

Report Reference ID:	286044-1TRFWL	
Test specification:	Title 47 - Telecommunication Chapter I - Federal Communications Commission Subchapter A - General Part 15 - Radio Frequency Devices Subpart C - Intentional Radiators §15.247 - Operation within the bands 2400–2483.5 MHz	

Applicant:	Advanced Microwave Engineering s.r.l.	
	Via Lucca, 50	
	Firenze, 5142 Italy	
Apparatus:	Sensor for anticollision system for detecting hazards in real-time	
Model:	EGO PRO SAFETY MOVE SENSOR	
FCC ID:	UKOPLXSENSSFT	

Testing laboratory:	Nemko Spa Via del Carrocc I 20853 Biasso	io, 4 no (Italy)
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	Name and title	Date
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Tested by.	Daniele Guarnone, Wireless/EMC Specialist	
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Product: Sensor

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Section 1: Report summary

Section 1: Report summary

1.1 Test specification		
Specifications	FCC Part 15 Subpart C, 15.247 Operation within the bands 2400–2483.5 MHz	

Product: Sensor

1.2 Statement of compliance			
Compliance	In the configuration tested the EUT was found compliant		
	Yes 🛛 No 🗌		
	This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.		

1.3 Exclusions	
Exclusions	None

1.4 Registration nur	nber
Test site FCC ID	481407
number	

1.5 Test report revis	ion history
Revision #	Details of changes made to test report
TRF	Original report issued

1.6 Limits of responsibility

The date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Section 2: Summary of test results

2.1 FCC Part 15 Subpart C – Intentional Radiators, test results				
General requirements for FCC Part 15				
Part	Test description Verdict			
§15.31(e)	Variation of power source NA			
§15.31(m)	Number of operating frequencies	Pass		
§15.203	Antenna requirement	Pass		
§15.207(a)	Conducted limits	NA		
Specific requirem	ents for FCC Part 15 Subpart C, 15.247			
Part	Test description	Verdict		
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	N/A		
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	N/A		
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	N/A		
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass		
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in N/A the 2400–2483.5 MHz band			
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in N/A the 902–928 MHz band			
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 2400–2483.5 MHz	Pass		
§15.247(b)(4)	Maximum peak output power	Pass		
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	N/A		
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple N/A directional beams			
§15.247(d)	Spurious emissions	Pass		
§15.247(e)	Power spectral density for digitally modulated devices	Pass		
§15.247(f)	Time of occupancy for hybrid systems	N/A		
Notes: None				

Product Sensor



Section 3: Equipment under test (EUT) and application details

3.1 Applicant details			
Applicant complete	Name:	Advanced Microwave Engineering s.r.l.	
business name	Federal Registration Number (FRN):	FRN0015463417	
	Grantee code	UKO	
Mailing address	Address:	Via Lucca, 50	
	City:	Firenze	
	Province/State:	Firenze	
	Post code:	50142	
	Country:	Italy	

3.2 Modular equipment		
a) Single modular	Single modular approval	
approval	Yes 🗌 No 🖂	
b) Limited single	Limited single modular approval	
modular approval	Yes 🗌 No 🖂	

3.3 Product details		
FCC ID	Grantee code:	UKO
	Product code:	PLXSENSSFT
Equipment class	DTS – Digital Transmis	sion system 15C
Description of		
product as it is	Model name/number:	EGO PRO SAFETY MOVE SENSOR
marketed	Serial number:	

3.4 Application purpose		
Type of application	\square	Original certification Change in identification of presently authorized equipment Original ECC ID:
		Class II permissive change or modification of presently authorized equipment

3.5 Composite/related equipment	
a) Composite	The EUT is a composite device subject to an additional equipment authorization
equipment	Yes 🛛 No 🗌
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that
	requires an equipment authorization
	Yes 🖂 No 🗌
c) Related FCC ID	If either of the above is "yes":
	has been granted under the FCC ID(s) listed below:
	is in the process of being filled under the FCC ID(s) listed below:
	is pending with the FCC ID(s) listed below:
	has a mix of pending and granted statues under the FCC ID(s) listed below:
	i FCC ID:UKOPLXTAGSFT
	ii FCC ID:

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	Section 3: EUT and application details	Product Sensor
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I 20853 Biassono (Italy)		

3.6 Sample information		
Receipt date:	2015-12-03	
Nemko sample ID number:		

3.7 EUT technical specifications		
Operating band:	2400 MHz ÷ 2483.5 MHz	
Operating frequency:	2402 MHz ÷ 2462 MHz	
Modulation type:	OOK on a random MSK modulated carrier	
Occupied bandwidth:	2 MHz	
Channel spacing:	5 MHz	
Emission designator:	1M96WXD	
Antenna type:	Integral, 7 dBi max	
	-	
Power source:	External 12-24Vdc	

