FCC 47CFR part 15C
Test Report
For
MEMS Command Unit
RV3-01-CF

Reference Standard: FCC 47CFR part 15C
Report produced for: Michelin
For type of equipment and serial number, refer to section 3
Report Number: 02-530/4927/1A/12
Supercedes report # 02-530/4927/1/12
Report Produced by: -

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Certificate of Test 4927/1A

The unit noted below has been tested by **R.N. Electronics Limited** and, where appropriate, conforms to the relevant subpart of FCC 47CFR Part 15. This is a certificate of test only and should not be confused with an equipment authorisation. Other standards may also apply.

Equipment:	MEMS Command Unit
Model Number: Proposed FCC ID:	RV3-01-CF FI5-RV3-01-CF
Unique Serial Number:	#1
Applicant:	Michelin Americas Research & Development Corp 515 Michelin Rd Greenville South Carolina SC 29615 USA
Customer Purchase Order Number:	Not stated
Full measurement results are detailed in Report Number:	02-530/4927/1A/12
Test Standards:	FCC 47CFR Part 15B & C effective date **October 1st 2011,** Class DSR and DCD Intentional Radiator

NOTE:
Certain other requirements are subject to manufacturer declaration only and have not been tested/verified.

DEVIATIONS:
Deviations from the standards have been applied. For details refer to section 4.2 of this report.

This certificate relates only to the unit tested as identified by a unique serial number and in the condition at the time it was tested. It does not relate to any other similar equipment and performance of the product before or after the test cannot be guaranteed. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of unit not meeting the intentions of the standard or the requirements of the Federal Regulations, particularly under different conditions to those during testing. Any compliance statements are made reliant on (a) the application of the product and use of the assigned band being acceptable to the FCC and (b) the modes of operation as instructed to us by the Customer based on their specific knowledge of the application and functionality of the EUT. Statements of compliance, where measurements were made, do not include the measurement uncertainty. The measurement uncertainty, where stated, is the expanded uncertainty based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Date of Test: 19/Jan/2012 to 01/Feb/2012

Test Engineer:

Approved By:
Technical Director.

Customer Representative:

File name RASTERVISION.4927-1.DOCM
The contents of this report, apart from the referenced ANSI C63.4-2003, are beyond the scope of UKAS Testing Laboratory No. 2360 accreditation.

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1. Contents

1. Contents 3
2. Summary of test results 4
3. Equipment Under Test (EUT) 5
3.1 EQUIPMENT SPECIFICATION 5
3.2 EQUIPMENT FUNCTIONAL DESCRIPTION 5
3.3 EUT CONFIGURATIONS FOR TESTING 6
3.4 EUT MODES 6
3.5 EMISSIONS CONFIGURATION 7
4. Specifications 8
4.1 DEVIATIONS 8
4.2 TESTS AT EXTREMES OF TEMPERATURE & VOLTAGE 8
4.3 MEASUREMENT UNCERTAINTIES 8
5. Tests, Methods and Results 9
5.1 CONDUCTED EMISSIONS 9
5.2 INTENTIONAL RADIATOR FIELD STRENGTH 11
5.3 RADIATED EMISSIONS 12
5.4 FREQUENCY STABILITY 15
5.5 PERIODIC OPERATION AND EMISSIONS 15
5.6 OCCUPIED BANDWIDTH AND BAND EDGE 16
6. Plots and Results 17
6.1 CONDUCTED EMISSIONS 17
6.2 RADIATED EMISSIONS 9KHZ – 1GHZ 19
6.3 RADIATED EMISSIONS ABOVE 1GHZ 22
6.4 20DB BANDWIDTH 23
6.5 BAND EDGE COMPLIANCE 24
7 Explanatory Notes 25
7.1 EXPLANATION OF TABLE OF SIGNALS MEASURED 25
7.2 EXPLANATION OF LIMIT LINE CALCULATIONS FOR RADIATED MEASUREMENTS 25
8. Photographs 26
9. Signal Leads 32
10. Test Equipment Calibration list 33
11. Auxiliary equipment 34
11.1 AUXILIARY EQUIPMENT SUPPLIED BY RASTER VISION LTD / MICHELIN 34
11.2 AUXILIARY EQUIPMENT SUPPLIED BY RN ELECTRONICS LIMITED 34
12. Modifications 35
12.1 MODIFICATIONS BEFORE TEST 35
12.2 MODIFICATIONS DURING TEST 35
13. Compliance information 36
14 Description of Test Sites 37
15 Abbreviations and Units 38

The contents of this report, apart from the referenced ANSI C63.4-2003, are beyond the scope of UKAS Testing Laboratory No. 2360 accreditation.

2. Summary of test results

The MEMS Command Unit RV3-01-CF was tested to the following standards: -

FCC 47CFR Part 15 (effective date October 1st, 2011); Class DSR and DCD Intentional Radiator installed in a Class A digital device host

Any compliance statements are made reliant on the modes of operation as instructed to us by the Manufacturer based on their specific knowledge of the application and functionality of the equipment tested. Whilst every effort is made to assure quality of testing, type tests are not exhaustive and although no non-conformances may be found, this doesn't exclude the possibility of equipment not meeting the intentions of the standard, particularly under different conditions to those during testing.

Title	Reference	Results
1. Conducted emissions	ANSI C63.10 §6.2.	PASSED
2. Intentional radiator field strength	ANSI C63.10 §6.4 – 6.5.	PASSED
3. Radiated emissions	ANSI C63.10 §6.4 – 6.6.	PASSED
4. Frequency stability	ANSI C63.10 §6.8.	Not Applicable[1]
5. Occupied bandwidth and band edge	ANSI C63.10 §6.9.	PASSED
6. Periodic operation and emissions	ANSI C63.10 §7.4 – 7.6.	PASSED[2]

[1] EUT is not operating in the 40.66 – 40.70 MHz band, therefore no limits are specified.
[2] Equipment is manually operated in normal use, hence may exhibit alternative periodicities to the unit tested.

3. Equipment Under Test (EUT)

3.1 Equipment Specification

Applicant	Michelin Americas Research & Development Corp 515 Michelin Rd Greenville South Carolina SC 29615 USA
Manufacturer of EUT	Michelin Americas Research & Development Corp
Brand name of EUT	Michelin
Model Number of EUT	RV3-01-CF
Proposed FCC ID	FI5-RV3-01-CF
Serial Number of EUT	#1
Date when equipment was received by RN Electronics	18-Jan-12
Date of test:	19/Jan/2012 to 01/Feb/2012
Customer order number:	TBC
Visual description of EUT:	A CF-card and cover, with detachable antenna that is exclusively for connection to the host PDA - a hand held unit with a touch screen display above a numerical keyboard entry pad.
Main function of the EUT:	A transmitter module for use in a single host PDA. The module's purpose is for installation / interrogation of tyre pressure monitors via RF.
Height	110 mm (excluding antenna and host)
Width	90 mm (excluding antenna and host)
Depth	45 mm (excluding antenna and host)
Weight	140 g
Voltage	5.0V DC (host)
Current required from above voltage source	4500 mA (host)

3.2 Equipment functional description

The MEMS Command Unit is a Hand Held device (based on an existing PDA) which is used exclusively for configuration and installation of tyre pressure sensors in earth mover tyres. The CF Card (RV3-01-CF) provides the following extra resources to the Hand Held configuration device when it is installed:

- 433.92MHz FM transmitter.
- 433.92MHz FM receiver.
- 125kHz Inductive trigger.
- Air Pressure transducer.
- Audible Sounder.
- Indicator LEDs.

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3.3 EUT Configurations for testing

Frequency range	433.92 MHz and 125kHz
Normal use position	hand held – tested in 3 orthogonal planes
Normal test signals	Internally generated
Declared power level	-14.5 dBm @ 433.92MHz
Declared channel bandwidth	50kHz @ 433.92MHz
Highest frequency generated / used	433.92MHz tx/rx in EUT; 806MHz processor in host.
Lowest frequency generated / used	125kHz tx in EUT

3.4 EUT Modes

Mode	Description of mode	Used for Testing
Sensor search	125kHz message repeated every 100ms	YES
Sensor activate	125kHz message to particular sensor ID	NO
Monitoring	Receive 433.92MHz signals from active sensors	NO
Vehicle configure	433.92MHz installation messages, manually activated	NO
Test mode	433.92MHz transmissions to two specific sensors every 500ms	YES

The unit tested was operated from test software not normally available to the user, which allowed for continuously repeated transmissions. In this software, the 'Vehicle configure' mode was not available. Description of ancillary equipment connected to the equipment under test, for the purpose of tests, can be found in Section 10.

Any modifications made to the EUT, whilst under test, can be found in Section 11.

