SIMRAD
A KONGSBERG Company

NAVIGATION AND
COMMUNICATION
SYSTEMS

REPORT FORM FOR TESTING TO EN 300 828

ELECTROMAGNETIC COMPATIBILITY
AND RADIO SPECTRUM MATTERS (ERM)
ELECTROMAGNETIC COMPATIBILITY (EMC)
FOR RADIOTELEPHONE TRANSMITTERS AND RECEIVERS FOR THE
MARITIME MOBILE SERVICE OPERATING IN THE VHF BANDS

CONTENTS

		Page
Section 1	*Introduction……*	3
Section 2	*Product……*	4
Section 3	*Test Schedule……*	4
Section 4	*Test Technical Details……*	5
Section 5	*Summary of Tests……*	6
Section 6	*Results……*	7
Section 7	*Test Equipment List……*	13
Section 8	*Measurement Scan Results……*	14
Section 9	*Photographs of EUT……*	20

SECTION 1 INTRODUCTION

This report contains the results of tests performed on the product RT1800 VHF radio with DSC, on this premises of :

Simrad Navico Ltd
Star Lane
Margate
Kent
CT9 4NP

Simrad Navico Ltd complies with the accreditation criteria requirements of the quality standards, BS EN ISO 9001:1994. The accreditation covers the quality system of the EMC test department as well as the, design,manufacture, distribution, aftersales, marketing and support of communications and marine electronics for the leisure, commercial and military markets, as described in the certificate of approval bearing the certificate number 21460 and was granted on 3 december 1998 for a period of 3 years.

All testing was carried out within the EMC test department of Simrad Navico Ltd, to the requirements of EN 300 828 V1.1.1 (1998-03).

Testing carried out by: …….

Report checked by: …….

Date: ……..

SECTION 2 PRODUCT

A sample of the following product was submitted for testing:

Maritime Integraded VHF/DSC Radiotelephone with ATIS

Manufacture: *Simrad Navico Ltd*

Parts of Product: *RT1800; Transceiver Unit with DSC controller & ATIS.*
Handset or Fistmike.

Serial Number: *TA Unit 3*

Software Release: *Issue 1*

Particulars: *DSC Class D*

SECTION 3 TEST SCHEDULE

All tests were carried out within the EMC department at Simrad Navico Ltd.

The sample unit was tested between the following dates: 1st March 2000 - 14th April 2000.

The RT1800 VHF radio with DSC & ATIS, is intended for use in the following application area:

MARINE COMMUNICATIONS EQUIPMENT; and was tested to ETSI EN 300 828 V1.1.1(1997-12).

The following tests shown below were carried out on a sample of the RT1800 VHF radio with DSC & ATIS

Test Clause	Description of Test	Date of Test
8.1.2.1	*Radiated Emissions (150kHz-30Mhz)*	27/03/00
8.2	*DC Power Ports*	27/03/00
9.1	*RF Electromagnetic Field (80Mhz-1Ghz)*	05/04/00
9.2	*Electrostatic Discharge*	14/04/00
9.4	*Conducted disturbances induced by RF fields (150Khz-80Mhz)*	05/04/00
9.6	*Power Supply Failure*	05/04/00

Excempt from Testing

Test Clause	Description of Test	Reason
8.1.2.2	*Radiated Emissions (30Mhz-1Ghz)*	*This test is covered by EN 301 025 V1.1.1 (1998-08), See test report for RT1800 VHF radio with DSC & ATIS to EN 301 025.*
9.3	*Fast Transient*	*This test was not conducted as no cables were longer than 3 metres.*
9.5	*Power Supply Short Term Vari*	*This test is required on AC power input ports only, the RT1800 requires a 12v DC input only, therefore is excempt.*
9.7	*Surge*	*This test is required on AC power input ports only, the RT1800 requires a 12v DC input only, therefore is excempt.*

SECTION 4 TEST TECHNICAL DETAILS

Test Unit =	*RT1800 VHF Radio with DSC & ATIS.*	
Serial Number =	*TA UNIT 3*	
Additional Parts =	*Telephone handset / Fistmike*	
Nominal Voltage =	*12.0 Volts*	
Nominal Temperature =	*20°C*	
Channel 16 =	*156.800MHz*	
Upper Frequency =	*162.975MHz*	
Lower Frequency =	*155.025MHz*	
Second Receiver Frequency =	*156.525MHz*	
Channel Spacing =	*25.0kHz*	
First IF Main Rx =	*21.4MHz*	
Second IF Main Rx =	*455.0kHz*	
First IF 2nd Rx =	*17.9MHz*	
Second IF 2nd Rx =	*455.0kHz*	
Rated Audio Power =	*6.0 Watts*	*(external speaker)*
	2 mW	*(handset earphone)*
Rated Audio Load =	*4 Ohms*	*(external speaker)*
	300 Ohms	*(handset earphone)*

SECTION 5 SUMMARY OF TEST RESULTS

Clause No	Description of Test	Complies?
8.1.2.1	*Radiated Emissions (150kHz-30Mhz)*	***Yes***
8.1.2.1	*Radiated Emissions (30Mhz-1Ghz)*	***Yes****
8.2	*DC power in/out*	***Yes***
9.1	*RF electromagnetic field (80Mhz-1Ghz)*	***Yes***
9.2	*Electrostatic Discharge*	***Yes***
9.3	*Fast Transients*	***Yes****
9.4	*Conducted disturbances induced by RF fields (150Khz-80Mhz)*	***Yes***
9.5	*Power Supply Short Term Variations*	***Yes****
9.6	*Power Supply Failure*	***Yes***
9.7	*Surge*	***Yes****

Note: * = See Section 3 (excempt from testing)

The test sample of RT1800 VHF radio with DSC & ATIS has successfully passed a series of tests to EN 300 828 V1.1.1(1998-03), which indicate its compliance with the EMC criteria of ETSI EN 300 828 V1.1.1 (1998-03).

SECTION 6

RADIATED EMISSIONS **Clause : 8.1**

Definition: *This test assesses the ability of the EUT to limit unwanted emissions from the enclosure.*

Product: *RT1800 VHF radio with DSC & ATIS*

Method: *As per EN 300-828, clause 8.1.2.1.*

Results:

General conditions:

Date of test:	*27th March 2000*
Temperature:	*Tnom (20°C)*
Relative Humidity:	*32%*
Rated power:	*25 Watts*
Supply:	*Vnom (12V)*
Channel tested:	*156.800MHz*

To identify any potential emissions the EUT was placed inside a anechoic chamber, connected to 12v dc power supply. With the radio placed in receive and (25w) transmit mode, a measurement scan was then carried out under software control, and the emissions compared against the limits as defined in table 1, Clause 8.1.3 EN 300-828 V1.1.1.

Results from this test can be found at section 8, Plots 1 & 2, showing all measured radiated spurious emissions in the required test frequency range (150kHz-30Mhz).

Complies: ***Yes***

Limits:

The levels of field strength of any radiated spurious emission in the frequency range 150kHz-30Mhz shall not exceed the specified values.	*80dbuV - 50dbuV*

Equipment used:

Equipment used refers to item numbers, specified in section 7	*2, 3, 16, 17, 20, 21, 27, 28, 29, 32, 33, 34*

Conclusion:

The EUT complies with the requirements of EN 300-828 for radiated spurious emissions between 150kHz - 30Mhz. (Clause 8.1 EN 300-828)

POWER PORTS **Clause : 8.2**

Definition: *This test assesses the ability of the EUT to limit internal noise from the power ports.*

Product: *RT1800 VHF radio with DSC & ATIS*

Method: *As per EN 300-828, clause 8.2.2.*

Results:

General conditions:

Date of test:	*27th March 2000*
Temperature:	*Tnom (20°C)*
Relative Humidity:	*32%*
Rated power:	*25 Watts*
Supply:	*Vnom (12V)*
Channel tested:	*156.800MHz*

To identify any potential emissions the EUT and measuring equipment were placed on and bonded to an earth plane. The 12v dc power supply was connected to the EUT via a LISN conforming to CISPR-16 with the output connected to a measuring receiver. The EUT was then placed in receive and transmit mode (25w), and a measurement scan then carried out under software control. The emissions were then comparied with the limits as defined in Clause 8.2.3 EN 300-828 V1.1.1.

Results from this test can be found at section 8, Plots 3 & 4, showing all measured conducted spurious emissions detected in the frequency range (10kHz-30Mhz).

Complies: ***Yes***

Limits:

The levels of field strength of any conducted spurious emission in the frequency range 10kHz-30Mhz shall not exceed the specified values as defined in clause 8.2.3 EN 300-828 V1.1.1.

Equipment used:

Equipment used refers to item numbers, specified in section 7	*3, 16, 17, 20, 30, 32, 35, 36, 38*

Conclusion:

The EUT complies with the requirements of EN 300-828 for power ports. (Clause 8.2 EN 300-828)

RADIO FREQUENCY ELECTROMAGNETIC FIELD **Clause : 9.1**

Definition: *This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic field disturburbance at the enclosure.*

Product: *RT1800 VHF radio with DSC & ATIS*

Method: *As per EN 300-828, clause 9.1.2.*

Results:

General conditions:

Date of test:	*5th April 2000*
Temperature:	*Tnom (20°C)*
Relative Humidity:	*32%*
Rated power:	*25 Watts*
Supply:	*Vnom (12V)*
Channel tested:	*156.800MHz*

The EUT was placed inside an anechoic screened room, and mounted as it would be in normal operation, with the test setup corresponding to EN 61000-4-6(5). The EUT was placed in (25w) transmit and receive mode whilst under test, the applied field strength, test frequency range and modulation was as described in subclause 9.1.2 EN 300-828 V1.1.1 and controlled via software.
The EUT was then continuosly monitored for degradation or loss of performance with a communication test set, under software control.
The test was carried out, with the generated field in both vertical and horizontal polarisation.

