40	0.04	1.60	-59.84	-54.00	5.84
146.63	29.38	V	-60.73	0.05	0.38	-60.40	-36.00	24.40
268.29	30.96	V	-65.09	0.15	6.96	-58.28	-36.00	22.28
353.43	29.72	V	-65.45	0.25	5.89	-59.81	-36.00	23.81
469.24	30.29	V	-67.77	0.38	6.79	-61.37	-36.00	25.37
569.34	30.16	V	-66.36	0.47	6.81	-60.02	-54.00	6.02
98.53	30.47	H	-62.84	0.04	1.50	-61.38	-54.00	7.38
158.49	29.23	H	-64.86	0.06	1.00	-63.92	-36.00	27.92
289.31	29.26	H	-65.18	0.17	6.44	-58.91	-36.00	22.91
459.31	30.73	H	-66.89	0.37	6.67	-60.60	-36.00	24.60
598.29	29.46	H	-67.91	0.49	6.44	-61.96	-54.00	7.96
639.17	29.32	H	-67.19	0.52	7.12	-60.59	-54.00	6.59

Note: The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Low Channel: Transmitter Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
2558.98	42.63	V	-56.34	1.58	7.94	-49.98	-30.00	19.98
4804.73	43.29	V	-56.09	2.64	9.30	-49.43	-30.00	19.43
7206.46	31.46	V	-57.38	3.14	11.28	-49.24	-30.00	19.24
7656.32	29.32	V	-70.71	3.04	11.55	-62.20	-30.00	32.20
7638.69	30.36	V	-68.41	3.05	11.57	-59.89	-30.00	29.89
7829.41	29.24	V	-70.69	3.01	11.38	-62.31	-30.00	32.31
2558.68	40.73	H	-58.32	1.58	7.94	-51.96	-30.00	21.96
4804.53	42.62	H	-55.98	2.64	9.30	-49.32	-30.00	19.32
7205.69	42.42	H	-57.83	3.14	11.28	-49.69	-30.00	19.69
7358.42	41.29	H	-59.32	3.11	11.49	-50.94	-30.00	20.94
7536.69	39.29	H	-60.92	3.07	11.67	-52.31	-30.00	22.31
7896.43	30.41	H	-67.63	2.99	11.31	-59.32	-30.00	29.32

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

High Channel: Transmitter Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuV)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
2563.29	46.24	V	-58.79	1.58	7.93	-52.44	-30.00	22.44
4960.73	45.35	V	-58.80	2.75	9.62	-51.93	-30.00	21.93
7359.26	30.52	V	-65.66	3.11	11.49	-57.28	-30.00	27.28
7468.43	30.49	V	-60.19	3.08	11.64	-51.63	-30.00	21.63
7638.19	30.26	V	-69.45	3.05	11.57	-60.93	-30.00	30.93
7828.27	30.49	V	-68.43	3.01	11.38	-60.06	-30.00	30.06
2563.29	51.56	H	-57.93	1.58	7.93	-51.58	-30.00	21.58
4960.36	40.53	H	-57.50	2.75	9.62	-50.63	-30.00	20.63
7256.46	30.24	H	-69.25	3.13	11.35	-61.02	-30.00	31.02
7359.13	40.26	H	-60.59	3.11	11.49	-52.21	-30.00	22.21
7459.34	35.34	H	-59.82	3.09	11.63	-51.28	-30.00	21.28
7559.16	40.89	H	-59.05	3.06	11.65	-50.47	-30.00	20.47

Note:

1. The margins of the other spectrum above 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.
2. The emission behaviour belongs to narrowband spurious emission.

Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.7. RECEIVER SPURIOUS EMISSIONS

ETSI EN300328 SUBCLAUSE 4.3.2.10

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode. The spurious emissions of the receiver shall not exceed the values given in table 5.

