



**Telecommunications & Telematics
for Transports Lab.**

TEST REPORT

Ref. No. ARSK00037

Date: 2010-05-07

Measurements performed in accordance with:



**FCC Rules : Code of Federal Regulations (CFR) no. 47
PART 15 – RADIO FREQUENCY DEVICES**

PRODUCT : RADIOCONTROL 4 CHANNEL

TESTED MODEL : KOMPASS4

FCC ID : X97KMZ

APPLICANT : MZ ELECTRONIC S.r.l. – Via Bainsizza, 2 –I- 20052 MONZA

MANUFACTURER : MZ ELECTRONIC S.r.l. – Via Bainsizza, 2 –I- 20052 MONZA

TRADEMARK : MZ ELECTRONIC; LEWMAN; LOFRANS', MARINNO.

OTHER INFORMATION : Testing dates : 2010-03-04÷2010-03-05
IMQ BEM: 53367

Tested samples No. : 1

Testing Laboratory : IMQ S.p.A. Via Quintiliano, 43 I-20138 MILANO

Tested by : R. Radice Signature: *Roberto Radice* Date : 2010-05-07

Checked by: R. Colombo (Lab. Deputy) Signature: *R. Colombo* Date : 2010-05-07

Revision Sheet

Release No.	Date	Revision Description
Rev. 0	2010-05-04	Test Results and Evaluation Report
Rev. 1	2010-05-07	Substitution of duty cycle graphics on" Radiated disturbances" test

NOTICE: The results of tests and checks reported in this Test Report refer exclusively to the samples tested and described in the Report itself. This report shall not be reproduced partially or in its entirety without the written approval of IMQ S.p.A.

IMQ S.p.A. - Via Quintiliano, 43 – I-20138 MILANO

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1 GENERAL DESCRIPTION OF EQUIPMENT UNDER TEST

1.1 APPLICANT

NAME	MZ ELECTRONIC S.r.l.
ADDRESS	Via Bainsizza, 2 – 20052 MONZA
COUNTRY	ITALY

1.2 MANUFACTURER

NAME	MZ ELECTRONIC S.r.l.
ADDRESS	Via Bainsizza, 2 – 20052 MONZA
COUNTRY	ITALY

1.3 EQUIPMENT CLASSIFICATION

According to the definition 15.3 (o) EUT is a Class B digital device. A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments. Examples of such devices include, but are not limited to, personal computers, calculators, and similar electronic devices that are marketed for use by the general public. Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as a Class B device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use so it shall fulfil provisions of **47CFR Part 15 Subpart C – Intentional radiators** – Section 15.231 and 15.209.

1.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Parameters	Value
Type of equipment :	▪ Radiocontrol 4 channel
Model:	▪ KOMPASS4
FCC ID. :	▪ X97KMZ
Trade Name:	▪ MZ ELECTRONIC; LEWMAN; LOFRANS', MARINNO.
Data cable :	▪ None
Telecom cable :	▪ None
Power supply type :	▪ None
AC power input cable :	▪ None
DC power input cable :	▪ None

1.5 FEATURE OF EQUIPMENT UNDER TEST

Power specification	▪ 2 x 1,5V batteries type AAA
Operating frequency:	▪ 433,92 MHz
Maximum RF output power:	▪ 72,54dBuV/m (peak)
Modulation:	▪ ASK / FSK
Channel Spacing:	▪ Wideband
Antenna:	▪ Integrated on PCB
Main SW identification	▪ /
Main HW Board identification	▪ /
Peripherals included (for system application)	▪ None
Interfaces :	▪ None
Integrated interfaces :	▪ None
AC adapter:	▪ None

1.6 MODELS AND VARIANTS

MODEL (basic)	
<ul style="list-style-type: none"> RADIOCONTROL 4 CHANNEL mod. KOMPASS4 	Transmitter with 5 push-button
VARIANT	
<ul style="list-style-type: none"> RADIOCONTROL 2 CHANNEL mod. KOMPASS2 	Transmitter with 3 push-button; no electrical difference. The only difference is the external front side case with only 3 push-buttons
Tested Model consideration:	
On the above items only tests on basic model were considered to be carried out, it is deemed the worst case situation from the emission measurements tests.	

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST

2.1 ENVIRONMENTAL CONDITIONS

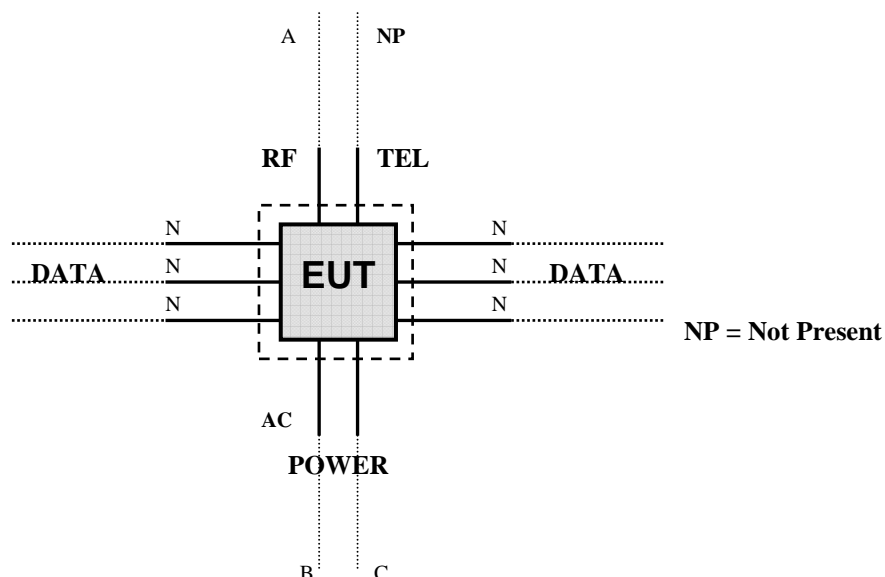
TEST CONDITIONS	MEASURED
Ambient Temperature	20 ÷ 25 °C
Relative Humidity	50 ÷ 60 %
Atmospheric Pressure	900 ÷ 1000 mbar

