

TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Multitone Electronics PLC.
Radio Paging Receiver TLA 853

To: FCC Part 15: 1998 Class B
(Radiated Emissions Only)

Test Report Serial No:
RFI/EMCB1/RP41589ETF01A

This Test Report Is Issued Under The Authority Of Brian Watson Technical Director: 	Checked By: 
Tested By: 	Release Version No: PDF01
Issue Date: 27 November 2000	Test Date: 8 November 2000

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RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

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1. Client Information

Company Name:	Multitone Electronics PLC.
Address:	Multitone House Beggarwood Lane Kempshot Hill Basingstoke RG23 7LL Hampshire.
Contact Name:	Mr. Brian Merchant.

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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)

Brand Name	Multitone (414.775 MHz version)
Model Name or Number	TLA 583
Unique Type Identification	Not stated by client
Serial Number	0111369W:03
Country Of Manufacture	U.K.
F.C.C. ID Number	E86TLA853
Date Of Receipt	08 November 2000

Brand Name	Multitone (430.35 MHz version)
Model Name or Number	TLA 853
Unique Type Identification	Not stated by client
Serial Number	0111370W:03
Country Of Manufacture	U.K.
F.C.C. ID Number	E86TLA853
Date Of Receipt	08 November 2000

Brand Name	Multitone (464.6875 MHz version)
Model Name or Number	TLA 853
Unique Type Identification	Not stated by client
Serial Number	0111368W:03
Country Of Manufacture	U.K.
F.C.C. ID Number	E86TLA853
Date Of Receipt	08 November 2000

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2.2. Description Of EUT

The EUT is an alpha-numeric Radio Paging Receiver, utilising the CCIR No1 radio-paging code format (POCSAG). The unit has tone-alert, vibrate and alpha-numeric display facilities.

2.3. Modifications Incorporated In EUT

The EUT incorporates the following modifications:

No physical changes have been made to the EUT build, but the operating software has been adjusted to a "test mode" which allows for "continuous calling" with a faster reset cycle time, in order to more easily assimilate worst case EMC conditions.

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2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal battery supply of +1.5V nominal
Intended Operating Environment:	Domestic, Office & light industrial, Industrial, Hospital
Weight:	62 g
Dimensions:	75 x 50 x 16 mm
Interface Ports:	None
Cycle Time:	3 secs

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2.5. Support Equipment: (Remotely Located)

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

Description	POCSAG Encoder
Brand Name	Multitone
Model Name or Number	P645
Serial Number	3830:01
F.C.C. ID Number	Not applicable
Cable Length And Type	Not applicable
Connected to Port	PC RS232 - RF Signal Generator DC Modulation I/P

Description	RF Signal Generator
Brand Name	Not stated by client
Model Name or Number	Not stated by client
Serial Number	Not stated by client
F.C.C. ID Number	Not Applicable
Cable Length And Type	< 10m, Coaxial
Connected to Port	RF

Description	Personal Computer
Brand Name	Not stated by client
Model Name or Number	Not stated by client
Serial Number	Not stated by client
F.C.C. ID Number	Not applicable
Cable Length And Type	3m, RS232
Connected to Port	RS 232

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3. Test Specification, Methods & Procedures

3.1. Test Specification

Reference:	FCC Part 15: 1998 Class B
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.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (1992)

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 (1993)

Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1. Radio disturbance and immunity measuring apparatus.

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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.

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4. Deviations From The Test Specification

None.

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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 Internal battery supply of +1.5V nominal

5.2. Operating Modes

The EUT was tested in the following operating mode:

The EUT continually paged from the remotely located support equipment, (Signal Generator) and therefore continually receiving, decoding and displaying paging calls.

The reason for choosing this mode 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:

Standalone unit.

The reason for choosing this configuration was that it was defined by the client as being typical of normal use and likely to be a worst case with regard to EMC.

NB Section 2 of this report contains a full list of support equipment used and Appendix 3 contains a schematic diagram of the test configuration.

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6. Summary Of Test Results

6.1. Summary Of Tests

Test Name	Specification Reference (Clause Number)	Port Type	Compliance Status
Electric Field Strength Emissions	Section 15 of C.F.R. 47: 1998	Enclosure (414.775 MHz version)	Complied
Electric Field Strength Emissions	Section 15 of C.F.R. 47: 1998	Enclosure (430.35 MHz version)	Complied
Electric Field Strength Emissions	Section 15 of C.F.R. 47: 1998	Enclosure (464.6875 MHz version)	Complied

6.2. 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.