Table 5: Spurious emission limits for receivers

Frequency range	Maximum power, e.r.p.	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

TEST CONFIGURATION

Radiated Spurious Emissions: Same as section 4.4 in this test report

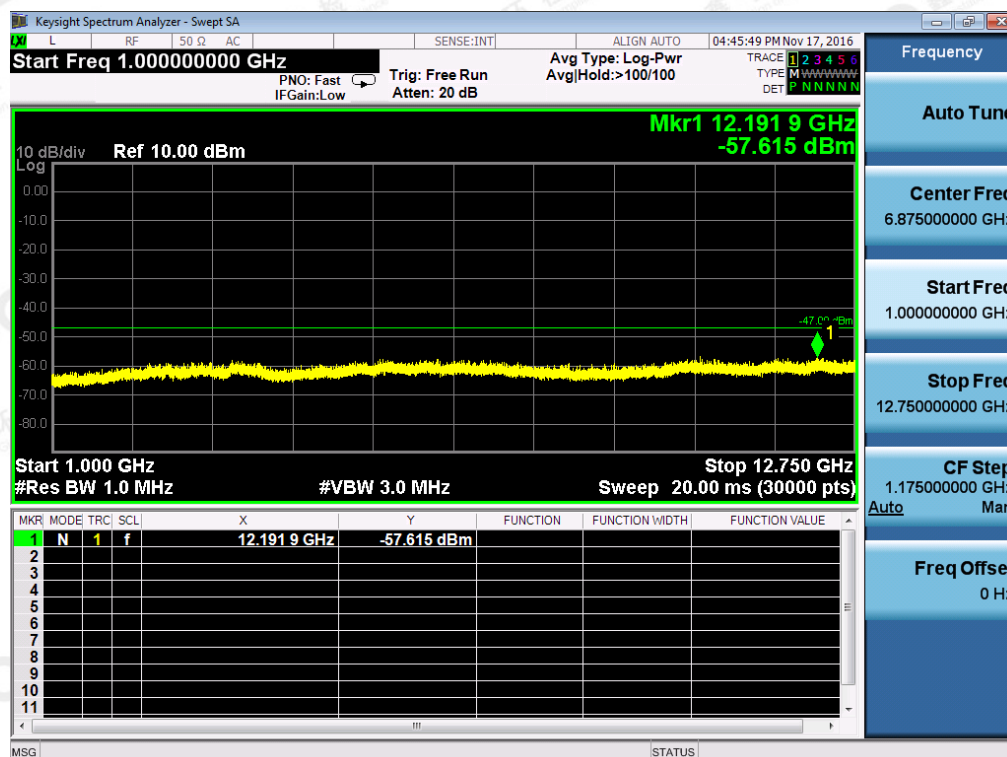
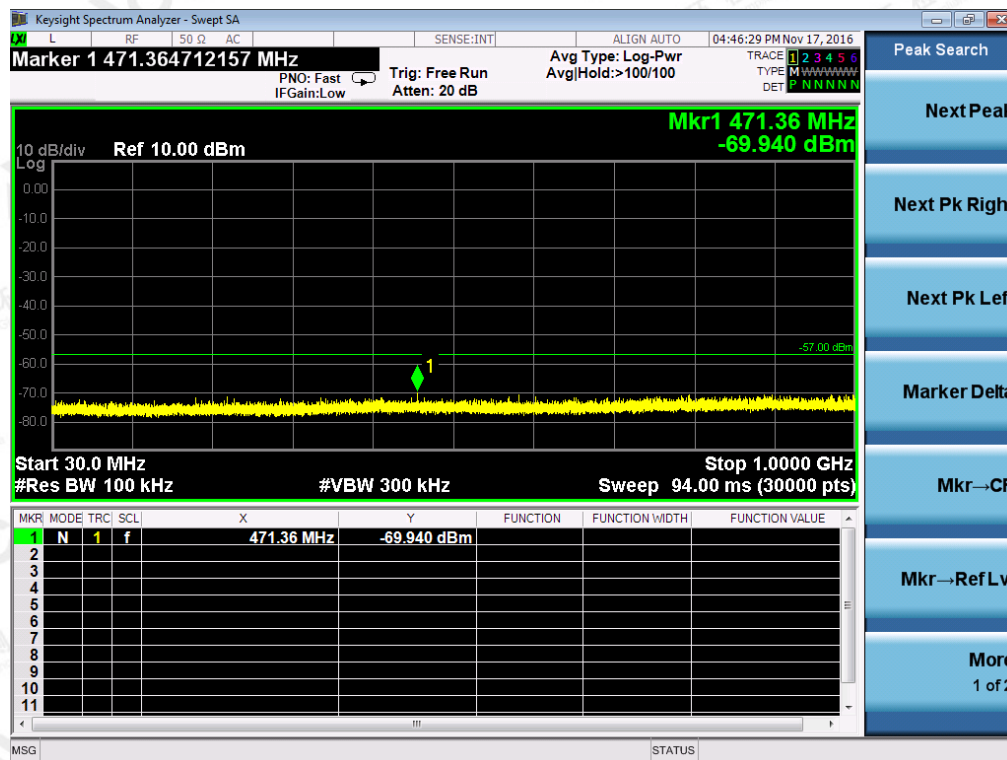
TEST PROCEDURE

