

# **TEST REPORT**

APPLICANT:	D.F.B. Global certification S.r.l. Via Fiume, 35 – 24030 Paladina (BG) –ITALY Tel. +39 373 7313617 E-mail: f.barbierato@dfbcert.com		
EUT DESCRIPTION	WIRELESS PROGRAMMABLE THE	RMOSTAT	
EUT TYPE	EQUICALOR-AC		
EUT CODE	506366US		
FCC ID	2AB4Y506366US		
EUT TRADEMARK	<b>₩IVAR</b>		
REFERENCE STANDARDS	47 CFR FCC part 15.247		
TEST REPORT NUMBER	FCCTR_140117-7		
TEST REPORT ISSUE DATE	26/09/2014		
TESTING LABORATORY	Prima Ricerca & Sviluppo S.r.l. Via Campagna, 92 -22020 Faloppio (Co) – Italy		
TESTING LOCATION	As Above		
DATE OF TEST SAMPLE RECEIPT	07/02/2014		
NO. OF TESTED SAMPLES	1		
DATE OF TEST	07/02/2014		
TESTED BY	Andrea BORTOLOTTI Tecnico laboratorio / Laboratory technician		
APPROVED BY	Giacomo ARMELLINI Responsabile Laboratorio EMC e RADIO/ EMC and RADIO Laboratory Manager  Giacomo ARMELLINI  Giacomo ARMELLINI  Giacomo ARMELLINI  Amuellini   Amuellini  Amuell		

The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have be obtained.

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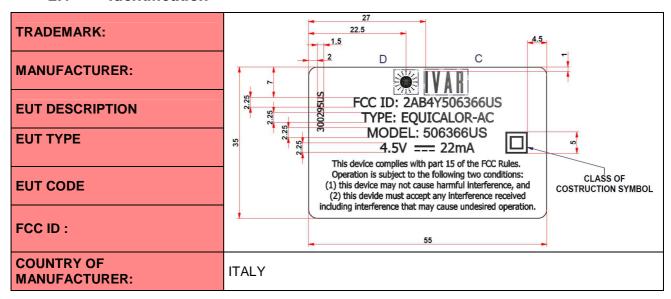
# 1. RELEASE CONTROL RECORD

TEST REPORT NUMBER	REASON OF CHANGE	DATE OF ISSUE
FCCTR_140117-0	Original release	13/03/2014
FCCTR_140117-1	Added new label + added new FCC ID	14/04/2014
FCCTR_140117-2	Updated test in acc. to 550874 D01 DTS  Meas. Guidance v03r02	24/07/2014
FCCTR_140117-3	Correct typing error on antenna model description	30/07/2014
FCCTR_140117-4	Correct test result in acc. to 550874 D01 DTS Meas. Guidance v03r02	02/09/2014
FCCTR_140117-5	Added test description	04/09/2014
FCCTR_140117-6	Updated graph on page 21/22	15/09/2014
FCCTR_140117-7	Added instrument for radio test	26/09/2014



# 2. TECHNICAL INFORMATION OF EQUIPMENT UNDER TEST (EUT)

#### 2.1 Identification



#### 2.2 Technical data

FCC CLASS:	47 CFR FCC Part 15 Subpart C § 15.247	
PRODUCT TYPE:	Radio Equipment	
RADIO TYPE:	Intentional radiators	
POWER SUPPLY REQUIREMENTS:	4,5 Vdc powered by internal battery (3x1,5V type AA)	
FREQUENCY RANGE:	915MHz	
TYPE MODULATION:	GFSK	
CHANNEL BANDWIDTH:	1.74MHz	
CHANNEL SPACING:		
ANTENNA CONNECTOR /TYPES:	Integrated	

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#### 2.3 Technical information

MODULE MANUFACTURER:	
MODULE TYPE:	
TYPE OF ANTENNA:	Johanson technology mod. 0915AT43A0026  ☑ Integral; ☐ External; ☐ Dedicated
ANTENNA GAIN:	Average Gain (XZ total): -4.0dBi typ.
	Peak gain (XZ total): -1.0dBi typ.