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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. The measurement uncertainties stated were calculated in accordance with the requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Section 8 for details of measurement uncertainties.

7.1.3. It should be noted that this report covers 3 different versions of the TLA 853 unit. Each unit is set to receive at different frequencies, 464.6875 MHz, 430.35 MHz and 414.775 MHz.

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7.2. Test Results For Radiated Emissions (414.775 MHz version)

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

7.2.1.1. Plots of the initial scans can be found in Section 7.3.

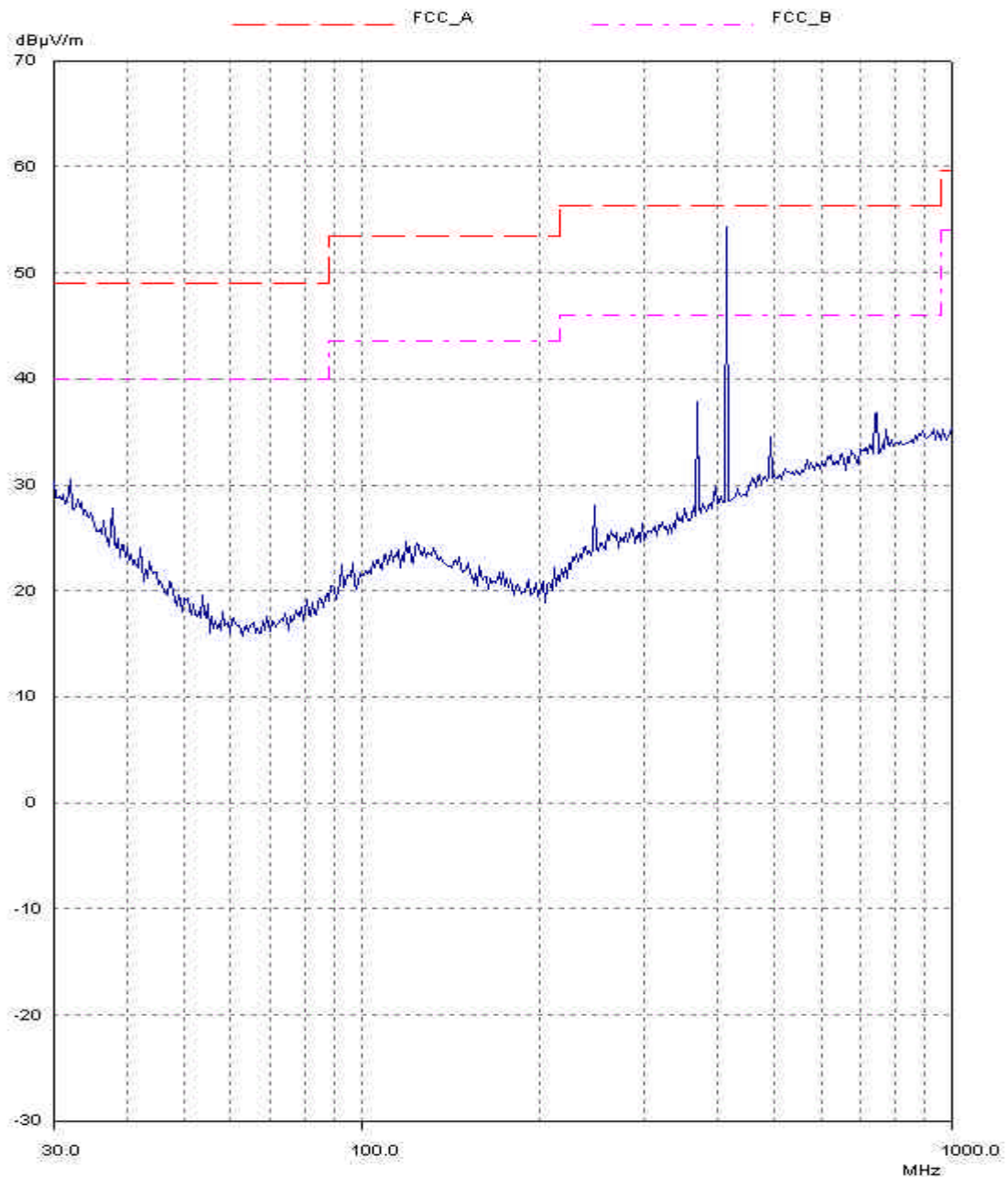
7.2.1.2. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Ant. Pol.	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
31.953	Vert.	25.800	40.000	14.200	Complied
37.777	Vert.	24.300	40.000	15.700	Complied
246.539	Vert.	18.300	46.000	27.700	Complied
369.771	Vert.	25.300	46.000	20.700	Complied
493.031	Horiz.	26.000	46.000	20.000	Complied
742.136	Horiz.	35.700	46.000	10.300	Complied