3.8 Operation of the EUT during testing	
Details:	Transmitting to maximum power at 2402 MHz, 2442 MHz, 2462 MHz with the following modulation: OOK on a random MSK modulated carrier





Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT		
Modifications	Modifications performed to the EUT during this assessment	
	None 🛛 Yes 🗌, performed by Client 🗍 or Nemko 🗌	
	Details:	

4.2 Deviations from laboratory tests procedures	
Deviations	Deviations from laboratory test procedures None Yes - details are listed below:

4.3 Technical judgment		
Judgment	None	



Section 5: Test conditions

5.1 Power source and ambient temperatures		
Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.	
Power supply range:	The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ± 5 %, for which the equipment was designed.	



Section 6: Measurement uncertainty F

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Section 6: Measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to CISPR 16-4-2 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements" and is documented in the Nemko Spa Technical Procedure WML1002. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.



Section 7: Test equipment

7.1 Test equipment list				
Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
Spectrum Analizer 9 KHz ÷ 40 GHz	R&S	FSEK	848255/005	09/2016
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	11/2016
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018/07
Semi-anechoic chamber	Nemko	10m semi-anechoic chamber	530	2016/09
Antenna mast	R&S	HCM	836 529/05	NCR
Controller	R&S	HCC	836 620/7	NCR
EMI receiver 9 kHz ÷ 3 GHz	R&S	ESCI	100888	2016/09
LISN 9 kHz ÷ 30 MHz	R&S	ESH2-Z5	872 460/041	2016/11
Climatic Chamber	ESPEC	ARS 1100	410000067	2016/11
Loop antenna	R&S	HFH2-Z2	831247/011	2017/02
EMI receiver 20 Hz ÷ 8 GHz	R&S	ESU8	100202	2016/04
Bilog antenna 1 ÷18 GHz	Schwarzbeck	STLP 9148-123	123	09/2018
Double Ridged Waveguide Horn	RF SPIN	DRH40	061106a40	08/2016
Wide band Amplifier 18 GHz ÷ 40 GHz	MITEQ	AMF-5F-18004000- 37-8P	128061	11/2016
High pass filter	Wainwright Instruments	WHNX6-2555-3500- 26500-60CC	01	11/2016
Note: N/A = Not applicable, NCR = No cal re	equired, COU = Cal on use			



Section 8: Testing data

8.1 Clause 15.31(e) Variation of power source

§ 15.31 Measurement standards.

(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Special notes

None

Test data

NA

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8.2 Clause 15.31(m) Number of operating frequencies

§ 15.31 Measurement standards.

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz and less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Special notes

The frequency range over which the device operates is greater than 10 MHz. The tests were performed on three operating channels (low, mid, high)

Test data

The frequency band is 2402 MHz (channel 1) to 2462 MHz (channel 13) MHz therefore number of operating frequencies is 3.

Low frequency / channel 1	2402 MHz
Mid frequency / channel 7	2442 MHz
High frequency / channel 13	2462 MHz



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8.3 Clause 15.203 Antenna requirement

§ 15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Special notes

None

Test data

- The EUT uses a non-detachable antenna to the intentional radiator.

Detailed photo of RF connector:

E.U.T didn't have antenna connector but integral antenna.



8.4) tech	Clause 15.247(a)(2) Minimum 6 dB bandwidth for systems using digital modulation niques
§ 15	.247	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.
(a)	Ope inter	ration under the provisions of this Section is limited to frequency hopping and digitally modulated ntional radiators that comply with the following provisions:
	(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.
Spe	cial n	otes
Non	е	





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8.5	Cla	use 15.247(b) Maximum peak conducted output power
§ 15.2	47 Op	peration within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.
(b) T	he ma	aximum peak conducted output power of the intentional radiator shall not exceed the following:
(1	1) Foi hor hor	r frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping opping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency opping systems in the systems in the 2400–2483.5 MHz band: 0.125 watts.
(2	2) For hor cha	r frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 oping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping annels, as permitted under paragraph (a)(1)(i) of this section.
(3	3) For As me trai alp ant or i me	r systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. an alternative to a peak power measurement, compliance with the one Watt limit can be based on a asurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total namit power delivered to all antennas and antenna elements averaged across all symbols in the signaling habet when the transmitter is operating at its maximum power control level. Power must be summed across all ennas and antenna elements. The average must not include any time intervals during which the transmitter is off s transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation thods), the maximum conducted output power is the highest total transmit power occurring in any mode.
(4	4) The dire of c red am	e conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with ectional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be luced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the ount in dB that the directional gain of the antenna exceeds 6 dBi.
	(i)	Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.
	(ii)	Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.
	(iii)	Fixed, point-to-point operation, as used in paragraphs (b)(3)(i) and (b)(3)(ii) of this section, excludes the use of point-to- multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