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#### 2.4 Ports identification

This section contains descriptions of all signal ports and AC/DC power input/output ports, the length and the type of the cable provided by manufacturer needed for the tests. Moreover it is specified if the ports are ever or optionally connected.

Port		Description	Connection
1 Enclosure		Plastic	Pressure
2 AC Power Supply		Port not present	
3 DC power supply		Port not present (internal battery)	
4 Signal lines		NA contact	Connector
5 Telecomm. Lines		Port not present	
6 Antenna		Port not present (integrated antenna)	

Note: During the tests all cables must be what provided the manufacturer or the same that used in the real employment of the EUT.

#### 2.5 Auxiliary equipment

None

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#### 3. TEST CONDITIONS

#### 3.1 Operating test modes and test conditions

The equipment has been tested according to the operative conditions described in the user/installation manual provided by the manufacturer and by following reference standards:

### **Reference Standard:**

47 CFR FCC Part 15 Subpart C § 15.247

In the following table there are the operating conditions adopted during tests identified by an indicator (#..) at which has been referred the item "Operating condition of the equipment under test" of all technical sheets of the tests (see Section 4)

Operating condition	Description
#1	Continuous transmission, modulated carrier

#### 3.2 Test overview

The appliance is classified as "Intentional radiator" in conformity to FCC Part 15 Subpart C § 15.247. The application is mainly as thermostatic control

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#### 4. REFERENCE STANDARD FOR PERFORMED TESTS

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in ANSI C63.4-2003 and 47 CFR FCC Part 15 Subpart C.

#### 5. SUMMARY OF TEST RESULTS

#### 5.1 Emission tests

Port	Phenomena	Basic standard	Operating condition	Result
	Antenna requirement <sup>1</sup>	FCC Part 15 §15.203		Within the limit
	Maximum Peak Output Power <sup>1</sup>	FCC Part 15 §15.247 (b) (3)	#1	Within the limit
	6 dB Bandwidth <sup>1</sup>	FCC Part 15 §15.247 (a) (2)	#1	Within the limit
Antenna port	Power Spectral Density <sup>1</sup>	FCC Part 15 §15.247 (e)	#1	Within the limit
, and ma port	Band-Edge <sup>1</sup>	FCC Part 15 § 15.247 (d)	#1 Within the lim	
	RF <b>conducted</b> Spurious Emissions at the Transmitter Antenna Terminal	FCC Part 15 § 15.247 (d), 15.209	Not applicable : integrated antenna	
	RF <b>radiated</b> Spurious Emissions at the Transmitter Antenna Terminal	FCC Part 15 § 15.247 (d), 15.209	#1 Within the lin	
AC Mains	Conducted Emissions	Title 47 Part 15 Subpart B § 15.107	Not applicable: internal battery powered	

Notes: <sup>1</sup> The EUT complies with the requirement; it employs an internal not removable antenna. In acc. to 558074 D01 DTS Meas Guidance v03R02:" *If antenna-port conducted tests cannot be performed on an EUT (e.g., portable or handheld devices with integral antenna), then radiated tests are acceptable for demonstrating compliance to the conducted emission requirements.*"

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# 6. TEST RESULTS

MAXIMUM PEAK OUTPUT POWER	9
6dB CHANNEL BANDWIDTH	
Band-Edge	13
Power Spectral Density	15
RADIATED EMISSION 9 kHz +10 <sup>th</sup> Harmonic	17



TEST 1.

#### **MAXIMUM PEAK OUTPUT POWER**

# REFERENCE DOCUMENT

According to §15.247(b) (3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

- TEST SETUP:
- TEST LOCATION:
- TEST equipment used for radiated test:

In according to manufacturer specifications

#### Radio test area

- Spectrum Analyzer Rohde&Schwarz mod, FSP40
- Variable Power supply
- Test Fixture Prima Ricerca & Sviluppo
- Climatic Chamber MAZZALI
- Attenuator 10dB mod MCL BW-N10W5+

TEST CONDITIONS:			MEASURED
Ambient temperature :	23°C ± 5°C		24 °C
Ambient humidity:	25 - 75 %rH		45%
Pressure :	85 - 106 kPa	(860 mbar - 1060 mbar)	960 mbar

modulation:	C	ON
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#### **Measurement Procedure**

The test has been executed in acc. to cap.9.0 of 55084 D01 DTS measure guidance v03r02.