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7.3.Scan of Radiated Emissions (414.775 MHz version)

7.3.1.The following graph was produced as a result of the initial preliminary exploratory scans. These scans were performed at a 3 metre test distance to all four sides of the EUT in both polarisations. The scans were performed in a shielded enclosure using a max hold mode incorporating a Peak detector.



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7.4. Test Results For Radiated Emissions (430.35 MHz version)

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

7.4.1.1. Plots of the initial scans can be found in Section 7.5.

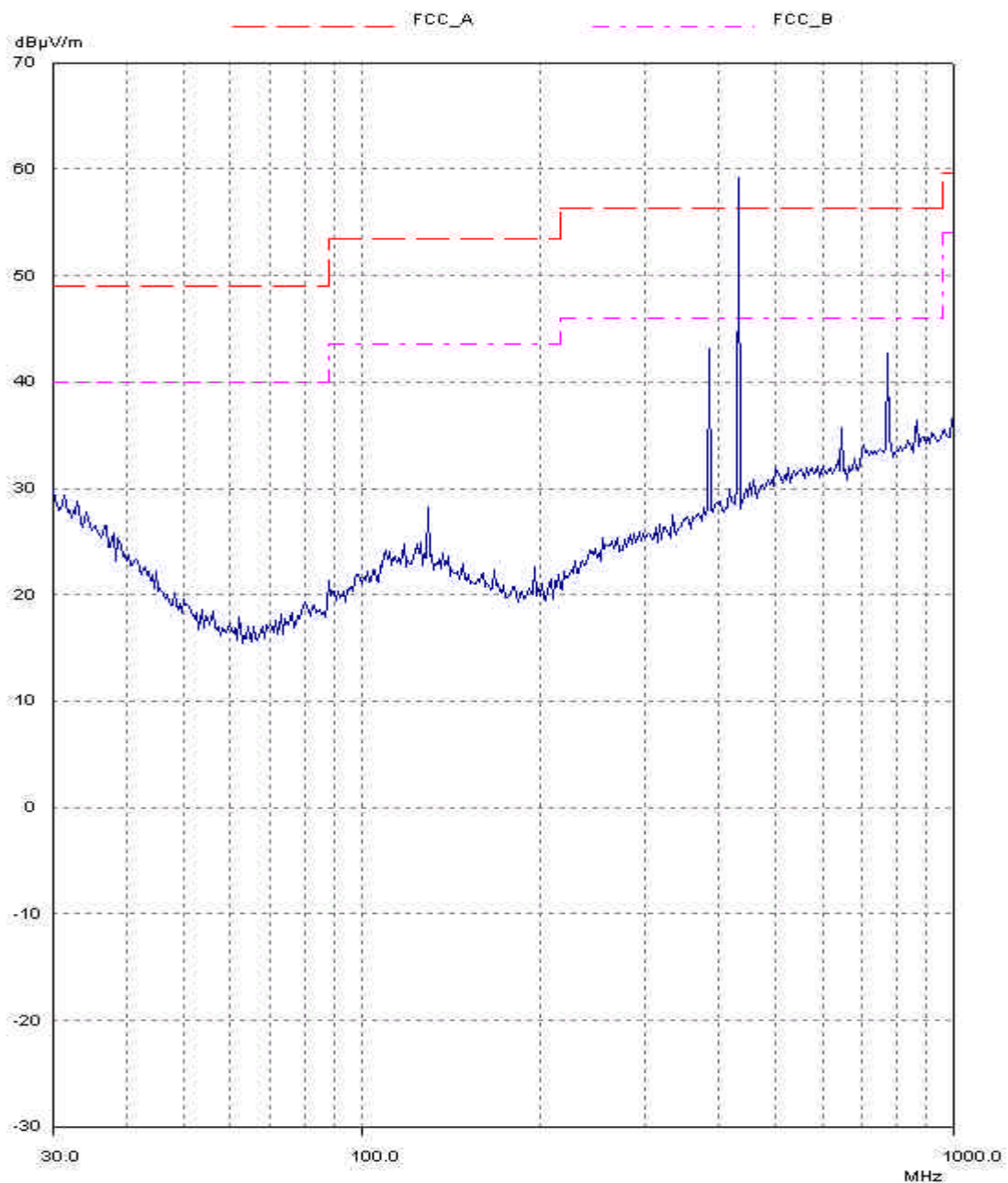
7.4.1.2. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Ant. Pol.	Q-P Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
31.328	Vert.	23.000	40.000	17.000	Complied
129.453	Vert.	14.400	43.500	29.100	Complied
385.349	Horiz.	28.900	46.000	17.100	Complied
646.500	Vert.	38.000	46.000	8.000	Complied
770.707	Horiz.	35.300	46.000	10.700	Complied
863.900	Horiz.	36.100	46.000	9.900	Complied

