TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Multitone Electronics PLC.
TLA853 Receiver

To: FCC Part 15: 2001 Class B

Test Report Serial No:
RFI/MPTB2/RP44305JD01A

Supersedes Test Report Serial No:
RFI/MPTB1/RP44305JD01A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	**Checked By:** 
Tested By: 	**Release Version No: PDF01**
Issue Date: 13 January 2003	**Test Dates: 02 December 2002 to 03 December 2002**

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To: FCC Part 15: 2001 Class B

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Note: Test Report Serial No: RFI/MPTB2/RP44305JD01A supersedes Test Report Serial No: RFI/MPTB1/RP44305JD01A.

1. Client Information

Company Name:	Multitone Electronics plc
Address:	Multitone House Beggarwood Lane Kempshott Hill Basingstoke Hampshire RG23 7LL
Contact Name:	Mr. B. Merchant

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
Model Name or Number:	TLA853
Serial Number:	0000457W:03M
Nominal Receive Frequency:	407.475 MHz
Country of Manufacture:	UK
Date of Receipt:	02 December 2002

2.2. Description Of EUT

The Equipment under test is an alphanumeric Radio Paging Receiver, utilising the CCIR No1. Radio-paging code format (POCSAG). The unit has tone-alert, vibrate and alphanumeric display facilities.

2.3. Modifications Incorporated In EUT

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.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal battery supply of 1.5 V nominal
Intended Operating Environment:	Domestic, Office & Light Industrial, Industrial, Hospital
Weight:	60 g
Dimensions:	75 x 48 x 17 mm
Interface Ports:	None

2.5. Support Equipment

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		
FCC ID Number:	Not applicable		
Cable Length And Type:	2 m, 8 Core	1 m BNC	2 m Mains
Connected to Port:	PC RS232 RF Signal Generator DC modulation I/P	Sig I/P	Supply in

Description:	RF Signal Generator	
Brand Name:	Marconi Instruments	
Model Name or Number:	20220	
Serial Number:	119140/015	
FCC ID Number:	Not applicable	
Cable Length And Type:	2 m BNC Cable	2 m Mains Cable
Connected to Port:	RF O/P	Supply in

Support Equipment (Continued)

Description:	Personal Computer
Brand Name:	Compaq
Model Name or Number:	Armada 1120
Serial Number:	7633HYC33258
FCC ID Number:	CNT75MB2CE
Cable Length And Type:	1.5 m, 7 Core Mouse Cable
Connected to Port:	Mouse Port

Description:	AC/DC Adapter; 110 V – 240 V AC to 16.5 V DC	
Brand Name:	Compaq	
Model Name or Number:	Series 2862	
Serial Number:	1544017463T	
FCC ID Number:	Not applicable	
Cable Length And Type:	1.5 m Mains Cable	1.5 m 2 Core
Connected to Port:	I/P	O/P

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 15: 2001 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 complies with the requirements of the specification to achieve the relevant approval.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1996)
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 (1998)
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.

5.2. Operating Modes

The EUT was continually paged from the support equipment and, therefore, continually receiving, decoding and displaying paging calls.

5.3. Configuration And Peripherals

The EUT was tested as a standalone unit.

6. Summary Of Test Results

6.1. Radiated Emissions

Range Of Measurements	Specification Reference	Compliancy Status
Electric Field Strength, 30 MHz to 1000 MHz	Section 15 of C.F.R. 47 Part 15.109	Complied
Electric Field Strength, 1 GHz to 2 GHz	Section 15 of C.F.R. 47 Part 15.109	Complied

6.2. Location Of Tests

Radio Frequency Investigation Ltd. Ewhurst Park, Ramsdell, Basingstoke, Hampshire, England, RG26 5RQ.

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. Radiated Emissions

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

7.2.1.1. Plots of the initial scans can be found in Appendix 4.

7.2.1.2. Measurements were performed at a test distance of 10 metres. The measured value was then corrected to the required 3 metre test distance using the formula 20log (D1/D2) where D1 was 10 metres and D2 was 3 metres i.e. by 10.5 dB (refer to Part 15.31(f)(1)).

7.2.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
362.4561	Horiz.	27.3	46.0	18.7	Complied
407.4426	Vert.	33.6	46.0	12.4	Complied
483.2581	Horiz.	32.6	46.0	13.4	Complied
604.0961	Horiz.	32.7	46.0	13.3	Complied

7.2.2. Electric Field Strength Measurements (1 GHz to 2 GHz)

7.2.2.1. The client has stated that the highest operating frequency for the EUT was 407.475 MHz. Therefore tests were performed up to 2.0 GHz.