1. Please refer to ETSI EN 300 328 clause 5.3.11.1 for the test conditions.
2. Please refer to ETSI EN 300 328 clause 5.3.11.2.1 for the measurement methods.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

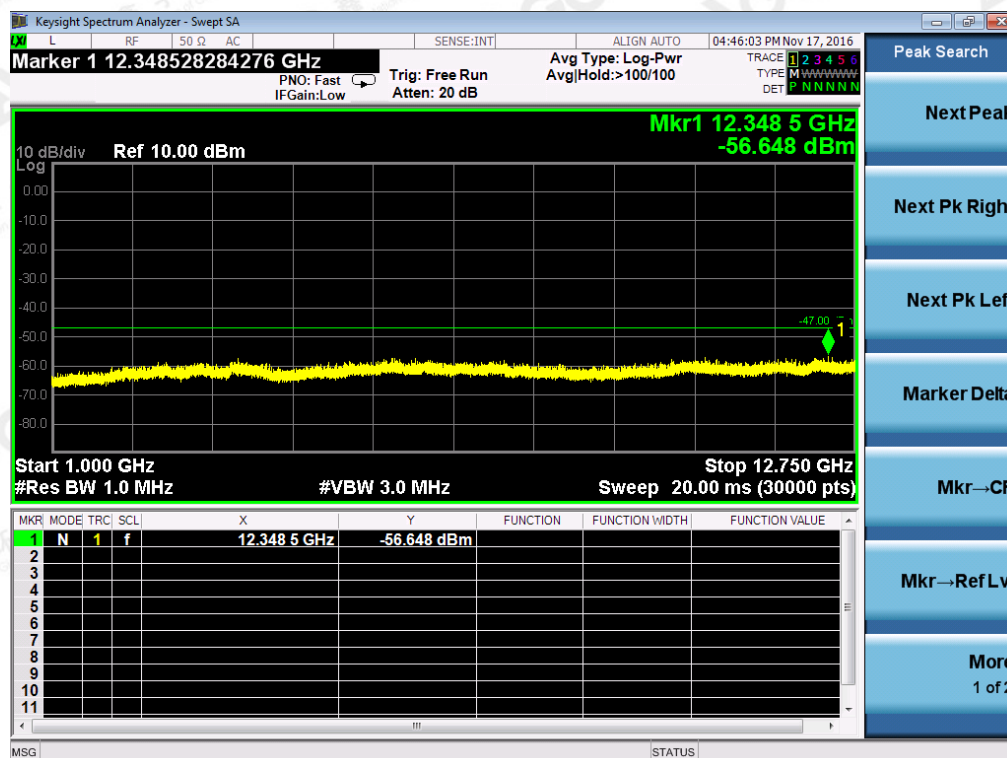
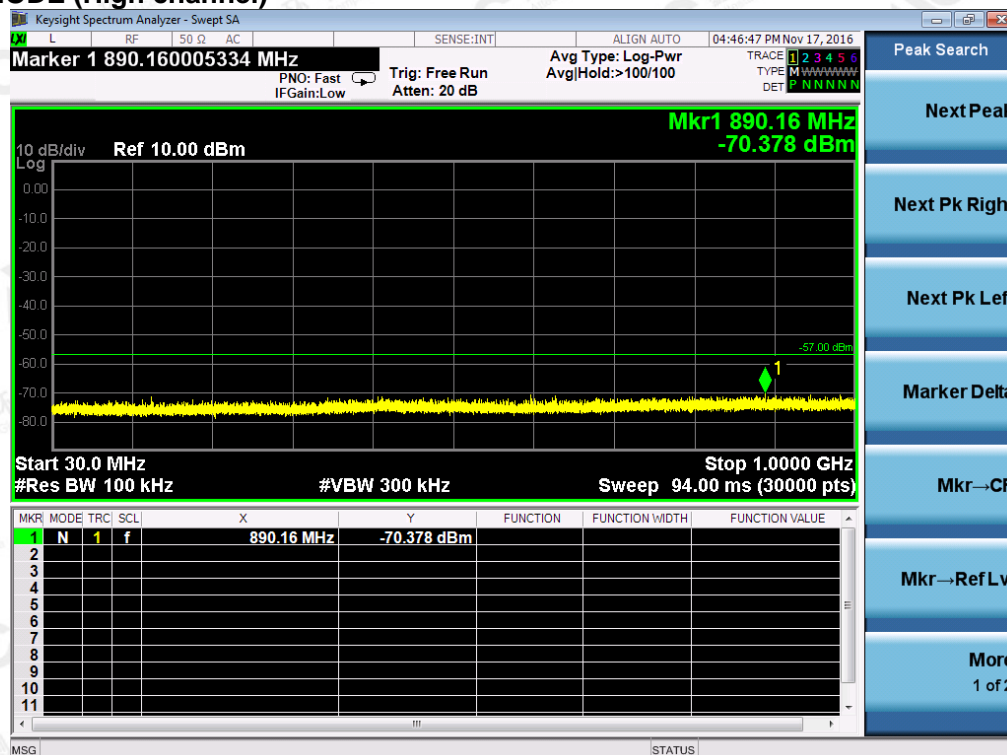
TEST RESULTS FOR CONDUCTED METHOD