Results from this test can be found at section 8, Plots 5 - 8, showing the field strength, SINAD, frequency and output power measurements.

Complies: ***Yes***

Limits:

EUT shall meet the requirements of performance criteria A (clause 6.2 & 6.5 EN 300-828 V1.1.1.)

Equipment used:

Equipment used refers to item numbers, specified in section 7	*2, 3, 6, 13, 16, 18, 19, 28, 29, 30*

Conclusion:

The EUT complies with the requirements of EN 300-828 for Radio frequency electromagnetic field (80Mhz - 1Ghz). (Clause 9.1 EN 300-828)

ELECTROSTATIC DISCHARGE **Clause : 9.2**

Definition: *This test assesses the ability of the EUT to operate as intended in the event of an electrostatic discharge.*

Product: *RT1800 VHF radio with DSC & ATIS*

Method: *As per EN 300-828, clause 9.2.2.*

Results:

General conditions:

Date of test:	*14th April 2000*
Temperature:	*Tnom (20°C)*
Relative Humidity:	*32%*
Rated power:	*1 Watt / 25 Watts*
Supply:	*Vnom (12V)*
Channel tested:	*156.800MHz*

The EUT was placed on, but insulated from a horizontal coupling plane as in accordance with BS EN 61000-4-2 [2]. Using a electrostatic discharge generator with test levels set to 6KV for contact discharge and 8KV for air discharge, 10 positive and 10 negative discharges were applied to 10 points of the EUT, these points are shown in section 9, photographs 6,7 & 8, with the test carried out in both receive and transmit modes. Throughout the test, the EUT was monitored to ensure it conformed to performance *criteria B.*

Complies: ***Yes***

Limits:

EUT shall meet the requirements of performance criteria B (clause 6.3 & 6.5 EN 300-828 V1.1.1.)

Equipment used:

Equipment used refers to item numbers, specified in section 7	*3, 6, 20, 21, 37*

Conclusion:

The EUT complies with the requirements of EN 300-828 for Electrostatic discharge. (Clause 9.2 EN 300-828)

Note : The telephone handset was not subjected to ESD testing because the case was constructed of plastic, and the metal screws were recessed to a depth such that a discharge to them was not possible.

CONDUCTED DISTURBANCES INDUCED BY RF-FIELDS IN THE FREQUENCY RANGE 150kHz - 80Mhz **Clause : 9.4**

Definition: *This test assesses the ability of the EUT to operate as intended in the presence of a radio frequency electromagnetic disturbance.*

Product: *RT1800 VHF radio with DSC & ATIS*

Method: *As per EN 300-828, clause 9.4.2.*

Results:

General conditions:

Date of test:	*5th April 2000*
Temperature:	*Tnom (20°C)*
Relative Humidity:	*32%*
Rated power:	*1 Watt / 25 Watts*
Supply:	*Vnom (12V)*
Channel tested:	*156.800MHz*

The test was conducted as described in BS EN 61000-4-6[5], with the test levels, modulation and frequency range, as detailed in clause 9.4.2 EN 300-828 V1.1.1.
A current injection clamp was used for this test, as described in BS EN 61000-4-6[5].
The EUT was placed on an insulating support, above the ground plane, with the current injection clamp placed around each supply cable in turn. The EUT was then subjected to the induced disturbance as defined in clause 9.4.2 EN 300-828 V1.1.1, and *the EUT was continuously monitored so as to conform to the required performance* criteria.
All testing was under software control, which included the injection clamp undergoing a pre-calibration, via use of a calibration jig.

Results from this test can be found at section 8, Plots 9 & 12, showing the field strength, SINAD, frequency and output power measurements.

Complies: ***Yes***

Limits:

EUT shall meet the requirements of performance criteria A (clause 6.2 & 6.5 EN 300-828 V1.1.1.)

Equipment used:

Equipment used refers to item numbers, specified in section 7	*3, 6, 7, 8, 17, 19, 20, 21,2 x 22, 24, 30, 39*

Conclusion:

The EUT complies with the requirements of EN 300-828 for conducted disturbances induced by RF-fields in the frequency range 150kHz - 80Mhz. (Clause 9.2 EN 300-828)

POWER SUPPLY FAILURE **Clause : 9.6**

Definition: *This test assesses the ability of the EUT to operate as intended after being subjected to short breaks in the power supply, due to power supply change over and breaker dropout.*

Product: *RT1800 VHF radio with DSC & ATIS*

Method: *As per EN 300-828, clause 9.6.2.*

Results:

General conditions:

Date of test:	*5th April 2000*
Temperature:	*Tnom (20°C)*
Relative Humidity:	*32%*
Rated power:	*1 Watt / 25 Watts*
Supply:	*Vnom (12V)*
Channel tested:	*156.800MHz*

The EUT was subjected to 3 breaks in the supply, of a duration of 60 seconds. The power to the EUT was switched off as described in clause 9.6.2 EN 300-828 V1.1.1. The test was conducted with the EUT in both receive and transmit modes of operation. The EUT was subjected to meet the requirements of performance criteria C, after each break in the supply.

Complies: ***Yes***

Limits:

EUT shall meet the requirements of performance criteria C (clause 6.4 EN 300-828 V1.1.1.)

Equipment used:

Equipment used refers to item numbers, specified in section 7	*6, 9, 20, 21, 22*

Conclusion:

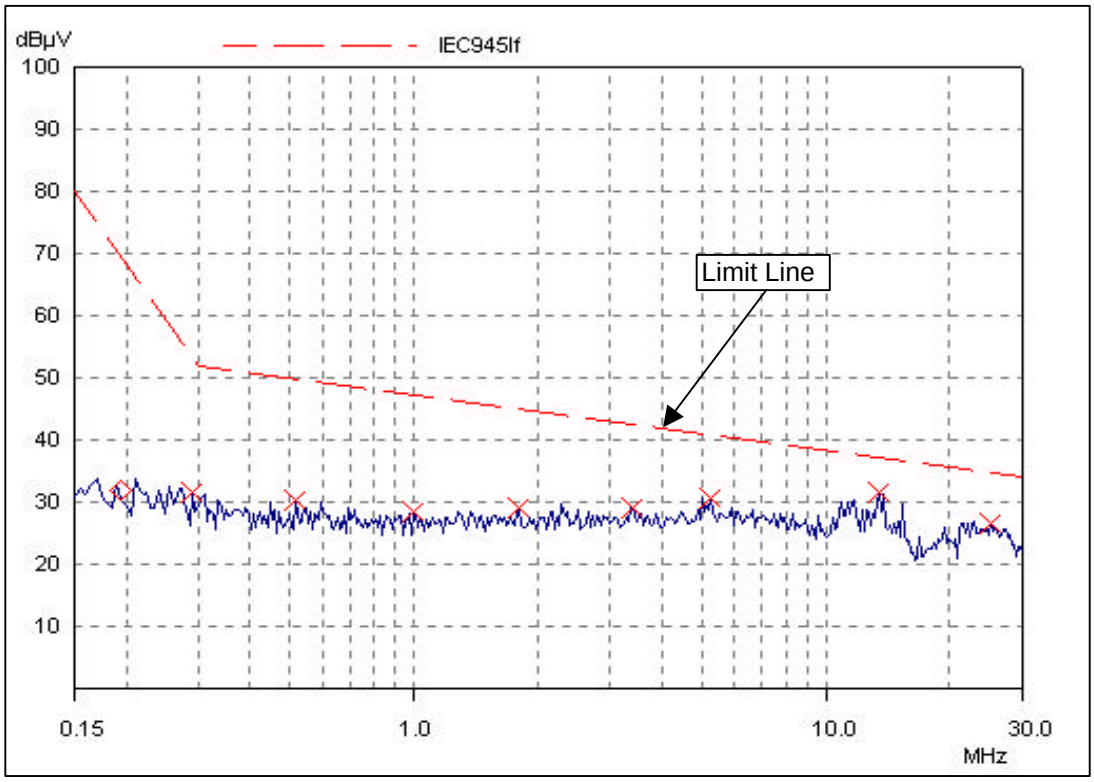
The EUT complies with the requirements of EN 300-828 for power supply failure. (Clause 9.6 EN 300-828)