7.2.2.2. Plots of the initial scans can be found in Appendix 4.

7.2.2.3. The following tables list frequencies at which emissions were measured using Peak and Average detector functions:

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
1.07777	Horiz.	14.55	22.2	0.8	37.55	54.0	16.45	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
1.07777	Horiz.	26.86	22.2	0.8	49.86	74.0	24.14	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**
Radiated Emissions at 10 metres	30 MHz to 1000 MHz	95%	+/- 5.1 dB
Radiated Emissions	1 GHz to 18 GHz	95%	+/- 4.18 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	Maker	Type No.	Serial No.
A027	Horn Antenna	Eaton	9188-2	301
A259	Bilog Antenna	Chase	CBL6111	1513
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	-
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
A553	Bi-log Antenna	Chase	CBL6111A	1593
C160	Cables	Rosenberger	UFA210A-1-1181-70x70	None
C202	Rosenberger cable	Rosenberger	UFA 210A-1-1180-70X70	1543
C342	Cable	Andrews	None	None
C361	Cable	Rosenberger	UFA210A-1-1180-70x70	1542
C362	Cable	Rosenberger	UFA210A-1-1181-70x70	1925
C453	Cable	Rosenberger	RG142XX-001-RFIB	C453-10081998
C457	Cable	Rosenberger	RG142XX-002-RFIB	C457-10081998
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M088	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:835862/018 RU:835387/006
M115	Temperature/Humidity Meter	RS Components	212-146	None
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
S201	Site 1	RFI	1	-
S212	Site 12	RFI	12	-

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

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 each detector function.

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 receivers with a Quasi-Peak detector (below 1000 MHz), where applicable, for measurements above 1000 MHz average and peak detectors were used.

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.

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

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

Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\44305JD01\EMIRAD	Test configuration for measurement of radiated emissions
DRG\44305JD01\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

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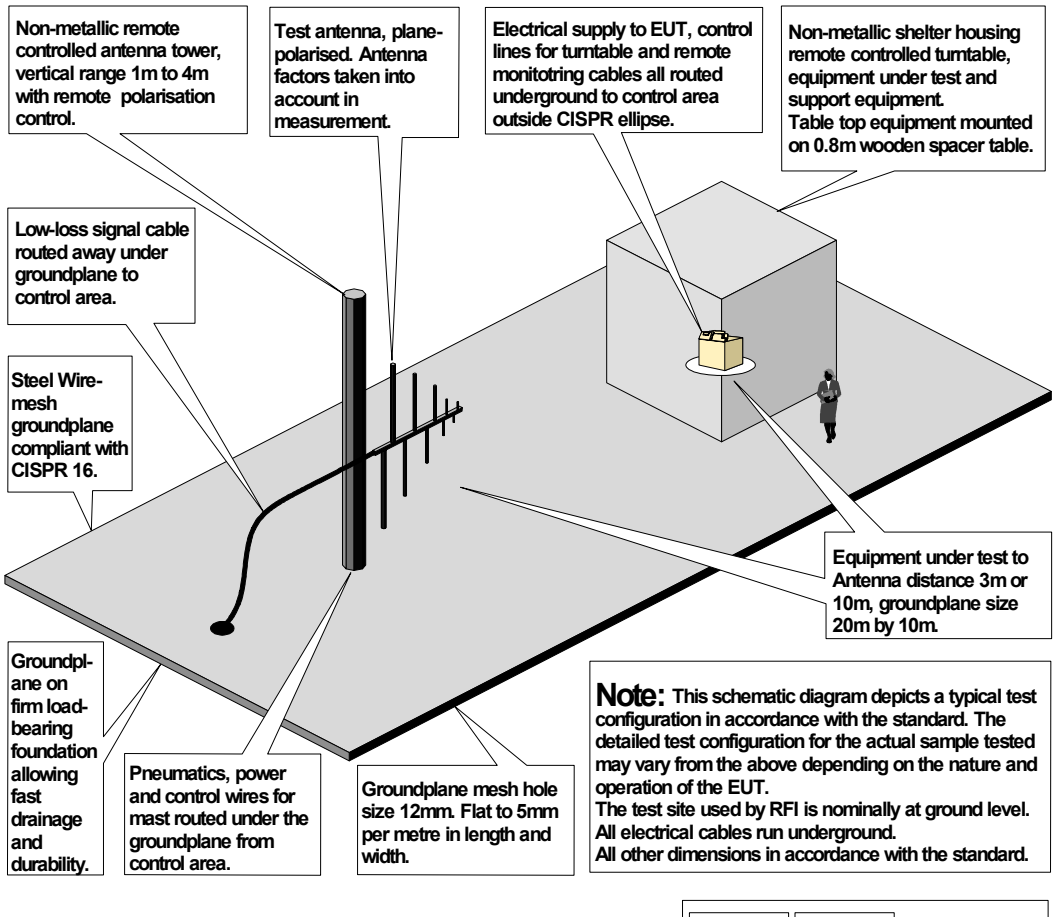
DRG\44305JD01\EMIRAD