2.2 DESCRIPTION OF SUPPORT EQUIPMENT

Here following the details concerning equipment needed for correct operation or loading of the EUT:

EQUIPMENT	MANUFACTURER	MODEL
Radiocontrol 4 channel (receiver unit)	MZ ELECTRONIC	KOMPASS4
It has been used only for to control the correct working of transmitter unit.		

2.3 INTERFACE IDENTIFICATION AND CONNECTION DIAGRAM OF TEST SYSTEM



#	Interface	Description	Maximum length	Ref. Document
1	Enclosure	Plastic surface, closed by 6 metallic screws	/	/
2	AC mains power input/output port	Not present	/	/
3	DC power port	Nº2 Internal batteries 1,5V type AAA	/	/
4	Signal / control port	Not present	/	/
5	Antenna port (RF)	Integrated on PCB	/	/

3 OPERATION OF EQUIPMENT UNDER TEST

3.1 OPERATING TEST CONDITIONS

Ref.	Description
#1	TX: continuous transmission at 433,92MHz

4 TESTS IDENTIFICATION AND RESULTS

TABLE 1 : SUMMARY OF TESTS

PERIODIC OPERATION – TRANSMISSION OF A CONTROL SIGNAL

CFR47 Part 15 Section	Title	Operating condition	Result	Test No.
15.203	Antenna Requirements	/	PASS	1
15.109	Radiated Emission (unintentional)	Not applicable		
15.207 (a)	Conducted Emission	Not applicable: the equipment is supplied by an internal battery		
15.209 (a) (f)	Radiated Emission	#1	PASS	2
15.231	Periodic operation in the band 40.66-40.70 MHz and above 70 MHz			
15.231 (a) (1)	Duration of manually activated transmission	#1	PASS	3
15.231 (a) (2)	Duration of automatically activated transmission	Not applicable		
15.231 (a) (3)	Transmission at predetermined / regular intervals	Not applicable		
15.231 (a) (4)	Pendency of transmission used during emergencies	Not applicable		
15.231 (a) (5)	Transmission of set-up information for security systems	Not applicable		
15.231 (b)	Fundamental Signal Strength 433.92 MHz	#1	PASS	2
15.231 (b)	Radiated Spurious Emission (intentional)	#1	PASS	2
15.231 (c)	Bandwidth of the emission	#1	PASS	4
15.231 (d)	Frequency stability in band 40.66÷40.70 MHz	Not applicable		

**PERIODIC OPERATION – PERIODIC RATE EXCEEDING THAT SPECIFIED
IN PARAGRAPH 15.231 (a)**

CFR47 Part 15 Section	Title	Operating condition	Result	Test No.
15.231 (e)	Fundamental Signal Strength 433.92 MHz		Not applicable	
15.231 (e)	Radiated Spurious Emission (intentional)		Not applicable	
15.231 (e)	Duration of transmission		Not applicable	
15.231 (e)	Period between transmissions		Not applicable	

4.1 METHODS OF MEASUREMENT

All compliance measurements have been carried out using the procedures described in the standard ANSI C63.4-2003 (excluding sub-par. 4.1.5.2, 5.7.9 and 14) and Section 15.31 of CFR47 Part 15 – Subpart A (General).

Additional test requirements have been adopted according to the reference Section indicated in the Test Table

4.2 FREQUENCY RANGE INVESTIGATED

- a. Radiated emission tests : from 2 MHz to tenth harmonic of fundamental

5 EMC TEST DATA

TEST No. 1	Title "Antenna Requirements"	47CFR Part 15 Ref. Section
		15.203 / 15.204
TEST REQUIREMENTS	<p>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 Sections 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 Section 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.</p>	

Antenna specifications		
N° of authorized antenna types	▪ 1	
Antenna type	▪ Integrated on PCB	
Maximum total gain	▪ < 6 dBi	
External power amplifiers	▪ Not present	
Antenna Description		
No.	Manufacturer	Model Type
1	By MZ ELECTRONIC	/

Test Result:

The transmitter meets the requirements of section 15.203 and 15.204

TEST No.2	Title “Radiated disturbances”	47CFR Part 15 Ref. Section
		15.209 15.231 (b)
TEST REQUIREMENTS	Test setup	ANSI C63.4
	Test facility	Anechoic chamber
	Test distance	3 m
	Limits for radiated disturbances	15.209 (a)
	Frequency range	2 MHz to tenth harmonic of fundamental
	IF bandwidth (below 30 MHz)	9 kHz
	IF bandwidth (below 1000 MHz)	120 kHz
	IF bandwidth (above 1000 MHz)	1 MHz
	EMC class	B
	(*) In accordance with part 15.31 (f) (2), where the measurement distance was specified to be 30 or 300 meters, a correction factor was applied in order to permit measurement to be performed at a separation distance. The applied formula for limits at 3 meter is: Extrapolation (dB) = $40\log(300\text{meter} / 3\text{meter}) = +80\text{db}$ Extrapolation (dB) = $40\log(30\text{meter} / 3\text{meter}) = +40\text{db}$	

