TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Giant Electronics Ltd.
OLUSB Bluetooth Dongle

To: F.C.C. Part 15 Subpart C: 2001
(Intentional Radiators)
Section 15.247

Test Report Serial No:
RFI/EMCB1/RP43908JD04A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	**Checked By:** 
Tested By: 	**Release Version No:** **PDF01**
Issue Date: 17 December 2002	**Test Dates: 28 October to 05 November 2002**

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1. Client Information

Company Name:	Giant Electronics Ltd.
Address:	7/F.,Elite Industrial Building 135-137 Hoi Bun Road Kwun Tong Kowloon Hong Kong
Contact Name:	Mr Alan Poon

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification Of Equipment Under Test (EUT)

Sample 1: Integral Antenna

Brand Name:	Olympia
Model Name or Number:	OLUSB Bluetooth Dongle
Unique Type Identification:	ba: 0X00096E001000
Serial Number:	None
Country of Manufacture:	China
FCC ID Number:	Not stated by client
Date of Receipt:	28 October 2002

Sample 2: Modified for Conducted Port Measurements

Brand Name:	Olympia
Model Name or Number:	Bluetooth USB Dongle
Unique Type Identification:	OLUSB
Serial Number:	ba:0X00096E001000
Country of Manufacture:	China
FCC ID Number:	Not stated by client
Date of Receipt:	28 October 2002

2.2. Description Of EUT

The equipment under test is a USB Bluetooth Dongle.

2.3. Modifications Incorporated In EUT

None

2.4. Additional Information Related To Testing

Power Supply Requirement:	Nominal 115 V, 60 Hz AC Mains Supply 13 Amp (max) (supplied via laptop)
Intended Operating Environment:	Residential
Interface Ports:	USB Port

2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Laptop PC
Brand Name:	Toshiba
Model Name or Number:	Tecra 550 CDT
Serial Number:	58016122
Cable Length And Type:	See AC Adaptor below
Connected to Port:	See AC Adaptor below

Description:	AC Adapter
Brand Name:	Toshiba
Model Name or Number:	PA2484U
Serial Number:	Not stated by client
Cable Length And Type:	2m 2 Core / 1.5m 2 Core
Connected to Port:	Input / Output

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 15 Subpart C: 2001 (Section 15.247)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Digital Devices.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

Reference:	FCC Part 15 Subpart B: 2001 (Section 15.107 and 15.109)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Radio Frequency Devices.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

FCC Code of Federal Regulations 47.
Telecommunication. Parts 0 to 19, October 2001.

ANSI C63.2 (1987)
Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)
Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)
Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)
Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)
Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

3.3. Definition Of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

4. Deviations From The Test Specification

None.

5. Operation Of The EUT During Testing

5.1. Operating Conditions

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by a 110 V, 60 Hz AC Mains supply, supplied via the laptop.

5.2. Operating Modes

The EUT was tested in the following operating modes:

Transmitting on Top, Middle or Bottom channels, hopping over the full operating range or in receive mode.

The reason for choosing these modes was that it was defined by the client as being likely to be the worst case with regards EMC.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

During all tests the EUT was connected to, powered and controlled by a laptop personal computer, containing the appropriate software.

6. Summary Of Test Results

Range Of Measurements	Specification Reference	Port Type	Compliancy Status
Receiver Radiated Emissions	C.F.R. 47 FCC Part 15: 2001 Section 15.109	Antenna	Complied
Transmitter Conducted Emissions (AC Mains)	C.F.R. 47 FCC Part 15: 2001 Section 15.207	AC Mains Terminals	Complied
Transmitter Carrier Frequency Separation	C.F.R. 47 FCC Part 15: 2001 Section 15.247(a)(1)	Antenna Terminals	Complied
Transmitter 20dB Bandwidth	C.F.R. 47 FCC Part 15: 2001 Section 15.247(a)(1)	Antenna Terminals	Complied
Transmitter Average Time of Occupancy	C.F.R. 47 FCC Part 15: 2001 Section 15.247(a)(1)(iii)	Antenna Terminals	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2001 Section 15.247(b)(1)	Antenna Terminals	Complied
Transmitter Conducted Emissions	C.F.R. 47 FCC Part 15: 2001 Section 15.247 (c)	Antenna Terminals	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2001 Section 15.247(c) Section 15.209(a)	Antenna	Complied
Transmitter Band Edge Conducted Emissions	CFR 47: 2001, Section 15.247(c)	Antenna Terminals	Complied
Transmitter Band Edge Radiated Emission	CFR 47: 2001, Section 15.247(c) Section 15.209(a)	Antenna	Complied

6.1. Location Of Tests

All the measurements described in this report were performed at the premises of Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

7. Measurements, Examinations And Derived Results

7.1. General Comments

7.1.1. This section contains test results only. Details of the test methods and procedures can be found in Appendix 2 of this report.