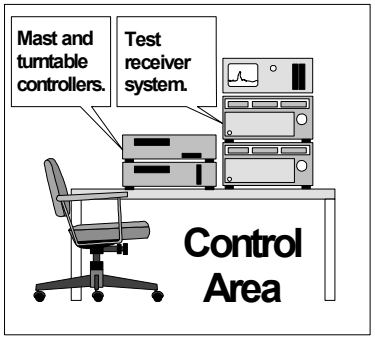


Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)

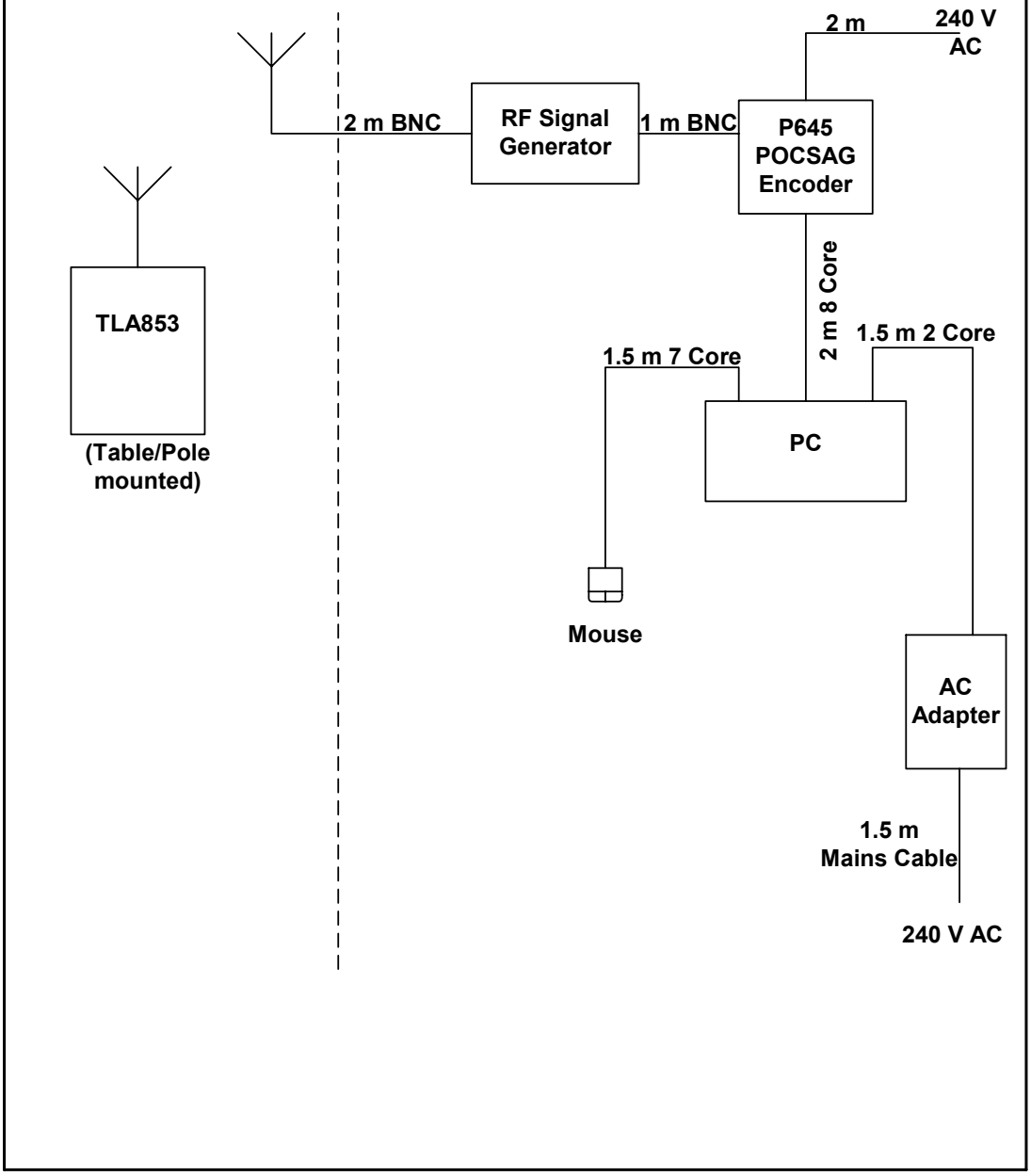
Groundplane Earthed

Control room outside CISPR ellipse



DRG\44305JD01\001

Configuration of EUT and Local Support Equipment



Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\44305JD01\001	Receiver Radiated Emissions 1.0 GHz to 2.0 GHz
GPH\44305JD01\002	Receiver Radiated Emissions 30.0 MHz to 1000 MHz