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7.5.Scan of Radiated Emissions (430.35 MHz version)

7.5.1.The following graph was produced as a result of the initial preliminary exploratory scans. These scans were performed at a 3 metre test distance to all four sides of the EUT in both polarisations. The scans were performed in a shielded enclosure using a max hold mode incorporating a Peak detector.



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7.6. Test Results For Radiated Emissions (464.6875 MHz version)

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

7.6.1.1. Plots of the initial scans can be found in Section 7.7.

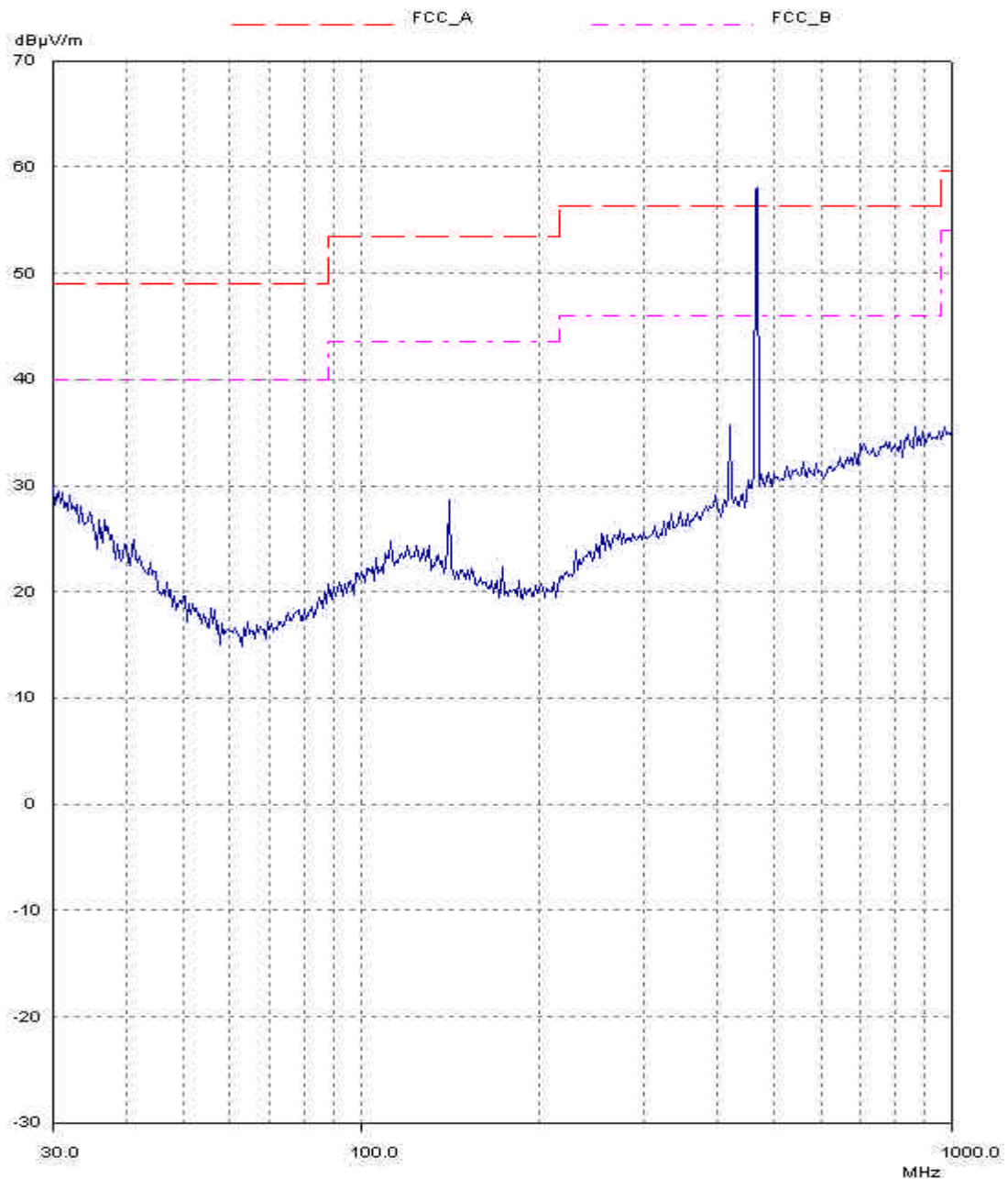
7.6.1.2. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Ant. Pol.	Q-P Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
32.066	Vert.	20.400	40.000	19.600	Complied
41.345	Vert.	18.400	40.000	21.600	Complied
139.880	Vert.	26.800	43.500	16.700	Complied
255.000	Vert.	18.000	46.000	28.000	Complied
421.040	Vert.	27.800	46.000	18.200	Complied
867.373	Horiz.	36.100	46.000	9.900	Complied