Special notes	
None	

Test data, continued

Section (3) Results

Radiated measurements: 558074 D01 DTS Meas Guidance v03r03

Radiated measurements were performed:

- The EUT was measured on three orthogonal axis.
 - All measurements were performed at a distance of 3 m.



Test data, continued

Section (3) Results

Radiated measurements: 558074 D01 DTS Meas Guidance v03r03

Radiated measurements were performed:

- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:



Test data, continued

Section (3) Results, continued

Radiated measurements, horizontal polarization

Radiated measurements were performed:

- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:

Calculate the EIRP from the radiated field strength in the far field using Equation (22):

EIRP = E + 20log d -104.7 (22)

where

EIRP is the equivalent isotropically radiated power, in dBm

EMeas is the field strength of the emission at the measurement distance, in $dB\mu V\!/m$

dMeas is the measurement distance, in m (3m)

Frequency (MHz)	Field strength (dBµV/m)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
2402	119.6	24.44	36	-11.56
2442	116.9	21.74	36	-14.26
2462	116.6	21.44	36	-13.86

Note:.

Output power [dBm] = EIRP – Antenna gain [dBi] (7dBi)

Frequency (MHz)	EIRP (dBm)	Output power (dBm)	Limit (dBm)	Margin (dBm)
2402	24.44	17.44 (0.055 W)	30	-12.56
2442	21.74	14.74 (0.030 W)	30	-15.26
2462	21.44	14.44 (0.028 W)	30	-15.56
Note:				

Test data, continued

Section (3) Results, continued

Radiated measurements, vertical polarization

Radiated measurements were performed:

- The EUT was measured on three orthogonal axis.
- All measurements were performed at a distance of 3 m.
- All measurements were performed:

Calculate the EIRP from the radiated field strength in the far field using Equation (22):

EIRP = E + 20log d -104.7 (22)

where

EIRP is the equivalent isotropically radiated power, in dBm

EMeas is the field strength of the emission at the measurement distance, in $dB\mu V\!/m$

dMeas is the measurement distance, in m (3m)

Frequency (MHz)	Field strength (dBµV/m)	EIRP (dBm)	Limit (dBm)	Margin (dBm)
2402	113.5	18.34	36	-17.66
2442	114.00	18.84	36	-17.16
2462	116.82	21.66	36	-14.34

Note:.

Output power [dBm] = EIRP – Antenna gain [dBi] (7dBi)

Frequency (MHz)	EIRP (dBm)	Output power (dBm)	Limit (dBm)	Margin (dBm)
2402	18.34	11.34 (0.014 W)	30	-18.66
2442	18.84	11.84 (0.015 W)	30	-18.16
2462	21.66	14.66 (0.029 W)	30	-15.34
Note:.				



8.6 Clause 15.247(d) Spurious emissions

§ 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(d) 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 §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).



Special notes

§15.209 – Radiated emission limits					
Frequency	Field	Measurement distance			
(MHz)	(µV/m)	(dBµV/m)	(m)		
0.009-0.490	2400/F	67.6-20log(F)	300		
0.490-1.705	24000/F	87.6-20log(F)	30		
1.705–30.0	30	29.5	30		
30–88	100	40.0	3		
88–216	150	43.5	3		
216–960	200	46.0	3		
above 960	500	54.0	3		

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Notes:

F = fundamental frequency in kHz

– In the emission table above, the tighter limit applies at the band edges.

Section 8: Testing data

 For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

§15.205 – Restricted bands of operation

<u> </u>			
MHz	MHz	MHz	GHz
0.090-0.110	16.42–16.423	399.9–410	4.5–5.15
0.495-0.505	16.69475-16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425-16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725-4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291-8.294	149.9–150.05	2310-2390	15.35–16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7–21.4
8.37625-8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975-12.52025	240–285	3345.8–3358	36.43-36.5
12.57675-12.57725	322–335.4	3600-4400	Above 38.6
13.36–13.41			

- The spectrum was searched from 30 MHz to the 10th harmonic.

- The EUT was measured on three orthogonal axis.

All measurements were performed at a distance of 3 m.