The test has been executed on radiated EIRP method, because EUT don't have removable antenna (see Paragraphs 2-4 in section 3.0 of 558074). The EUT shall be placed on not-conductive table, height 80cm. Measure distance from the antenna: 3mt. EUT shall be rotated during the test on 0°, 90°, 180° & 270°. Antenna height 100&250cm, polarization vertical & horizontal. The measurement was verified by substitution method.

Calculation for the conversion from radiated to conducted measurement are:

Conducted power=Radiated power-Antenna Gain

-0.91dBm[Radiated power]-(-1dBi[antenna gain]-2.14[Conversion factor])=2.23dBm(1,7mW)

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#### Measurement Result

Channel	Frequency MHz	Output Power radiated (dBm)	Antenna Gain (dBi)	Power conducted <sup>1</sup> (mW)	Limit (W)	Result
1	915.004	-0.91	-1.0	1,7	1	COMPLIANT

Incertezza di misura / Measurement Uncertainty: ± 3 dB

Path attenuation @915MHz: -4dB Antenna Factor @915MHz: -70 dB External attenuator @915MHz: 10dB

#### Graphics (radiated):



<sup>&</sup>lt;sup>1</sup> Power conducted shall be measured by requirement stated on Paragraphs 2-4 in section 3.0 of 558074:

Antenna-port conducted measurements shall be performed using test equipment that matches the nominal impedance of the antenna assembly to be used with the EUT. Additional attenuation may be required in the conducted RF path to prevent overloading of the measurement instrument. The measured power levels shall be adjusted to account for all losses or gains introduced into the conducted RF path, including cable loss, external attenuation or amplification. These adjustments shall be recorded in the test report.

Radiated measurements shall utilize the procedures specified in ANSI C63.10, as applicable."

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<sup>&</sup>quot;If a radiated test configuration is used, then the measured power or field strength levels shall be converted to equivalent conducted power levels for comparison to the applicable output power limit. This may be accomplished by first measuring the radiated field strength or power levels using a methodology for maximum peak conducted power or maximum conducted (average) power as applicable and peak or average power spectral density as applicable. The radiated field strength or power level can then be converted to EIRP (see ANSI C63.10 for guidance). The equivalent conducted output power or power spectral density is then determined by subtracting the EUT transmit antenna gain (guidance applicable to devices utilizing multiple antenna technologies is provided in KDB 662911) from the EIRP (assuming logarithmic representation). All calculations and parameter assumptions shall be provided in the test report.



TEST 2.

#### **6dB CHANNEL BANDWIDTH**

REFERENCE DOCUMENT

According to §15,247(a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483,5 MHz, and 5725-5850 MHz bands, The minimum 6 dB bandwidth shall be at least 500 kHz,

TEST SETUP: In according to manufacturer specifications

TEST LOCATION:
 Radio test area

• TEST EQUIPMENT USED FOR TEST: • Spectrum Analyzer Rohde&Schwarz mod, FSP40

• Variable Power supply

Test Fixture Prima Ricerca & Sviluppo

• Climatic Chamber MAZZALI

Attenuator 10dB mod MCL BW-N10W5+

TEST CONDITIONS:		MEASURED
Ambient temperature :	23°C ± 5°C	24 °C
Ambient humidity:	25 - 75 %rH	45%
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	960 mbar

modulation:	ON	
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#### **Measurement Procedure**

The test has been executed in acc. to cap.8.0 of 55084 D01 DTS measure guidance v03r02.