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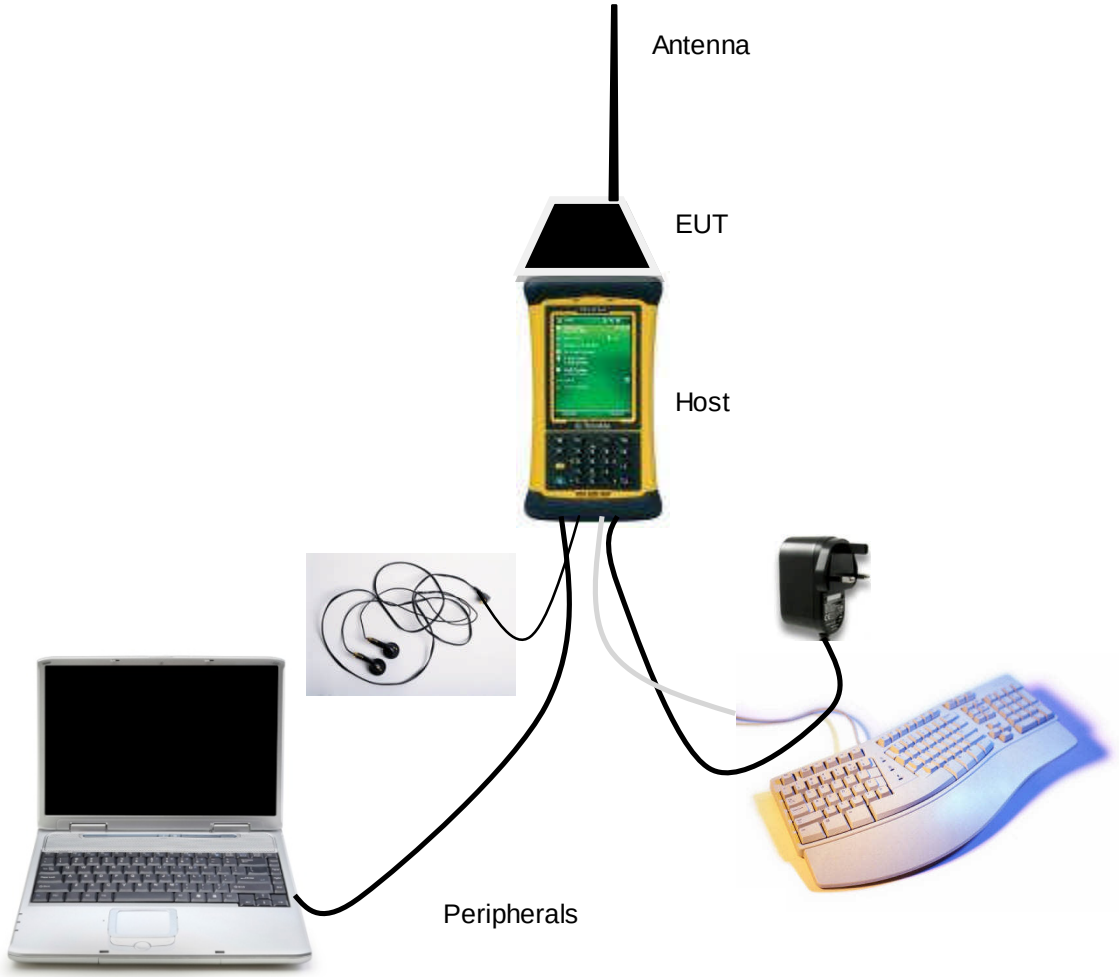
3.5 Emissions Configuration



For the spurious emissions tests, the EUT was attached to the host device which was powered from a dedicated plugtop supply and fully populated with off-the-shelf peripherals. This was deemed to be a worst case scenario.
For the fundamental emissions a more typical configuration of just the EUT attached to the host device was used.

4. Specifications

The tests were performed by RN Electronics Engineer Peter Finley and Paul Darragh who set up the tests, the test equipment, and operated it in accordance with the ***R.N. Electronics Ltd*** procedures manual, ANSI C63.10-2009, FCC Part 15 and those specifications incorporated by reference into 47CFR15 (e.g. ANSI C63.4-2003).

R.N. Electronics Ltd sites M and OATS are listed with the FCC. Registration Number 293246

4.1 Deviations

ANSI C63-10-2009 deviations:
The reference standard ANSI C63.4-2003 was used, not the latest ANSI C63.4-2009

FCC Part 15 deviations:
None.

4.2 Tests at Extremes of Temperature & Voltage

No tests were required at extremes of temperature.
All tests were performed with the dedicated antenna attached.

4.3 Measurement Uncertainties

Parameter	Uncertainty	
Transmitter Tests		
Occupied bandwidth	± 1.9 %	
Radiated RF power	± 3.5 dB	
Radiated H-field	9kHz – 30MHz	±2.8dB
Radiated spurious emissions	30MHz - 1000MHz	±5.1dB
	1000MHz - 2000MHz	±4.5dB
	1 – 18 GHz	±3.5dB
	18 – 26.5 GHz	±3.9dB
AC line conducted emissions	(For LISN) 150kHz to 30MHz	±3.6dB

5. Tests, Methods and Results

5.1 Conducted emissions

5.1.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.207)

Test Method: ANSI C63.10, Reference (6.2.)

5.1.1.1 Configuration of EUT

The EUT/host device was placed on a wooden table 0.8m above the ground plane with the dedicated AC/DC adaptor at 100mm separation from it. The plugtop adaptor was connected to a LISN via a 1m mains cable.

Details of the Peripheral and Ancillary Equipment connected for this test is listed in section 11.

The EUT was operated simultaneously in modes 'Sensor search' and 'Test mode' – refer to section 3.3.

5.1.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted in the 'Test Equipment' Section. Measurements were made on the live and neutral conductors using both average and quasi-peak detection.
At least 6 signals within 20dB and/or all signals within 10dB of the limit were investigated.

Tests were performed in Test Site F.

5.1.2 Test results

Temperature of test Environment: 19°C

Analyser plots for the Quasi-Peak / Average values as applicable can be found in Section 6.1 of this report.

TABLE OF CONDUCTED EMISSIONS ON THE LIVE CONDUCTOR

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Peak - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	0.153863	48.55	-7.24	31.89	-23.90
2	0.154159	48.58	-7.19	31.63	-24.14
3	0.176226	45.19	-9.47	29.47	-25.19
4	0.179000	46.32	-8.21	30.19	-24.34
5	0.182691	43.40	-10.96	22.88	-31.48
6	0.224929	38.51	-14.12	23.69	-28.94
7	0.403234	35.81	-11.98	34.02	-13.77
8	0.422758	35.59	-11.80	29.85	-17.54
9	0.427098	36.01	-11.30	33.57	-13.74
10	0.433188	31.51	-15.68	20.77	-26.42
11	23.268093	32.64	-17.36	27.50	-22.50
12	24.724406	31.51	-18.49	26.44	-23.56
13	26.177418	32.19	-17.81	28.30	-21.70
14	27.628885	31.94	-18.06	27.94	-22.06

No signals were observed within 20dB of the QP limit.

TABLE OF CONDUCTED EMISSIONS ON THE NEUTRAL CONDUCTOR

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Peak - Lim1 (dB)	AV Amp (dBuV)	AV - Lim1 (dB)
1	0.163160	46.38	-8.922	27.24	-28.06
2	0.182715	43.02	-11.34	26.18	-28.18
3	0.415903	34.83	-12.70	31.43	-16.10
4	0.420111	34.37	-13.08	30.43	-17.02
5	21.818475	30.19	-19.81	23.52	-26.48
6	23.276435	30.71	-19.29	27.11	-22.89
7	29.095938	31.00	-19.00	28.31	-21.69

No signals were observed within 20dB of the QP limit.

These results show that the **EUT** has **PASSED** this test.

5.1.2.1 Test Equipment used

E001, E035, E465
See Section 10 for more details.

5.2 Intentional radiator field strength

5.2.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.231(b))

Test Method: ANSI C63.10, Reference (6.5)

5.2.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The antenna was scanned 1-4m in height in both Horizontal and Vertical polarisations. The EUT was rotated in all three orthogonal planes. The EUT was operated simultaneously in modes 'Sensor search' and 'Test mode' – refer to section 3.3. Both battery and ac/dc plugtop supply configurations were checked for worst case.

5.2.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Measurements were made in a semi-anechoic chamber and/ or on an OATS. This site is listed with the FCC.

Both the equipment and the antenna were rotated 360° to record the maximised emission.

5.2.2 Test results

Tests were performed using Test Site **M.**

Test Environment:
Temperature: 15°C Humidity: 38%

Any Analyser plots can be found in Section 6.3 of this report.

Channel	Measured result PK (dBuV/m @3m)	EUT polarisation	Measurement polarisation
433.92MHz	80.17	V	V

EUT powered from battery alone gave worst case (highest erp) result.

LIMITS:
15.231(b) Average = 11,000 uV/m = 80.8 dBuV/m @ 3m.
15.231(e) Average = 4,400 uV/m = 72.9 dBuV/m @ 3m.
15.35 Peak = 20dB above the maximum permitted average emission limit = 100.8 & 92.9 dBuV/m @ 3m, respectively.

These results show that the EUT has **PASSED** this test.

5.2.2.1 Test Equipment used

E410, E411, E412, TMS933
See Section 10 for more details

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5.3 Radiated emissions

5.3.1 Test Methods

Test Requirements	FCC Part 15C, Reference (15.109, 15.209)
Test Method:	ANSI C63.10, Reference (6.4 – 6.6.)

5.3.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was rotated in all three orthogonal planes. Radiated Emissions testing was performed with the host device fully populated by off-the-shelf accessories. The EUT was operated simultaneously in modes 'Sensor search' and 'Test mode' – refer to section 3.3.

5.3.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below.

Below 30MHz, measurements were made in a semi-anechoic chamber (pre-scan) with final measurements on an OATS without a ground plane. The antenna was placed 1m above the ground. The equipment and the antenna were rotated 360° to record the worst case emissions.