7.1.2. Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 8 for details of measurement uncertainties.

7.2. Receiver Conducted Emissions: AC Mains - Section 15.107

7.2.1. Quasi-Peak Detector Measurements On Live And Neutral Lines

7.2.1.1. The following table lists results for AC conducted emissions.

7.2.1.2. Preliminary AC conducted spurious scans were performed with the EUT set to receive mode.

7.2.1.3. Final measurements were performed on the worst-case configuration as described in Part 15.31(i).

7.2.1.4. Plots of all the initial scans can be found in the accompanying graph document.

7.2.1.5. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Results

Frequency (MHz)	Line	Q-P Level (dBμV)	Q-P Limit (dBμV)	Margin (dB)	Result
0.4733	Live/Neutral	44.71	48.0	3.29	Complied
0.71118	Live/Neutral	36.33	48.0	11.67	Complied
17.25801	Live/Neutral	35.26	48.0	12.74	Complied

7.3. Receiver Radiated Emissions: Section 15.109

7.3.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

7.3.1.1. The EUT was operated in receive mode to the limits specified in Part 15.109.

7.3.1.2. Preliminary Radiated spurious scans were performed at a test distance of 3 meters with the EUT set to Receive Mode, as stated in section 5.2. Final measurements were made at a test distance of 3 meters on any visible spurious emissions that were within 20 dB of the limit.

7.3.1.3. Plots of all the initial scans can be found in the accompanying graph document.

Results

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
46.19	Vert.	31.13	40.0	8.87	Complied
166.162	Vert.	37.57	43.5	5.93	Complied
239.991	Horiz.	35.83	46.0	10.17	Complied
325.213	Horiz.	40.54	46.0	5.46	Complied
390.255	Horiz.	43.05	46.0	2.95	Complied
455.303	Vert.	45.13	46.0	0.87	Complied
487.838	Vert.	38.76	46.0	7.24	Complied

7.4. Receiver Radiated Emissions: Section 15.109

7.4.1. Electric Field Strength Measurements (Frequency Range: 1.0 to 12.5 GHz)

7.4.1.1. The following table indicates results measured in the receive mode to the limits specified in Part 15.109.

7.4.1.2. Tests were performed up to five times the highest generated clock frequency.

7.4.1.3. Preliminary Radiated spurious scans were performed with final measurements being taken for any emission within 20dB of the limit.

7.4.1.4. Due to dynamic range limitations of the measuring receiver, scans at high frequencies above 12 GHz were performed at 1 metre measurement distances, with an corrected limit line for the reduced test distances.

7.4.1.5. Plots of all the initial scans can be found in the accompanying graph document.

7.4.1.6. The following results are for the EUT configured with an internal antenna connected and operating.

Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
4.7772	Vert.	11.08	22.4	1.8	35.28	54.0	18.72	Complied

Highest Peak Level:

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
4.7772	Vert.	19.9	22.4	1.8	44.10	74.0	29.9	Complied

7.5. Transmitter Conducted Emissions: AC Mains - Section 15.207

7.5.1. Quasi-Peak Detector Measurements On Live And Neutral Lines

7.5.1.1. The following table lists results for AC conducted emissions.

7.5.1.2. Preliminary conducted spurious scans were performed with the EUT set to Top, Middle, Bottom as requested in FCC Part 15.31(m).

7.5.1.3. Final measurements were then performed on the worst-case configuration as described in Part 15.31(i).

7.5.1.4. Plots of all the initial scans can be found in the accompanying graph document.

7.5.1.5. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

All Channels Channel

Frequency (kHz)	Line	Q-P Level (dBμV)	Q-P Limit (dBμV)	Margin (dB)	Result
0.4733	Live/Neutral	44.71	48.0	3.29	Complied
0.71118	Live/Neutral	36.33	48.0	11.67	Complied
17.25801	Live/Neutral	35.26	48.0	12.74	Complied

7.6. Transmitter Carrier Frequency Separation: Section 15.247(a)(1)

7.6.1. Tests were performed to identify the carrier frequency separation as per FCC Part 15.247(a)(1).

7.6.2. Section 15.247 (a)(1) specifies that the channels should be separated by at least 25kHz or the 20dB bandwidth of the channel.

7.6.3. A graphical plot of the characteristics of two adjacent channels was obtained. The following results were noted:

Result:

Transmitter Carrier Frequency Separation (kHz)	Graph
998	GPH/43908JD04/CE010

7.7.Transmitter 20dB Bandwidth: Section 15.247(a)(1)

7.7.1. Tests were performed to identify the 20dB bandwidth as per FCC Part 15.247(a)(1).

7.7.2. A graphical plot of the 20dB was obtained. The following results were noted:

Result:

Transmitter 20dB Bandwidth (kHz)	Graph
826	GPH/43908JD04/CE014

7.8.Transmitter Average Time of Occupancy: Section 15.247(a)(1)(iii)

7.8.1. Tests were performed to identify the average time occupancy as per FCC Part 15.247(a)(1)(iii).

7.8.2. Section 15.247 (a)(1)(iii) specifies that the average time occupancy shall not be greater than 0.4 seconds.

7.8.3. The time occupancy of the system was tested on a single carrier. The maximum packet length was measured and multiplied by the number of transmissions within a 30 second period. The result was noted as being the average time of occupancy.