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7.7.Scan of Radiated Emissions (464.6875 MHz version)

7.7.1.The following graph was produced as a result of the initial preliminary exploratory scans. These scans were performed at a 3 metre test distance to all four sides of the EUT in both polarisations. The scans were performed in a shielded enclosure using a max hold mode incorporating a Peak detector.



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8. Measurement Uncertainty

8.1. Company Policy, as based on the UKAS Accreditation Standard, M10, paragraph 12.11 (o), states that Test Reports shall include estimated uncertainty of the calibration or test result (this information need only appear in test reports and test certificates where it is relevant to the validity or application of the test result, where a client's instructions so require or where uncertainty affects compliance to a specification or limit).

8.2. 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. The uncertainty evaluation has been carried out in accordance with UKAS requirements:

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Emissions	30 MHz to 1000 MHz @ 10 m	95%	+/- 5.1 dB

8.3. Measurement uncertainties have been applied in accordance with UKAS document NIS 81 (edition 1, May 1994), and in the absence of any specification criteria, guidance, or code of practice, compliance has been judged on the basis of shared risk.

8.4. In the case of emissions tests, the measured value of the disturbance from the product sample shall be compared directly with the limits. If the measured value is equal to or less than the limit the product is deemed to pass the test.

8.5. In the case of immunity tests, the equipment is deemed to pass the test if it fulfils the stated performance criteria at the required or a higher severity level. The measurement uncertainty has been taken into account in the calibration procedures stated in the relevant basic standard.

8.6. The methods used to calculate the above uncertainties are in line with those used for calibration laboratories contained in UKAS document M 3003 Edition 1 "The Expression of Uncertainty and Confidence in Measurement" December 1997, which align with international recommendations "Guide to the Expression of Uncertainty in Measurement" ISO/IEC/OIML/BIPM (Prepared by ISO/TAG 4: January 1993).

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Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model Number	RFI No.
Chase Bilog Antenna	Chase EMC Ltd	CBL6112B	A1037
Bilog Antenna	Chase	CBL6111	A259
OATS Positioning Controller	Rohde & Schwarz	HCC	A276
3 dB attenuator (9)	Suhner	6803.17.B	A392
Cable	RFI	None	C049
Cable	RFI	None	C055
Cables	Rosenberger	UFA210A-1-1181-70x70	C160
Cable	Andrews	None	C341
Cable	Rosenberger	UFA210A-1-1182-704704	C459
Spectrum Monitor	Rohde & Schwarz	EZM	M003
ESVP Receiver	Rohde & Schwarz	ESVP	M023
Turntable Controller	R.H.Electrical Services	RH351	M173
Thermo/hygro meter	RS Components Ltd	RS212-124	M210
Analyser Display Unit	Rohde & Schwarz	ESAI-D	M505
RF unit	Rohde & Schwarz	ESBI-RF	M506
Site 1	RFI	1	S201
Site 12	RFI	12	S212

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

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Appendix 2. Measurement Methods

A2.1. Radiated Emissions

A2.1.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for a Quasi-Peak detector.