30MHz - 1GHz, measurements were made on a site listed with the FCC. The equipment was rotated 360° and the antenna scanned 1 – 4 metres in both horizontal and vertical polarisations to record the worst case emissions. Where emissions were observed above the 15.209 limits (30 – 90 MHz) the measurements were repeated with the transmitters turned off. No significant difference in emissions was observed.

Above 1GHz, measurements were made in a semi-anechoic chamber with appropriate absorbing material for use in this range. The antenna was placed in line with the EUT, which was rotated through 360° to record the worst case emissions.

At least 6 signals within 20dB and all signals within 10dB of the limit were investigated.

5.3.2 Test results

Tests were performed using Test Site M and OATS**.**

Test Environment:

Site M	Temperature: 17-19°C	Humidity: 33-34%
Site OATS	Temperature: 1-2°C	Humidity: 33-40%

Analyser plots for the Quasi-Peak / Average values as applicable can be found in Section 6.2 and 6.3 of this report. n.b. the general limits of 15.209 are as drawn on the respective plots.

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TABLE OF EMISSIONS BELOW 30MHZ

Signal No.	Freq (kHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV[1] - Lim1 (dB)
1	66.375	47.9	-	-63.3
2	125.0	54.3	-	-51.4

TABLE OF EMISSIONS 30-300MHZ, VERTICAL (15.109 CLASS A LIMIT)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)
1	30.412	47.29	40.79	-8.71
2	31.980	45.49	38.89	-10.61
3	33.465	46.09	40.09	-9.41
4	36.513	45.37	40.07	-9.43
5	38.999	40.87	37.57	-11.93
6	42.599	49.7	44.4	-5.1
7	48.684	43.7	41.6	-7.9
8	51.726	43.4	39.3	-10.2
9	54.769	42.2	39.4	-10.1
10	60.855	34.8	31.3	-18.2
11	66.940	35.9	32.7	-16.8
12	84.092	40.9	32.1	-17.4
13	97.499	36.6	31.5	-22.5
14	103.452	32.7	27.7	-26.3
15	115.623	34.5	28.3	-25.7
16	127.793	35.0	29.2	-24.8
17	135.406	32.5	22.7	-31.3
18	155.998	33.7	26.0	-28
19	231.108	25.5	20.8	-36.1
20	232.344	29.4	25.7	-31.2
21	298.662	30.8	26.1	-30.8

TABLE OF EMISSIONS 30-300MHZ, HORIZONTAL (15.109 CLASS A LIMIT)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)
1	38.991	34.6	30.0	-19.5
2	44.103	35.2	26.6	-22.9
3	66.938	32.7	29.3	-20.2
4	80.622	41.7	40.8	-8.7
5	86.671	30.9	22.9	-26.6
6	91.998	41.6	40.7	-13.3
7	103.450	39.1	36.4	-17.6
8	115.621	45.2	41.1	-12.9
9	127.791	42.0	37.0	-17
10	130.833	44.2	34.8	-19.2
11	233.118	37.5	34.5	-22.4

[1] The EUT was not operating at 100% duty cycle, therefore peak values have been used for comparison with the limits.

The contents of this report, apart from the referenced ANSI C63.4-2003, are beyond the scope of UKAS Testing Laboratory No. 2360 accreditation.

TABLE OF EMISSIONS 300MHz-1GHz, VERTICAL (15.209 LIMIT)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)
1	337.849	38.8	31.6	-14.4
2	406.773	37.0	29.0	-17.0
3	418.047	35.7	33.8	-12.2
4	439.105	32.0	27.7	-18.3
5	485.327	34.5	31.7	-14.3
6	500.001	34.1	29.7	-16.3

TABLE OF EMISSIONS 300MHz-1GHz, HORIZONTAL (15.209 LIMIT)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	QP Amp (dBuV)	QP - Lim1 (dB)
1	338.664	38.1	30.3	-15.7
2	366.377	33.3	28.7	-17.3
3	406.124	36.0	30.0	-16.0
4	439.106	31.6	28.2	-17.8
5	474.652	38.5	32.3	-13.7
6	497.760	33.8	28.4	-17.6

TABLE OF EMISSIONS ABOVE 1GHz, VERTICAL (15.209 LIMIT)

Signal No.	Freq (MHz)	Peak Amp (dBuV)	AV Amp (dBuV)	AV - Lim1 (dB)
1	1345.482	41.1	36.1	-17.9
2	3037.063	29.0[2]	-	-

There were no emissions within 20dB of the limit above 1GHz, horizontal.

LIMITS:
The EUT is a composite device consisting of a Class A PDA, a periodic transceiver and a below 1705kHz unlicensed transmitter. The limits are the highest level allowed by all relevant rule parts:

i. Periodic operation.
15.209 limits are applicable in the restricted bands of 15.205 with the relevant detector. 15.231(b) limits are applicable elsewhere, although 15.209 limits may be used where these allow a higher field strength.

ii. Below 1705kHz operation.
15.209 limits are applicable.

iii. Class A digital device operation.
15.109 limits are applicable.

These show that the EUT has PASSED this test.

5.3.2.1 Test Equipment used

E007-2, E268, E410, E411, E412, TMS81, TMS82, TMS933

See Section 10 for more details

[2] Highest harmonic was below the noise floor, this result measured in 30kHz RBW.

5.4 Frequency stability

Not applicable. The EUT is not operating in the 40.66 – 40.70 MHz band, therefore no limits are specified.

5.5 Periodic operation and emissions

5.5.1 Test Methods

Test Requirements	FCC Part 15C, Reference (15.231a)
Test Method:	ANSI C63.10, Reference (7.4 – 7.6)

5.5.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was manually operated to interrogate two sensors.

5.5.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. The centre frequency of the analyser was set to that of the transmitter, and the span set to zero. The sweep time was adjusted so that either the pulse width or the periodic operation could be observed.

Test site 'M' has been listed with the FCC.

5.5.2 Test results

Tests were performed using Test Site **M.**

Temperature of test Environment: 15°C

Analyser plots for the dwell time and duty cycle can be found in Section 6.4 of this report.

State	Result (ms)	Plot reference
TX on	20+20	J4927-1 duty plot 1

Limits:
15.231(a)a manually operated transmitter shall employ a switch that will deactivate the transmitter within not more than 5 seconds of being released.

These results show that the **EUT** has PASSED this test.

The EUT could be manually activated, possibly several times in 100ms, therefore no duty cycle correction factor is appropriate.

5.5.2.1 Test Equipment used

E410, E411, E412, TMS933

See Section 10 for more details.

5.6 Occupied bandwidth and band edge

5.6.1 Test Methods

Test Requirements FCC Part 15C, Reference (15.231(c))

Test Method: ANSI C63.10, Reference (6.9)

5.6.1.1 Configuration of EUT

The EUT was placed on a 0.8 metres high turntable. The front edge of the EUT was initially positioned facing the antenna. The EUT was measured at a distance of 3 metres. The EUT was operated in 'Test mode' mode.

5.6.1.2 Test Procedure

Tests were made in accordance with FCC Part 15 using the measuring equipment noted below. A 3kHz RBW, >=3x VBW, auto sweep time and max hold settings were used for the 20dB bandwidth measured with the analyser built-in function.
A 50MHz span plot in 120kHz RBW was taken for the nearest restricted band edge compliance plot.

5.6.2 Test results

Tests were performed using Test Site **M**.

Temperature of test Environment: 15°C

Analyser plots for the 20dB bandwidth can be found in Section 6.5 of this report.

Channel	Result	Plot reference
Bottom	-	
Middle	68kHz	J4927-1 434MHz Occupied BW plot
Top	-	

LIMITS: 15.231(c) must be <0.25% / 0.5% of centre frequency.
Fc = 433.92MHz = 1.085MHz.

Band edge compliance applies only to 40.66 – 40.70 MHz band.

The restricted band edges closest to the EUT frequency of 433.92MHz are 410 & 608MHz. Further wider span plots have been taken to show the fact that there are no spurious emissions above the restricted limits of 15.209. See section 6.6 of this report.

These results show that the **EUT** has PASSED this test.