Result:

Packet Width (μs)	Number of Transmissions in 30 Seconds	Average Time of Occupancy (s)	Graph
530	200	0.106	GPH/43908JD04/CE012 GPH/43908JD04/CE013

7.9. Transmitter Peak Output Power: Section 15.247(b)(1)

7.9.1. Tests were performed to identify the maximum transmit power in accordance with FCC Part 15.247(b)(1).

7.9.2. The client has provided a temporary antenna port to allow a direct connection to be made.

7.9.3. The client has specified that the EUT employs frequency hopping with 79 hopping channels. Therefore the maximum transmitter power level under FCC Part 15.247(b)(1) is 1 Watt.

7.9.4. Results are shown for the EUT set to Top, Middle and Bottom channels as stated in FCC Part 15.31 (m) and section 5.2 of this report. Graphical measurements are shown for the transmit power levels within the accompanying graph document.

7.9.5. Measurements were performed on the Top, Middle and Bottom channels for the specified extremes of input voltages:

Results

Number of Hopping Channels Employed	Graph
79	GPH/43908JD04/CE001 to GPH/43908JD04/CE009

Peak Output Power Conducted

Channel	Input Voltage (AC)	Maximum Transmitter Output Level (Watts)	Limit (Watts)	Margin	Result
Top	93.5	0.019916	1.0	0.980084	Complied
Top	110	0.019916	1.0	0.980084	Complied
Top	126.5	0.019916	1.0	0.980084	Complied
Middle	93.5	0.020141	1.0	0.979859	Complied
Middle	110	0.020141	1.0	0.979859	Complied
Middle	126.5	0.020331	1.0	0.979669	Complied
Bottom	93.5	0.016921	1.0	0.983079	Complied
Bottom	110	0.016969	1.0	0.983021	Complied
Bottom	126.5	0.016969	1.0	0.983021	Complied

Transmitter Peak Output Power: Section 15.247(b)(1) (continued)

Peak Output Power EIRP

Channel	Input Voltage (AC)	Maximum Transmitter Output Level (Watts)	Antenna Gain (dBi)	Limit (Watts)	Margin	Result
Top	93.5	0.019916	0.0	1.0	0.980084	Complied
Top	110	0.019916	0.0	1.0	0.980084	Complied
Top	126.5	0.019916	0.0	1.0	0.980084	Complied
Middle	93.5	0.020141	0.0	1.0	0.979859	Complied
Middle	110	0.020141	0.0	1.0	0.979859	Complied
Middle	126.5	0.020331	0.0	1.0	0.979669	Complied
Bottom	93.5	0.016921	0.0	1.0	0.983079	Complied
Bottom	110	0.016969	0.0	1.0	0.983021	Complied
Bottom	126.5	0.016969	0.0	1.0	0.983021	Complied

7.10. Transmitter Conducted Emissions: Section 15.247(c)

7.10.1. Spurious emissions tests on the antenna port were performed in accordance with FCC Part 15.247(c).

7.10.2. Section 15.247(c) specifies that all spurious emissions measured within a 100 kHz bandwidth shall be attenuated by at least 20 dB below the level of the highest fundamental level measured in a 100 kHz bandwidth.

7.10.3. Conducted spurious emission scans were performed between 30 to 26500MHz with the EUT operating at the Top, Middle, Bottom channels as specified within clause 15.31(m). All channels were active and transmitting data. Initial scans indicate that all spurious emissions were of an amplitude of at least 20dB below the reference limit line, therefore final measurements were not required.

7.10.4. Plots of the initial scans can be found in the accompanying graph document.

7.11. Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a)

7.11.1. Electric Field Strength Measurements: 30 to 1000 MHz.

7.11.1.1. The following table specifies frequencies, which fall close or that were within the restricted bands as specified in section 15.205(a).

7.11.1.2. Preliminary radiated spurious scans were performed with the EUT set to Top, Middle and Bottom channels.

7.11.1.3. Due to dynamic range limitations of the measuring receiver, scans at high frequencies above 12 GHz were performed at a 1 metre measurement distance. The measured value was then corrected by 9.5 dB using the formula 20log(D1/D2) Where D1 was 3 meters and D2 was 1 meter.