- 1) The EUT was placed on turntable which is 0.8 m above the ground plane
- 2) The turntable shall rotate from 0° to 360° degrees to determine the position of maximum emission level.
- 3) The EUT is positioned 3 m away from the receiving antenna which varied from 1 to 4 m to find the highest emission.
- 4) The measurements were made with the detector set to PEAK and AVERAGE amplitude within a bandwidth of 100 kHz below 1000 MHz and 1 MHz above 1000 MHz.
- 5) The receiving antenna was positioned in both horizontal and vertical polarization.
- 6) The measurements with Quasi-Peak detector, below 1000 MHz are performed only for frequencies for which the Peak values are \geq (Q.P. limit – 6 dB).

LIMITS FOR FUNDAMENTAL

Fundamental	Average Limit (dB μ V/m)	Peak (dB μ V/m)
433,92 MHz	80,82	100,82 (Average + 20 dB)

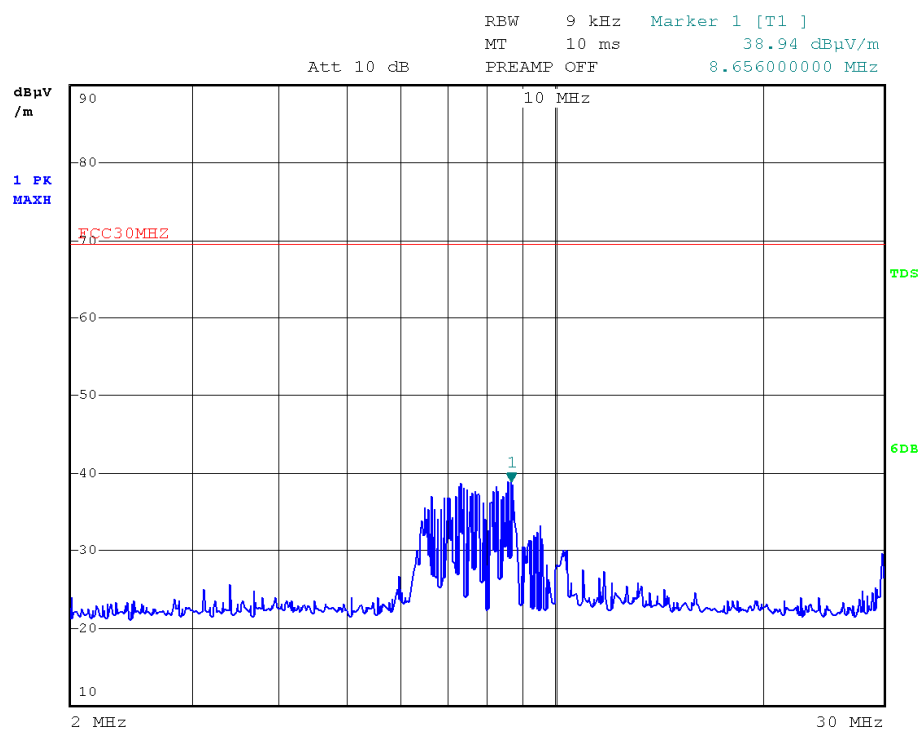
LIMITS FOR SPURIOUS

Band of operations	Peak (dB μ V/m)	Average Limit (dB μ V/m)
Restricted bands (par. 15.205)	74,00	54,00
Other bands	According to 15.209 or fundamental –20dB (which is greater)	According to 15.209 or fundamental –20dB (which is greater)
Unintentional radiators	According to 15.109	/

Tested samples

SAMPLE	
1)	Model Kompass4 with 4 channel

MEASUREMENTS RESULTS (2MHz+30 MHz)



MEASUREMENTS RESULTS (30+1000 MHz)