A2.1.2. 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.

A2.1.3. 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 detector.

A2.1.4. 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.

A2.1.5. All measurements on the open area test site were performed using broadband antennas.

A2.1.6. 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° and then varying the antenna height between 1 m and 4 m. 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.

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A2.1.7. The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
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

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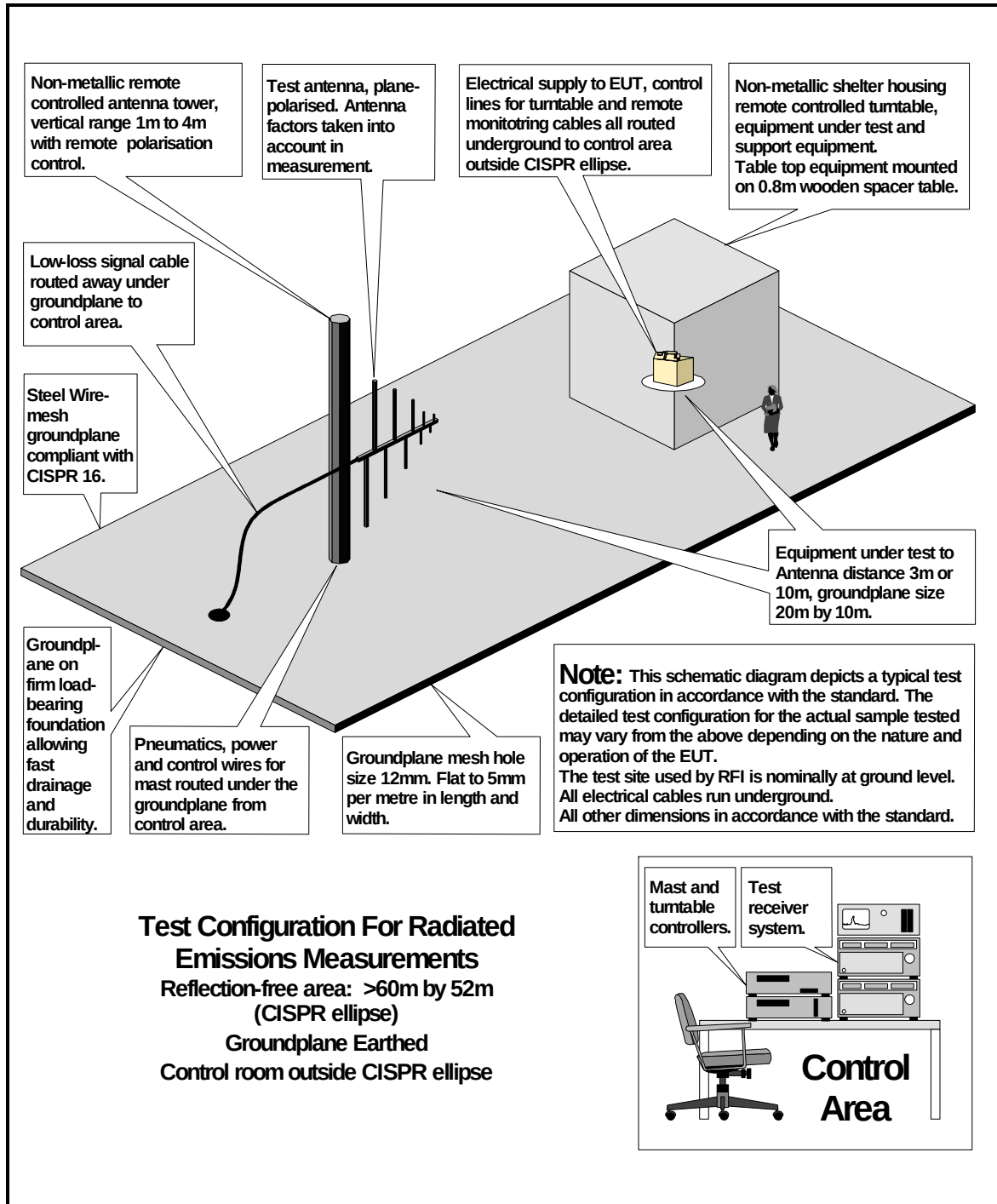
Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\41589ETF01\EMIRAD	Test configuration for measurement of radiated emissions
DRG\41589ETF01\001	Schematic Diagram of the EUT, support equipment and interconnecting cables used for the test