RECEIVER MODE (Low channel)



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

RECEIVER MODE (High channel)



Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST RESULTS FOR RADIATED METHOD
Low Channel: Receiver Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
83.64	28.36	V	-72.03	0.04	0.38	-71.69	-57.00	14.69
168.38	28.74	V	-73.26	0.06	1.84	-71.48	-57.00	14.48
249.96	28.96	V	-78.86	0.13	7.06	-71.93	-57.00	14.93
384.63	28.96	V	-76.74	0.28	6.46	-70.56	-57.00	13.56
458.36	28.34	V	-76.70	0.37	6.64	-70.43	-57.00	13.43
834.42	28.11	V	-76.17	0.66	6.58	-70.25	-57.00	13.25
92.69	27.96	H	-73.15	0.04	1.56	-71.63	-57.00	14.63
158.43	27.36	H	-71.28	0.06	1.00	-70.34	-57.00	13.34
253.24	28.85	H	-77.71	0.13	7.22	-70.62	-57.00	13.62
455.67	28.34	H	-77.67	0.37	6.55	-71.49	-57.00	14.49
559.35	28.69	H	-77.63	0.46	6.88	-71.21	-57.00	14.21
669.47	28.49	H	-76.68	0.54	6.83	-70.39	-57.00	13.39

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

High Channel: Receiver Spurious Emission below 1GHz (30MHz-1GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
92.28	29.69	V	-71.76	0.04	1.56	-70.24	-57.00	13.24
155.63	28.42	V	-71.33	0.06	0.70	-70.69	-57.00	13.69
289.43	28.69	V	-76.58	0.17	6.44	-70.31	-57.00	13.31
389.47	28.24	V	-76.90	0.29	6.41	-70.78	-57.00	13.78
458.62	28.32	V	-76.50	0.37	6.64	-70.23	-57.00	13.23
969.31	29.42	V	-75.69	0.75	5.98	-70.46	-57.00	13.46
82.91	29.39	H	-70.87	0.04	0.22	-70.69	-57.00	13.69
167.46	29.53	H	-73.04	0.06	1.76	-71.34	-57.00	14.34
259.28	28.46	H	-77.40	0.14	7.22	-70.32	-57.00	13.32
468.36	29.63	H	-76.66	0.38	6.78	-70.26	-57.00	13.26
549.69	29.32	H	-77.78	0.46	6.75	-71.49	-57.00	14.49
82.91	29.39	H	-70.87	0.04	0.22	-70.69	-57.00	13.69

Note: The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

Low Channel: Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
9263.86	28.32	V	-69.94	2.97	11.20	-61.71	-47.00	14.71
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
9664.38	29.47	H	-69.55	2.97	11.20	-61.32	-47.00	14.32
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