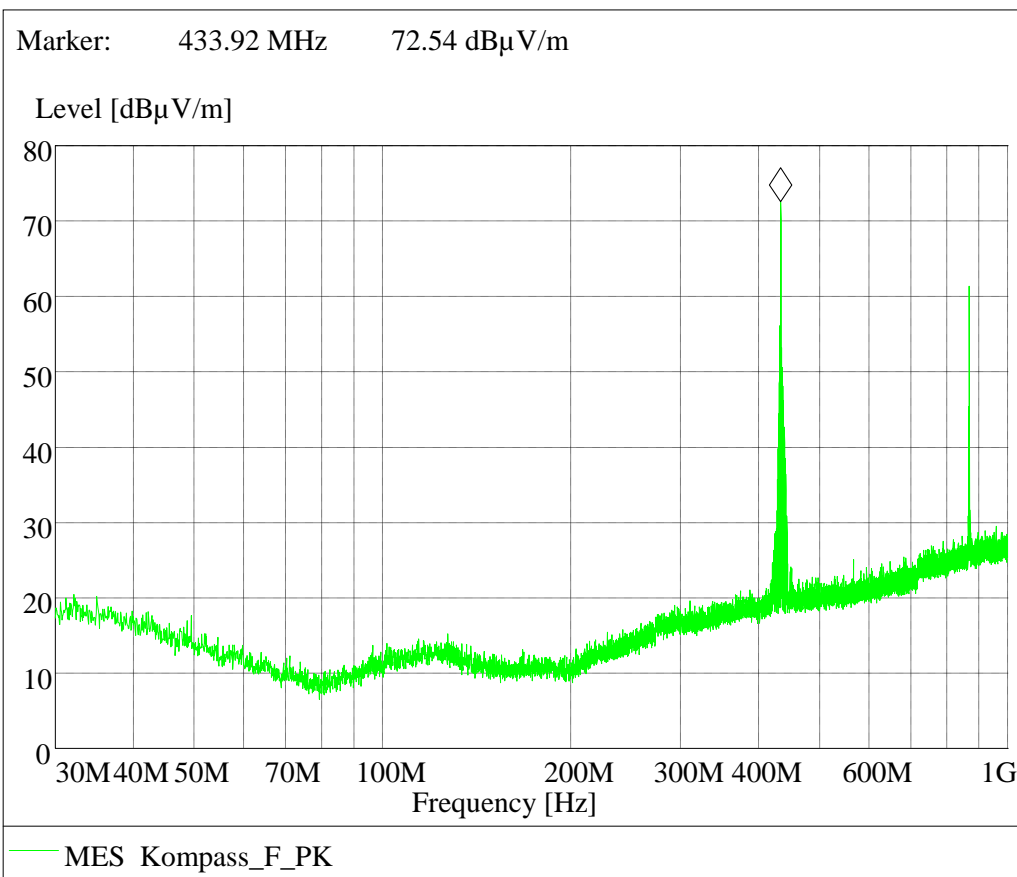


TABLE OF RESULTS (30+1000 MHz)
PEAK RESULT (RBW=100kHz; VBW=300kHz)

Frequency (MHz)	Measured Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)	Pol.
433,92 (fundamental)	72,54	109900,58	100,82	28,28	Horizontal
867,84	61,34	10996,68	80,82	19,48	Vertical

AVERAGE FACTOR

TX on (ms)	TX on + TX off (ms)	Duty cycle (Tx on/ Tx on + Tx off)	Average Factor (dB) 20log (1/duty cycle)
16,92	45,36	0,373	8,56

AVERAGE RESULT

Frequency (MHz)	Calculated Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)	Pol.
433,92 (fundamental)	63,98	10996,68	80,82	16,84	Horizontal
867,84	52,78	1199	60,82	8,04	Vertical

MEASUREMENTS RESULTS (1000 MHz to 4400 MHz)

PEAK RESULT (RBW=1MHz; VBW=1MHz)

Frequency (MHz)	Measured Level (dB μ V/m)	Limit (μ Volt/meter)	Limit (dB μ V/m)	Margin (dB)	Pol.
1301,76*	53,74	5000	74,00	20,26	Vertical
1735,68	59,89	10996,68	80,82	20,93	Vertical
2169,60	61,27	10996,68	80,82	19,55	Horizontal
2603,52	63,35	10996,68	80,82	17,47	Horizontal
3037,44	57,96	10996,68	80,82	22,86	Horizontal
3471,36	45,58	10996,68	80,82	35,24	Horizontal
3905,28*	58,24	5000	74,00	15,76	Horizontal
4339,20*	52,51	5000	74,00	21,49	Vertical

*= frequencies inside of restricted bands of operation; field strength emission limit at these frequencies is 74 dB μ V/m

AVERAGE FACTOR

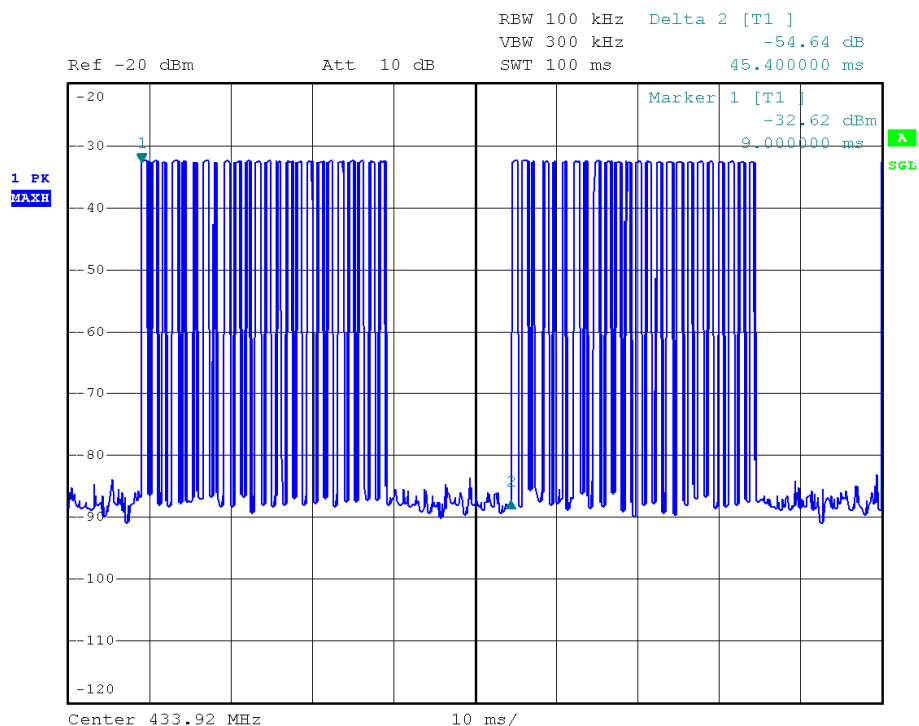
TX on (ms)	TX on + TX off (ms)	Duty cycle (Tx on/ Tx on + Tx off)	Average Factor (dB) 20log(1/duty cycle)
16,92	45,36	0,373	8,56