The EUT was placed on Climatic chamber with Prima Ricerca & Sviluppo text fixture. A value equal to cable attenuation + antenna factor + external attenuator with this formula compensated the measurement: 1,2dBm(cable attenuation)+10dBm(external attenuator)+10dBm(antenna factor)=21,2dBm

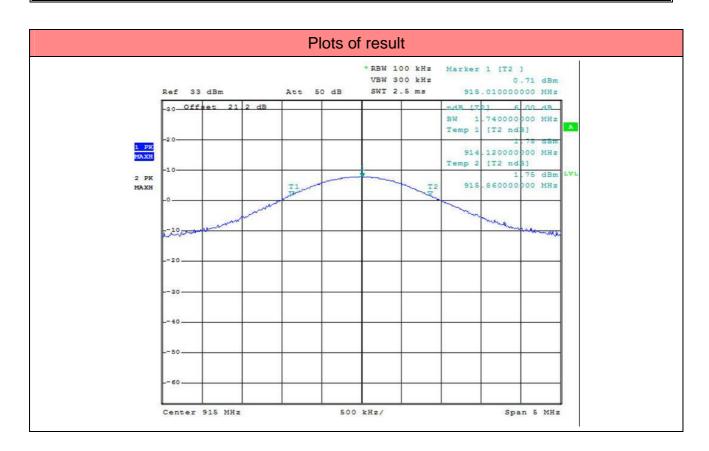
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#### **Measurement Result**

Channel	Frequency (MHz)	Measurement (MHz) 6 dB band	Result	LIMIT
1	915.010	1.740	COMPLIANT	> 500 kHz

Incertezza di misura / Measurement Uncertainty : ±1 KHz



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**TEST** 3.

#### **Band-Edge**

#### REFERENCE DOCUMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits, If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB, Attenuation below the general limits specified in Sec, 15,209(a) is not required, In addition, radiated emissions which fall in the restricted bands, as defined in Sec, 15,205(a), must also comply with the radiated emission limits specified in Sec, 15,209(a) (see Sec, 15,205(c)),

• TEST SETUP:

In according to manufacturer specifications

TEST LOCATION:

Radio test area

- TEST EQUIPMENT USED FOR TEST: Spectrum Analyzer Rohde&Schwarz mod, FSP40
  - Variable Power supply
  - Test Fixture Prima Ricerca & Sviluppo
  - Climatic Chamber MAZZALI
  - Attenuator 10dB mod MCL BW-N10W5+

TEST CONDITIONS:			MEASURED
Ambient temperature :	23°C ± 5°C		24 °C
Ambient humidity :	25 - 75 %rH		45%
Pressure :	85 - 106 kPa	(860 mbar - 1060 mbar)	960 mbar
Measurement Result:			Compliant

#### **Measurement Procedure**

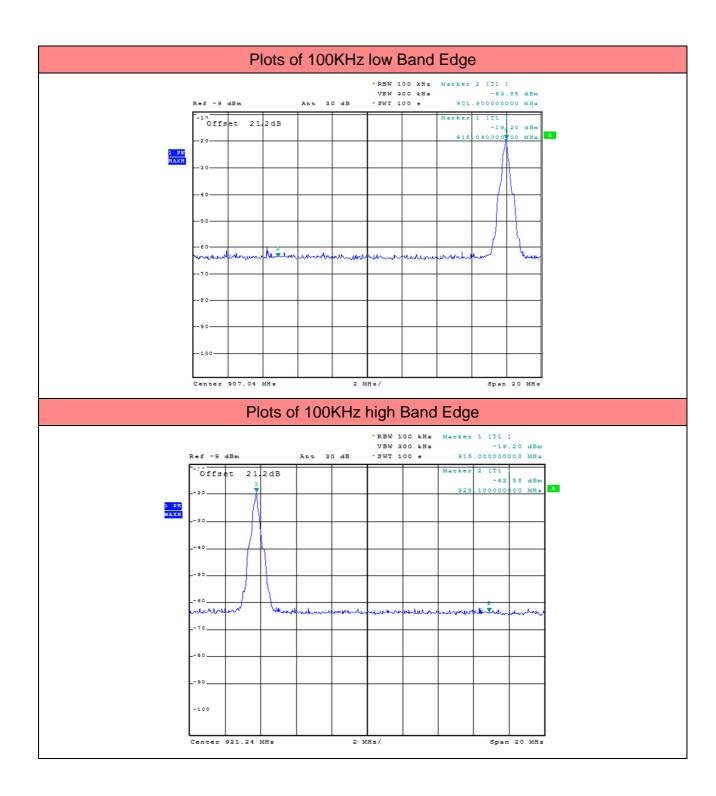
The test has been executed in acc. to cap.13 of 55084 D01 DTS measure guidance v03r02. The EUT was placed on Climatic chamber with Prima Ricerca & Sviluppo Text fixture. The measurement

was compensated by a value equal to cable attenuation+antenna factor+external attenuator with this formula:

1,2dBm(cable attenuation)+10dBm(external attenuator)+10dBm(antenna factor)=21,2dBm

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TEST 4.