High Channel: Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

Frequency	Reading Level	Antenna	S.G.	Cable Loss	Ant.Gain	Emission Level	Limit	Margin
(MHz)	(dBuv)	Polarization	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
9556.36	29.79	V	-70.26	2.97	11.20	-62.03	-47.00	15.03
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
--	--	V	--	--	--	--	--	--
9938.68	29.68	H	-69.33	2.97	11.20	-61.10	-47.00	14.10
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--
--	--	H	--	--	--	--	--	--

Note:

1. The margins of the other spectrum above 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.
2. The emission behaviour belongs to narrowband spurious emission.
3. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "--" remark, if no specific emission from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

Conclusion: PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

4.8. RECEIVER BLOCKING

ETSI EN300328 SUBCLAUSE 4.3.2.11

This requirement does not apply to non-adaptive equipment or adaptive equipment 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.

Adaptive Frequency Hopping equipment shall comply with the requirements defined in clauses 4.3.1.6.1 (LBT based DAA) or 4.3.1.6.2 (non-LBT based DAA) in the presence of a blocking signal with characteristics as provided in table 3.

Table 6: Receiver Blocking parameters

Equipment Type (LBT / non- LBT)	Wanted signal mean power from companion device	Blocking signal frequency [MHz]	Blocking signal power [dBm]	Type of interfering signal
LBT	sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35	CW
Non-LBT	-30 dBm			
NOTE 1: The highest blocking frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest blocking frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.3.7.1.				
NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz.				

TEST PROCEDURE

1. Please refer to ETSI EN 300 328 clause 5.3.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 clause 5.3.7.2 for the measurement methods.

TEST RESULTS

N/A

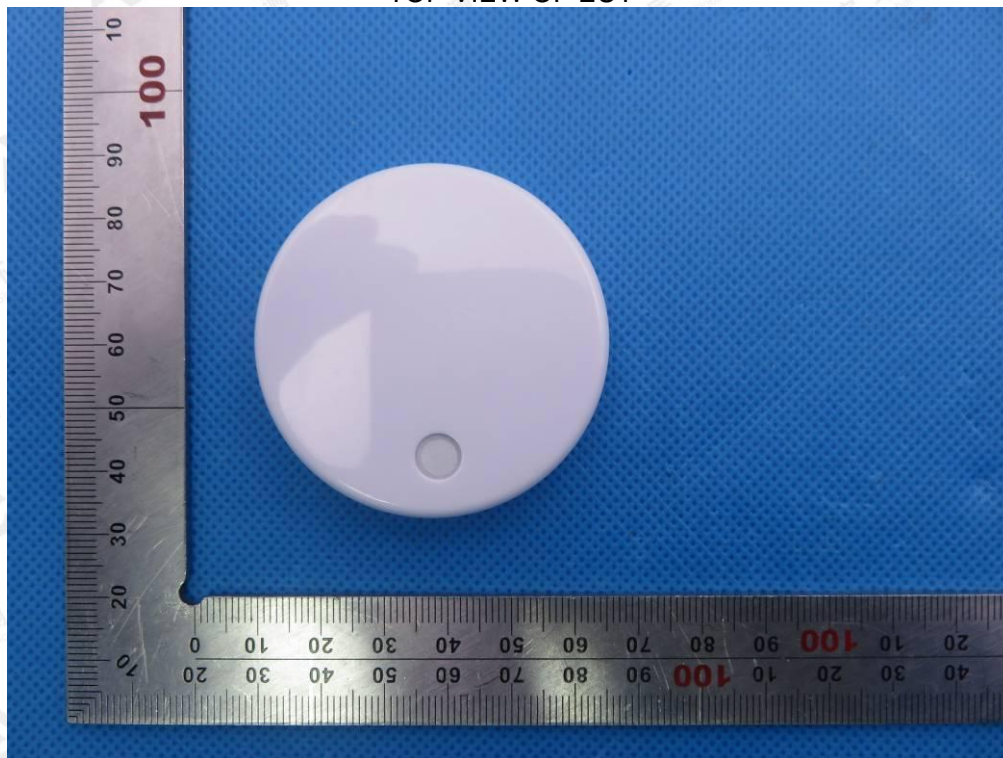
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