AVERAGE RESULT

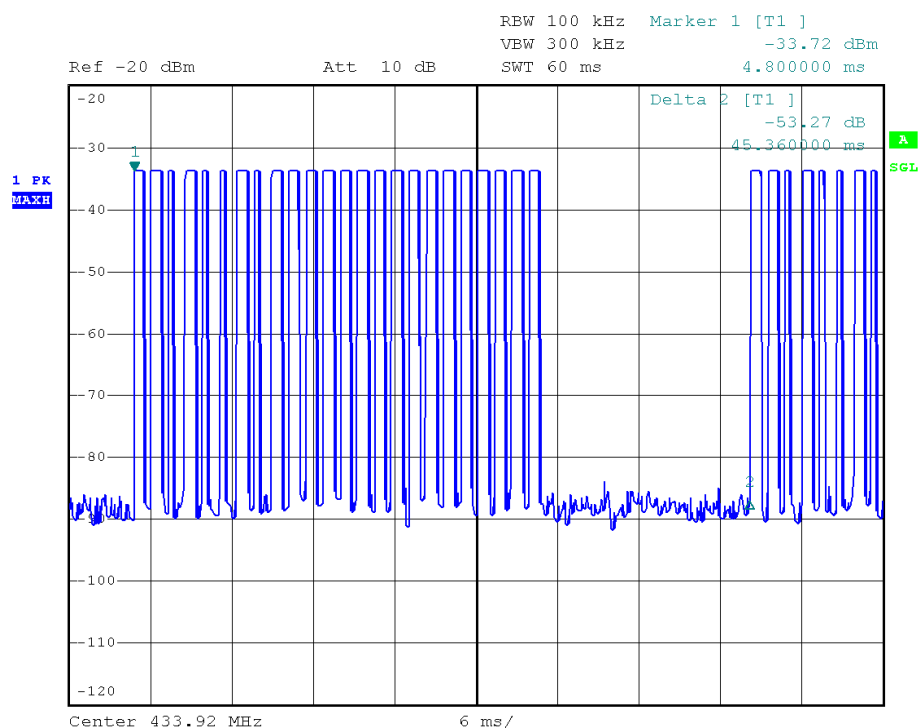
Frequency (MHz)	Calculated Level (dBμV/m)	Limit (μVolt/meter)	Limit (dBμV/m)	Margin (dB)	Pol.
1301,76*	45,12	500	54,00	8,88	Vertical
1735,68	51,33	500	60,82	9,49	Vertical
2169,60	52,71	500	60,82	8,11	Horizontal
2603,52	54,79	500	60,82	6,03	Horizontal
3037,44	49,40	500	60,82	11,42	Horizontal
3471,36	37,02	500	60,82	23,8	Horizontal
3905,28*	49,68	500	54,00	4,32	Horizontal
4339,20*	43,95	500	54,00	10,05	Vertical

*= frequencies inside of restricted bands of operation; field strength emission limit at these frequencies is 54 dBμV/m

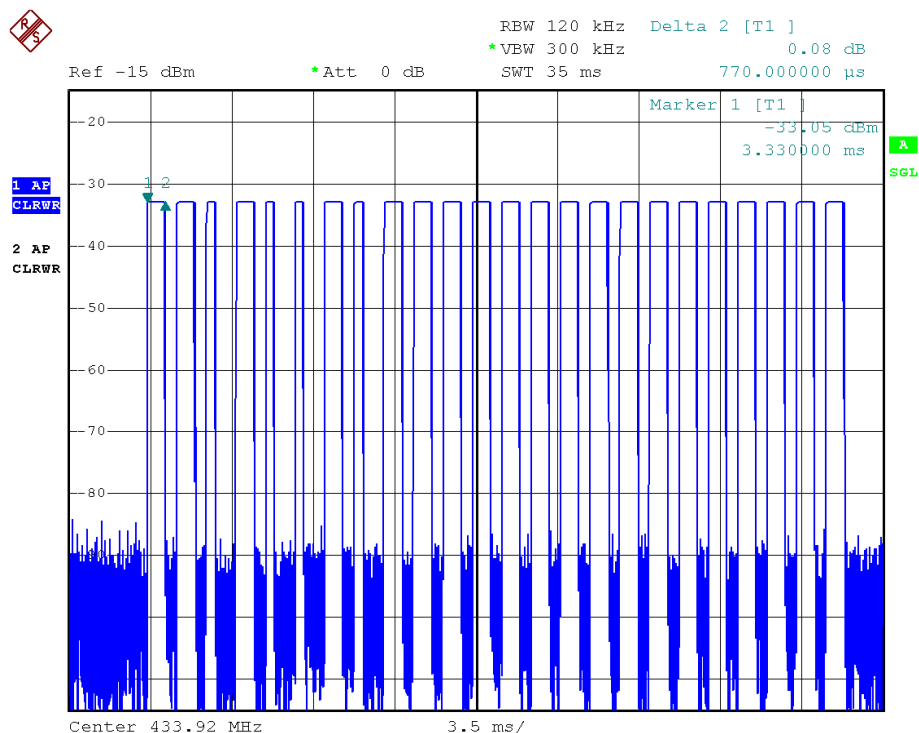
Number of transmissions in 100ms : 2 transmissions



Duration of single packet (TX ON + TX OFF): 45,36 ms



Duration of single time slot (TX ON): 770 μ s



CONCLUSIONS:

In a single packet data (45,36 ms) there are:

20 time slot of 770 μ s, 2 time slot of 420 μ s and 2 time slot of 350 μ s.

