

TEST REPORT NO: RL1021/286
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**REPORT ON THE
CERTIFICATION TESTING OF A
RENISHAW METROLOGY LTD
RMP2-224, inc. MP3
RADIO PROBE TRANSMITTER
S/No's P68713 & E74889
WITH RESPECT TO
THE FCC 47CFR, Pt 15.209
INTENTIONAL RADIATOR
SPECIFICATION**

TEST DATE: 18 FEBRUARY 1999

TESTED BY: *R P I Parry* R P I PARRY
APPROVED BY: *S P Hayes* S P HAYES
ISSUE DATE: *23rd April 1999*

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| Notes:- | | |
| 1. Component failure during test | YES NO | [] [X] |
| 2. If Yes, details of failure:- | | |
| 3. All measurement uncertainty calculations detailed in this report are carried out in accordance with UKAS Publication NIS 81, Edition 1, May 1994, for a 95% confidence level. | | |
| 4. The contents of the attached applicant's declarations and other supplied information are not covered by the scope of this laboratory's UKAS or FCC accreditations and is provided in good faith. | | |

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): RMP2-224, inc. MP3

EQUIPMENT TYPE: RADIO PROBE TRANSMITTER

SERIAL NUMBER OF EUT: S/No's P68713 & E74889

PURPOSE OF TEST: FCC CERTIFICATION

TEST SPECIFICATION: FCC 47CFR Pt 15.209

RESULT OF TEST: COMPLIANT YES
NO

CATEGORY OF APPLICANT: (a) MANUFACTURER
(b) IMPORTER
(c) DISTRIBUTOR
(d) AGENT

APPLICANT'S ORDER NO: RM095794

APPLICANT'S CONTACT PERSON: MARTIN WOOLLETT

APPLICANT: RENISHAW METROLOGY LTD

ADDRESS: NEW MILLS
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EUT(s) COUNTRY OF ORIGIN: UNITED KINGDOM

TEST LABORATORY: TRL EMC LTD

UKAS ACCREDITATION NO: 0728

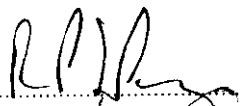
DATE OF TEST: 18 FEBRUARY 1999


TEST REPORT No: RL1021/286



CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY: KGQ RMP2-224
PURPOSE OF TEST: FCC Certification
TEST SPECIFICATION: FCC 47CFR, Part 15.209
TEST RESULT: Compliant to Specification
EQUIPMENT UNDER TEST: RMP2-224, inc. MP3
EQUIPMENT SERIAL No: S/No's P68713 & E74889
ITU EMISSION CODE: 7K00F2DAN
EQUIPMENT TYPE: Radio Probe Transmitter
UTILISATION: Machine Tool Telemetry
CARRIER EMISSION: +43.9dB μ V/m @ 3m
ANTENNA TYPE: Fixed, or Integral
ALTERNATIVE AE: None, as per Part 15.203
BAND OF OPERATION: 224.5MHz to 225.475MHz
CHANNEL SPACING: 5kHz
No. of CHANNELS: 40
FREQUENCY GENERATION: SAW Resonator []; Crystal []; Synthesizer [X]
MODULATION METHOD: Amplitude []; Digital []; Angle [X]
POWER SOURCE(s): +9Vdc, 6 x AA alkaline cells
TEST DATE: 18 FEBRUARY 1999
ORDER No: RM095794
APPLICANT: RENISHAW METROLOGY LTD
NEW MILLS
WOTTON-UNDER-EDGE
GLOUCESTERSHIRE
GL12 8JR
UNITED KINGDOM

TESTED BY:  R P I PARRY

APPROVED BY:  S P HAYES
EMC MANAGER

TESTS REQUIRED

TRANSMITTER TESTS

| | |
|--|-------|
| Transmitter Spurious Emissions - Powerline - Part 15.207 | [n/a] |
| Transmitter Carrier Emission - Radiated - Part 15.209.a | [X] |
| Transmitter Spurious Emissions - Radiated - Part 15.209.c - <30MHz | [X] |
| Transmitter Spurious Emissions - Radiated - Part 15.209.c - >30MHz | [X] |