APPENDIX A
PHOTOGRAPHS OF THE TEST SETUP
CONDUCTED SPURIOUS EMISSION TEST

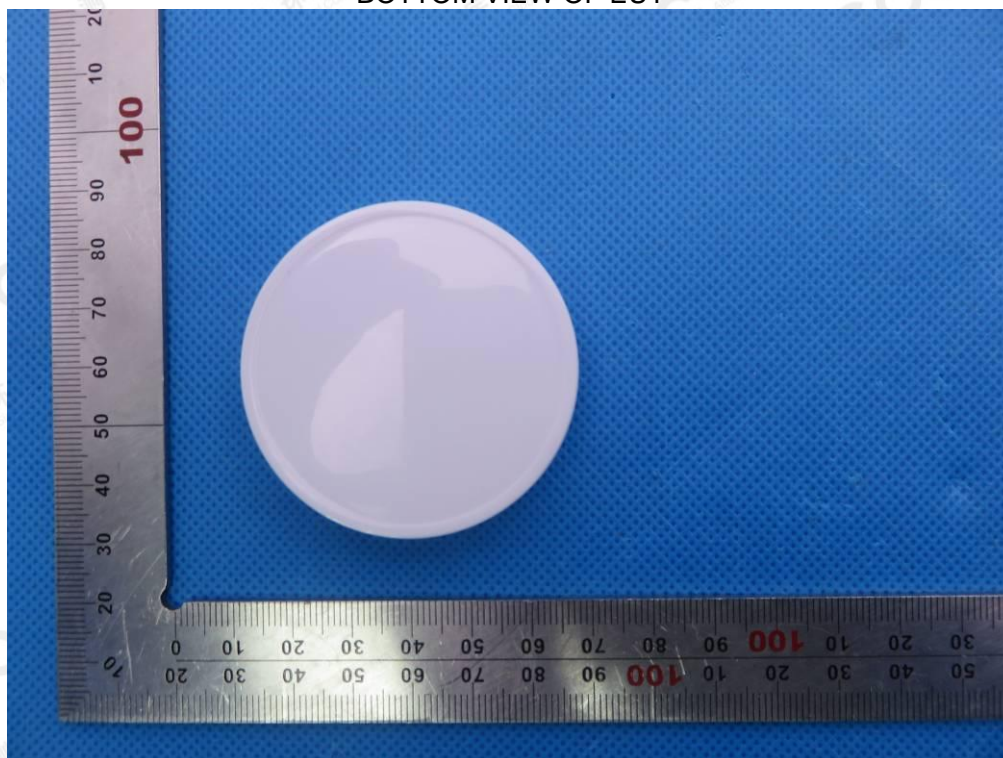


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

APPENDIX B
PHOTOGRAPHS OF THE EUT
TOP VIEW OF EUT



BOTTOM VIEW OF EUT



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