7.11.1.4. Plots of all the initial scans can be found in the accompanying graph document.

7.11.1.5. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector at a test distance of 3m (results incorporate antenna factors and cable losses):

7.11.1.6. The following results are for the EUT configured with an internal antenna connected and operating.

Results

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
46.19	Vert.	31.13	59.46	28.33	Complied
166.162	Vert.	37.57	43.50	5.93	Complied
239.991	Horiz.	35.83	59.46	23.63	Complied
325.213	Horiz.	40.54	46.00	5.46	Complied
390.255	Horiz.	43.05	59.46	16.41	Complied
455.303	Vert.	45.13	59.46	14.33	Complied
487.838	Vert.	38.76	59.46	20.70	Complied

Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)

7.11.2. Electric Field Strength Measurements: 1.0 to 26.0 GHz

Highest Average Level: Bottom Channel

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
4.80411	Vert.	16.75	22.4	1.8	40.95	54.0	13.05	Complied
7.20640	Vert.	10.56	24.9	1.9	37.36	54.0	16.64	Complied
9.60835	Vert.	4.41	28.1	2.3	34.81	54.0	19.19	Complied

Highest Peak Level: Bottom Channel

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
4.80411	Vert.	28.71	22.4	1.8	52.91	74.0	21.09	Complied
7.20640	Vert.	24.40	24.9	1.9	51.20	74.0	22.80	Complied
9.60835	Vert.	18.61	28.1	2.3	49.01	74.0	24.99	Complied

Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)

Highest Average Level: Middle Channel

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
4.88225	Vert.	17.30	22.4	1.8	41.50	54.0	12.50	Complied
7.32340	Vert.	10.75	24.9	1.9	37.55	54.0	16.45	Complied
9.76480	Vert.	3.86	28.1	2.3	34.26	54.0	19.74	Complied

Highest Peak Level: Middle Channel

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
4.88225	Vert.	30.5	22.4	1.8	54.70	54.0	19.30	Complied
7.32340	Vert.	25.21	24.9	1.9	52.01	74.0	21.99	Complied
9.76480	Vert.	18.87	28.1	2.3	49.27	74.0	24.73	Complied

Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)

Highest Average Level: Top Channel

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
4.6019	Vert.	20.71	22.4	1.8	44.91	54.0	9.09	Complied
7.44027	Vert.	15.05	24.9	1.9	41.85	54.0	12.15	Complied
9.9207	Vert.	8.86	28.1	2.3	39.26	54.0	14.74	Complied

Highest Peak Level: Top Channel

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
4.6019	Vert.	33.64	22.4	1.8	57.84	74.0	16.16	Complied
7.44027	Vert.	28.29	24.9	1.9	55.59	74.0	18.41	Complied
9.9207	Vert.	24.65	28.1	2.3	55.05	74.0	18.95	Complied

7.12. Transmitter Band Edge Conducted Emissions FCC 15.247(c)

7.12.1.The EUT and spectrum analyser were configured as for conducted antenna port measurements, and as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

7.12.2.The applicant to allow for conducted measurements provided a temporary antenna port.

7.12.3. A plot of the upper channel and the protected band closest to the upper channel was produced. A marker was set to the peak of the highest channel and a delta marker set to the highest out of band peak. (The specification states that either the band edge level must be measured or the highest out of band emission, whichever is greater). The plots show that the emission complies with the 20dBc limit.

7.12.4. A plot of the lower channel and the protected band closest to the lower channel was produced. A marker was set to the peak of the lowest channel and a delta marker set to the highest out of band peak. (The specification states that either the band edge level must be measured or the highest out of band emission, whichever is greater). The plots show that the emission complies with the 20dBc limit.

7.12.5. Two graphs in total were produced, with the device set to top and bottom channels. The plots GPH/43908JD04/CE015 and GPH/43908JD04/CE016 can be seen in the accompanying graph document.

7.13. Transmitter Band Edge Radiated Emissions

7.13.1. Electric Field Strength Measurements

7.13.1.1. The EUT and spectrum analyser were configured for radiated measurements as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

7.13.1.2. A plot of the protected band closest to the upper channel was produced with frequency hopping mode turned off and the device set to transmit on the top channel. A marker was set to the peak of the highest out of band emission. (The specification states that either the band edge level must be measured or the highest out of band emission, which ever is greater).

7.13.1.3. The highest noted emission was then measured as per the requirements of FCC Part 15.209 for electric field strength measurements.

7.13.1.4. A plot of the protected band closest to the lower channel was then produced with frequency hopping turned off and the device set to transmit on the bottom channel. A marker was set to the peak of the highest out of band emission. (The specification states that either the band edge level must be measured or the highest out of band emission, which ever is greater).

7.13.1.5. The highest noted emission was then measured as per the requirements of FCC Part 15.209 for electric field strength measurements.

7.13.1.6. Two graphs were produced showing the responses in the limited frequency bands. The plots indicate the tighter of the peak and average limits, however, final measurements were performed against the appropriate limits for the detector being used. The plots GPH/43908JD04/037 and GPH/43908JD04/038 can be seen in the accompanying graph document.