SECTION 7 EQUIPMENT LIST

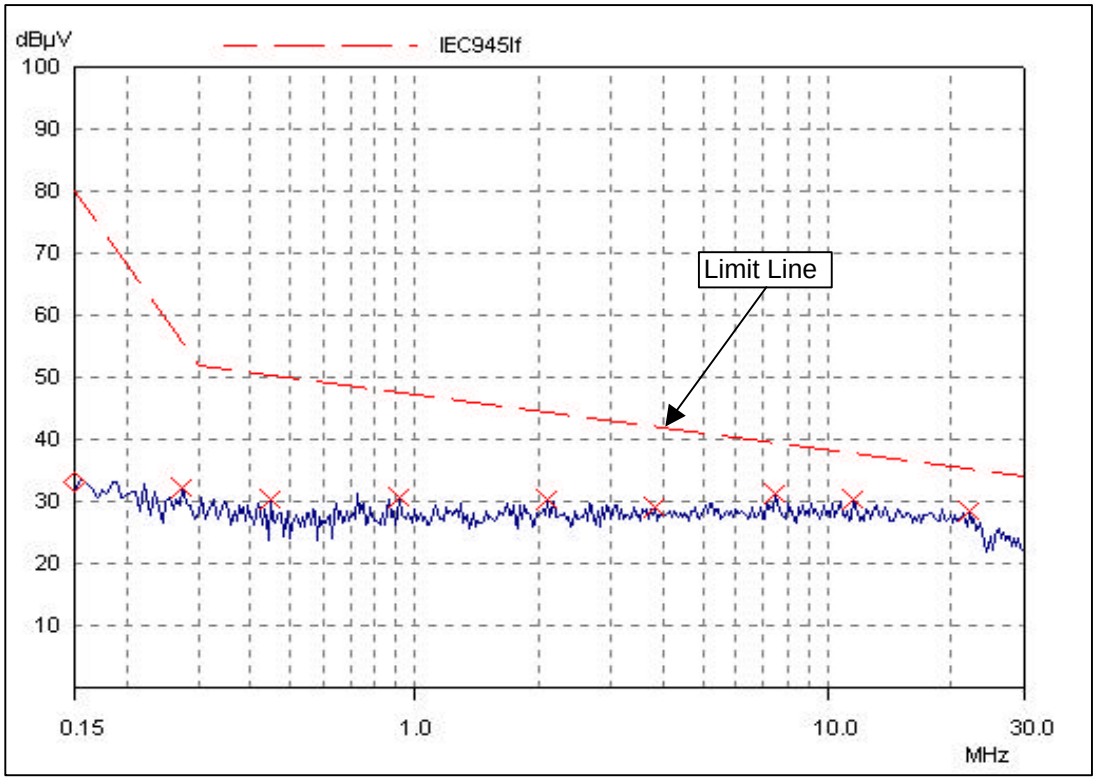
ITEM	MANUFACTURE	TYPE	DESCRIPTION	NAVICO SERIAL
1	Rohde & Schwarz	ESVS10	EMI Test Receiver	Nav 284
2	IFR	2023B	Signal Generator	Nav 1309
3	Xantrex	XHR33-33	Power Supply	Nav 1312
4	IFR	2041	Signal Generator	Nav 1310
5	Marconi	2041	Signal Generator	Nav 280
6	Rohde & Schwarz	CMTA54	Radio Comms Set	Nav 1329
7	Rohde & Schwarz	FSEA	Spectrum Analyser	Nav 1308
8	Solar Electronics	9607-1N	Current Injection Clamp	Nav 1331
9	Thurby Thandar	TSX3510	Power Supply	Nav 1328
10	Lecroy	9361C	Oscilloscope	Nav 1320
11	Design Enviromental Ltd	B5125-40	Enviromental Chamber	Nav 1381
12	Mini-Circuits	15542	Splitter	Nav 1379
13	Antenna Research Ltd	LPB2513	Log Periodic Antenna	Nav 1376
14	Chase	VHA9103	Dipole 30-300Mhz	Nav 893
15	Chase	VHA9105	Dipole 300-1000Mhz	Nav 894
16	MPE	C1162-D1	Anechoic Chamber	Nav 1307
17	Reseda	-	Pc - Running Software	Nav 1232
18	Chauvin Arnoux	C.A.43	Field Meter	Nav 1334
19	IFR	SMX100	Power Amplifier	Nav 1401
20	In - House	-	Ptt Connection Box	-
21	In - House	-	PL259 to Bnc Lead	-
22	In - House	-	1m Bnc Lead	-
23	ICS	DSC2	GMDSS Controller	-
24	In - House	-	Isolation Transformer	-
25	Castle	GA601	Acoustic Calibrator	Nav 1457
26	In - House	-	Band Pass Filter	-
27	Bird	-	20db Attenuator	Nav 1380
28	In - House	Cable	Chamber to Receiver	TJ0224/C
29	In - House	Cable	Antenna to Chamber	TJ0224/B
30	In - House	Cable	5m Bnc to Bnc	-
31	Racal Dana	1991	Frequency Counter	Konav CR018
32	Rohde & Schwarz	ESHS10	EMI Test Receiver	Nav 283
33	Chase	HLA6120	Loop Antenna	Nav 1338
34	Chase	CBP9720	DC Battery Supply	Nav 1339
35	Rohde & Schwarz	ESH3-Z-5	LISN	Nav 282
36	Rendar	Safebloc	Safety Connect Block	Nav 363
37	Haefely	PSD-25B	ESD Tester	Nav 279
38	In - House	-	10db Transient Limiter	TJ0133
39	Solar Electronics	9125-1	Calibration Jig	Nav 1332

SECTION 8 MEASUREMENT SCAN RESULTS

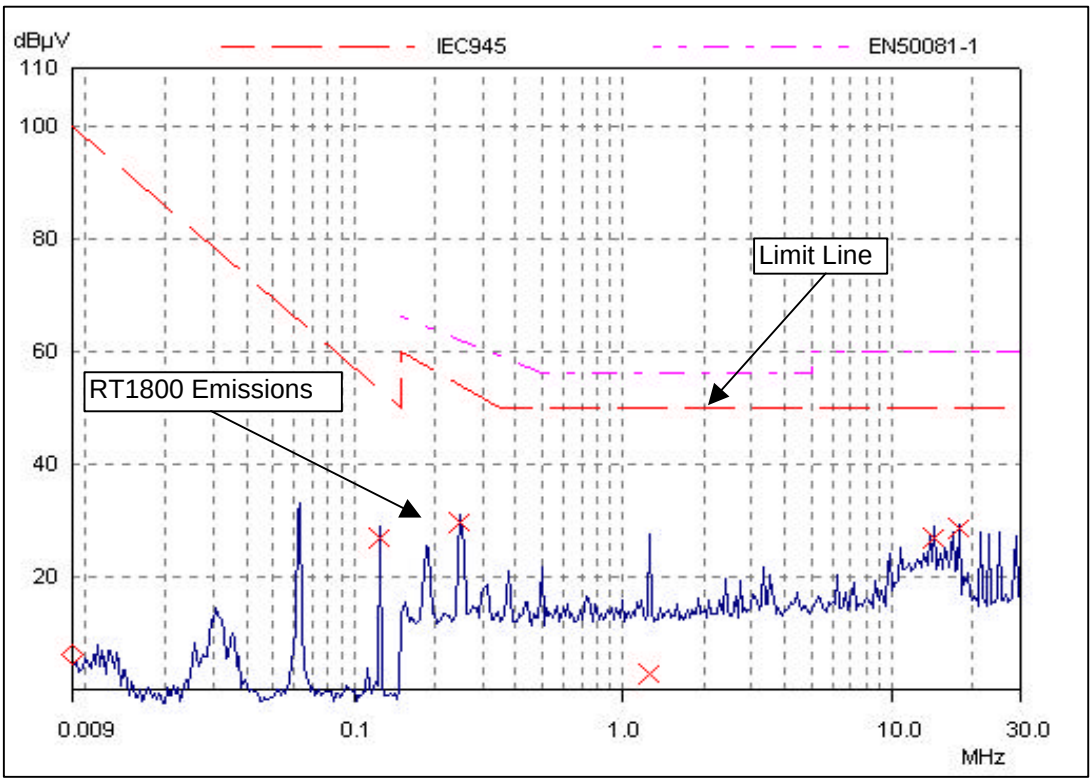
PLOT 1 RT1800 Transmitter (25w) Radiated Emissions (150kHz-30Mhz)