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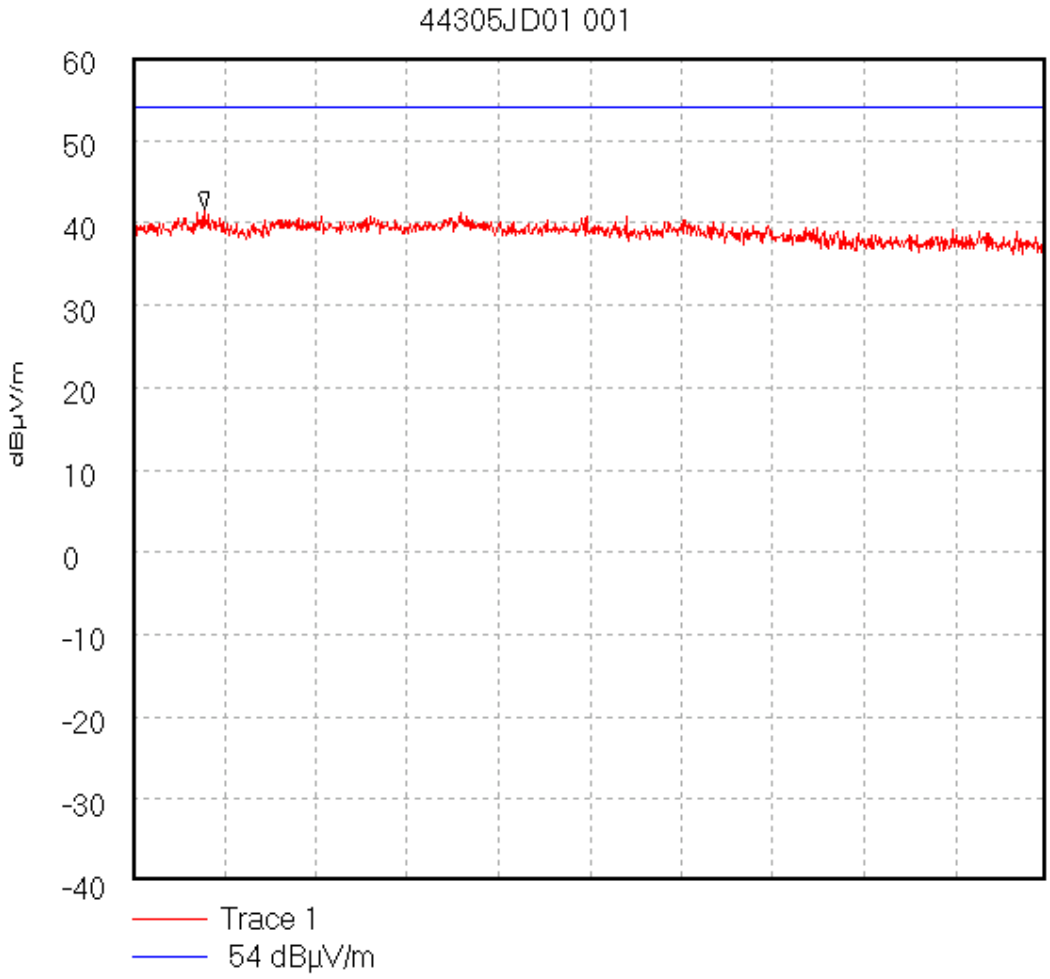
GPH\44305JD01\001
Receiver Radiated Spurious Emissions.
Serial Number: 0000457W:03M



Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.078 GHz, 41.72 dBµV/m
Display Line: 54 dBµV/m; ; Limit Test Failed
Transducer Factors: 1 to 2
03/12/2002 11:30:33 AM

GPH\44305JD01\002
Receiver Radiated Spurious Emissions.
Serial Number: 0000457W:03M