#### **POWER SPECTRAL DENSITY**

# REFERENCE DOCUMENT

According to §15,247) (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission, This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section, The same method of determining the conducted output power shall be used to determine the power spectral density,

- TEST SETUP:
- TEST LOCATION:

TEST equipment used for conducted test:

In according to manufacturer specifications

Radio test area

- Spectrum Analyzer Rohde&Schwarz mod, FSP40
- Variable Power supply
- Test Fixture Prima Ricerca & Sviluppo
- Climatic Chamber MAZZALI
- Attenuator 10dB mod MCL BW-N10W5+

TEST CONDITIONS:		MEASURED
Ambient temperature :	23°C ± 5°C	24 °C
Ambient humidity:	25 - 75 %rH	45%
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	960 mbar

modulation:	ON	
Thousand the second	0.1	

#### **Measurement Procedure**

The test has been executed in acc. to cap.10 of 55084 D01 DTS measure guidance v03r02. The EUT was placed on Climatic chamber with Prima Ricerca & Sviluppo Text fixture. A value equal to cable attenuation + antenna factor + external attenuator with this formula compensated the measurement: 1,2dBm(cable attenuation)+10dBm(external attenuator)+10dBm(antenna factor)=21,2dBm

Calculation for the conversion from radiated to conducted measurement are:

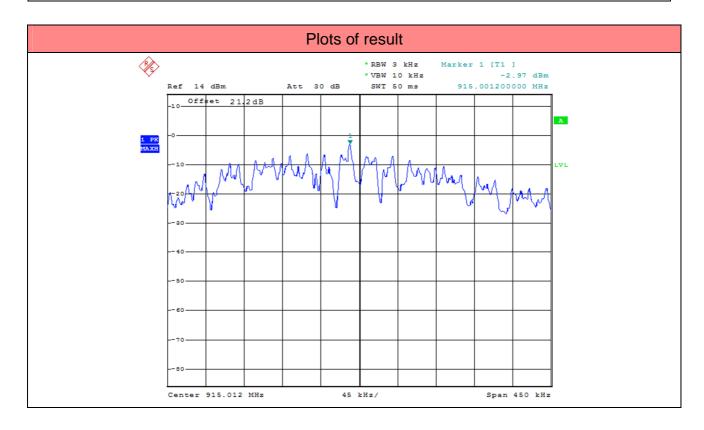
Conducted PSD=Radiated PSD-Antenna Gain -2.97dBm[Radiated power]-(-1dBi[antenna gain]-2.14[Conversion factor])=0.17dBm

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#### **Measurement Result**

Channel	Frequency (MHz)	Power density radiated (dBm)	Power density conducted <sup>1</sup> (dBm)	Limit (dBm)	Margin (dB)	Result
1	915.001	-2.97	0.17	8	7.83	COMPLIANT
	Incertezza di misura / Measurement Uncertainty : ± 1 dB					



Antenna-port conducted measurements shall be performed using test equipment that matches the nominal impedance of the antenna assembly to be used with the EUT. Additional attenuation may be required in the conducted RF path to prevent overloading of the measurement instrument. The measured power levels shall be adjusted to account for all losses or gains introduced into the conducted RF path, including cable loss, external attenuation or amplification. These adjustments shall be recorded in the test report. Radiated measurements shall utilize the procedures specified in ANSI C63.10, as applicable."