- All measurements were performed:

- within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
- above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results

	Section 8: Testing data	Product: Sensor
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Test data

Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Duty cycle/average factor calculations: duty cycle =100%

Duty cycle / average factor =
$$20 \times \log_{10} \left(\frac{Tx_{100 ms}}{100 ms} \right)$$
 = not applicable



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Test data, continued

Test method: see 558074 D01 DTS Meas Guidance v03r03

Marker-delta measurement for 2.400 GHz Band Edge: delta level >20 dB for peak and average measurements





Product: Sensor

Test data, continued 6.10.5 Restricted-band band-edge measurements, horizontal polarization Marker 2 [T2] 114.62 dBµV/m 2.462224359 GHz Ø * RBW 1 MHz * VBW 3 MHz SWT 2.5 ms 117 dBµV/m * Att 10 dB Ref 1 [T1] Mar dBµV/r A .46230 3 [T: Marl 1 PK MAXH .48350 4 [T2 Marl 2 AV MAXH .48350 1 74 للملكل Monthline dB* Center 2.472 GHz Span 50 MHz 5 MHz/ 6.10.5 Restricted-band band-edge measurements, vertical polarization Ø *RBW 1 MHz Marker 2 [T2] 114.62 dBµV/m 2.462224359 GHz *VBW 3 MHz SWT 2.5 ms Ref 117 dBuV/m * Att 10 dB Marl 1 [T1 dBµV/i А Mark 3 [Т1 1 PK MAXH .48350 4 [T2 00 GH Mark 2 AV MAXH 00 GH 1 74 . المحملة المحمل 4 DB AC dB* ين يوجيلون

Center 2.472 GHz

5 MHz/

Span 50 MHz



Test data, con	tinued								
Radiated mean	sureme	nt horizontal i	olarization						
				Low char	nnel				
				Lott ond					
		805 87 (Bull/a) *3	* RIN 1. MHz N * VIN 3. MHz	farker 1 [F1] 56.35 dBpV/m	Ref Lvi 80 dB+		RBH 1 MHz RFAtt VBH 3 MHz SHT 100 ms Unit	0 dB dBµV∕m	
				farker 2 [T1] 60.90 dBpV/m 2.40224 590 GHz A	60 			A	
		1 TK -70-01 /4 GB*		48.78 (Pg)37/m 7.326923077 GHz	60				
		2 MV * - co	Ì	70P		£8+		Lance	
			and the start of t		40 ²⁰⁰⁴	munerener			
			and a second	300 AC	30		\sim		
					20				
					10				
					-10				
		51301 I 518	LUC HINA	Clop + Giz	-20				
		Date: 3.3EC.20.5 20:52:32			Start 8 GHz Date: 14.DF	: 1 GHz. FC.2015 20:29:00	Stop	18 GHz	
			🛞 Ref Lyl	RB VB	NI 1 MHz RFAtt NI 3 MHz	t 0 dB			
			87 dB+	SH	IT 70 ms Unit	dBµ¥∕m			
			80 						
			60		- Maria and				
			-1110-02 54 dB+ 50 2HAX	Martin Martin Martin		1HA ZAV			
			40		+				
			30		¥	TDF			
			20						
			10						
			-10						
			-13 Start 18 GHz Date: 14.DFC.	700 MHz/ 2015 21:01:20	s	Stop 25 GHz			
	1	1	I	r		1		1	1
E	Del	Peak field	O a mag attice of	Peak	Peak	Duty	Avg field	A	Avg
(MHz)	P0I.	strength	Correction (dB)	limit	margin	cycle	strength	AVg limit	margin
(10112)	V/П	(dBµV/m)	(ub)	(dBµV/m)	(dB)	(dB)	(dBµV/m)	(ubµv/iii)	(dB)
2402	h			Carrier (*)					
2 °thd	h	56.35							
Note: Correc	tion fac	tor includes a	ntenna, cable	e loss, ampli	fier, and a	attenuators.			
Only worst re	sults w	ere reported	(horizontal po	larization)					
(*) Attenuate	d by no	tch filter							
Radiated Meas	sureme	nts							
– All measure	remente	s were perform	ned at a dista	ance of 3 m					
 All measure 	rements	s performed:							
– within	30-100	0 MHz range	: using a qua	si-peak dete	ctor with	120 kHz/300	kHz RBW/	VBW,	
– above	1 GHz:	using peak o	letector with	1 MHz/3 MHz	z RBW/V	BW for peak	results		
– and us	sing ave	erage detecto	r with 1 MHz/	3 MHz RBW	/VBW for	average res	sults		