Average Level

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Result
2.400	V	27.2	20.5	1.4	49.1	54	4.9	Complied
2.4835	V	10.6	20.5	1.4	32.5	54	21.5	Complied

Peak Level

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBμV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Result
2.400	V	34.3	20.5	1.4	56.2	74	17.8	Complied
2.4835	V	21.9	20.5	1.4	43.8	74	30.2	Complied

8. Measurement Uncertainty

8.1. No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

8.2. The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

8.3. The uncertainty of the result may need to be taken into account when interpreting the measurement results.

8.4. The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Conducted Emissions AC Mains	0.15 MHz to 30 MHz	95%	+/- 3.25 dB
Time Occupancy	Not applicable	95%	+/- 10 %
Channel Separation	Not applicable	95%	+/- 10 %
Occupied Bandwidth	1850 to 1910 MHz	95%	+/- 0.12 %
Radiated Emissions at 3.0 metres	30 MHz to 1000 MHz	95%	+/- 5.26 dB
Conducted Emissions Antenna Port	0.009 kHz to 26 GHz	95%	+/- 1.2 dB
Radiated Emissions at 3.0 metres	1 GHz to 26 GHz	95%	+/- 1.78 dB

8.5. The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A027	Horn Antenna	Eaton	9188-2	301
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557
A1069	ESH3-Z5	Rohde & Schwarz	ESH3-Z5	837469/012
A1211	Attenuator	Huber + Suhner	6830.17.B	None
A197	Site 2 Controller SC144	Unknown	SC144	150720
A238	3 dB Attenuator	Schaffner	6803-17-B	None
A239	6 dB Attenuator	Schaffner	6806-17-B	None
A244	20 dB Attenuator	Schaffner	6820-17-B	None
A259	Bilog Antenna	Chase	CBL6111	1513
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	None
A427	WG 14 horn	Flann	14240-20	150
A428	WG 12 horn	Flann	12240-20	134
A429	WG 16 horn	Flann	16240-20	561
A430	WG 18 horn	Flann	18240-20	425
A436	WG 20 horn	Flann	20240-20	330
A559	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	357881052
C1001	Cable	Rosenberger	FA210A1020 M30309	003
C160	Cables	Rosenberger	UFA210A-1-1181-70x70	None
C172	Cable	Rosenberger	UFA210A-1-1181-70x70	None
C341	Cable	Andrews	None	None
C362	Cable	Rosenberger	UFA210A-1-1181-70x70	1925
C375	Cable	Rosenberger	RG400	None
C453	Cable	Rosenberger	RG142XX-001-RFIB	C453-10081998
C457	Cable	Rosenberger	RG142XX-002-RFIB	C457-10081998

Test Equipment Used (continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
C468	N-Type Coaxial Cable	Rosenberger	UFA210A-1-3937-504504	98L0440
G011	SMGU Signal Generator	Rohde & Schwarz	SMGU	894 054/004
G085	Generator	Hewlett Packard	83650L	3614A00104
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M025	Fluke 87 Multimeter	Fluke	87	473 50093
M088	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:835862/018 RU:835387/006
M115	Temperature/Humidity Meter	RS Components	212-146	None
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016
M133	Temperature/Humidity/Pressure Meter	RS Components	None	None
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
M198	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	827 191/003
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075
S003	Power Control	Zen	E08	736699
S201	Site 1	RFI	1	None
S202	Site 2	RFI	2	None
S207	Site 7	RFI	7	None
S212	Site 12	RFI	12	None

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

Appendix 2. Measurement Methods

AC Mains Conducted Emissions

AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane and with the EUT powered via a 60 Hz AC mains supply.

Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

The test equipment settings for conducted emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
Detector Type:	Peak	Quasi-Peak (CISPR)*
Mode:	Max Hold	Not applicable
Bandwidth:	9 kHz	9 kHz
Amplitude Range:	60 dB	20 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

* In some instances an Average detector function may also have been used.

Radiated Field Strength Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested on the open area test site, at the appropriate distance, using a measuring receiver with a Quasi-Peak (below 1000 MHz), Average and Peak (above 1000 MHz) detector, where applicable.

For the main (final) measurements the EUT was arranged on a non-conducting table on an open area test site, as detailed in the specification.

All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360°. For frequencies below 1000 MHz, the antenna was varied in height between 1 m and 4 m. For frequencies above 1000 MHz, the antenna was fixed at a height of 1.5m. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Once the signal amplitude is determined the EUT is replace with a substitution antenna. A signal generator is connected to the antenna and its level adjusted in order to obtain the same indicated level as that which was observed from the EUT. The receive antenna is then adjusted in height until the signal measured has peaked. The signal generator level is then re-adjusted to regain the original reading. The level on the signal generator – cable losses plus the antenna gain is the recorded ERP.

