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RA-02-33183/03/A/ST

**FCC CERTIFICATION
E.M.C. Measurement
Technical Report**

standards to apply:

FCC Part 15.109

FCC Part 15.111

Equipment under test:

MI16-433

FCC ID : KQG MI16-433


Company:

RENISHAW METROLOGY LTD

DISTRIBUTION: Mr WOOLLETT

Company: RENISHAW METROLOGY LTD

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EQUIPMENT UNDER TEST

type: MI16-433
serial number: Q04620

MANUFACTURER: RENISHAW METROLOGY LTD

COORDINATES OF THE COMPANY SUBMITTING THE EQUIPMENT:

Company: RENISHAW METROLOGY LTD

Address: New Mills, Wotton Under Edge
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Responsible: Mr WOOLLETT

DATE (S) OF THE TEST: 22, 23 and 24 May 2002

LOCALITY OF THE TEST: EMITECH ATLANTIQUE open area test site in LA POUEZE
(49) France
EMITECH ATLANTIQUE laboratory at ANGERS (49) France

TESTED BY: D. GRATON

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1. INTRODUCTION

This document presents the result of E.M.C. test carried out on the following equipment: MI16-433 in accordance with normative reference.

2. PRODUCT DESCRIPTION

Utilization: interface for machine tools telemetry, receiver

Antenna type: 2 external antennas (diversity mode)

Operating frequency range: from 433.075 MHz to 434.775 MHz

No of channels: 69

Channel spacing: 25 kHz

Frequency generation: SAW Resonator Crystal Synthetiser

Modulation: Amplitude Digital Frequency Phase

Power source: 24 Vdc

Power level, frequency range and channels characteristics are not user adjustable.

The details pictures of the product and the circuit boards are joined with this file.

3. NORMATIVE REFERENCE

FCC Part 15 (2000) Code of Federal Regulations
Title 47 - Telecommunication
Chapter 1 - Federal Communications Commission
Part 15 - Radio frequency devices
Subpart C - Intentional Radiators

4. TEST METHODOLOGY

Radio performance tests procedures given in part 15:

- Paragraph 109: radiated emission unintentional
- Paragraph 111: antenna power conduction limits for receivers
- Paragraph 33: frequency range of radiated measurements
- Paragraph 35: measurement detector functions and bandwidths

5. RELATED SUBMITTAL GRANT

The receiver MI16-433 is used with the telemetry sensor transmitter RMP3-433 (FCC ID: KQG RMP3-433).

The receiver MI16-433 can be supplied with an optional source power voltage (FCC ID: KQG MI16-224).

6. TEST UNIT CONFIGURATION

JOINED DOCUMENTATIONS

<i>“Block diagram”</i>	<i>MI16 433 BREAK DOWN.pdf</i>
<i>“External photos and Product labeling”</i>	<i>MI16 433 EXTERNAL PHOTOS.pdf</i>
<i>“Assembly of components”</i>	<i>MI16 433 CAB.pdf</i>
<i>“Internal photos”</i>	<i>MI16 433 INTERNAL PHOTOS.pdf</i>
<i>“Layout pcb”</i>	<i>MI16 433 LAYOUT.pdf</i>
<i>“Bil of materials”</i>	<i>MI16 433 PART LIST.pdf</i>
<i>“Schematics”</i>	<i>MI16 433 SCHEMATIC.pdf</i>
<i>“Product description”</i>	<i>MI16 433 TECHNICAL SPEC.pdf</i>
<i>“User guide”</i>	<i>MI16 433 USER GUIDE.pdf</i>
<i>“Antenna drawing”</i>	<i>MI16 433 RMM2.pdf</i>

7. TESTS AND CONCLUSIONS

Test procedure	Description of test	Criteria respected ?				Comment
		Yes	No	NAP	NAs	
FCC Part 15.109	RADIATED EMISSIONS UNINTENTIONAL	X				
FCC Part 15.111	ANTENNA POWER CONDUCTION LIMITS FOR RECEIVERS	X				

NAP: Not Applicable

NAs: Not Asked

Conclusion:

The sample of MI16-433 submitted to the tests complies with the regulations of the standard FCC Part 15 in accordance with the limits or criteria defined in this report.

8. RADIATED EMISSIONS UNINTENTIONAL**Standard:** FCC Part 15 (2000)**Test procedure:** paragraph 109**Test equipment:**

TYPE	BRAND	REFERENCE
Test receiver	Rohde & Schwarz ESVS 10	1/02/12/049
Biconical antenna	Hewlet Packard 11966 C	3/24/18/117
Log periodic antenna	Rohde & Schwarz HL 223	3/24/18/194
Double ridged guide antenna	Electrometrics EM 6961	3/24/18/201
Spectrum analyser	Rohde & Schwarz FSEM30	1/02/12/050
Open area test site	EMITECH	3/16/12/016
Preamplifier	DBS Microwave DB97-1852	3/01/12/076
High pass filter	Micro-tronics HPM11630	3/18/12/146

Test set up:

The system is tested in an open area test site (OATS).

The test unit is placed on a rotating table, 1.5 m from a ground plane. Zero degree azimuth corresponds to the front of the equipment under test.