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<sup>&</sup>lt;sup>1</sup> PSD shall be measured by requirement stated on Paragraphs 2-4 in section 3.0 of 558074:

<sup>&</sup>quot;If a radiated test configuration is used, then the measured power or field strength levels shall be converted to equivalent conducted power levels for comparison to the applicable output power limit. This may be accomplished by first measuring the radiated field strength or power levels using a methodology for maximum peak conducted power or maximum conducted (average) power as applicable and peak or average power spectral density as applicable. The radiated field strength or power level can then be converted to EIRP (see ANSI C63.10 for guidance). The equivalent conducted output power or power spectral density is then determined by subtracting the EUT transmit antenna gain (guidance applicable to devices utilizing multiple antenna technologies is provided in KDB 662911) from the EIRP (assuming logarithmic representation). All calculations and parameter assumptions shall be provided in the test report.



TEST 5.

# RADIATED EMISSION 9 KHZ ÷10<sup>TH</sup> HARMONIC

REFERENCE DOCUMENT

FCC 47CFR Part 15

TEST LOCATION: Semi-anechoic chamber

• TEST EQUIPMENT USED EMI receiver Rohde & Schwarz Mod, ESU 40

FOR TEST: Chase Antenna Mod, CBL 6111 A

Antenna Rohde & Schwarz mod, HL50 Semi-anechoic chamber SIEMENS

• TESTED PORT: Enclosure

EMISSION LIMITS: Acc, to Section 15,209 of reference document

• UNCERTAINTY OF MEASURE: Combined uncertainty =  $\pm$  1,75 dB Total uncertainty = (k=2)  $\pm$  3,5 dB

TEST CONDITIONS:		MEASURED
Ambient temperature :	15 - 35 °C	23,5 ± 3 °C
Ambient humidity:	25 - 75 %rH	39 ± 5 %rH
Pressure :	85 - 106 kPa (860 mbar - 1060 mbar)	950 ± 50 mbar

OPERATING CONDITION (Rif. Section 2): #1

**RESULT: WITHIN THE LIMIT** 



#### **Measurement Procedure**

Radiated emissions tests were made over the frequency range of 30MHz to 12.75GHz, 10 times the highest fundamental frequency min. The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 100 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3MHz respectively. The EUT was caused to generate a continuous modulated carrier. Each emission found to be in a restricted band was compared to the applicable radiated emission limits. Radiated spurious emissions were evaluated for all orientations and worst case data presented.

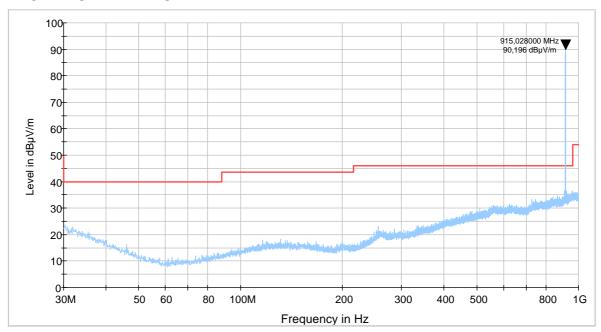
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#### RADIATED SPURIOUS ESMISSION ON RESTRICTED BAND

#### FREQUENCY RANGE 30MHz - 1GHz

#### **VERTICAL POLARIZATION**



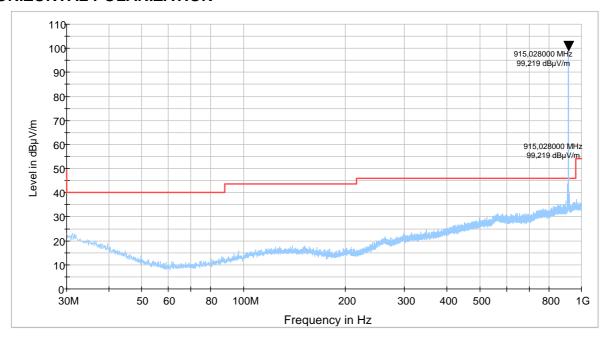
FCC 15\_209\_GENERAL\_EMISSIONS\_LIMIT
Preview Result 1-PK+

RBW	100KHz
VBW	300KHz

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#### **HORIZONTAL POLARIZATION**