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	**Initial Scan Below 1000 MHz**	**Final Measurements Below 1000 MHz**
Detector Type:	Peak	Quasi-Peak (CISPR)
Mode:	Max Hold	Not applicable
Bandwidth:	100 kHz	120 kHz
Amplitude Range:	60 dB	20 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Receiver Function	**Initial Scan Above 1000 MHz**	**Final Measurements Above 1000 MHz**
Detector Type:	Peak	Peak/Average
Mode:	Max Hold	Not applicable
Bandwidth:	1 MHz	1 MHz
Amplitude Range:	60 dB	20 dB (typical)
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Conducted Antenna Port Emissions

Conducted Antenna Port Emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequency range. For each measurement range performed, the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the measurement setup.

Initial measurements covering the entire measurement band in the form of swept scans were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which measurements were performed. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Due to the design of the EUT, conducted antenna port measurements were common for both the internal and external antenna connection.

To determine the transmitter output power, the EUT was operated as intended with the spectrum analyser operated in a maximum hold mode over the full operating frequency range of the EUT to identify the highest emission within the band.

To determine spurious emissions levels, the EUT was operated as intended with the spectrum analyser operated in a maximum hold mode over selected frequency ranges between 30 MHz and 26 GHz. A reference limit line of 20dB below the maximum output of the transmitter was noted. Levels within 20dB of this limit line were then recorded.

Channel Separation FCC 15.247(1)

The EUT and spectrum analyser was configured as for conducted antenna port measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine the bandwidth and separation of each transmission channel the analyser was configured to measure two adjacent channels.

To determine the occupied bandwidth, A resolution bandwidth of 10 kHz was used, which is greater than 1% of the 20 dB bandwidth. A video bandwidth of a least the same value was used. The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference line was drawn 20dB below the peak level. The bandwidth was determined at the points where the 20dB reference crossed the profile of the emission.

Occupied Bandwidth FCC 15.247(1)

For channel separation, the analyser was configured with a resolution bandwidth and video bandwidth of at least 1% of the frequency span set on the analyser. The EUT was operated as intended and the analyser set to a maximum hold mode scan to capture the profile of the signals.

The peak points on the two adjacent channels were noted and the separation between them recorded.

The channel separation was then determined as the greater of 25kHz or the 20dB bandwidth.

Average Time of Occupancy FCC 15.247(1)(ii)

The EUT and spectrum analyser was configured as for conducted antenna port measurements

To determine the maximum packet length on any given channel, the analyser was configured in the time domain mode and the EUT was configured to operate as intended.

To determine the average occupancy time on any given channel the analyser was configured in the time domain and a 30 second sweep carried out. The number of times the channel was occupied in any 30 second period multiplied by the maximum packet length will give the total time on the given channel.

Number Of Hopping Frequencies FCC 15.247(a)(1)(ii)

The EUT and spectrum analyser was configured as for conducted antenna port measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

To determine the number of hopping frequencies the EUT was set to operate in its normal mode of operation, hopping over all channels that it is intended to operate on.

The spectrum analyser had a span set to cover the frequency band of operation. The resolution bandwidth was set to >= 1% of the span. The video bandwidth was set to be no less than the resolution bandwidth. The sweep was set to auto, the detector function to peak and trace to max hold. This test was also performed with the span set to the lower half the operating frequency range and then to the upper half of the operating frequency range for better resolution.

Peak Output Power FCC 15.247(b)

The EUT and spectrum analyser was configured as for conducted antenna port measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

The applicant to allow for conducted measurements provided a temporary antenna port.

As the frequency range of operation was greater than 10 MHz, The test was performed on the BOTTOM, MIDDLE and TOP channels as per FCC 15.31(m).

The tests were performed at extremes of voltage of +/- 15%. The test was also performed at 240 Volts + 15% at the applicants request.

The analyser was setup as per FCC Public Notice DA 00-705.

Band Edge Compliance of RF Conducted Emissions FCC 15.247(c)

The EUT and spectrum analyser was configured as for conducted antenna port measurements, And as per FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

A temporary antenna port was provided by the applicant to allow for conducted measurements.

To determine band-edge compliance, the analyser bandwidth resolution bandwidth was set to >= the analyser span. The video bandwidth was set to be no less than the resolution bandwidth. The sweep was set to auto and the detector to peak. The trace was set to max hold and a trace was produced.

A Plot of the upper channel and the protected band closest to the upper channel was produced. A marker was set to the peak of the highest channel and a delta marker set to the highest out of band peak. (The specification states that either the band edge level must be measured or the highest out of band emission. Which ever is greater). The plots show that the emission complies with the 20 dBc limit.

A Plot of the lower channel and the protected band closest to the lower channel was produced. A marker was set to the peak of the lowest channel and a delta marker set to the highest out of band peak. (The specification states that either the band edge level must be measured or the highest out of band emission. Which ever is greater). The plots show that the emission complies with the 20 dBc limit.