Notes:-

- | | |
|--|-------|
| 1. Equipment tested for (mains ac) 110V powerline emissions. | [n/a] |
| 2. Equipment tested as (fixed) integral antenna configuration. | [X] |
| 3. All tests were carried out with new batteries, as per Part 15.31.e. | [X] |

SAMPLE CALCULATIONS

Part 15.207 - Powerline.

| Frequency (MHz) | Rx (dB μ V) | LISN Correction (dB) | Cable loss (dB) | Powerline (dB μ V) |
|-----------------|-----------------|----------------------|-----------------|------------------------|
| n/a | | | | |

Part 15.209 - Radiated.

| Frequency (MHz) | Rx (dB μ V) | 3m Correction (dB) | Ae AF & Cable loss (dB/m & dB) | Field Strength @ 3m (dB μ V/m) |
|-----------------|-----------------|--------------------|--------------------------------|------------------------------------|
| 224.500 | +24.7 | n/a | +19.2 | +43.9 |
| 898.000 | -17.7 | n/a | +32.5 | +14.8 |
| n/a | | | | |

TRANSMITTER TESTS

TRANSMITTER CARRIER EMISSION - RADIATED - PART 15.209.a

| | | | | |
|---------------------|---|----------------------------|---------------------------|-----|
| Ambient temperature | = | +12°C | 3m measurements <30MHz | [] |
| Relative humidity | = | 68% | 1m measurements >1GHz | [] |
| Conditions | = | Open Area Test Site (OATS) | 300m extrapolated from 3m | [] |
| Supply voltage | = | Vnom | 30m extrapolated from 3m | [] |
| Channel number | = | 1 | 3m extrapolated from 1m | [] |

| | | | |
|-------------------------|------------------|------------------------|------------------------|
| Frequency & Level | | 224.500MHz | +43.9dB μ V/m @ 3m |
| Limit | 216MHz to 960MHz | +46.0dB μ V/m @ 3m | |
| Measurement Uncertainty | | ±4.2dB | |

Notes:-

1. Results quoted are extrapolated as indicated.
2. Extrapolation factor @ 40dB/decade from 300m to 30m, as per Part 15.31f.
3. Extrapolation factor @ graph values from 30m to 3m, as per Annex D.
4. Extrapolation factor @ 9.5dB from 1m to 3m, as per Part 15.31f.
5. Measurements <490kHz @ 3m, as per Part 15.31f (2).
6. Measurements <1705kHz @ 3m, as per Part 15.31f (2).
7. Measurements <30MHz @ 3m, as per Part 15.31f (2).
8. Measurements >1GHz @ 1m, as per Part 15.31f (1).
9. Receiver detector <30MHz = CISPR, Quasi-Peak, 10kHz bandwidth.
10. Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
11. Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth.
12. Sample calculation, see page 6.

Test Method:-

1. As per Radio - Noise Emissions, ANSI C63.4: 1992.
2. Measuring distances as Notes 1 to 7 (inc) above.
3. EUT 0.8 metre above ground plane.
4. Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

1. Full description at Annex B.
2. TRL190, TRL191, TRL08, TRL415, TRL251.

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS - RADIATED - PART 15.209.c - <30MHz

| | | | | |
|---------------------|---|----------------------------|---------------------------|-----|
| Ambient temperature | = | +12°C | 3m measurements <30MHz | [X] |
| Relative humidity | = | 68% | 300m extrapolated from 3m | [X] |
| Conditions | = | Open Area Test Site (OATS) | 30m extrapolated from 3m | [X] |
| Supply voltage | = | Vnom | | |
| Channel number | = | 1 | | |

