



A KONGSBERG Company

NAVIGATION AND
COMMUNICATION
SYSTEMS

**REPORT FORM FOR TESTING
TO CFR47 part 80**

Stations in the Maritime Service

Test Report Number: TAR015

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Simrad 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 AJA02/4543 and granted on 28th January 2002.

All testing was carried out within the EMC test department of Simrad Ltd, to the requirements of CFR47 Part80

Testing carried out by: Stefan Kennedy

Report checked by: David Sheekey

Date: 15/03/2003

SECTION 4 TEST TECHNICAL DETAILS

Test Unit = RS87

Serial Number =

Additional Parts = EXB80

Nominal Voltage = 12.0 Volts

Maximum Voltage = 15.6 Volts

Minimum Voltage = 10.8 Volts

Nominal Temperature = 20°C

Maximum Temperature = 55°C

Minimum Temperature = -15°C

Channel 16 = 156.800MHz

Upper Frequency = 163.000MHz

Lower Frequency = 155.000MHz

Second Receiver Frequency = 157.525MHz

Channel Spacing = 25kHz

First IF Main Rx = 21.4MHz

Second IF Main Rx = 450kHz

First IF 2nd Rx = 17.9kHz

Second IF 2nd Rx = 450kHz

Rated Audio Power = 2.0 Watts *(external speaker)*

N/A *(handset earphone)*

Rated Audio Load = 2.0 Watts *(external speaker)*

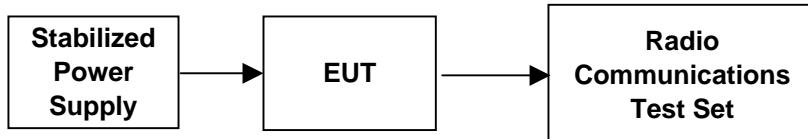
N/A *(handset earphone)*

SECTION 3 Transmitter RF Output Power conducted to the antenna

Specification: CFR47 2.1046(a)

Test Equipment Used: 6, 9, 11, 20, 21

Measurement Procedure



The EUT is connected to a regulated power supply set to the nominal supply voltage. The antenna socket is connected to a radiocommunications test set. This equipment is used for measurement of RF output power, transmitter frequency and modulation levels.

The Transmitter power is measured on channel 16 and the highest and lowest frequencies the transceiver is rated for. Measurements are made at the nominal supply voltage, at +30%, -10% of the supply voltage and at the extremes of temperature.

TEST CONDITIONS		OUTPUT POWER (Watts) on 25W setting			Pass/Fail
		155.000MHz	156.800MHz	163.000MHz	
T _{nom} (°C)	V _{nom} (12V)	22.7	22.5	20.9	Pass
T _{max} (°C)	V _{min} (10.8V)	20.3	18.0	15.0	Pass
	V _{max} (15.6V)	22.4	23.3	21.9	Pass
T _{min} (°C)	V _{min} (10.8V)	22.3	22.1	19.1	Pass
	V _{max} (15.6V)	22.7	21.9	21.2	Pass

TEST CONDITIONS		OUTPUT POWER (Watts) on 1W setting			Pass/Fail
		155.000MHz	156.800MHz	163.000MHz	
T _{nom} (°C)	V _{nom} (12V)	0.7850	0.7820	0.7150	Pass
T _{max} (°C)	V _{min} (10.8V)	0.865	0.867	0.771	Pass
	V _{max} (15.6V)	0.857	0.849	0.759	Pass
T _{min} (°C)	V _{min} (10.8V)	0.671	0.690	0.668	Pass
	V _{max} (15.6V)	0.687	0.687	0.631	Pass

Complies? Yes

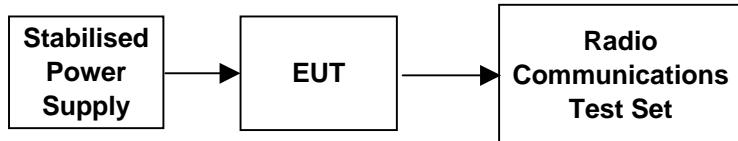
Note: Channels 02, 04, 60 and 62 are barred from operation. Channels 13 and 67 are low power only.

SECTION 3 Transmitter Frequency Error

Specification: CFR47 2.1055(a)

Test Equipment Used: 6, 9, 11, 20, 21, 22

Measurement Procedure



The EUT is connected to a regulated power supply set to the nominal supply voltage. The antenna socket is connected to a radiocommunications test set. This equipment is used for measurement of RF output power, transmitter frequency and modulation levels.

The Transceiver was placed in a temperature controlled environment and allowed to settle for 30 minutes at each test temperature before a measurement was made. Tests were carried out on channel 16 at both high and low powers. As there was no discernible change in frequency error with supply voltage these results have not been recorded