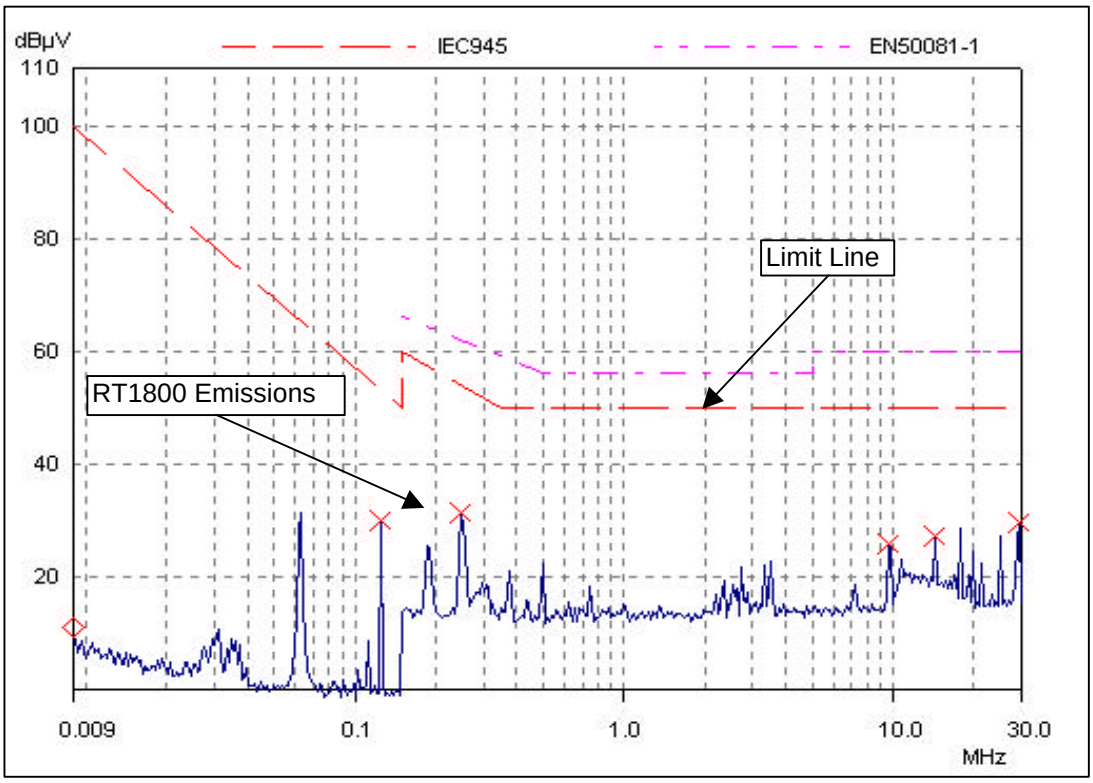
PLOT 2 RT1800 Receiver Radiated Emissions (150kHz-30Mhz)



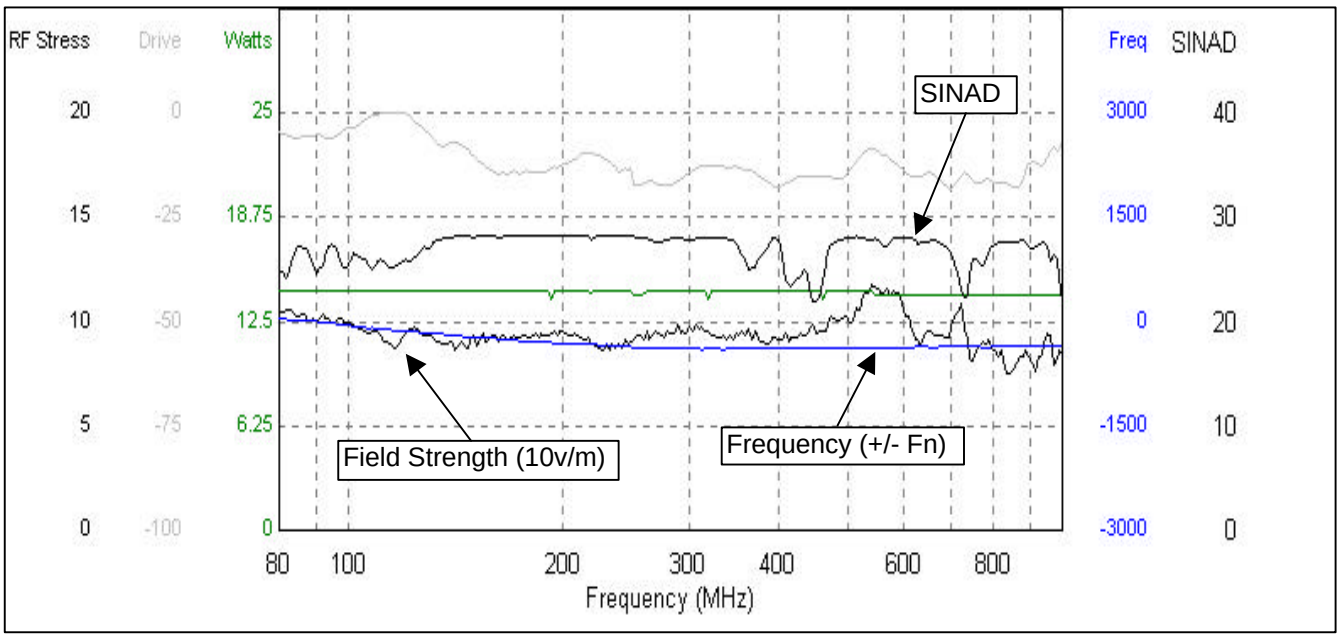
PLOT 3 RT1800 Conducted Emissions (10kHz - 30Mhz) in the receive mode of operation



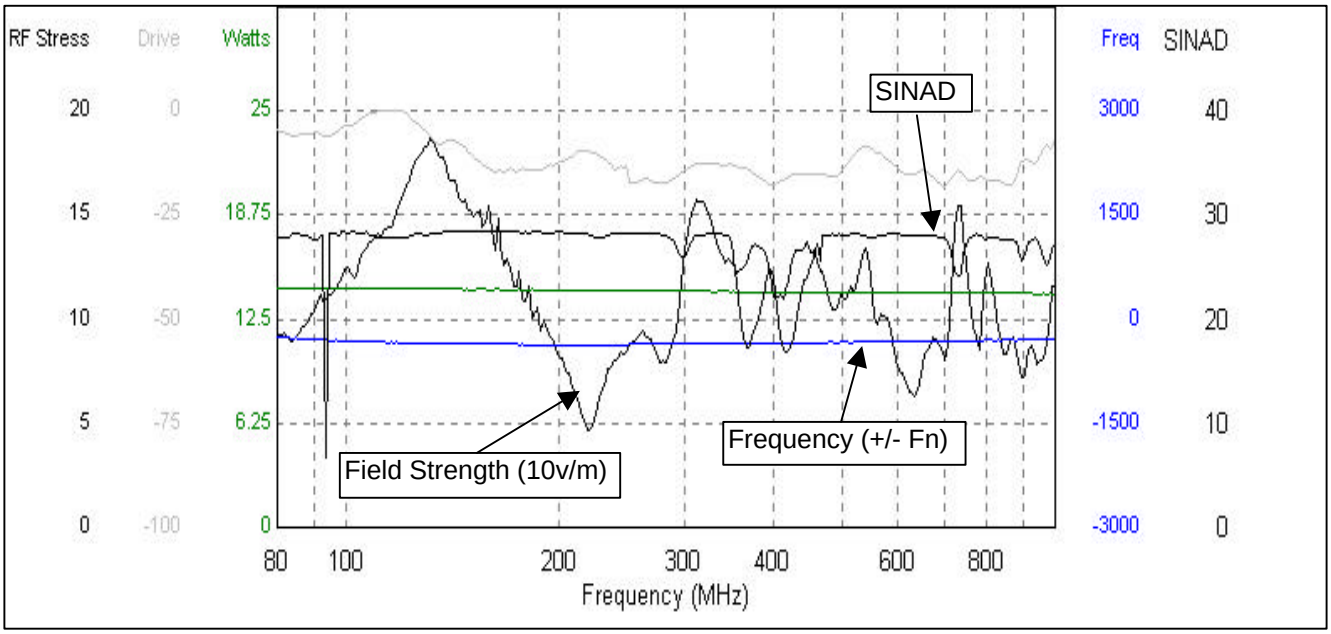
PLOT 4 RT1800 Conducted Emissions (10kHz - 30Mhz) in the (25w) transmit mode of operation



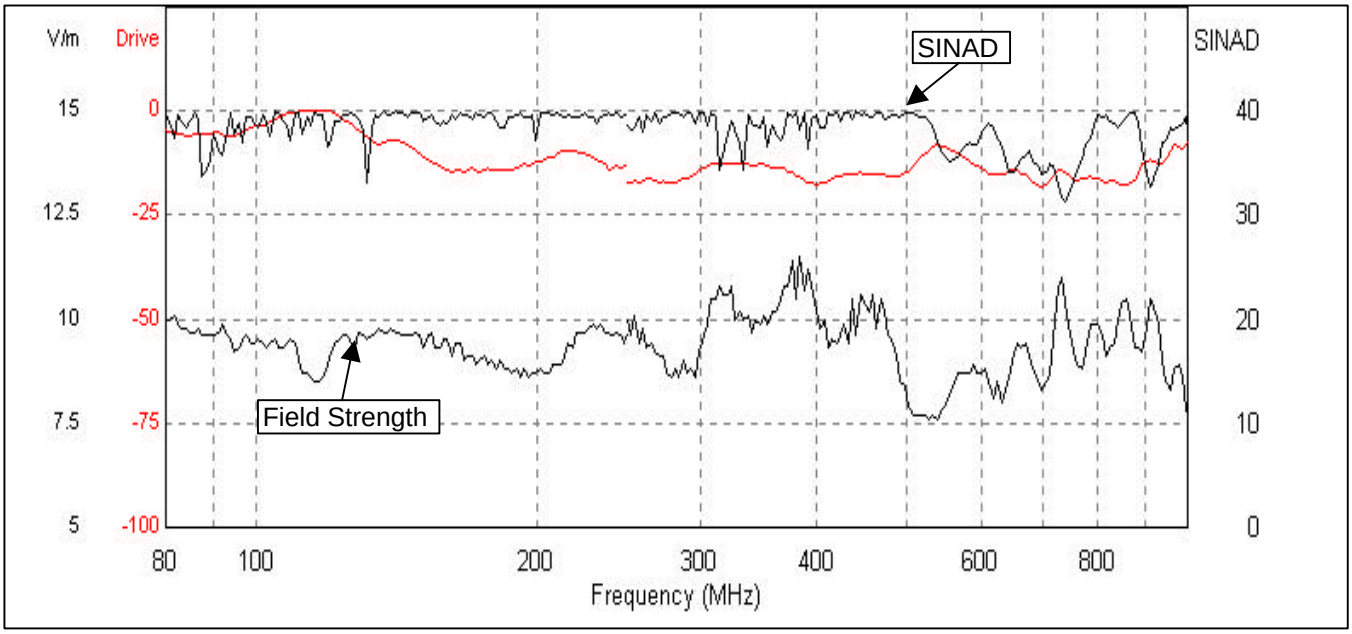
PLOT 5 **Radiated Immunity measurement scan on horizontal polarization with RT1800 in (25w) transmit mode of operation**