FCC 15\_209\_GENERAL\_EMISSIONS\_LIMIT
Preview Result 1-PK+

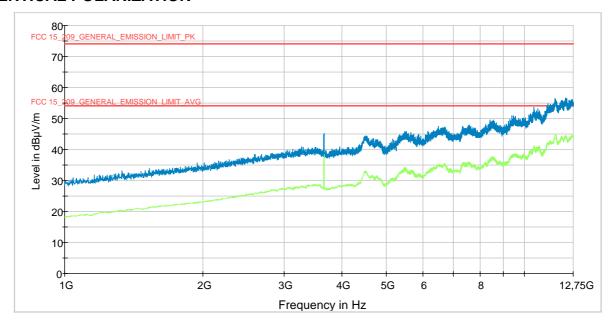
RBW	100KHz
VBW	300KHz

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#### FREQUENCY RANGE 1GHz - 12.75GHz

#### **VERTICAL POLARIZATION**



FCC 15\_209\_GENERAL\_EMISSION\_LIMIT\_AVG
MaxPeak-ClearWrite
FCC 15\_209\_GENERAL\_EMISSION\_LIMIT\_PK
Preview Result 2-AVG

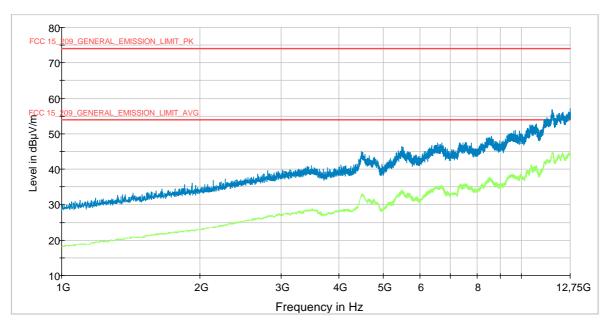
Frequency	Average	Azimuth	Margin	Limit
(MHz)	(dBµV/m)	(deg)	(dB)	(dBµV/m)
3660.200000	37.5	262.0	16.50	

RBW	1MHz
VBW	3MHz

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#### HORIZONTAL POLARIZATION



FCC 15\_209\_GENERAL\_EMISSION\_LIMIT\_AVG
MaxPeak-ClearWrite
FCC 15\_209\_GENERAL\_EMISSION\_LIMIT\_PK
Preview Result 2-AVG

RBW	1MHz
VBW	3MHz

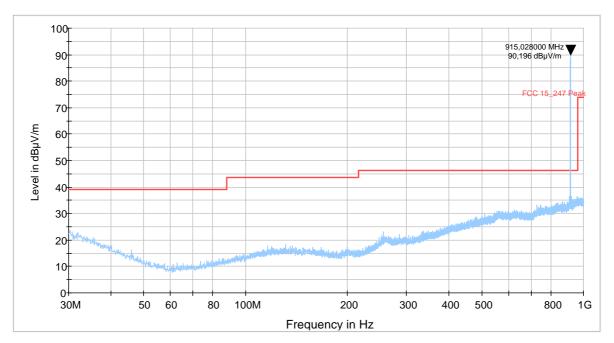
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#### RADIATED EMISSION IN NON-RESTRICTED FREQUENCY BANDS

# FREQUENCY RANGE 30MHz – 1GHz VERTICAL POLARIZATION

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



FCC 15\_247 Peak-CAR Preview Result 1-PK+

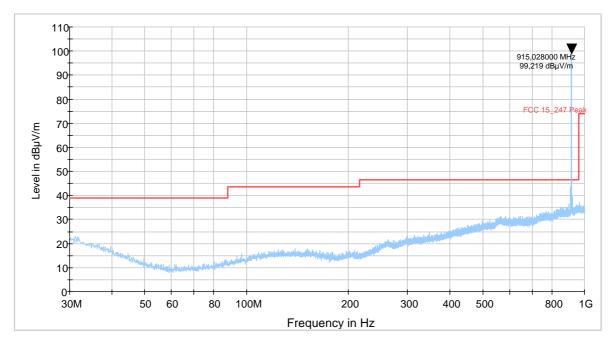
RBW	100KHz
VBW	300KHz

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#### **HORIZONTAL POLARIZATION**