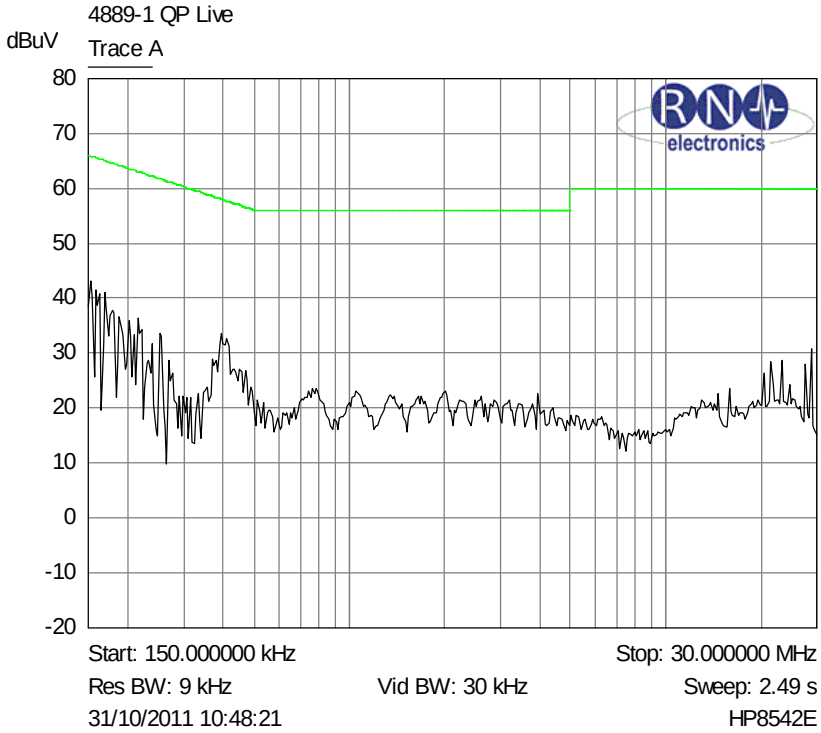
5.6.2.1 Test Equipment used

E410, E411, E412, TMS933

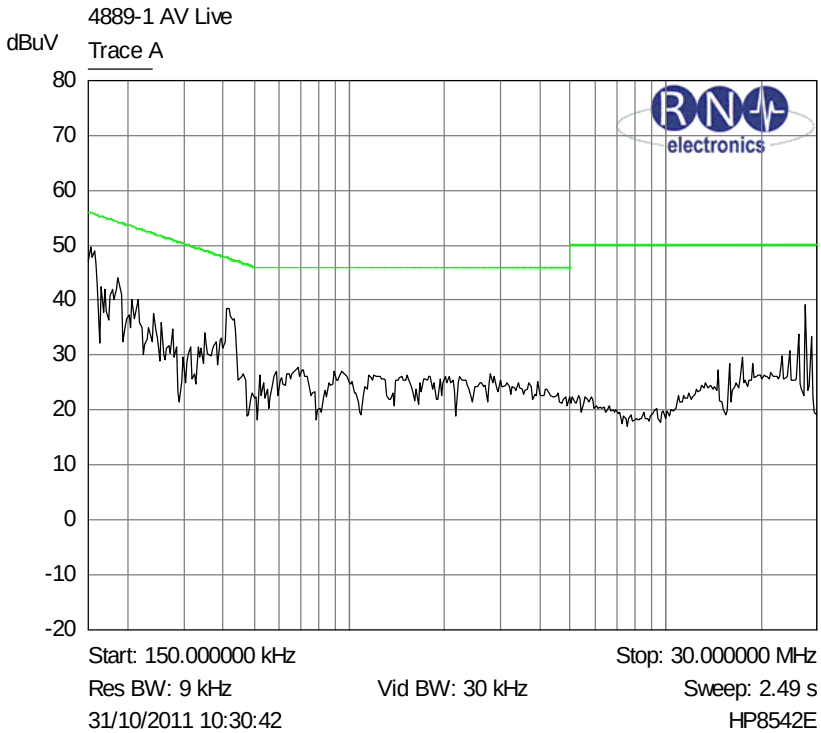
See Section 10 for more details.

6. Plots and Results

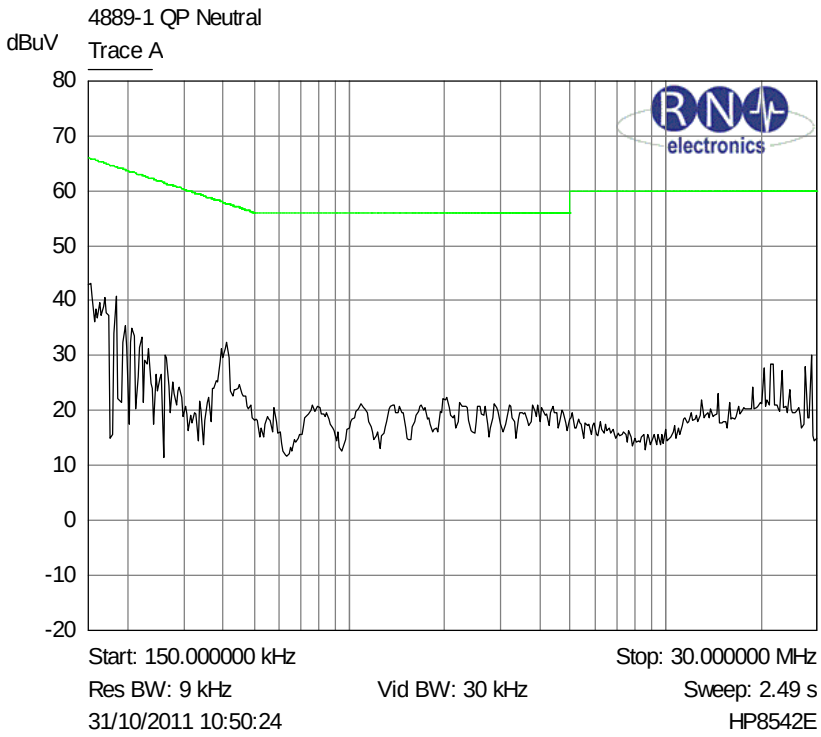
6.1 Conducted Emissions



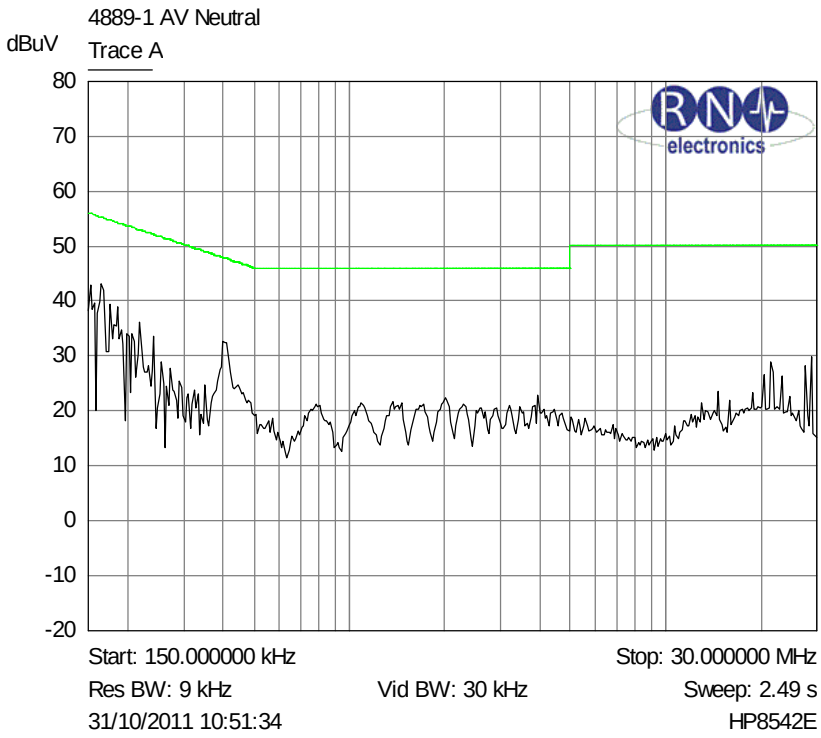
Plot of peak emissions 150kHz - 30MHz on the mains live terminal against the quasi-peak limit line.



Plot of peak emissions 150kHz - 30MHz on the mains live terminal against the average limit line.

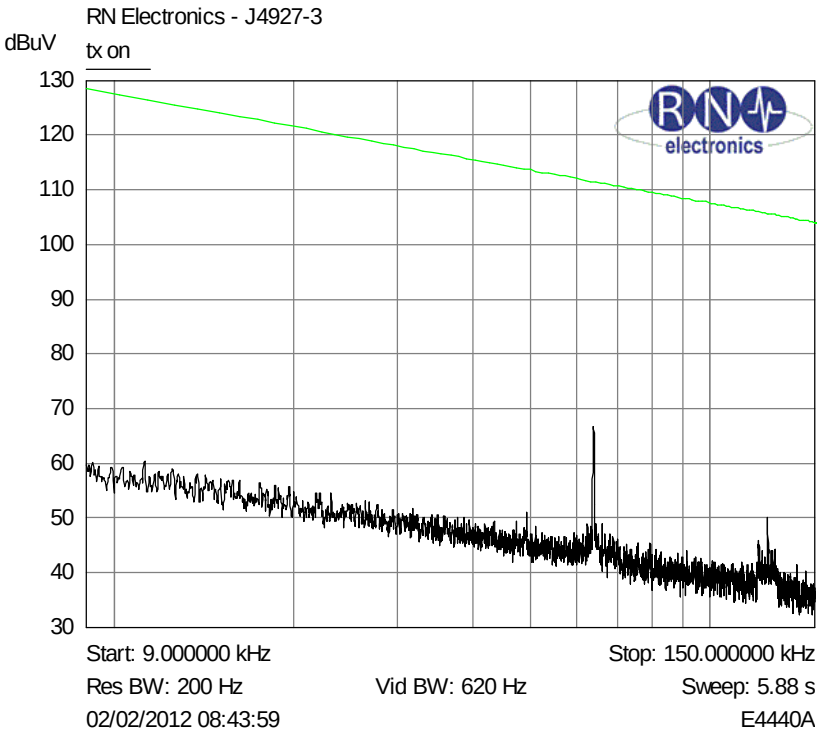


Plot of peak emissions 150kHz - 30MHz on the mains neutral terminal against the quasi-peak limit line.