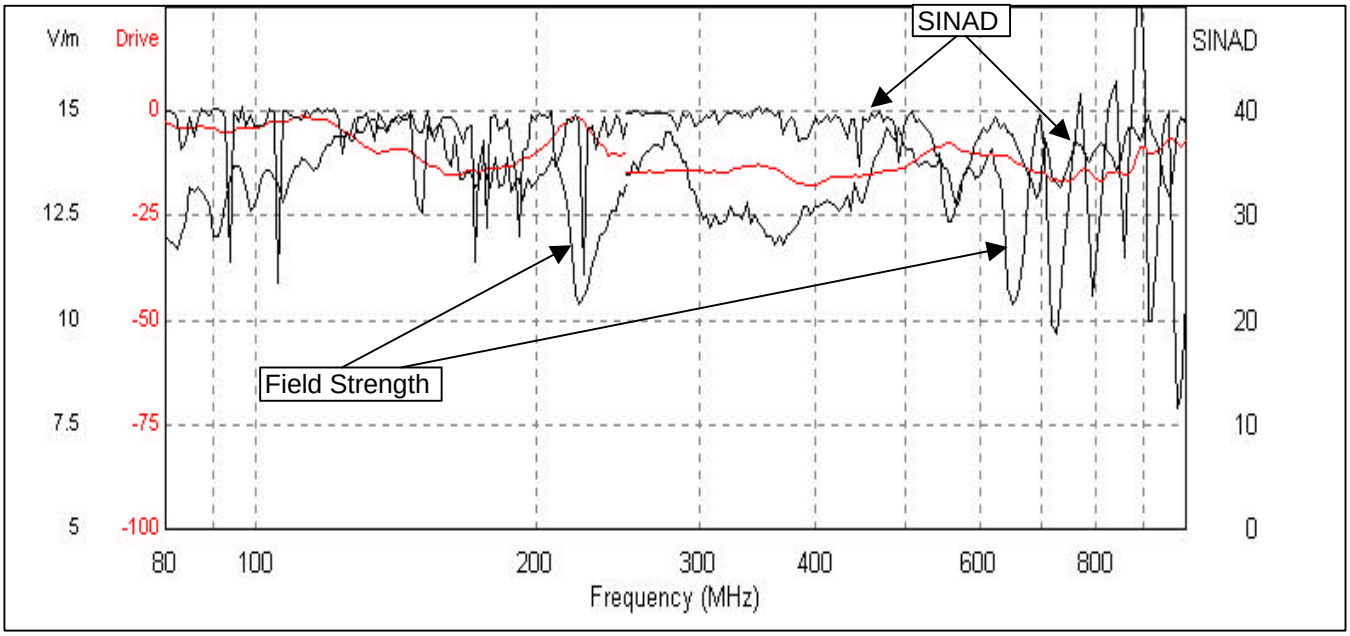
PLOT 6 **Radiated Immunity measurement scan on vertical polarization with RT1800 in (25w) transmit mode of operation**



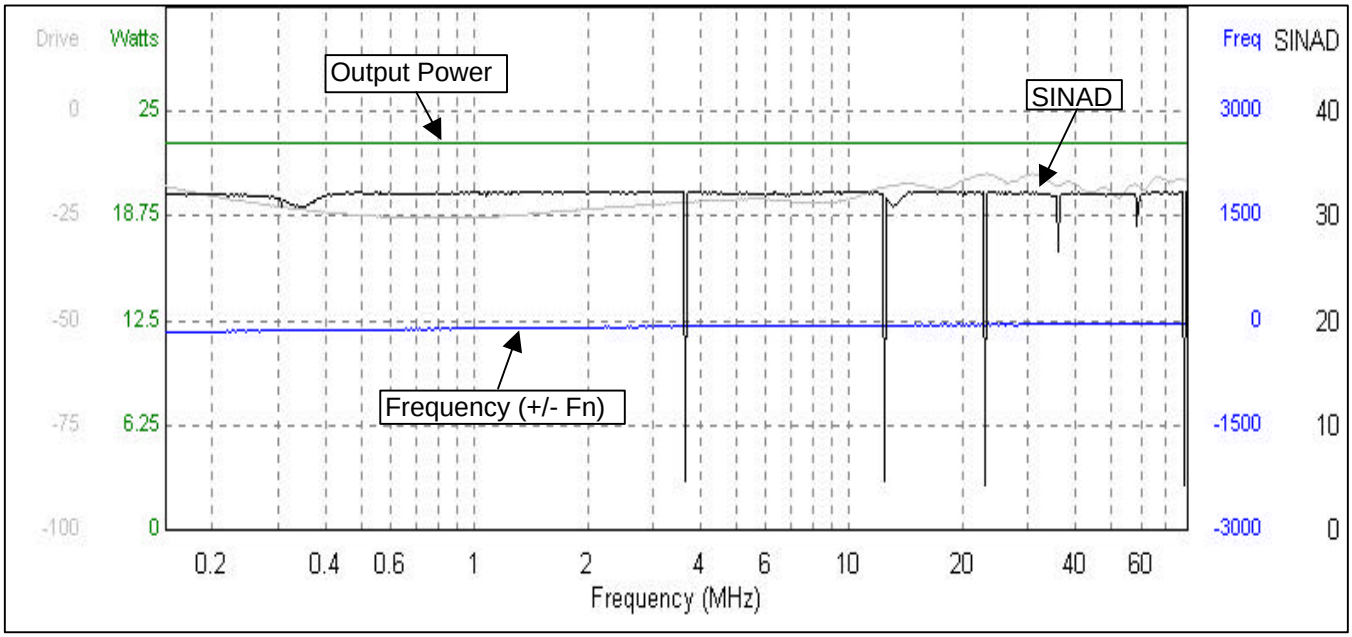
PLOT 7 **Radiated Immunity measurement scan on horizontal polarization with RT1800 in receive mode of operation**



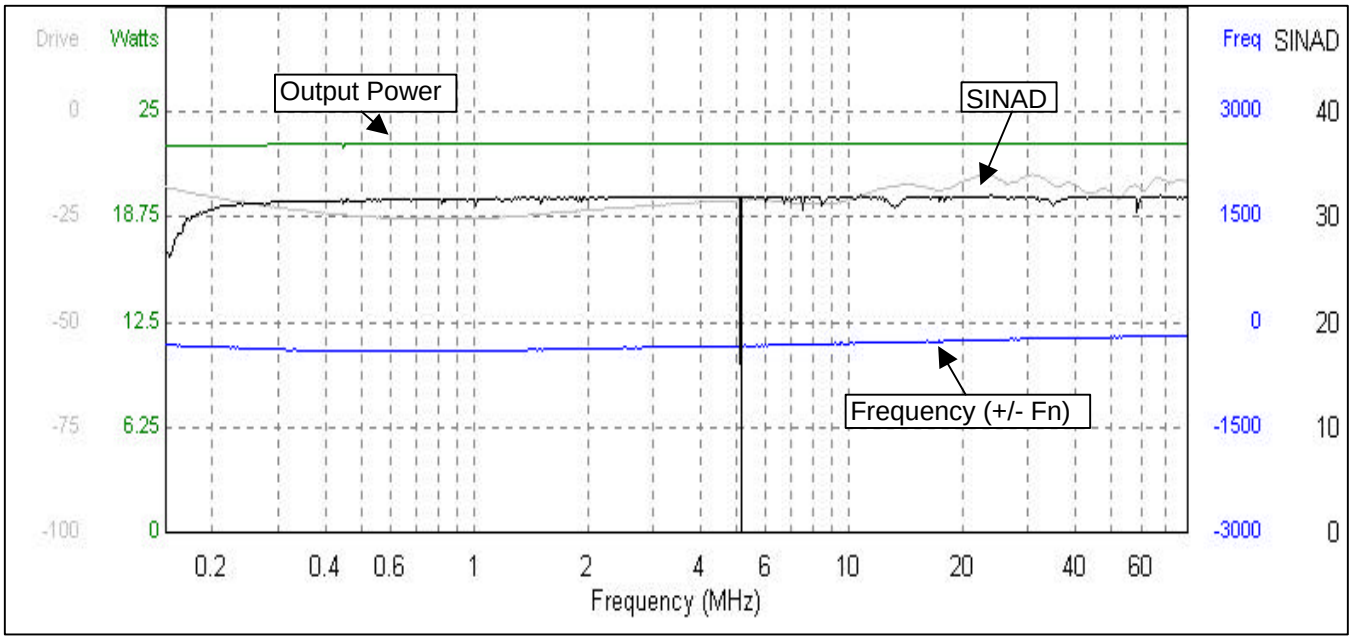
PLOT 8 **Radiated Immunity measurement scan on vertical polarization with RT1800 in receive mode of operation**