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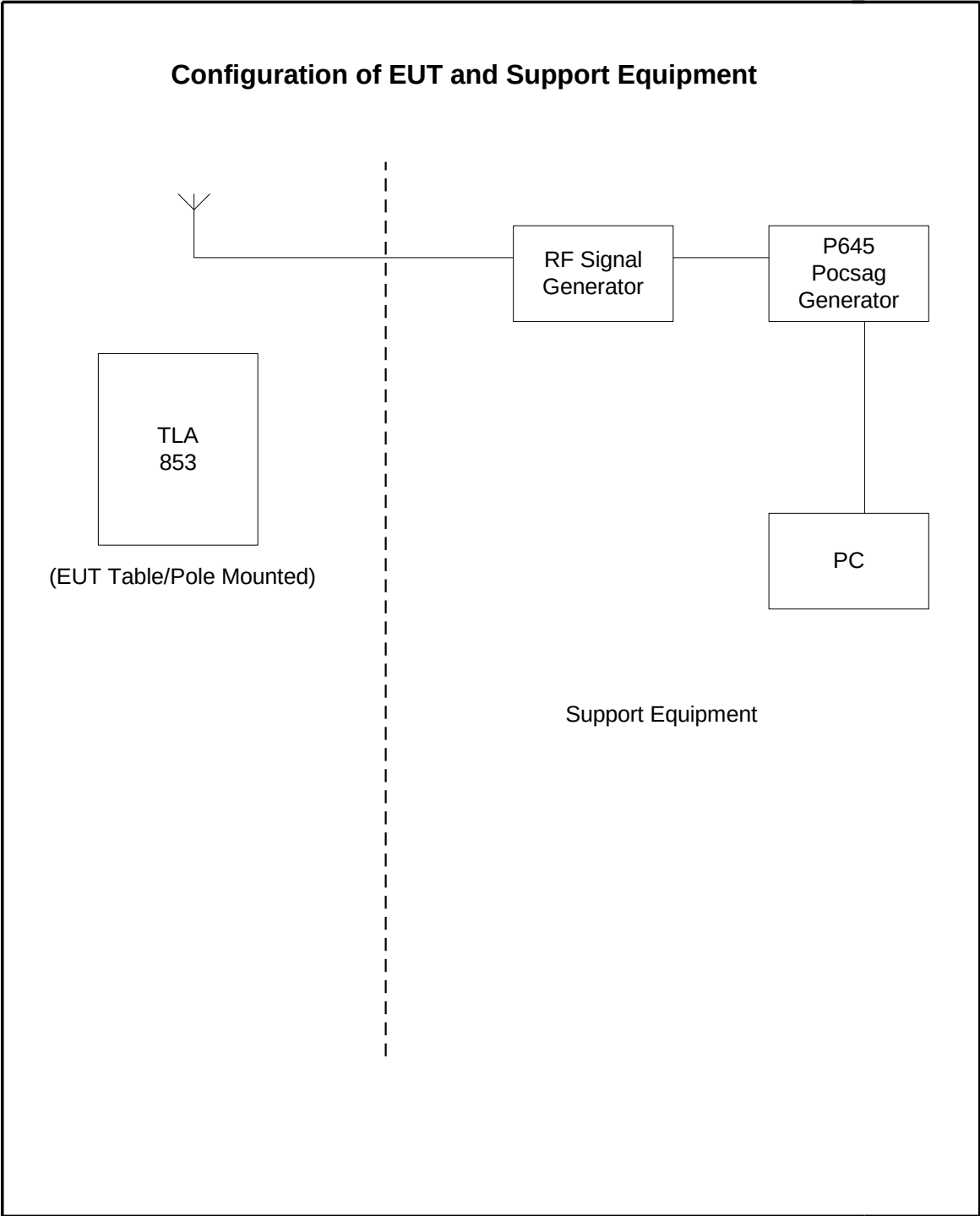
DRG\41589ETF01\EMIRAD



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Appendix 4. Photographs of EUT

This appendix contains the following photographs:

Photo Reference Number	Title
PHT\41589ETF01\001	Front view of Radiated Emissions
PHT\41589ETF01\002	Rear view of Radiated Emissions

These pages are not included in the total number of pages for this report.

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PHT\41589ETF01\001 Front view of Radiated Emissions



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PHT\41589ETF01\002 Rear view of Radiated Emissions