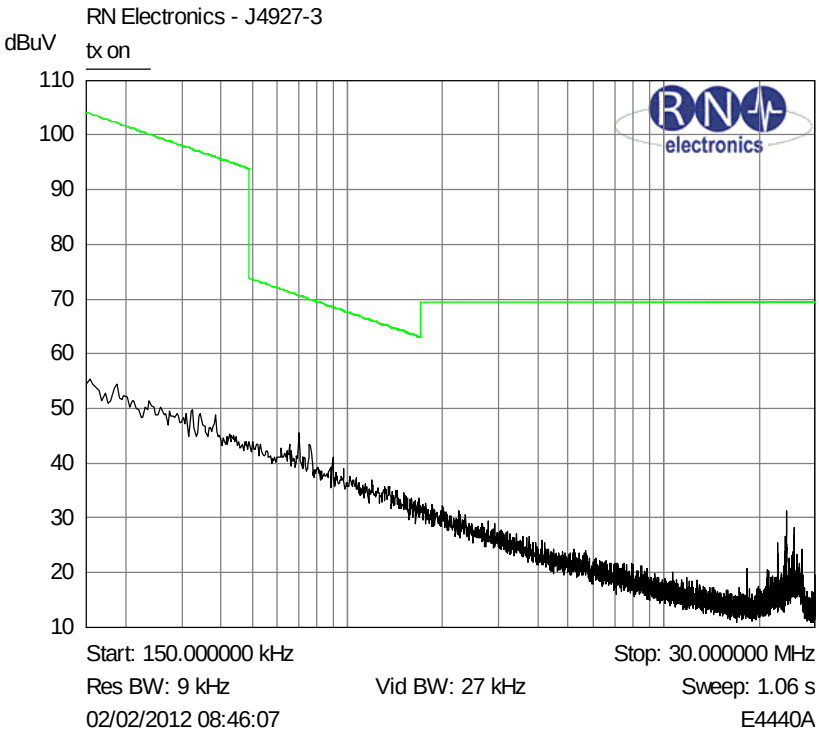


Plot of peak emissions 150kHz - 30MHz on the mains neutral terminal against the average limit line.

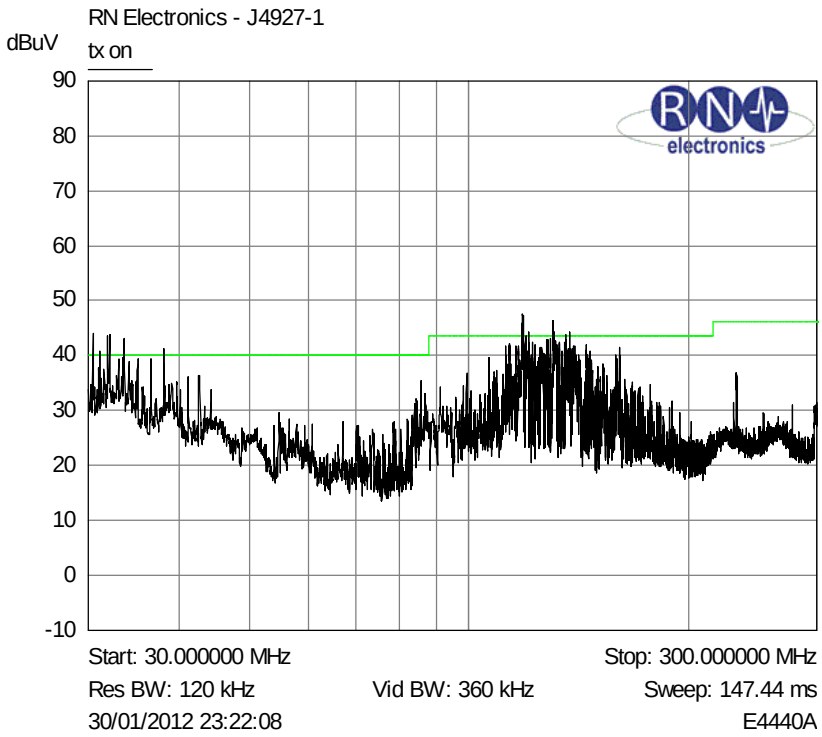
6.2 Radiated Emissions 9kHz – 1GHz



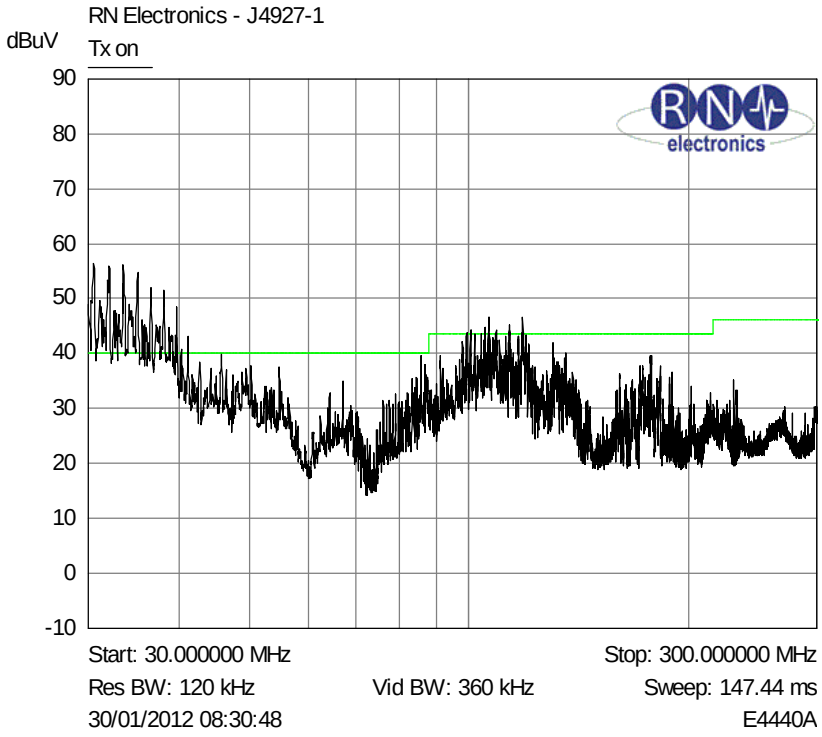
Plot of peak emissions 9 - 150kHz against the quasi-peak limit line.



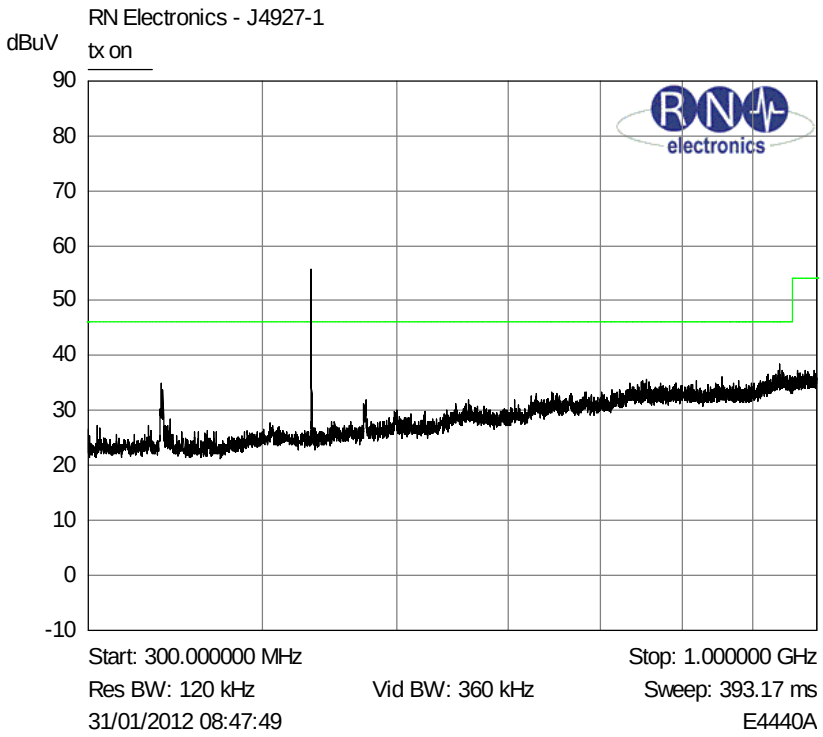
Plot of peak emissions 150kHz - 30MHz against the quasi-peak limit line.



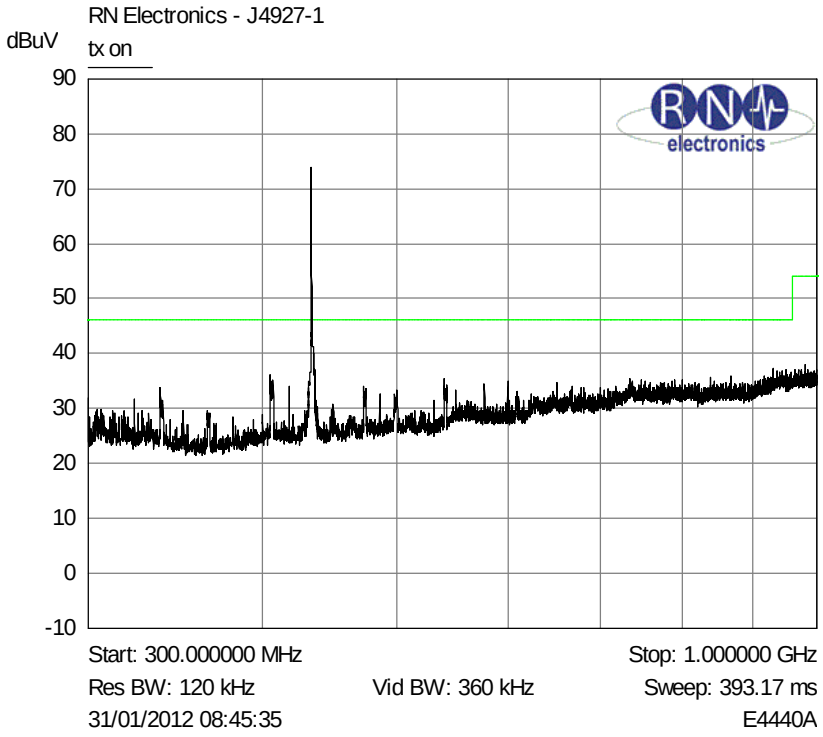
Plot of peak horizontal emissions 30MHz - 300MHz against the quasi-peak limit line per 15.209.