The total TX ON is: 16,920ms

The total TX OFF is: 28,440ms

TEST No. 3	Title “Characteristics of transmission”	47CFR Part 15 Ref. Section
		15.231 a) 1) 2) 3) 4)
TEST REQUIREMENTS	<p>The provisions of this Section are restricted to periodic operation within the band 40.66 -MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:</p> <p>(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.</p> <p>(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.</p> <p>(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.</p> <p>(4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.</p> <p>(5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.</p>	

Requirement	Description
15.231 a) 1	The equipment transmits only in manual condition; it ceases to function immediately after the push-button is released.
15.231 a) 2	No automatic transmission
15.231 a) 3	No Periodic transmissions
15.231 a) 4	Not applicable; the transmitter transmits only in manual condition and is not employed for radio control purposes during emergencies.
15.231 a) 5	Not applicable

Test Result:

The transmitter meets the requirements of section 15.231 a)

TEST No. 4	Title “Radiated disturbances and Bandwidth in periodic transmission”		47CFR Part 15 Ref. Section 15.231 c)
TEST REQUIREMENTS	TEST SETUP	CISPR Pub. 22 :1997	
	TEST FACILITY	Anechoic chamber	
	MAXIMUM PERMITTED BANDWIDTH	47CFR Part 15 Ref. Section: 15.231 (c) 0,25% of the center frequency	
	SPAN	Necessary to capture entire emission bandwidth	
	RBW	5% of permitted bandwidth	
	VBW	≥ to RBW	
	DETECTOR FOR BANDWIDTH WIDER	PEAK	

ANSI C63-4 Specification

▪ 13.1.7 Occupied bandwidth measurements

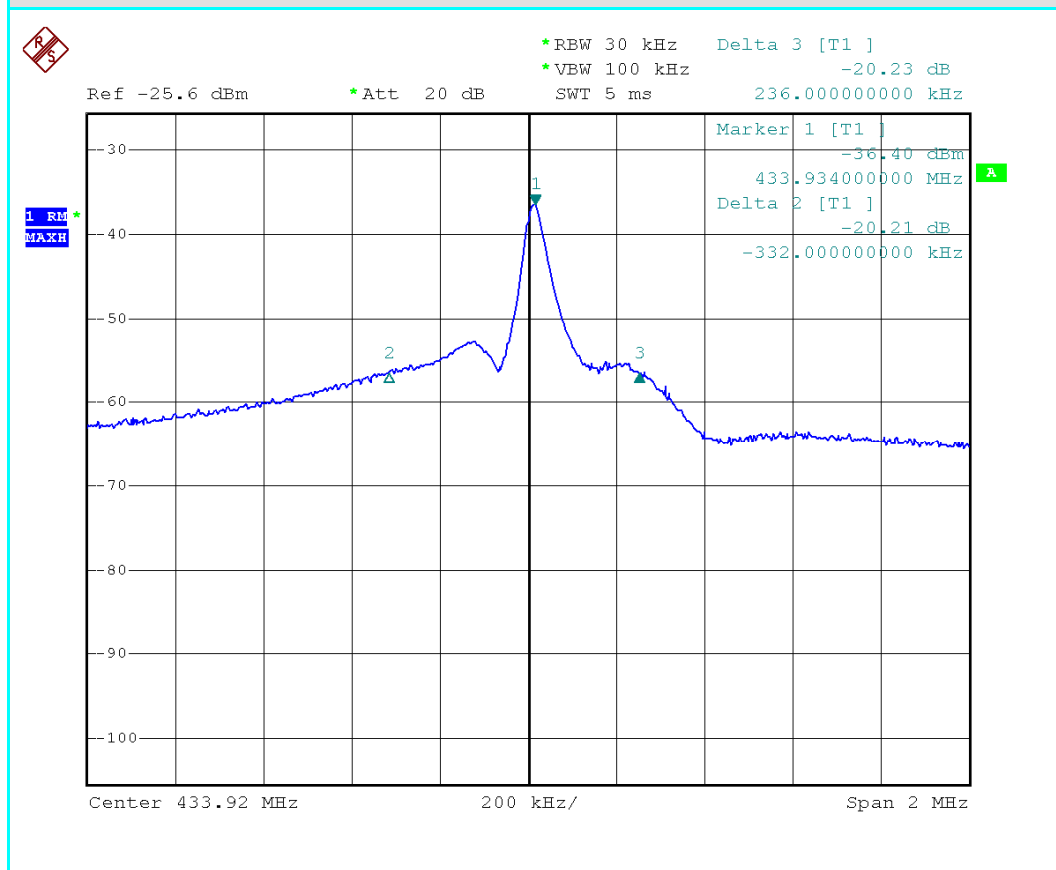
In order to measure the modulated signal properly, a resolution bandwidth that is small compared with the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument.

However, the resolution bandwidth of the measuring instrument shall be set to a value greater than 5% of the bandwidth requirements. When no bandwidth requirements are specified, the minimum resolution bandwidth of the measuring instrument is given in the following table:

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

Considering that the limit for 433,92 MHz is 1.084 kHz, 5% of this bandwidth is 54,2 kHz. Automatic setting of Spectrum Analyzer for this bandwidth is 30 kHz. For these consideration, the Laboratory has been used a Resolution Bandwidth of 30kHz and a Video Bandwidth of 100 kHz.