FRONT VIEW OF EUT



BACK VIEW OF EUT



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

LEFT VIEW OF EUT

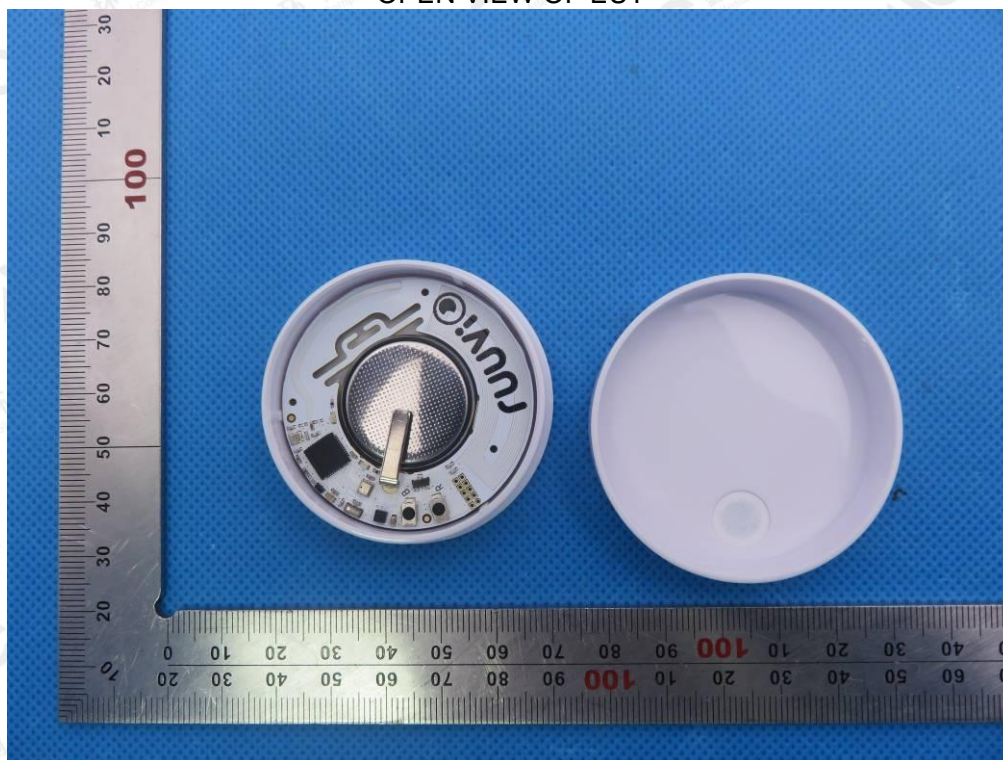


RIGHT VIEW OF EUT

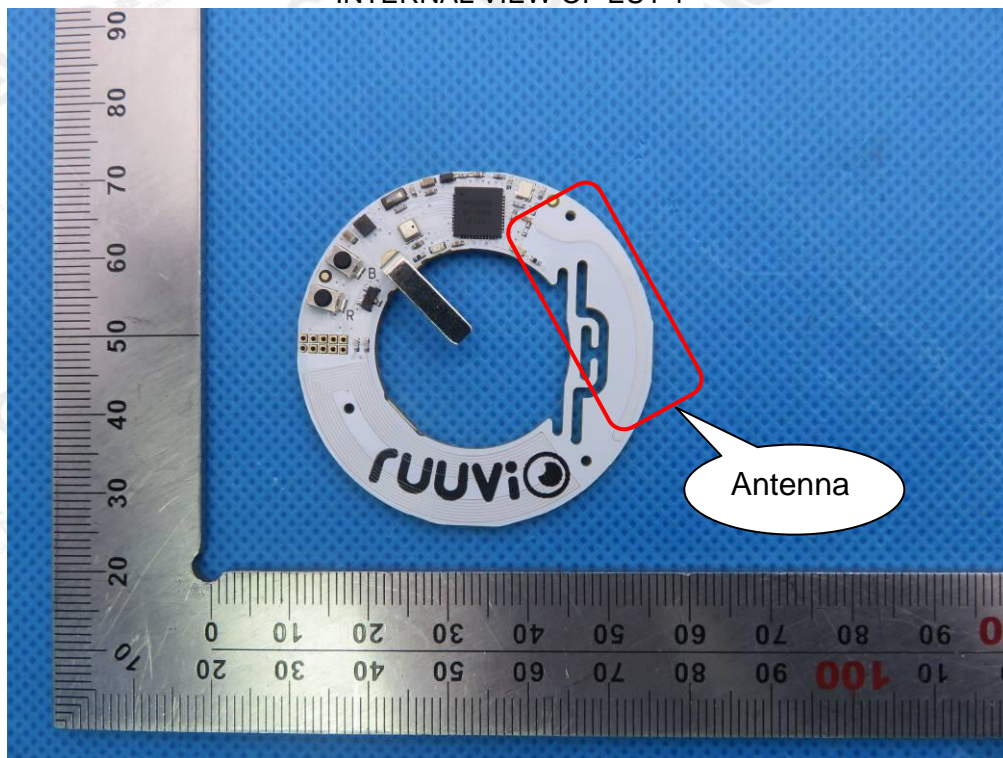


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