Plot of peak vertical emissions 30MHz - 300MHz against the quasi-peak limit line per 15.209.

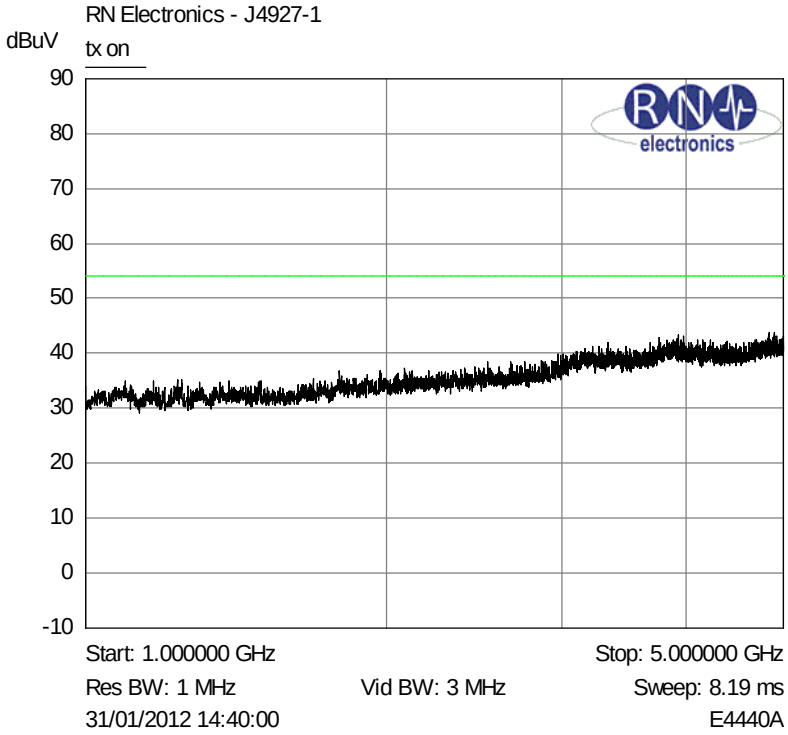


Plot of peak horizontal emissions 300MHz - 1GHz against the quasi-peak limit line per 15.209.

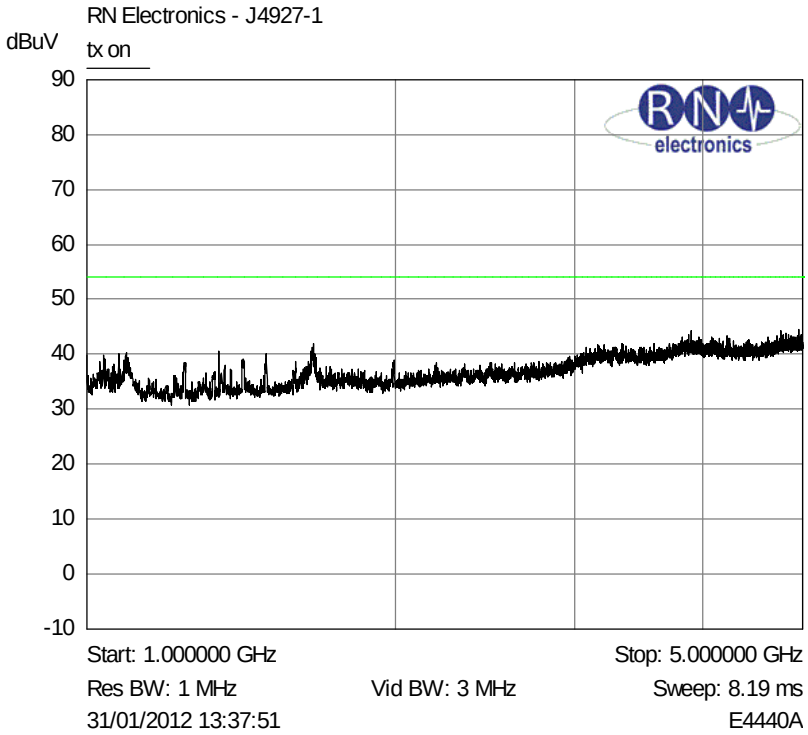


Plot of peak vertical emissions 300MHz - 1GHz against the quasi-peak limit line.

6.3 Radiated Emissions above 1GHz

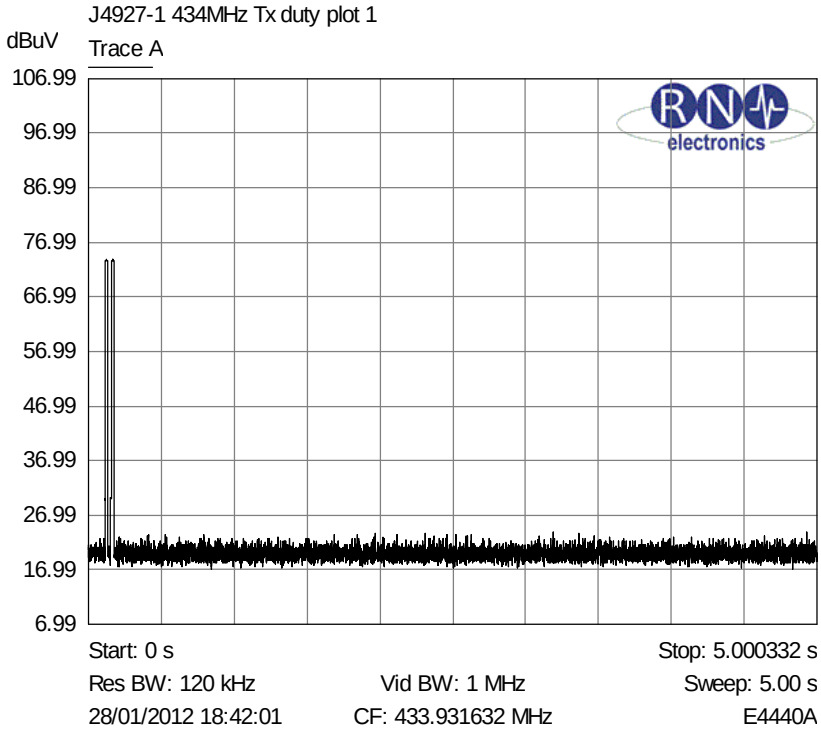


Plot of peak horizontal emissions 1 - 5GHz against the average limit line per 15.209.

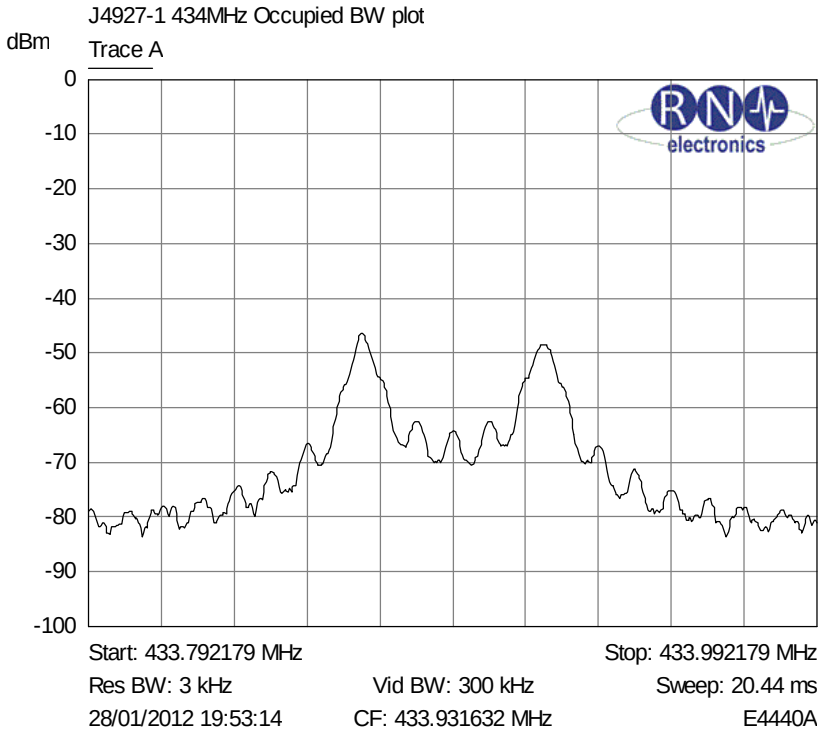


Plot of peak vertical emissions 1 - 5GHz against the average limit line per 15.209.