Product: Sensor

(*) Attenuated by notch filter

Report reference ID 286044-1TRFWL



Test data, cont	tinued								
Radiated meas	uremen	t vertical pola	arization						
		•		Low chan	nel	224	4 Mile 05 444 0 40		
		<i>Ŷ</i> ₽	* RBW 1 MHz Mark	er 1 [T1]	Ref Lvl 80 dB+	VBM SHT	3 MHz 100 ms Unit dBμV∕	n	
		Ref 87 dBµV/n *Att	* VIW 3 MBz 0 dB SW7 90 ms Mark	51.48 dBpV/m 4.802884615 GHz 4.2 [T1]	80 			A	
		1 3X -70		2.402243590 GHz - 3 UTL 3 40. nr. 2003020	60				
		SOCKI 2 333 ° - 60		7.326923077 GHz	D2 54 dB+				
		-50	un multime un	and the second as	1HAX 2010X	merenerariterine	and the second s	100 2AV	
		- Two			30	man			
			~	508 AC	20			TDF	
					10			-	
		-			•			-	
		a contract of the	70c M022	Here = 10 a	-10			-	
					-20 Start 8 GHz	1 GHz/	Stop 18 GH:		
		Date: 3.0EC.2015 20:53:19			Date: 14.DEC.201	15 20:29:00			
			Ref Lvi 87 dR-	RBH VBH GUT	1 MHz RFAtt 3 MHz 70 ms lin1t	0 dB			
			87			A			
			-D1 74 dB+						
			60			the second se			
			111002 54 dB+	Marchard and Marchard		1HA 2AV			
			40						
			30	1444		TDF			
			20						
			10						
			0						
			-10 -13 Start 18 SHr	200 MHz /	Stor	25.6Hz			
			Date: 14.DEC.20	15 21:03:14	510				
		Dool field		Deek	Deek	Duty	Avaitad		٨٠
Freq.	Pol.	strength	Correction	limit	Peak	cycle	Avg lielu	Avg limit	Avg
(MHz)	V/H	(dPu)//m)	(dB)	(dBu)//m)	(dB)	corr.	(dBu)//m)	(dBµV/m)	(dB)
		(ασμν/Π)		(ubµv/iii)	(ub)	(dB)	(ubµv/iii)		(ub)
2402	V	52.2		Carrier (*)	-				
2 thu	v 	51.5		74					
		-	-	17	_	1		-	
Note: Correct	ion facto	or includes an	tenna, cable	loss, amplifi	er, and at	ttenuators.			
Only worst re	sults we	re reported (h	orizontal pol	arization)					
(*) Attenuated	d by noto	ch filter							
Radiated Meas	uremen	ts							
– All measur	ements	were perform	ed at a dista	nce of 3 m.					
– All measur	ements	performed:							
– within 3	30–1000) MHz range:	using a quas	i-peak detec	tor with 1	20 kHz/300 l	KHz RBW/V	BW,	
– above	1 GHz:	using peak de	tector with 1	MHz/3 MHz	RBW/VB	W for peak i	results		
 – and us 	ing aver	age detector	with 1 MHz/3	MHz RBW/	VBW for a	average resu	ılts		



Test data, continued
Radiated measurement vertical polarization
Middle channel
Freq. (MHz)Pol. V/HPeak field strength (dBµV/m)Correction (dB)Peak limit (dBµV/m)Peak margin (dB)Duty cycle corr. (dB)Avg field strength (dBµV/m)Avg limit margin (dB)
2436 v 59.1 Carrier (*)
<u>2 tha V 50.5 /4</u>
Note: Correction factor includes antenna, cable loss, amplifier, and attenuators. Only worst results were reported (horizontal polarization) (*) Attenuated by notch filter
Radiated Measurements
 All measurements were performed at a distance of 3 m. All measurements performed: within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW, above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results and using average detector with 1 MHz/3 MHz RBW/VBW for average results