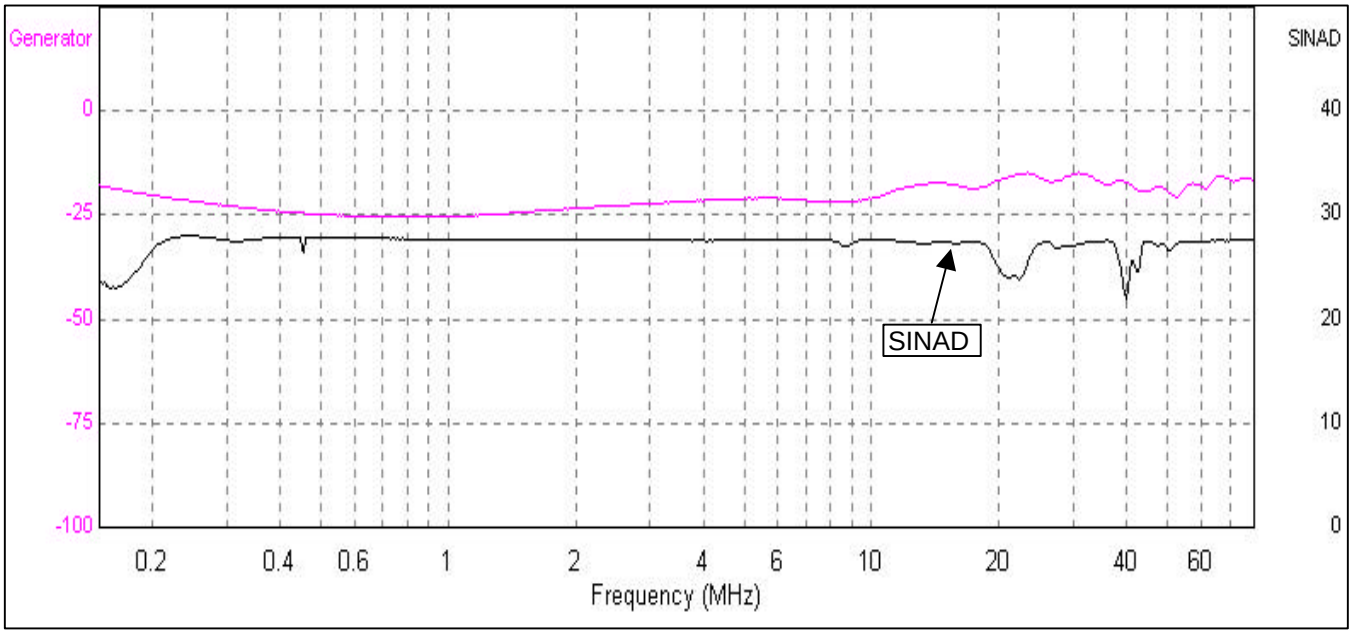
PLOT 9 **Conducted Immunity measurement scan on the +ve supply line of the RT1800 in (25w) transmit mode of operation**



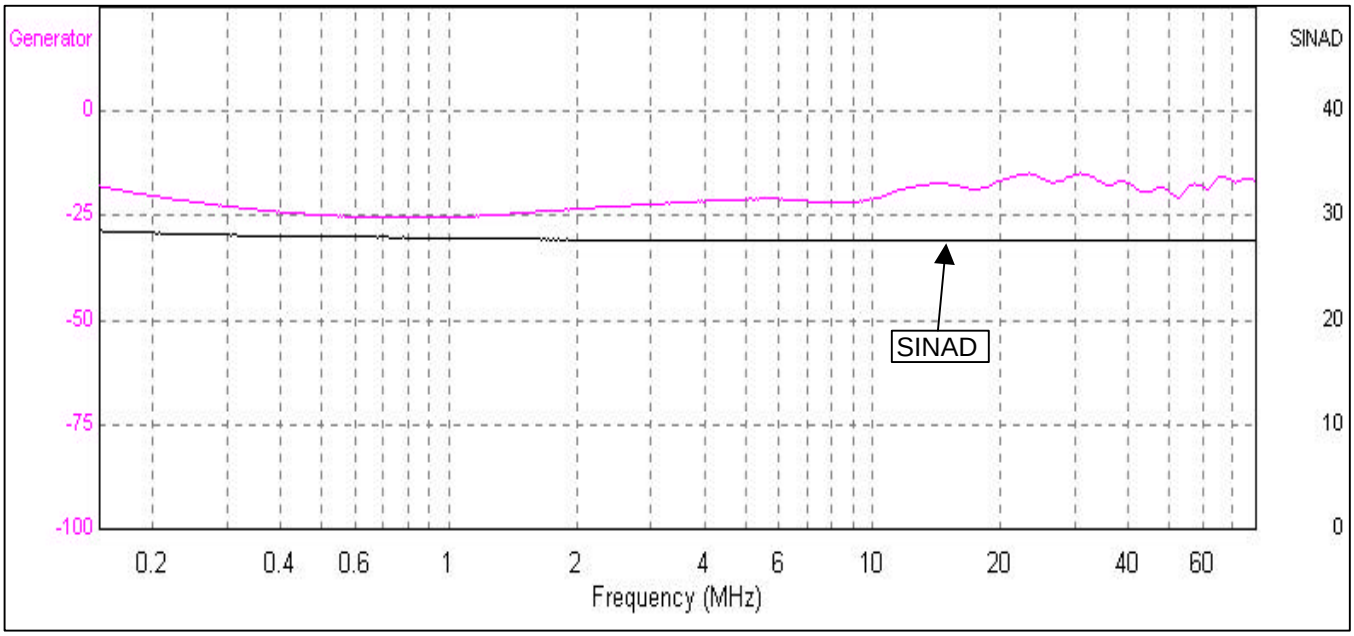
PLOT 10 **Conducted Immunity measurement scan on the -ve supply line of the RT1800 in (25w) transmit mode of operation**



PLOT 11 Conducted Immunity measurement scan on the +ve supply line of the RT1800 in receive mode of operation

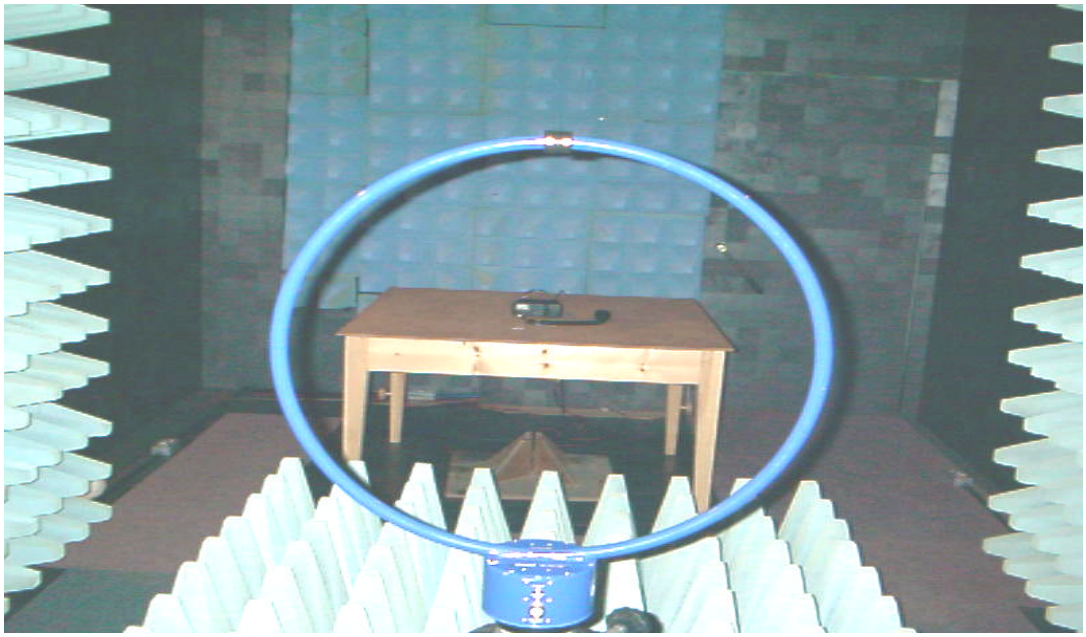


PLOT 12 Conducted Immunity measurement scan on the -ve supply line of the RT1800 in receive mode of operation