Four plots were produced, Two times top and bottom channels with hopping on and two time top and bottom channels with hopping off.

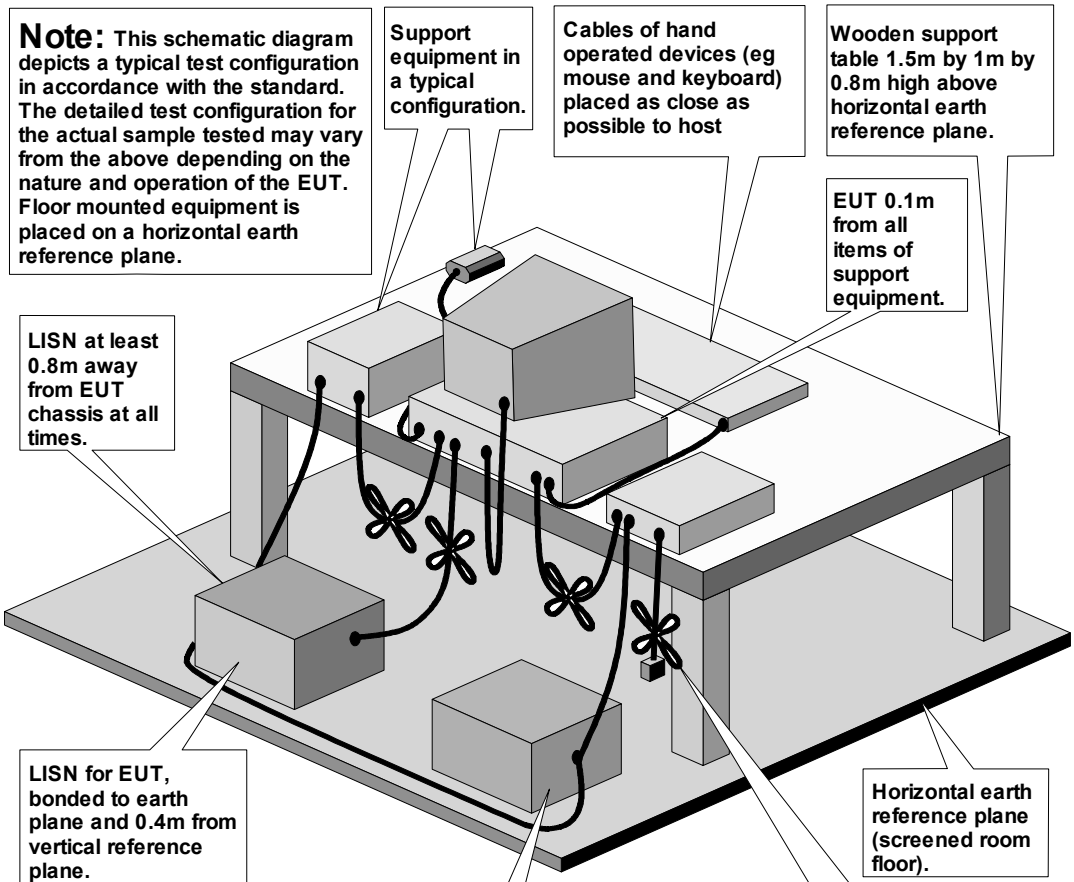
Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\43908JD04\EMICON	Test configuration for measurement of conducted emissions
DRG\43908JD04\EMIRAD	Test configuration for measurement of radiated emissions
DRG\43908JD04\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

Test Of: Giant Electronics Ltd.
OLUSB Bluetooth Dongle
To: F.C.C. Part 15 Subpart C: 2000 (Intentional Radiators) Section 15.247