Test data, cont	tinued								
Radiated meas	uremer	it horizontal po	olarization						
				Middle cha	nnel				
				6	.	RBW	1 MHz RFAtt 0 dB		
		Image: Note of the second s	1 000 1 100 v v 1000 v v 1000 v v 1000 v v 1000 v v 1000 v v 1000 v v 1		Ref Lui 80 db- 10 db- 11 db- 10 db	884 V84 V84 Sur 10	1 PHL PF Att 0 dB 1 PHL 0 ms Unit dBpt/// 	A NA DF	
			Start 18 GHz Date: 14.DEC.20	700 MHz/ 15 21:09:03	Stop	p 25 GHz	I	1	
Freq. (MHz)	Pol. V/H	Peak field strength (dBµV/m)	Correction (dB)	Peak limit (dBµV/m)	Peak margin (dB)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
2436	h	57.1		Carrier (*)					
2° thd	h 	52.9							
	1	<u>I</u>	L	I	I	I	1	I	
Note: Correct Only worst re: (*) Attenuated	ion facto sults we by note	or includes an re reported (h ch filter	tenna, cable lorizontal pol	loss, amplifi arization)	er, and at	ttenuators.			
Radiated Meas	uremen	its							
– All measure	ements	were perform	ed at a dista	nce of 3 m.					
– All measur – within 3 – above	ements 30–100(1 GHz:	performed:) MHz range: using peak de	using a quas etector with 1	i-peak detec MHz/3 MHz	tor with 1 RBW/VB	20 kHz/300 k W for peak r	(Hz RBW/VI results	BW,	

Product: Sensor

- and using average detector with 1 MHz/3 MHz RBW/VBW for average results



Test data, continued Radiated measurement horizontal polarization High channel 1 MHz 3 MHz 100 ms RBW VBW SWT RF Att 0 dB Ref Lv1 80 dB• Ì 1 MHz 3 MHz Unit dBµV∕m 74 1 29 2 AV dB 8 GH 1 GHz/ Stop 18 GH Date: 23.APR.2016 11:16:19 Date RBN VBN SNT 14.DEC.2015 20:44:24 1 MHz RFAtt 0 dB 3 MHz 70 ms Unit dBµ4V/m Ref Lvi 87 dB+ -10 Start 18 GHz 14.DFC.2015 21:11:46 Stop 25 GHz 700 MHz/ Dete: Duty Peak field Peak Peak Avg field Avg Avg limit Freq. Pol. Correction cycle strength limit margin strength margin (MHz) V/H (dBµV/m) (dB) corr. (dBµV/m) $(dB\mu V/m)$ (dBµV/m) (dB) (dB) (dB) h --------------------------2° thd h 57.2 -------------------__ __ Note: Correction factor includes antenna, cable loss, amplifier, and attenuators. Only worst results were reported (horizontal polarization) (*) Attenuated by notch filter **Radiated Measurements** All measurements were performed at a distance of 3 m. All measurements performed: within 30-1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW, above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results _

Product: Sensor

- and using average detector with 1 MHz/3 MHz RBW/VBW for average results



Test data, continued Radiated measurement vertical polarization, High channel Ò 1 MHz RFAtt 3 MHz 100 ms Unit 0 dB Ref Lv1 80 dB+ rbh Vbh Sht dBµV∕i 1 196 2 AV 8 GH Date: 23.APR.2016 11:13:44 Date: 14.DEC.2015 20:46:53 1 MHz RFAtt 3 MHz 70 ms Unit 0 dB Ref Lvi 87 dB+ rbh Vbh Sut dBµV∕i -13 Start 18 GHz 700 MHz/ Stop 25 G Duty Peak field Peak Avg field Peak Avg Avg limit Freq. Pol. Correction cycle strength strength margin limit margin (dBµV/m) V/H (MHz) (dB) corr. $(dB\mu V/m)$ $(dB\mu V/m)$ (dBµV/m) (dB) (dB) (dB) 2480 60.6 Carrier (*) ٧ ---------------2° thd 54.7 ٧ ---74 ------------------___ --___ --___ ---Note: Correction factor includes antenna, cable loss, amplifier, and attenuators. Only worst results were reported (horizontal polarization) (*) Attenuated by notch filter **Radiated Measurements** All measurements were performed at a distance of 3 m. All measurements performed:

- within 30-1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
- above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results _
- and using average detector with 1 MHz/3 MHz RBW/VBW for average results _







Section 8: Testing data Product: Sensor

		¢	Demod AM	Att 0 dB AITTO	RBW 120 kHz Mar MT 1 s	ker 1 [T1] 26.53 dBµV	/m		
		di /r	BμV 60	100 MHz	PREAMP ON	1 G	Hz		
			-55				SGL		
		1 C1	-50						
			-45				TDS		
			FCCB						
			-35						
			-30				w		
				The second secon		- ANU LARY	6DB AC		
			20 June A		1 Indition	when the second s	_		
			Juny .		- Multimenter				
									