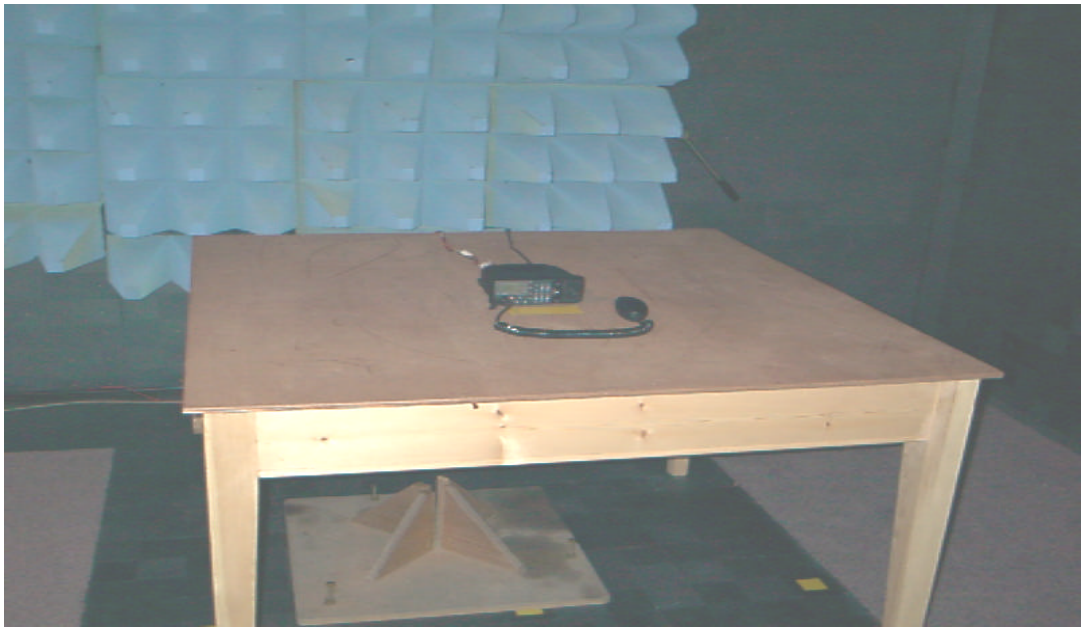


SECTION 9 PHOTOGRAPHS OF RT1800

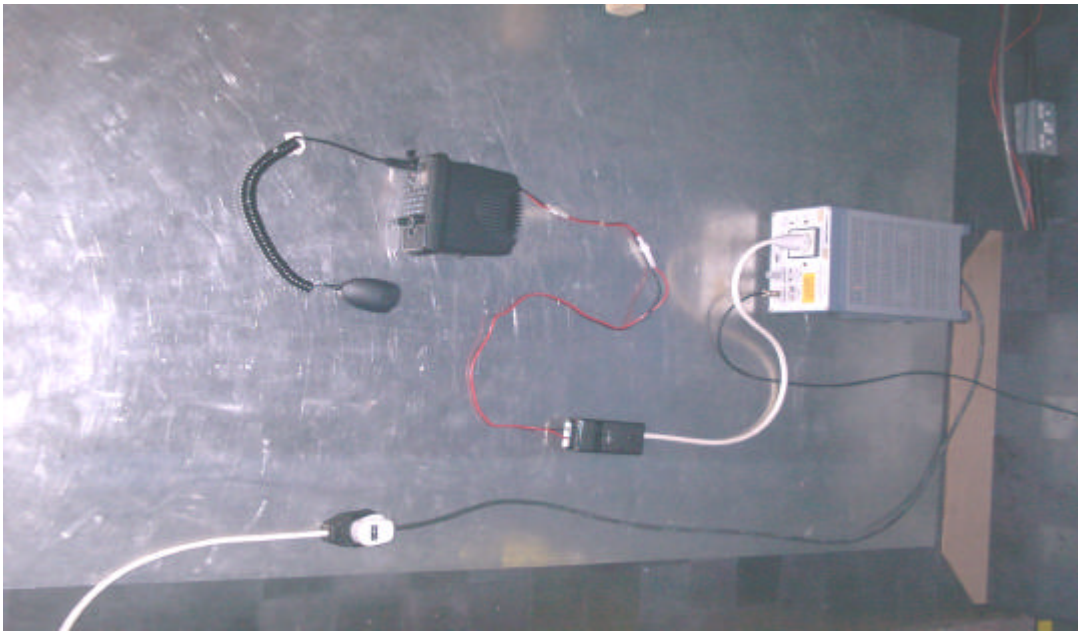
PHOTOGRAPH 1 Layout view of RT1800 during radiated emissions test (150kHz - 30Mhz)



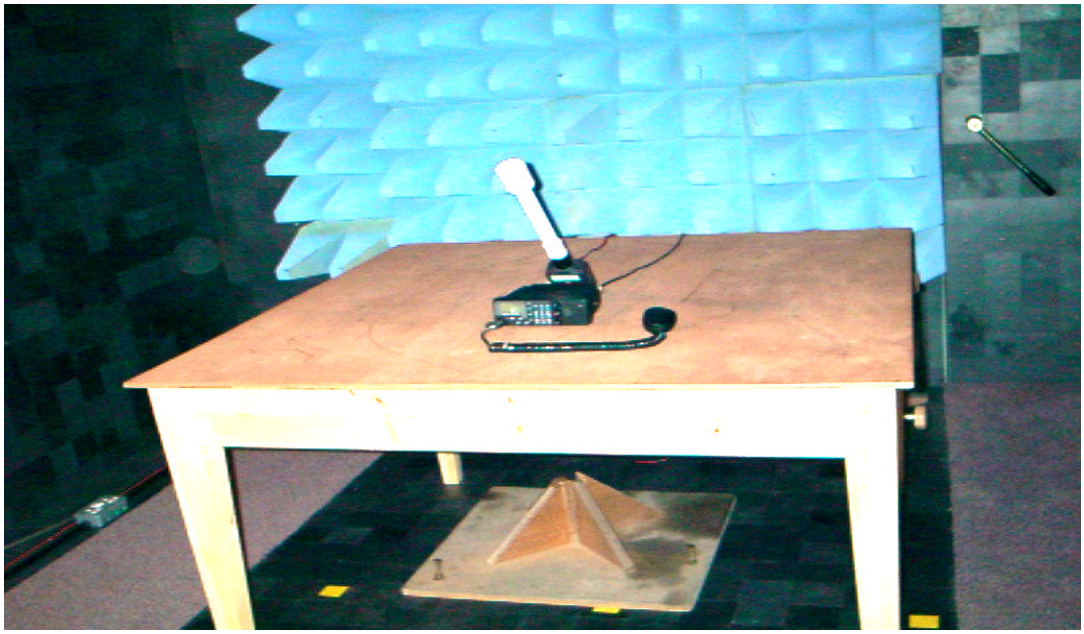
PHOTOGRAPH 2 Close up view of RT1800 during radiated emissions test