Frequency range: The highest frequency generated in the device being $F = 411.675$ MHz, then the frequency range is:
 from 30 MHz to harmonic 10 ($F_{\text{carrier}} \leq 1$ GHz)
 (See FCC Part 15 Sec.15.33)

Detection mode: Quasi-peak for the range 30 MHz - 1 GHz
 Average for $F > 1$ GHz

Bandwidth: 120 kHz for the range 30 MHz - 1 GHz
 1 MHz for $F > 1$ GHz

Distance of antenna: 10 meters (Class A)

Antenna height: 1 to 4 meters

Antenna polarization: vertical and horizontal

Equipment under test operating condition:

The equipment is in continuous receive mode.

Results:

Ambient temperature (°C): 17 | 16
 Relative humidity (%): 72 | 74

Power source: 24 V

Lowest Channel

FREQUENCIES (MHz)	Antenna height (cm)	Polarization H: Horizontal V: Vertical	Azimuth (degrees)	Field strength (dBµV/m)	Limits (dBµV/m)
411.676	100	H	230	41.8	46.44
448.022	303	H	290	30	46.44
492.022	100	H	80	35.6	46.44
648.029	145	V	180	35.3	46.44
823.35	132	V	140	36.6	46.44
1235.02	192	V	0	42.92	49.54
1646.7	128	V	200	36.15	49.54
2058.38	100	V	200	39.93	49.54
2470.07	125	V	260	41.41	49.54
2881.72	210	V	240	38.69	49.54
3293.4	151	V	270	40.8	49.54
4116.75	197	V	0	38	49.54

Highest Channel

FREQUENCIES (MHz)	Antenna height (cm)	Polarization H: Horizontal V: Vertical	Azimuth (degrees)	Field strength (dBµV/m)	Limits (dBµV/m)
413.376	100	H	240	42.2	46.44
448.022	100	H	90	30.8	46.44
492.022	100	H	80	34.7	46.44
648.029	304	V	0	35.5	46.44
826.752	110	V	100	36.8	46.44
1240.12	216	V	120	44.82	49.54
1653.5	173	V	180	35.49	49.54
2066.87	107	V	220	36.23	49.54
2480.25	193	V	270	43.26	49.54
2893.63	174	V	240	41	49.54
3307	145	V	270	41.7	49.54
4133.75	143	V	150	39.82	49.54

9. ANTENNA POWER CONDUCTION LIMITS FOR RECEIVERS

Standard: FCC Part 15 (2000)

Test procedure: paragraph 111

Test equipment:

TYPE	BRAND	REFERENCE
Spectrum analyser	Rohde & Schwarz	1/02/12/050
Radiofrequency generator	Rohde & Schwarz	2/04/24/055

Test set up:

Conducted measurement.

Frequency range: The highest frequency generated in the device being $F = 411.675$ MHz, then the frequency range is:
from 9 kHz to harmonic 10 ($F_{\text{carrier}} \leq 1$ GHz)
(See FCC Part 15 Sec.15.33)

Detection mode: Below 1 GHz: quasi peak
Above 1 Ghz: average

Bandwidth: 9 kHz for the range 9 kHz – 30 MHz
120 kHz for the range 30 MHz - 1 GHz
1 MHz for $F > 1$ GHz

Equipment under test operating condition:

The equipment is in continuous receive mode.

Results:

Ambient temperature (°C): 19

Relative humidity (%): 50

Power source: 24 V

Lowest Channel (antenna connector RMM21)

FREQUENCIES (MHz)	Field strength (nW)	Limits (nW)
5.63	0.024	2
411.675	0.968	2
596.03	0.015	2
720.031	0.024	2
823.35	0.005	2
856.036	0.021	2
1235.02	0.07	2
2058.37	0.041	2
2470.05	0.25	2
2881.72	0.631	2
3293.4	0.5	2
3705.07	0.2	2
4116.75	0.305	2

Highest Channel (antenna connector RMM21)

FREQUENCIES (MHz)	Field strength (nW)	Limits (nW)
5.62	0.019	2
413.375	1.7	2
648.028	0.017	2
826.75	0.009	2
856.04	0.019	2
1240.12	0.324	2
1653.5	0.006	2
2066.87	0.047	2
2480.25	0.136	2
2893.62	1.43	2
3307	0.034	2
3720.37	0.437	2
4133.75	0.023	2

Lowest Channel (antenna connector RMM22)

FREQUENCIES (MHz)	Field strength (nW)	Limits (nW)
5.61	146 x 10 ⁻⁹	2
411.675	1.2	2
660.03	0.012	2
823.35	0.01	2
876.04	0.017	2
1235.02	0.135	2
1646.7	0.033	2
2058.37	0.51	2
2470.05	1.69	2
2881.72	1.35	2
3293.4	0.107	2
3705.07	0.03	2
4116.75	0.556	2

Highest Channel (antenna connector RMM22)

FREQUENCIES (MHz)	Field strength (nW)	Limits (nW)
5.61	181 x 10 ⁻⁹	2
413.375	1.59	
648.028	0.027	2
826.75	0.02	2
928.04	0.01	2
1240.12	0.154	2
1653.5	0.054	2
2066.87	0.549	2
2480.25	1.13	2
2893.62	0.758	2
3307	0.734	2
3720.37	0.038	2
4133.75	1.1	2

10. PHOTOGRAPHIES OF THE EQUIPMENT UNDER TEST

General view



Photography open area test site: weather protection enclosure