6.4 Periodic operation



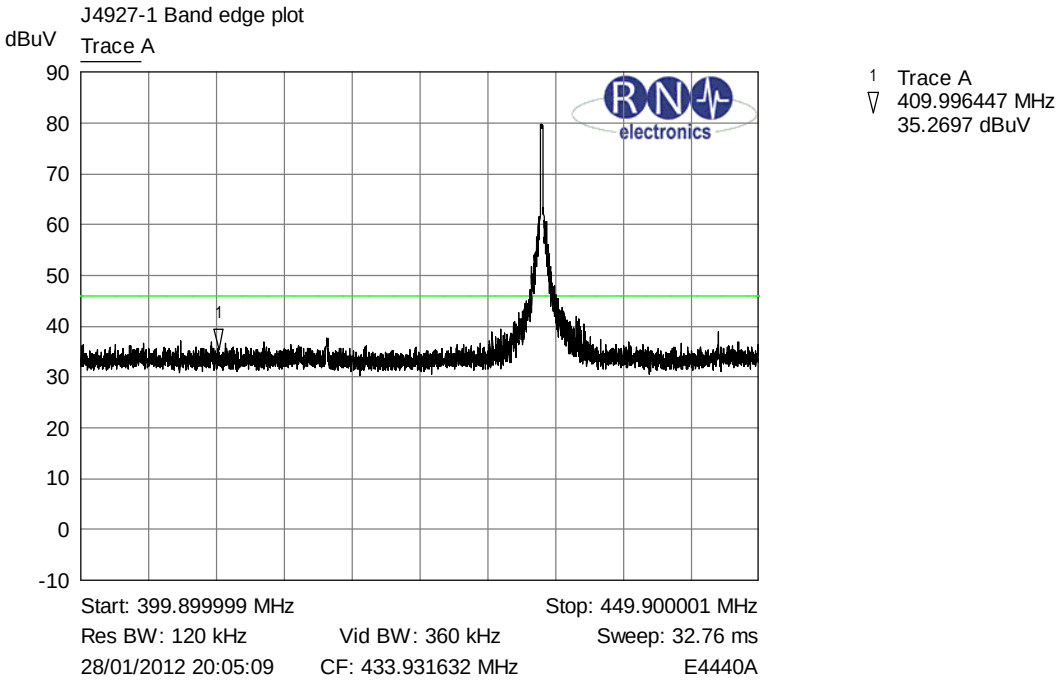
6.5 20dB Bandwidth



6.6 Band Edge Compliance

Band Edge.
Not applicable. EUT is not operating in the 40.66 – 40.70 MHz band.

Restricted band edge.



7 Explanatory Notes

7.1 Explanation of Table of Signals Measured

Measurements are made as required by the standard. These measurements are made and recorded using detectors, either peak, quasi peak or average dependant on the test. A table of results has been given following the relevant plots. This table looks similar to the one illustrated below dependant on the measurements required by the test: -

Signal No.	Freq (MHz)	Peak Amp (dBuV)	Pk – Lim 1 (dB)	QP Amp (dBuV)	QP - Lim1 (dB)	Av Amp (dBuV)	Av - Lim1 (dB)
1	12345	54.9	-10.5	48.0	-12.6	37.6	-14.4

Column One - Labelled Signal No. is an incremental number that the receiver has given to each signal that has been measured.

Column Two - Labelled Freq (MHz) is the approximate frequency of the signal received.

Column Three - Labelled Peak Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the peak detector.

Column Four - Labelled Pk - Lim1 (dB) is the difference in level from the peak signal given to the active limit line. If this column appears in the table the peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Five - Labelled QP Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the quasi-peak detector.

Column Six - Labelled QP - Lim1 (dB) is the difference in level from the quasi-peak signal given to the active limit line. If this column appears in the table the quasi-peak detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Column Seven - Labelled Av Amp (dBμV) is the level of received signal that was measured in dB above 1μV using the average detector.

Column Eight - Labelled Av - Lim1 (dB) is the difference in level from the average signal given to the active limit line. If this column appears in the table the average detector measurement is required by the standard for this test. The results entered in this column indicate the signal level relative to the compliance limit required. Negative numbers indicate that the product is compliant.

Only signals highlighted in red are deemed to exceed the limit of the detector required.

7.2 Explanation of limit line calculations for radiated measurements

The limits given in the test standard are normally expressed as absolute values (e.g. in μV/m at a specified distance), whereas the measured values are expressed as peak, quasi peak or average values in dBμV/m referenced to the measuring instrument inputs. RN Electronics calibrate the test set-up to account for any path losses, antenna gains, etc. so that the value read at the receiver relates directly to the absolute value required, except that it is expressed in dB relative to one microVolt and may need to take account of any alternative measuring distance used. Examples:

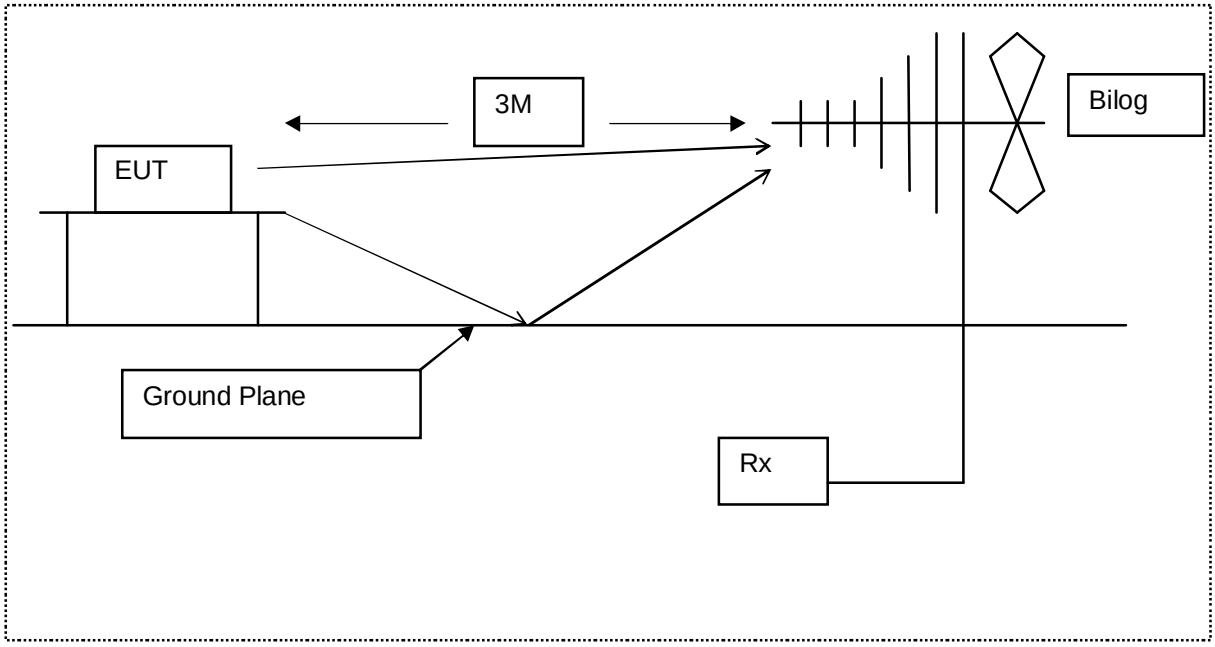
(a) limit of 500 μV/m equates to 20.log (500) = 54 dB μV/m.
(b) limit of 300 μV/m at 10m equates to 20.log (300 . 10/3) = 60 dB μV/m at 3m
(c) limit of 30 μV/m at 30m, but below 30MHz, equates to 20.log(30) + 40.log(30/3) = 69.5 dBμV/m at 3m, as extrapolation factor below 30MHz is 40dB/decade per 15.31(f)(2).

8. Photographs

Photographs of the EUT as viewed from in front of the antenna, site M.

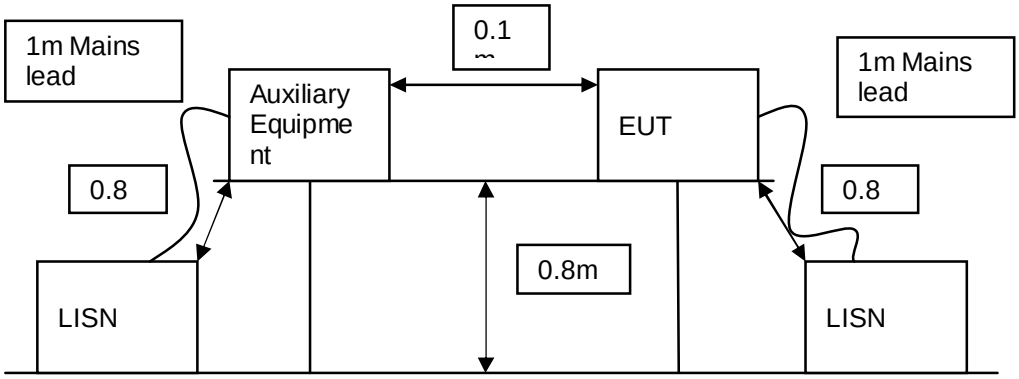
Photographs of the EUT as viewed from in front of the antenna, site OATS.