PHOTOGRAPH 3 Close up view of RT1800 during conducted emissions test

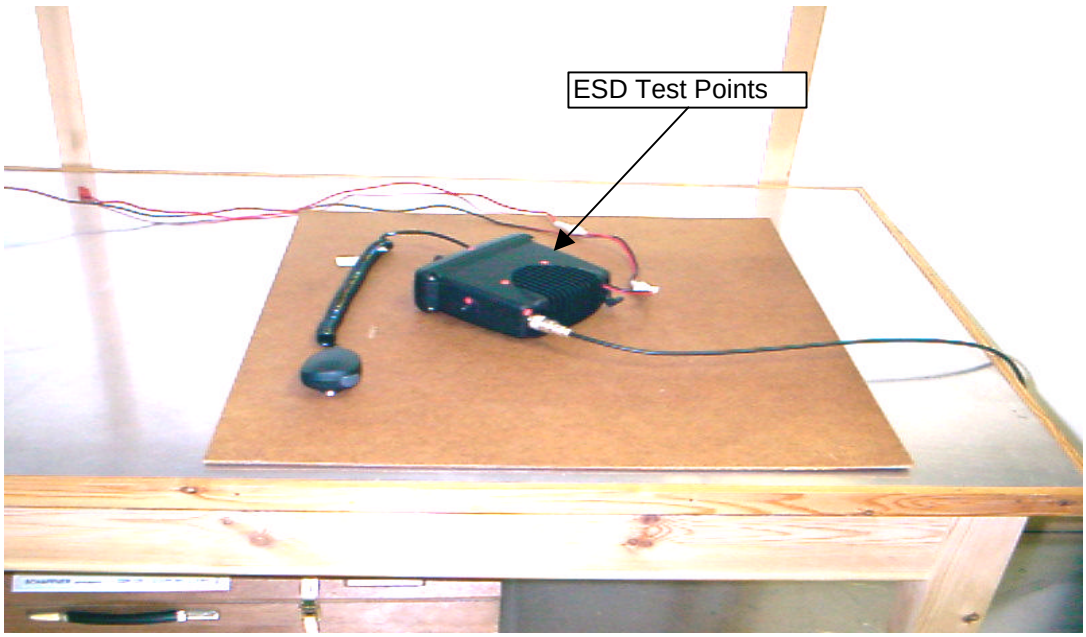


PHOTOGRAPH 4 Close up view of RT1800 during radiated immunity test

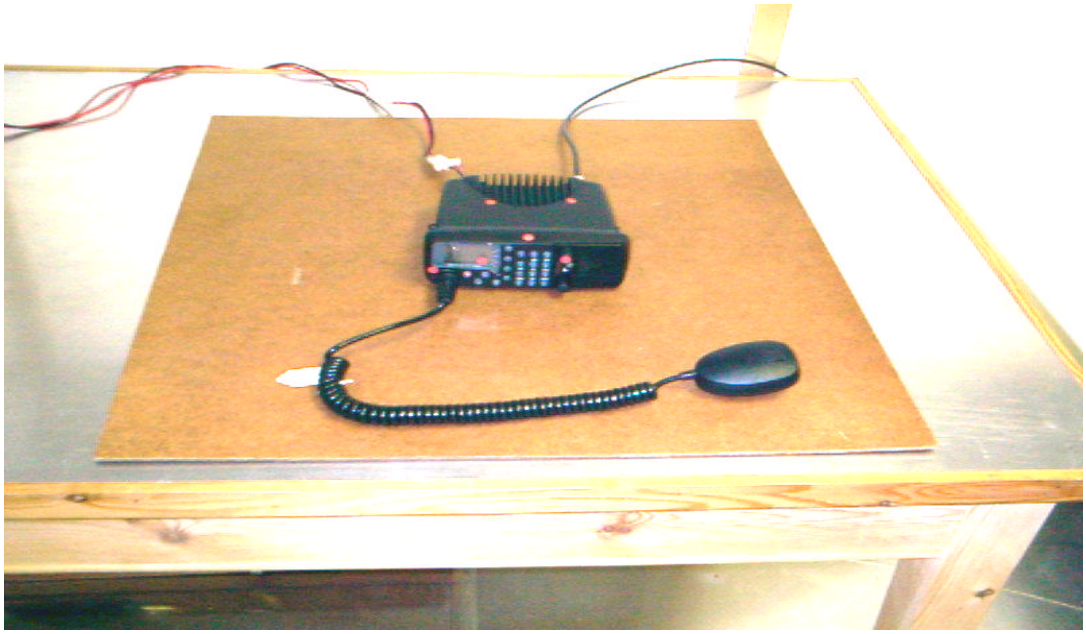


PHOTOGRAPH 5 Layout view of RT1800 during radiated immunity test

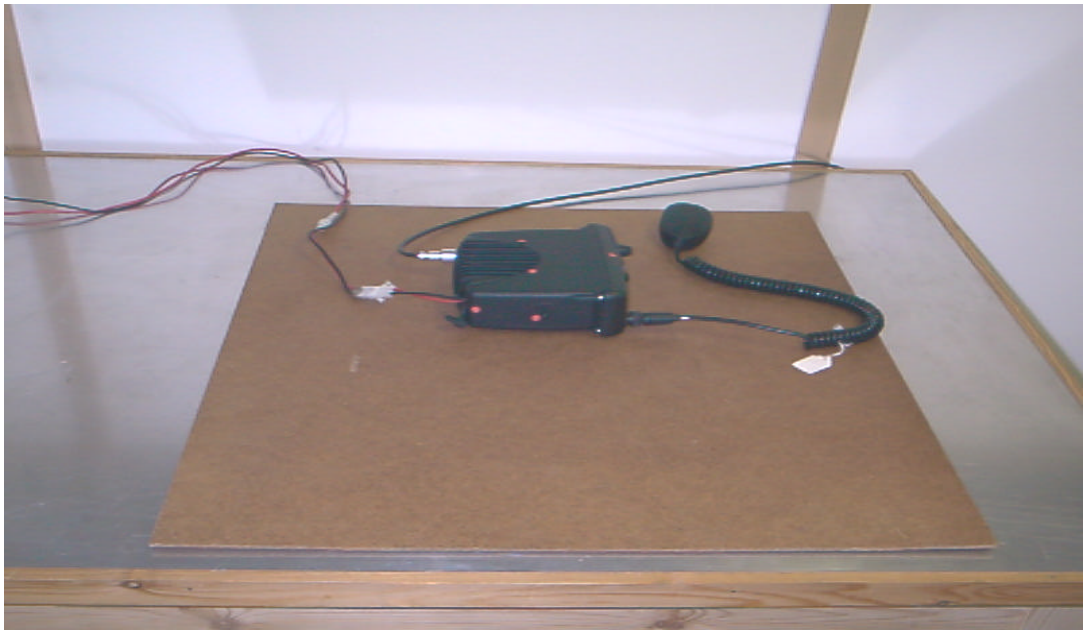
PHOTOGRAPH 6 Close up side/rear view of RT1800 showing ESD test points



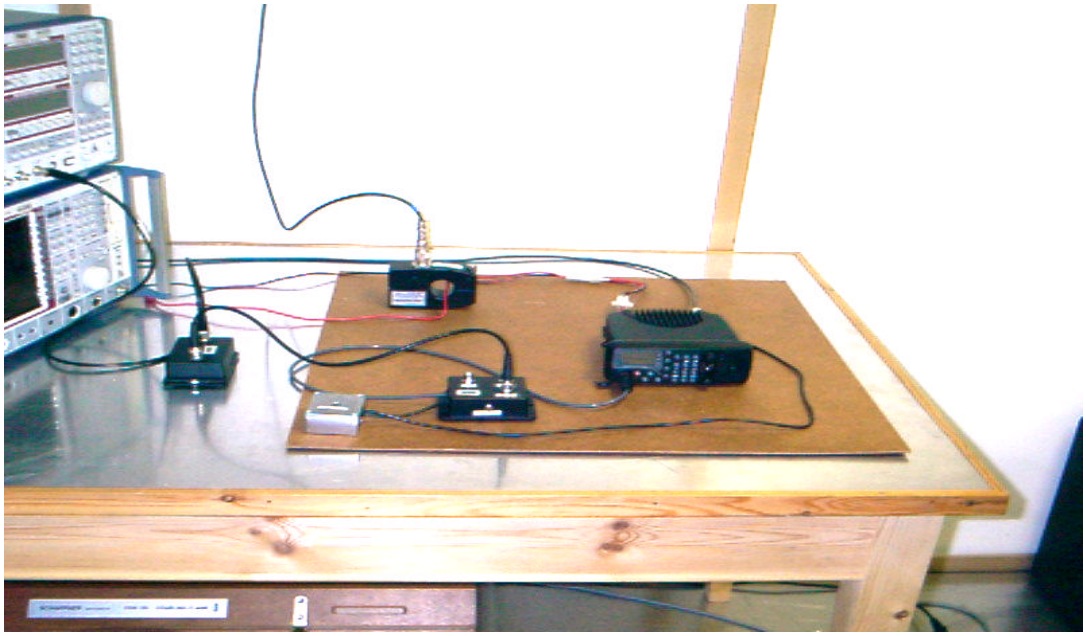
PHOTOGRAPH 7 Close up front view of RT1800 showing ESD test points



PHOTOGRAPH 8 Close up side view of RT1800 showing ESD test points



PHOTOGRAPH 9 Layout view of RT1800 during conducted immunity test

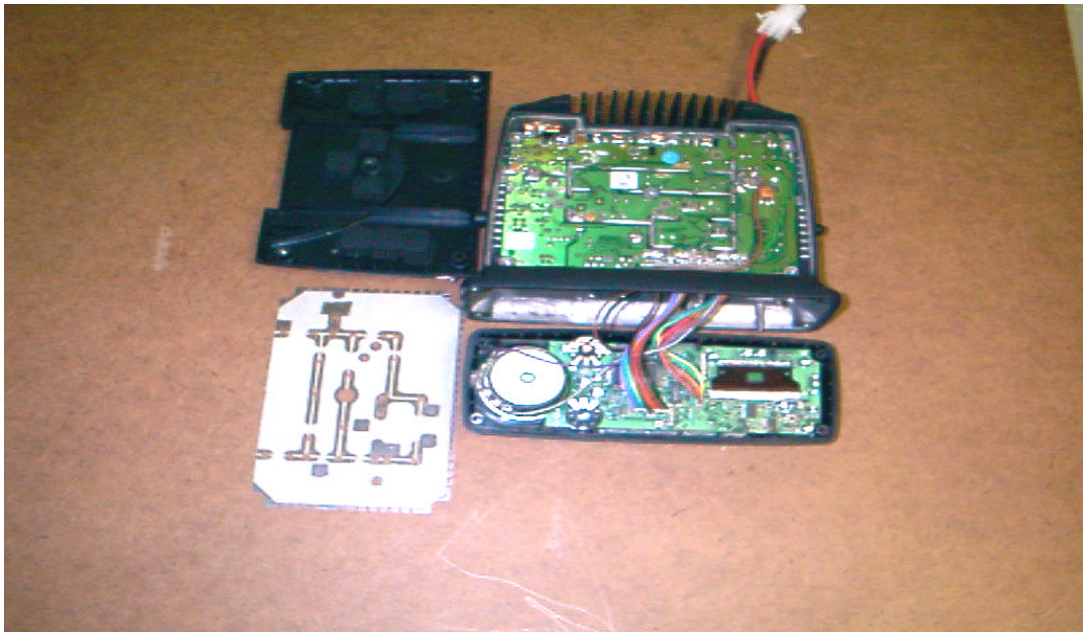


PHOTOGRAPH 10 General view of RT1800 radiotelephone with DSC

PHOTOGRAPH 11 Rear view of RT1800 radiotelephone

PHOTOGRAPH 12 RT1800 showing the Rx/Tx & front panel sections

PHOTOGRAPH 13 Internal view of the Rx/Tx transciever, front panel, screen & lid sections



PHOTOGRAPH 14 General view of ptt connection box used during testing

PHOTOGRAPH 15 Front view of RT1800 hand-microphone