| | | | |
|--|-------------------|--|-------------------|
| Frequency & Level 9kHz to 490kHz | | nil emissions | >10dB below limit |
| Frequency & Level 490kHz to 1705kHz | | nil emissions | >10dB below limit |
| Frequency & Level 1705kHz to 30MHz | | nil emissions | >10dB below limit |
| Limits | 9kHz to 490kHz | $20\text{Log}_{10}[2400/F(\text{kHz})]\text{dB}\mu\text{V/m @ 300m}$ | |
| | 490kHz to 1705kHz | $20\text{Log}_{10}[24000/F(\text{kHz})]\text{dB}\mu\text{V/m @ 30m}$ | |
| | 1705kHz to 30MHz | +29.5dB $\mu\text{V/m @ 30m}$ | |
| Measurement Uncertainty | | ±4.2dB | |

Notes:-

- Results quoted are extrapolated as indicated.
- Emissions were searched to:- (x) 2500MHz inclusive, as per Part 15.33a.
- Extrapolation factor @ 40dB/decade from 300m to 30m, as per Part 15.31f.
- Extrapolation factor @ graph values from 30m to 3m, as per Annex D.
- Measurements <490kHz @ 3m, as per Part 15.31f (2).
- Measurements <1705kHz @ 3m, as per Part 15.31f (2).
- Measurements <30MHz @ 3m, as per Part 15.31f (2).
- Receiver detector <30MHz = CISPR, Quasi-Peak, 10kHz bandwidth.
- Nil emissions sensitivity of +36dB $\mu\text{V/m @ 3m}$.
- Sample calculation, see page 6.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- Measuring distances as Notes 1 to 7 (inc) above.
- EUT 0.8 metre above ground plane.
- Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL08, TRL07, TRL237.

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS - RADIATED - PART 15.209.c - >30MHz

| | | | | |
|---------------------|---|------------------------------|-------------------------|-----|
| Ambient temperature | = | +12°C (<1GHz), +21°C (>1GHz) | 3m measurements <1GHz | [X] |
| Relative humidity | = | 68% (<1GHz), 66% (>1GHz) | 1m measurements >1GHz | [X] |
| Conditions | = | Open Area Test Site (OATS) | 3m extrapolated from 1m | [X] |
| Supply voltage | = | Vnom | | |
| Channel number | = | 1 | | |

| | | |
|--|--|---|
| Frequency & Level 30MHz to 88MHz | nil emissions | >10dB below limit |
| Frequency & Level 88MHz to 216MHz | nil emissions | >10dB below limit |
| Frequency & Level 216MHz to 960MHz | 449.000MHz 673.500MHz 898.000MHz | +7.7dBµV/m @ 3m +12.1dBµV/m @ 3m +14.8dBµV/m @ 3m |
| Frequency & Level 960MHz to (x) MHz | nil emissions | >10dB below limit |
| Limits | 30MHz to 88MHz | +40.0dBµV/m @ 3m |
| | 88MHz to 216MHz | +43.5dBµV/m @ 3m |
| | 216MHz to 960MHz | +46.0dBµV/m @ 3m |
| | 960MHz to (x) MHz | +54.0dBµV/m @ 3m |
| Measurement Uncertainty | ±4.1dB | |

Notes:-

1. Results quoted are extrapolated as indicated.
2. Emissions were searched to:- (x) 2500MHz inclusive, as per Part 15.33a.
3. Extrapolation factor @ 9.5dB from 1m to 3m, as per Part 15.31f.
4. Measurements >1GHz @ 1m, as per Part 15.31f (1).
5. Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
6. Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth.
7. Sample calculation, see page 6.

Test Method:-

1. As per Radio - Noise Emissions, ANSI C63.4: 1992.
2. Measuring distances as Notes 1 to 4 above.
3. EUT 0.8 metre above ground plane.
4. Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

1. Full description at Annex B.
2. TRL190, TRL191, TRL08, TRL415, TRL164, TRL251, TRL203, TRL138, TRL279.