			-10	W WV					
			-10						
			-10 -5						
			-10 -10 -5 -0 30 MHz			1 G	Hz		
			-10			1 G	Hz		
		Da	-10 -10 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5 -5	0:16:45		1 6	HZ		
		Da		0:16:45		1 G	Hz		
Freq		Da Quasi Peak		0:16:45	Quasi Peak	Duty cycle	Avg field	Avalimit	Avg
Freq. (MHz)	Pol. V/H	Da Quasi Peak field strength		0:16:45	Quasi Peak margin (dB)	Duty cycle corr.	Avg field strength	Avg limit (dBµV/m)	Avg margin (dB)
Freq. (MHz)	Pol. V/H	Da Quasi Peak field strength (dBμV/m)		Quasi Peak limit (dBµV/m)	Quasi Peak margin (dB)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
Freq. (MHz) 31.5750	Pol. V/H	De Quasi Peak field strength (dBµV/m) 26.1 22.1	ate: 3.DEC.2015 2 Correction (dB) 12.4 12.2	0:16:45	Quasi Peak margin (dB) -13.9	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m) 	Avg margin (dB)
Freq. (MHz) <u>31.5750 37.9250</u> 101.9500	Pol. V/H	Da Quasi Peak field strength (dBµV/m) 26.1 22.1 32.5	ate: 3.DEC.2015 2 Correction (dB) 12.4 12.2 13.8	Quasi Peak limit (dBµV/m) 40.0 43.5	Quasi Peak margin (dB) -13.9 -17.9 -11.0	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
Freq. (MHz) <u>31.5750</u> <u>67.9250</u> 101.9500 162.0000	Pol. V/H v v v v	Da Quasi Peak field strength (dBμV/m) 26.1 22.1 32.5 25.5	Correction (dB) 12.4 12.4 12.2 13.8 10.7	Quasi Peak limit (dBµV/m) 40.0 43.5 43.5	Quasi Peak margin (dB) -13.9 -17.9 -11.0 -18.0	Duty cycle corr. (dB) 	Avg field strength (dBµV/m) 	Avg limit (dBµV/m) 	Avg margir (dB)
Freq. (MHz) 31.5750 67.9250 101.9500 162.0000	Pol. V/H v v v v	Da Quasi Peak field strength (dBμV/m) 26.1 22.1 32.5 25.5	Correction (dB) 12.4 12.4 12.2 13.8 10.7	Quasi Peak limit (dBµV/m) 40.0 43.5 43.5	Quasi Peak margin (dB) -13.9 -17.9 -11.0 -18.0	Duty cycle corr. (dB) 	Avg field strength (dBµV/m) 	Avg limit (dBµV/m) 	Avg margir (dB)
Freq. (MHz) 31.5750 67.9250 101.9500 162.0000 Note: Co	Pol. V/H v v v rrection fa	Quasi Peak field strength (dBµV/m) 26.1 22.1 32.5 25.5 actor includes	Correction (dB) 12.4 12.2 13.8 10.7 antenna, ca	0:16:45 Quasi Peak limit (dBµV/m) 40.0 40.0 43.5 43.5 ble loss, amplif	Quasi Peak margin (dB) -13.9 -17.9 -11.0 -18.0 ier, and atter	Duty cycle corr. (dB) 	Avg field strength (dBµV/m) 	Avg limit (dBµV/m) 	Avg margin (dB)
Freq. (MHz) 31.5750 67.9250 101.9500 162.0000 Note: Co	Pol. V/H v v v rrection fa	Quasi Peak field strength (dBµV/m) 26.1 22.1 32.5 25.5 actor includes a	Correction (dB) 12.4 12.4 12.2 13.8 10.7 antenna, ca	Quasi Peak limit (dBµV/m) 40.0 43.5 43.5 ble loss, amplif	Quasi Peak margin (dB) -13.9 -17.9 -11.0 -18.0 ier, and atter	Duty cycle corr. (dB) nuators.	Avg field strength (dBµV/m) 	Avg limit (dBµV/m) 	Avg margir (dB)



Test data, continued

Radiated measurement vertical polarization, middle channel

Section 8: Testing data



Freq. (MHz)	Pol. V/H	Quasi Peak field strength (dBµV/m)	Correction (dB)	Quasi Peak limit (dBµV/m)	Quasi Peak margin (dB)	Duty cycle corr. (dB)	Avg field strength (dBµV/m)	Avg limit (dBµV/m)	Avg margin (dB)
31.2500	v	23.9	12.4	40.0	-16.1				
67.9250	V	21.6	12.2	40.0	-18.4				
101.9250	V	33.7	13.8	43.5	-9.8				
135.0250	V	21.2	10.4	43.5	-22.3				
148.5000	V	22.0	10.2	43.5	-21.5				
162.0250	v	23.9	10.7	43.5	-19.6				
Note: Corr	ection fac	tor includes ar	ntenna, cab	le loss, amplifi	er, and atten	uators.			