BANDWIDTH WIDER IN PERIODIC TRANSMISSION



Frequency	Bandwidth at -20dB point	Limit (0,25% of 433,92 MHz)	Margin
MHz	kHz	kHz	kHz
433,92	568	1084	516

6 ADDITIONAL TECHNICAL INFORMATION

6.1 Electromagnetically relevant components:

Components	No.	Manufacturer	Type – Technical data
Radio Transmitter	1	Infineon	TDK5110
Microcontroller with internal oscillator at 8MHz	1	Microchip	PIC16F627A
13,56 MHz Quartz	1	/	/

6.2 RFI suppression devices:

Components	N°	Manufacturer	Type – Technical data
None			

6.3 EMI protection devices:

Components	N°	Manufacturer	Type – Technical data
None			

7 TECHNICAL DOCUMENTATION

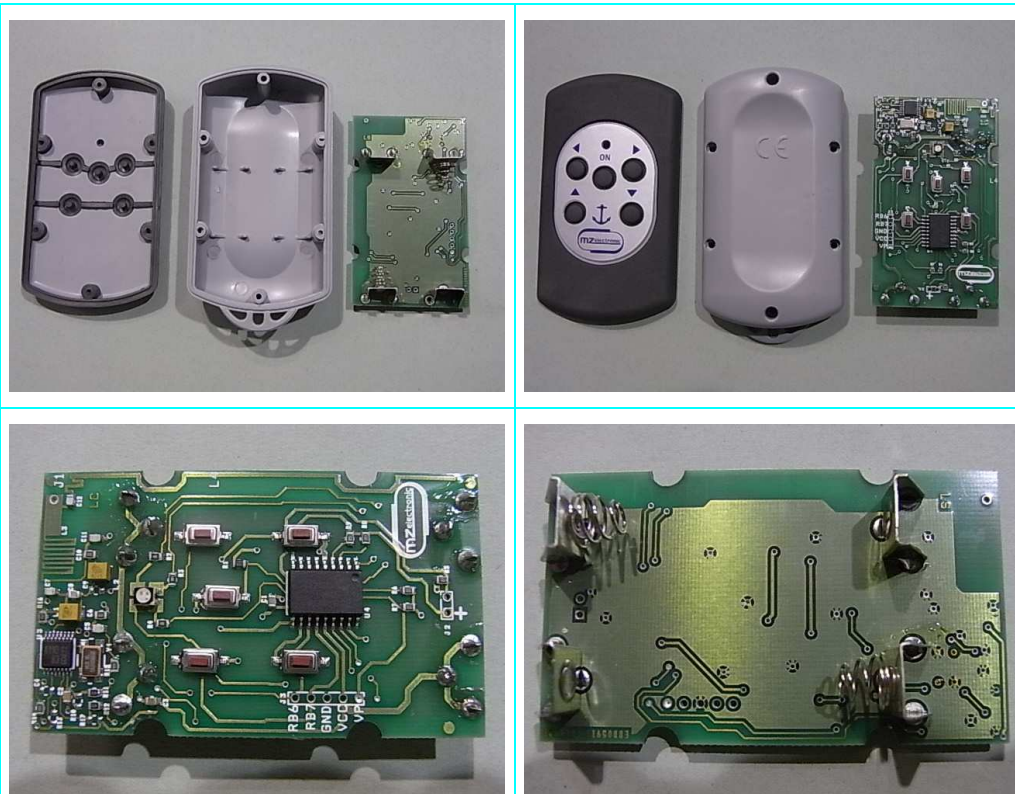
DOCUMENT	REFERENCE
Radiocontrol 2/4 channel - Instructions for use	Rev. 04 - 2010
Kompass_TX_BlockDiagram	Revision 1
Kompass_TX_BOM	Schematic code: EBB059TX Rev. 1
Kompass_TX_BottomLayer	Revision 1
Kompass_TX_Layout	Revision 1
Kompass_TX_Schematic	Schematic code: EBB059TX Rev. 1
Kompass_TX_TopLayer	Revision 1