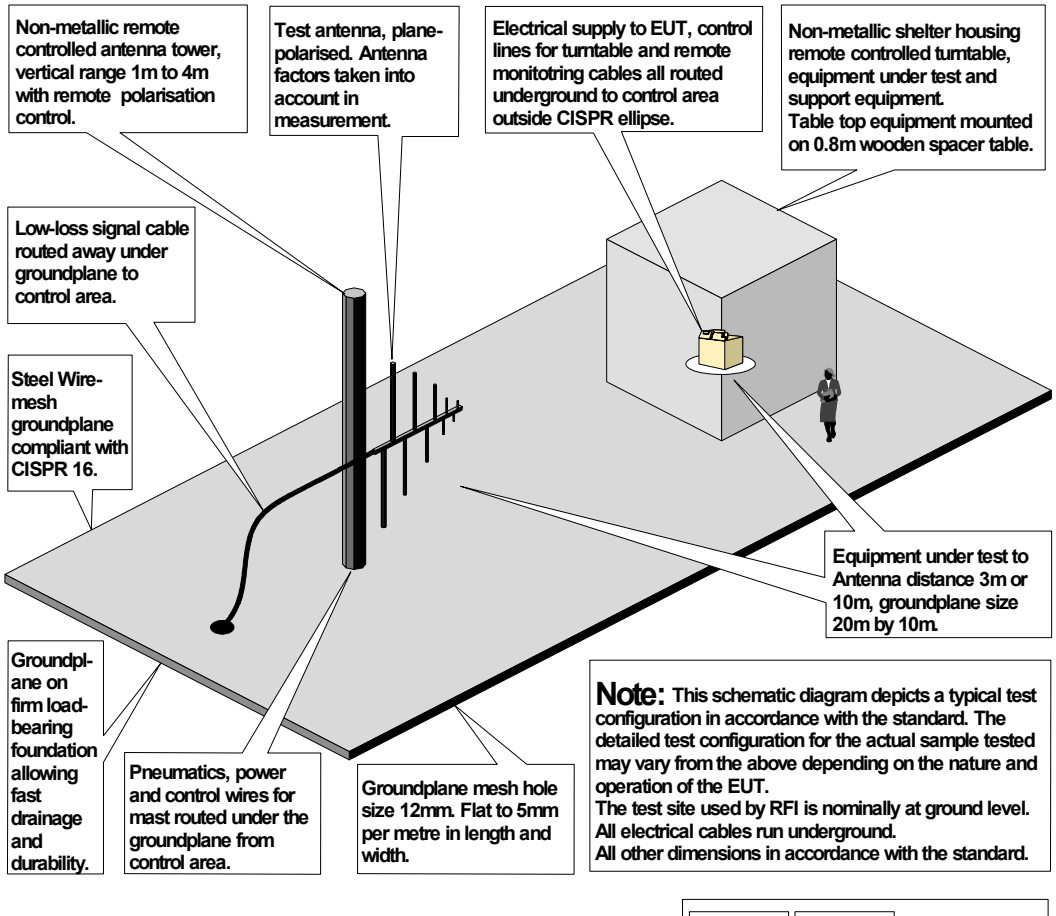
DRG\43908JD04\EMICON



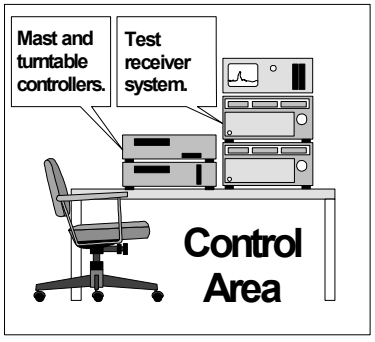
Typical Test Configuration For Conducted Emissions Measurements In Accordance With ANSI C63.4-1992
Tests performed in a screened enclosure

Test Of: **Giant Electronics Ltd.**
OLUSB Bluetooth Dongle
To: **F.C.C. Part 15 Subpart C: 2000 (Intentional Radiators) Section 15.247**

DRG\43908JD04\EMIRAD



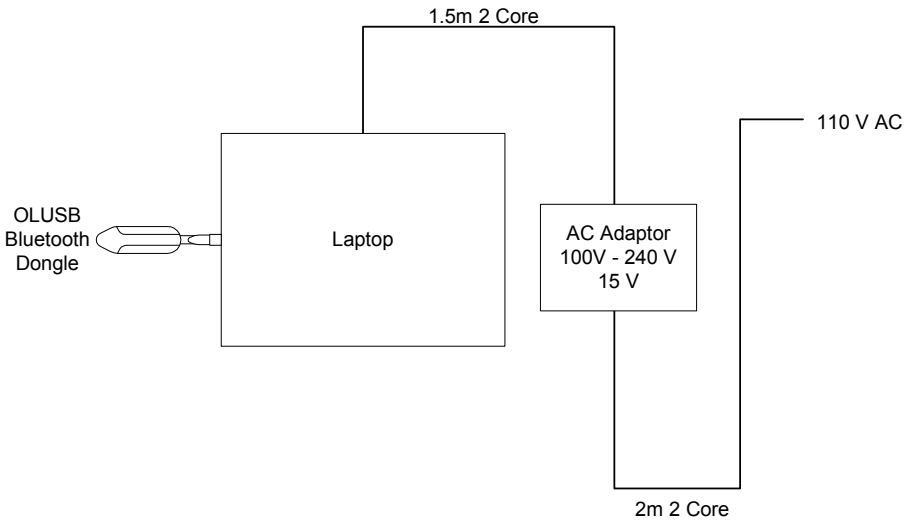
Test Configuration For Radiated Emissions Measurements
Reflection-free area: >60m by 52m (CISPR ellipse)
Groundplane Earthed
Control room outside CISPR ellipse



Test Of: **Giant Electronics Ltd.**
OLUSB Bluetooth Dongle
To: **F.C.C. Part 15 Subpart C: 2000 (Intentional Radiators) Section 15.247**

DRG\43908JD04\001

Configuration of EUT and Local Support Equipment



Configuration of Remote Support Equipment