Test data, continued Radiated measurement horizontal polarization, middle channel Marker 1 [T1] 31.09 dBµV/m 959.850000000 MHz Ì RBW 120 kHz Demod AM MT 1 s Att 0 dB AUTO PREAMP ON dBµV ∕m 10 MHz 1 PK Н FCCI + law W. Muyer wallak monorthe with 1 GHz 30 MHz Date: 3.DEC.2015 19:57:35 Quasi Quasi Duty Quasi Peak Avg field Avg Peak field Correction Peak Avg limit Freq. Pol. cycle limit strength margin (MHz) V/H strength (dB) margin corr. (dBµV/m) (dBµV/m) (dBµV/m) (dB) (dB) (dBµV/m) (dB) 98.0750 24.9 13.5 43.5 -18.6 h ------------162.0000 h 27.6 10.7 43.5 -15.9 ------------209.2000 h 23.9 13.3 43.5 -19.6 ----------Note: Correction factor includes antenna, cable loss, amplifier, and attenuators.



Test data, continued Radiated measurement horizontal polarization, high channel RBW 120 kHz Marker 1 [T1] 1 s 18.46 dBµV/m ON 162.00000000 MHz Ŷ MT 1 s PREAMP ON Demod AM Att 0 dB AUTO dBµV ∕m $100 \ MHz$ GHz GT. 1 PK CLRW ſ JA. 6DI AC the manunation tuht Mar 1 MWWW WWW 30 MHz 1 GHz Date: 3.DEC.2015 20:25:36 Duty Quasi Peak Quasi Peak Avg field Avg Freq. Pol. Correction Quasi Peak cycle Avg limit field strength limit strength margin V/H (dBµV/m) (MHz) (dB) margin (dB) corr. (dBµV/m) (dBµV/m) (dBµV/m) (dB) (dB) 40.0 68.0250 h 18.8 12.2 -21.2 -------------14.1 -27.9 101.9500 h 29.4 13.8 43.5 ------------43.5 135.0000 15.7 10.4 h ------------162.0000 h 25.1 10.7 43.5 -18.5 ------------Note: Correction factor includes antenna, cable loss, amplifier, and attenuators.



Test data,	contin	ued							
Radiated r	neasur	ement vertical	polarization	n, high channel					
			8		RBW 120 kHz	Marker 1 [T1]	,		
		d	Buy	Att 0 dB AUTO	PREAMP ON	170.800000000 M	/m Hz		
		7	m 60	100 MHz		1 GI	IZ		
		2	PK _50				SOL		
		Ŀ	-45						
			FCCB				TDS		
			-35						
			-30	/			7°		
			A-		+1	www.ww	6DB AC		
			20 11 10		Ă	where we have			
			-15		1 Mar March Walt				
			-10	W W					
			-5						
			0						
			50 MHZ			16	nz		
		D	ate: 3.DEC.2015	20:22:03					
Freq.	Pol.	Quasi Peak	Correction	Quasi Peak	Quasi Peak	Duty cycle	Avg field	Avg limit	Avg
(MHz)	V/H	(dBμV/m)	(dB)	limit (dBµV/m)	margin (dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
	v	24.7	10.4	40.0	15.2				
31.3500	v	24.7	12.4	40.0	-15.5				
67.7250	v	25.0	12.3	40.0 42 F	-10.2				
101.5500	v	35.3	13.8	43.5	-8.2				
135.0250	v	18.0	10.4	43.5	-25.5				
162.0000	V	24.4	10.7	43.5	-19.1				
170.8000	v	18.6	11.0	43.5	-24.9				
Note: Co	rrectio	n factor include	es antenna,	cable loss, am	plifier, and a	ttenuators.			
High cha	nnel ra	idiated measul	red in vertica	ai and norizont	ai polarizatio	n with proto	col 802.11n		



Setup photos





Product Sensor



8.7 Clause 15.247(e) Power spectral density for digitally modulated devices § 15.247 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz.

(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.

Special	l notes
-	The test was performed using guidelines of ANSI C63.10-2013,
_	PSD option 1 was used since output power option 1 was used. Emission peak was located and zoomed in. RBW was set to 3 kHz, VBW was set > RBW.
	Sweep line was set to Spanis kinz. Feak level was medsuled.



Product Sensor

Nemko Spa Via del Carroccio, 4 I 20853 Biassono (Italy)





Theoretical conversion from Field Strength measured at 3 m to power conducted from the intentional radiator to the PSD [dBm/3 kHz] = EIRP – Antenna gain [dBi] (7 dBi)





Section 9: Block diagrams of test set-ups





Section 10: EUT photos

Section 10: EUT photos