Diagram of the radiated emissions test setup



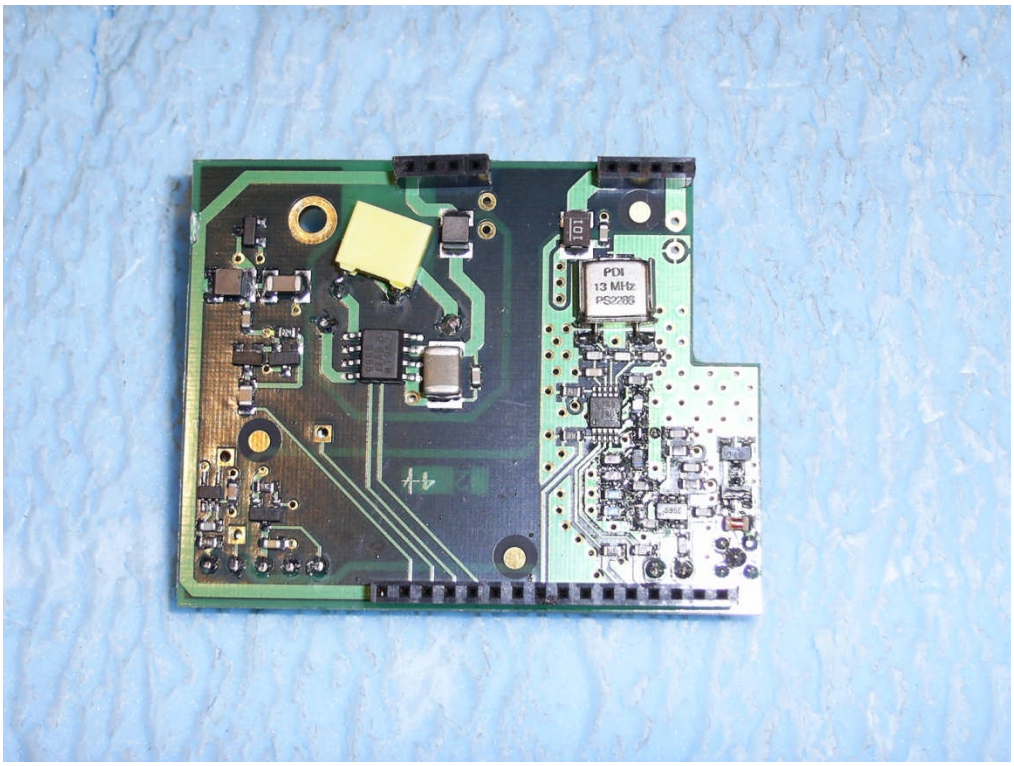
Photograph of the EUT as viewed from screened room (conducted emissions)

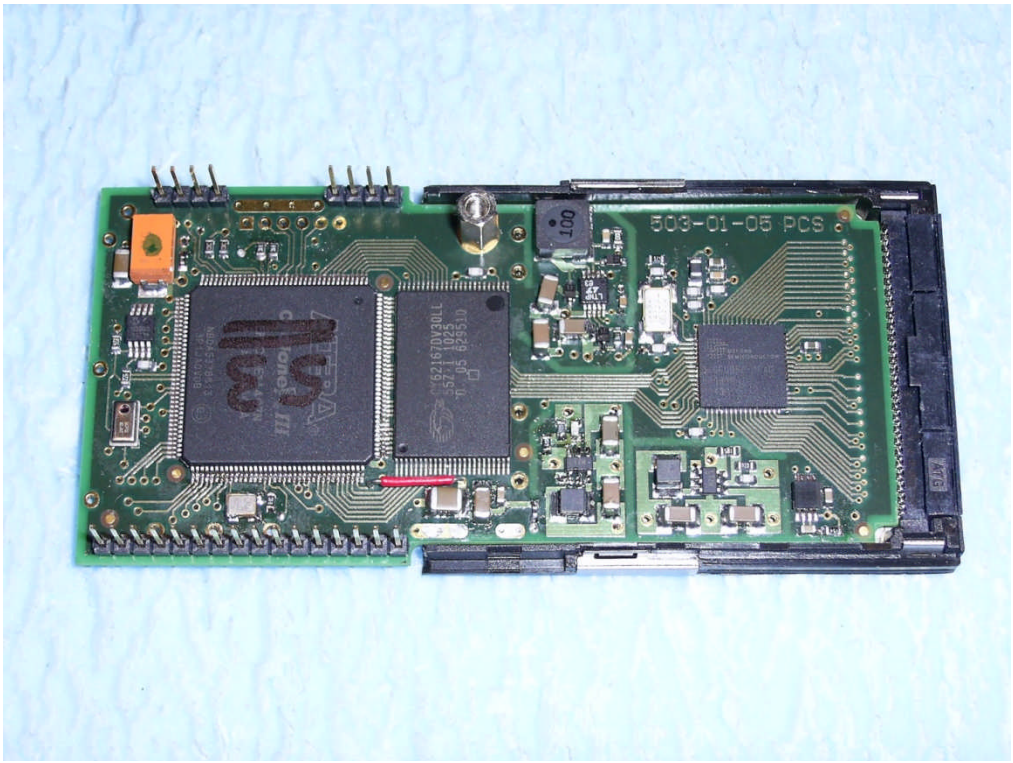
Diagram of the conducted emissions test setup.



Identifying Photograph of the EUT

Internal Photographs of the EUT


PDI
13 MHz


503-01-05 PCS

9. Signal Leads

Port Name	Cable Type
DC in	2 core dc lead from power adaptor
USB	multicore USB lead to accessory, e.g. keyboard
mini USB	multicore USB lead to PC
audio	mono audio lead to accessory, e.g. headphones

10. Test Equipment Calibration list

The following table lists the test equipment used, last calibration date and calibration interval. All test equipment used has been maintained within the calibration requirements of ***R.N. Electronics Ltd.*** test facility quality system. Calibration intervals are regularly reviewed dependent on equipment manufacturer's recommendations and actual usage of the equipment.

RNNo	Model	Description	Manufacturer	Date Calibrated	Period
E001	HP8542E	Receiver	Hewlett Packard	09-Nov-11	12
E007-2	VHA9103	Bi-conical antenna	Schwarzbeck	14-Feb-11	36
E035	HP11947A	Transient limiter	Hewlett Packard	22-Aug-11	6
E268	BHA 9118	1-18 GHz Horn Antenna	Schaffner	14-Apr-11	36
E410	N5181A	3 GHz MXG Signal Generator	Agilent Technologies	26-Oct-11	12
E411	N9039A	9 kHz - 1 GHz RF Filter Section	Agilent Technologies	26-Oct-11	12
E412	E4440A	3 Hz - 26.5 GHz PSA	Agilent Technologies	26-Oct-11	12
E465	PCR2000LA	AC Power Supply	KIKUSUI	09-May-11	12
TMS81	6502	Active Loop Antenna	EMCO	13-Apr-10	24
TMS82	8449B	Pre Amplifier 1 - 26 GHz	Agilent	14-Nov-11	12
TMS933	CBL6141A	Bilog Antenna 30MHz - 2GHz	York EMC	09-Sep-10	36

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11. Auxiliary equipment

11.1 Auxiliary equipment supplied by Raster Vision Ltd / Michelin

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

None.

11.2 Auxiliary equipment supplied by RN Electronics Limited

Auxiliary equipment used for the purpose of test supplied by the above has been listed below

RN Number	Manufacturer	Description	Model Number	Serial Number
I005	HP	Laptop	NX9010	CNF3512U85
-	-	Headphones	-	-
-	-	Keyboard	-	-

12. Modifications

In order for the EUT to produce the results shown within this report the following modifications, if any, were implemented.

12.1 Modifications before test

The test software utilised was set to power level 2 of 15 prior to testing.

12.2 Modifications during test

There were no modifications made by R.N. Electronics Ltd during testing.

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13. Compliance information

Products subject to the Declaration of Conformity procedure are required to be supplied with a compliance information statement. A copy of this statement may be included here:

CERTIFIED equipment – DoC not required.

14 Description of Test Sites

Site A	Radio / Calibration Laboratory and anechoic chamber
Site B	Semi-anechoic chamber
Site B1	Control Room for Site B
Site C	Transient Laboratory
Site D	Screened Room (Conducted Immunity)
Site E	Screened Room (Control Room for Site D)
Site F	Screened Room (Conducted Emissions) VCCI Registration No. C-2823
Site K	Screened Room (Control Room for Site M)
Site M	3m Semi-anechoic chamber (indoor OATS) FCC Registration No. 293246
Site Q	Fully-anechoic chamber
Site OATS	3m and 10m Open Area Test Site FCC Registration No. 293246 IC Registration No. 5612A-1 VCCI Registration No. R-2580
Site R	Screened Room (Conducted Immunity)
Site S	Safety Laboratory
Site T	Transient Laboratory

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15 Abbreviations and Units

%	Percent
µV	microVolts
µW	microWatts
AC	Alternating Current
ALSE	Absorber Lined Screened Enclosure
AM	Amplitude Modulation
Amb	Ambient
ANSI	American National Standards Institute
ºC	Degrees Celsius
CFR	Code of Federal Regulations
CS	Channel Spacing
CW	Continuous Wave
dB	deciBels
dBµV	deciBels relative to 1µV
dBc	deciBels relative to Carrier
dBm	deciBels relative to 1mW
DC	Direct Current
EIRP	Equivalent Isotropic Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
FCC	Federal Communications Commission
FM	Frequency Modulation
FSK	Frequency Shift Keying
g	Grams
GHz	GigaHertz
Hz	Hertz
IF	Intermediate Frequency
kHz	kiloHertz
LO	Local Oscillator
mA	milliAmps
max	maximum
mbar	milliBars
MHz	MegaHertz
min	minimum
mm	milliMetres
ms	milliSeconds
mW	milliWatts
NA	Not Applicable
nom	Nominal
nW	nanoWatt
OATS	Open Area Test Site
OFDM	Orthogonal Frequency Division Multiplexing
ppm	Parts per million
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
Ref	Reference
RF	Radio Frequency
RTP	Room Temperature and Pressure
s	Seconds
Tx	Transmitter
V	Volts