8 PHOTOGRAPHIC DOCUMENTATION

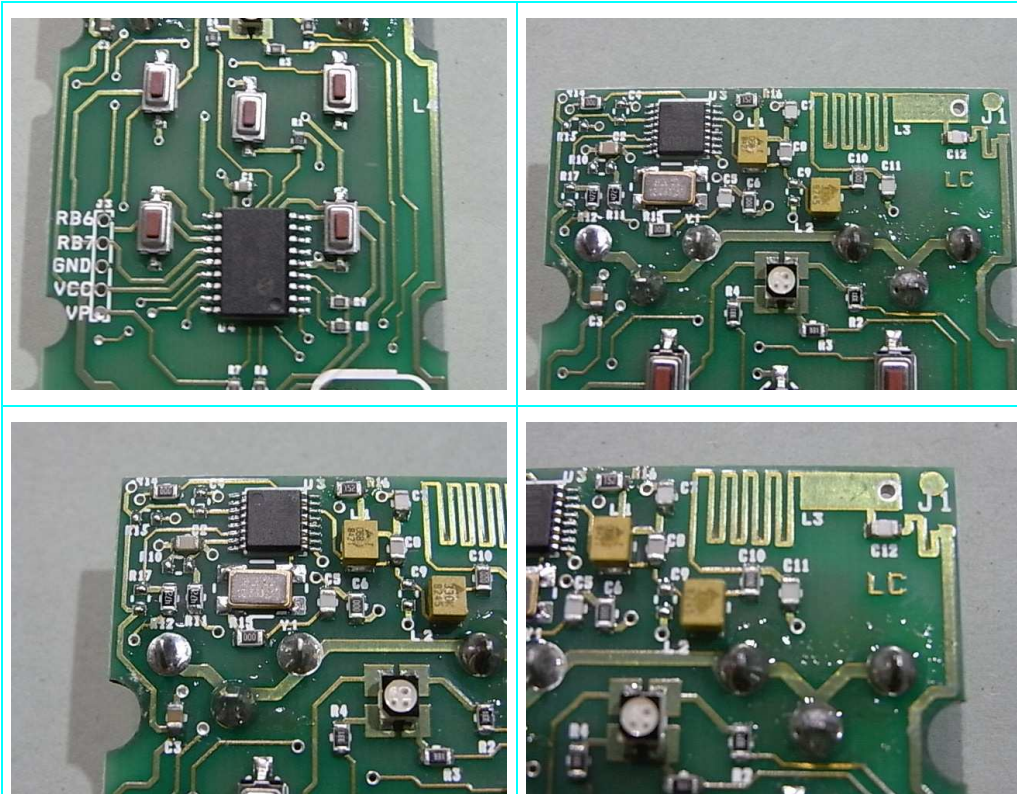
8.1 EUT IDENTIFICATION



Equipment under test identification



Internal view



Internal view

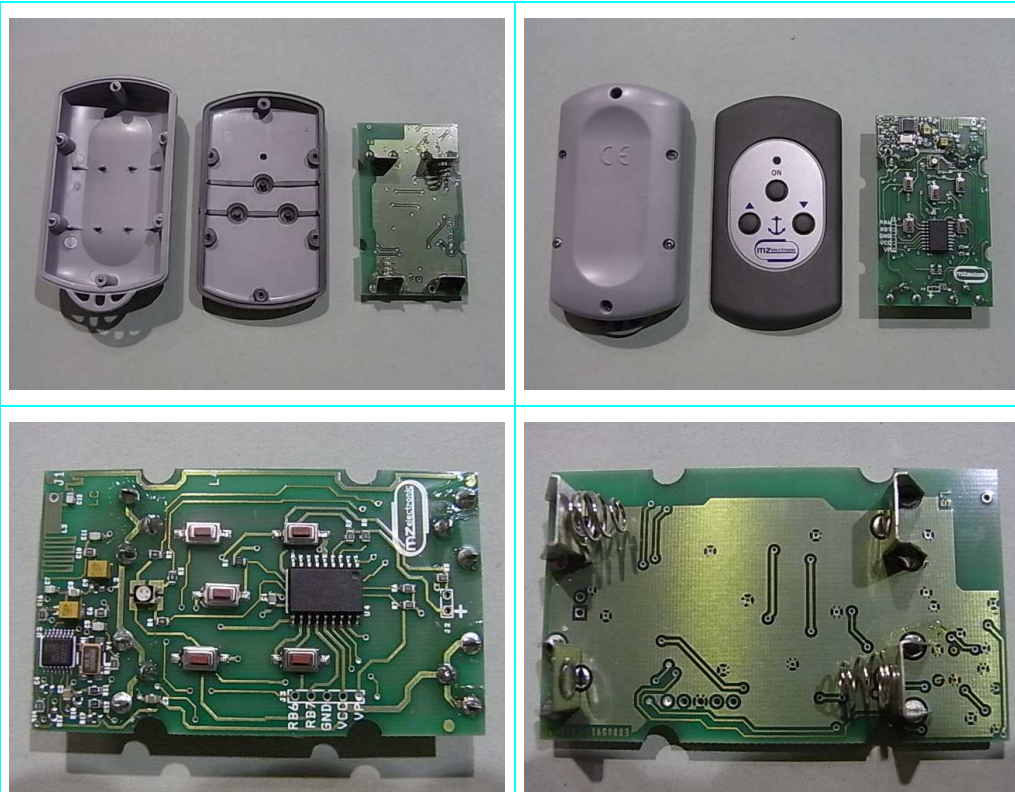


Set up for Radiated emission test

8.2 DERIVED MODEL



Derived model identification



Derived model - Internal view

9 MEASUREMENT AND TEST EQUIPMENT INSTRUMENTATION

Instruments	Manufacturer	Model	IMQ serial number	Calibration data	Calibration interval (Month)
Emi Receiver	Rohde & Schwarz	ESCI	S-04355	12/2009	12
Emi Receiver	Rohde & Schwarz	ESVS	S-04197	12/2008	18
Spectrum Analyzer	Rohde & Schwarz	FSP40	S-03629	11/2009	24
Loop Antenna	Rohde & Schwarz	HFH2-Z2	S-02508	12/2008	24
Antenna Bilog	ARA	LPD-2513	S-02385	07/2009	24
Antenna ridged horn 1÷18 GHz	Schwarzbeck	BBHA9120D	S-03464	02/2009	24
Pre-amplifier 1-26.5 GHz	HP	HP 8449 B	S-03542	07/2008	24
Pre-amplifier 30-1000 MHz	BONN ELEKTRONIK	BLNA	S-04193	12/2008	24
Digital Oscilloscope	Yokogawa	DL7200	S-03745	05/2009	12
Crystal Detector	Agilent	8472B	S-04467	/	/
Software for test automation	Rohde & Schwarz	ES-K1 V.1.60	/	/	/

The IMQ instruments are tested and calibrated according to UNI EN 45001, the IMQ procedure IP-037 "Calibration test equipment and measurement" and according to plans set on IMQ operating instruction IO-FT-034 "Criteria for the calibration of test equipment and measurement" which are an integral part of the Quality Manual of IMQ.