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



FCC 15\_247 Peak-CAR Preview Result 1-PK+

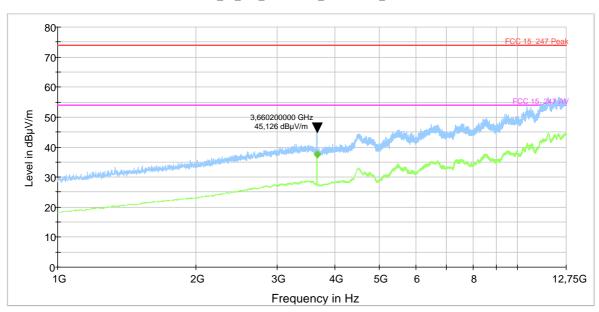
RBW	100KHz
VBW	300KHz

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#### FREQUENCY RANGE 1GHz – 12,75GHz VERTICAL POLARIZATION

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



FCC 15\_247 Peak-CAR
FCC 15\_247 AV-CAR
Preview Result 1-PK+
Preview Result 2-AVG
Final Result 2-AVG

RBW	100KHz
VBW	300KHz

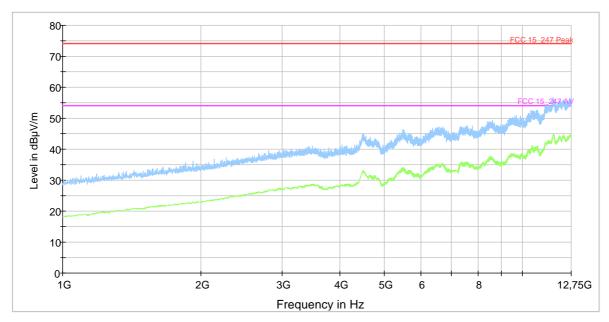
Frequency (MHz)	Carrier level (dBµV/m)	Spurious level (dBµV/m)		Difference (dBc)	Limit (dBc)	Result
3660,200	90.196	Harmonics	Level	45.07	- 20	Within the limits
3660.200	90.196	IV	45.126	43.07	>20	vviuiiii uie iiiiiis

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#### **HORIZONTAL POLARIZATION**

FCC\_15\_247\_RADIATED\_SPURIOUS\_VERTICAL



FCC 15\_247 Peak-CAR
FCC 15\_247 AV-CAR
Preview Result 1-PK+
Preview Result 2-AVG

RBW	100KHz
VBW	300KHz

Frequency (MHz)	Carrier level (dBµV/m)	Spurious level (dBµV/m)		Difference (dBc)	Limit (dBc)	Result
		Harmonics	Level			
	99.219		No spurious are detected		>20	Within the limits

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# 7. LIST OF EQUIPMENT USED

EQUIPMENT	MANUFACTURER	MODEL	SERIAL Nr.	CAL. DUE
EMI TEST RECEIVER 20Hz 40GHz	Rohde & Schwarz	ESU40	100111	10/05/2015
RF SEMI-ANECHOIC CHAMBER (CSSA)	Siemens	B83117- D6019- T232	003-005- 134/94C	01/07/2015
BILOG ANTENNA	Chase	CBL6111C	2717	05/05/2015
LOG PERIODIC ANTENNA BROAD BAND 1-26,5GHz	Rohde & Schwarz	HL050	100437	01/04/2015
SPECTRUM ANALYZER	Rohde & Schwarz	FSP	100038	20/01/2015
CLIMATIC CHAMBER	MAZZALI	M1574	A2C150HS 0000	30/12/2015
TEXT FIXTURE	Prima Ricerca & Sviluppo	Text fixture band 800- 1000MHz	00001	30/12/2015
ATTENUATOR	MCL	BW- N10W5+	0001	30/12/2015
VARIABLE POWER SUPPLY	Hewlett Packard	6623A	344BAo4501	30/12/2015

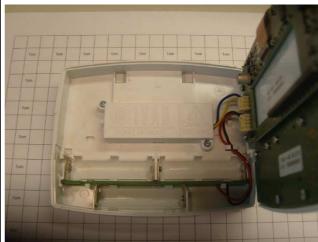
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# 8. EUT PHOTOGRAPHIC DOCUMENTATION

# **PHOTO N°1 – EUT IDENTIFICATION**









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# PHOTO N°2 – RADIATED MEASUREMENT SETUP