OPEN VIEW OF EUT

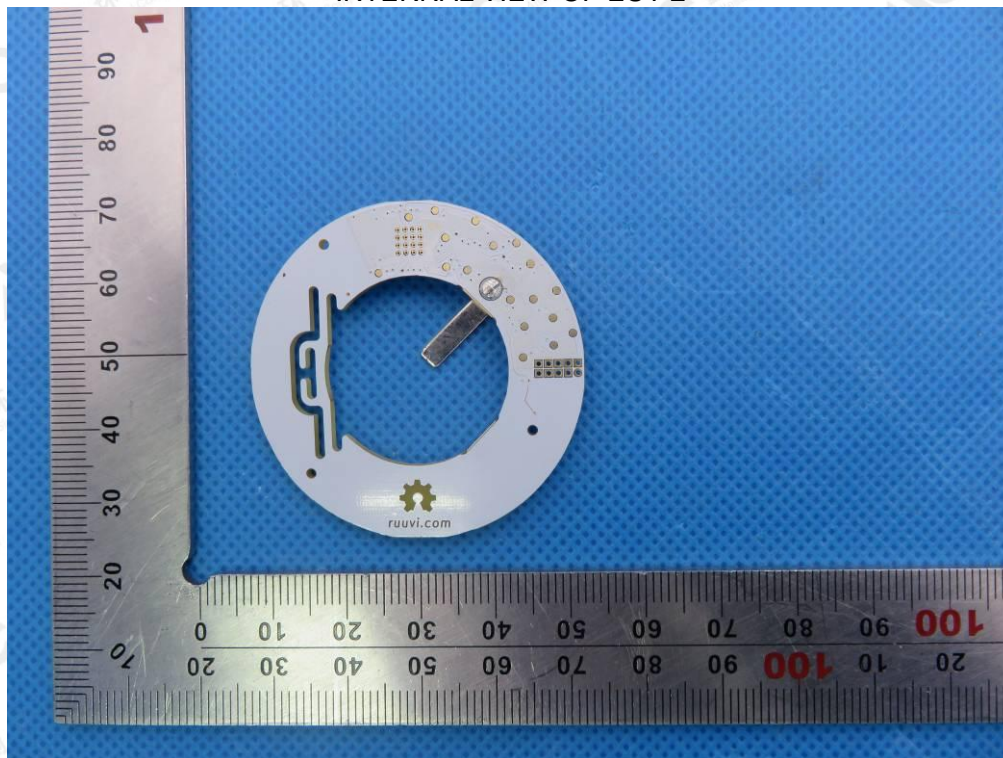


INTERNAL VIEW OF EUT-1

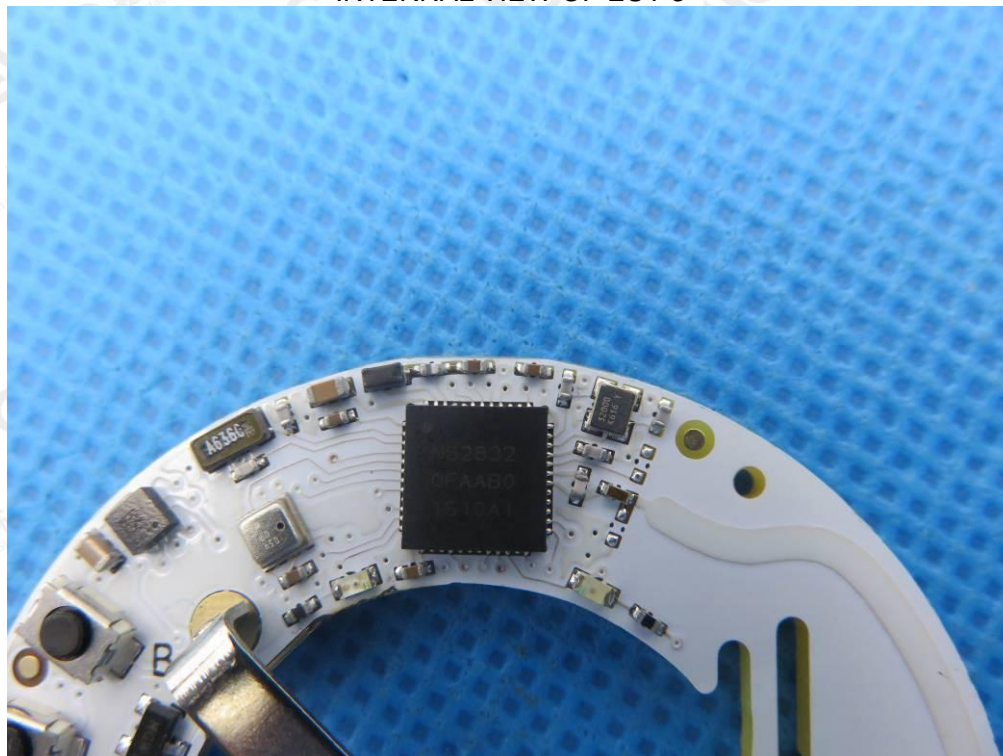


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-3



----END OF REPORT----

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.