Test Frequency: 156.800MHz

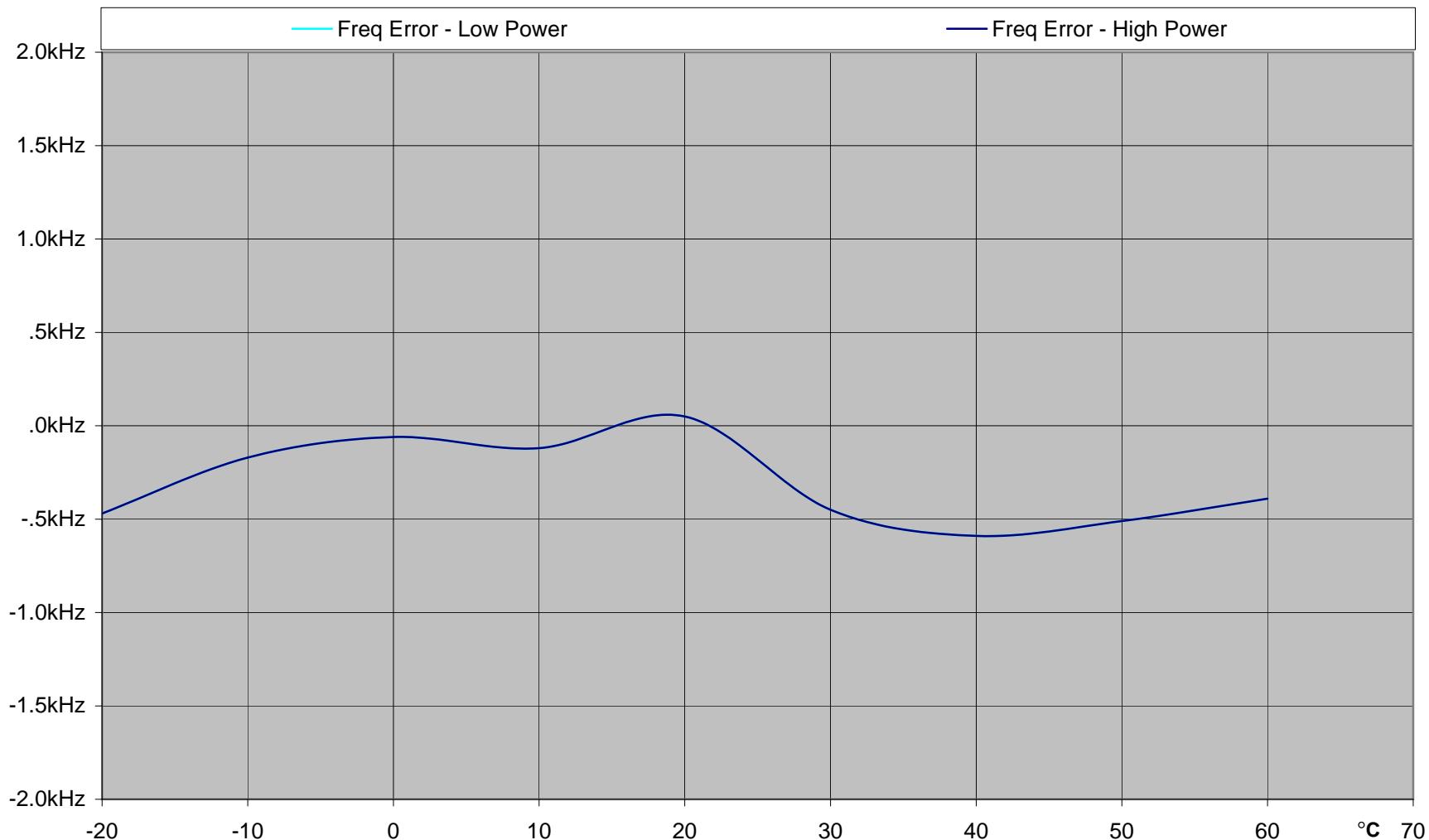
Temperature °C	Limit	Frequency(MHz)		Freq Error - High Power	Freq Error - Low Power	Pass/Fail
		High Power	Low Power			
-20	1.5kHz	156.799530	156.799530	-0.470	-0.470	Pass
-10	1.5kHz	156.799830	156.799830	-0.170	-0.170	Pass
0	1.5kHz	156.799940	156.799940	-0.060	-0.060	Pass
10	1.5kHz	156.799880	156.799880	-0.120	-0.120	Pass
20	1.5kHz	156.800050	156.800050	0.050	0.050	Pass
30	1.5kHz	156.799550	156.799550	-0.450	-0.450	Pass
40	1.5kHz	156.799410	156.799410	-0.590	-0.590	Pass
50	1.5kHz	156.799490	156.799490	-0.510	-0.510	Pass
60	1.5kHz	156.799610	156.799610	-0.390	-0.390	Pass

Limits:

Maximum permissible frequency error +/-1.5kHz

Complies: Yes

Transmitter Frequency Error

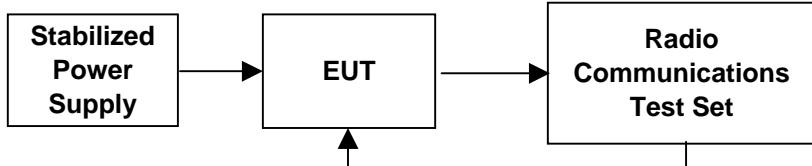


SECTION 3 Transmitter Audio Frequency Response

Specification: CFR47 2.1047(a)

Test Equipment Used: 6, 9, 20, 21, 22

Measurement Procedure



The EUT is connected to a regulated power supply set to the nominal supply voltage. The antenna socket is connected to a radiocommunications test set. This equipment is used for measurement of RF output power, transmitter frequency and modulation levels.

The AF input level to the modulator is adjusted to achieve $\pm 3\text{kHz}$ deviation at 1kHz. The input level is then increased by 20dB and the deviation measured from 100Hz to 3kHz.

The AF level is then adjusted to give $\pm 3\text{kHz}$ deviation at 1kHz again, and the deviation measured from 3kHz to 25kHz.

The results are tabulated below and shown graphically on the next page.

Modulation Frequency (Hz)	Input Level	Limit	Maximum Deviation (kHz)		Pass/Fail
			High Power	Low Power	
100	20db 3kHz	5.0kHz	2.07	2.06	Pass
200	20db 3kHz	5.0kHz	4.58	4.58	Pass
300	20db 3kHz	5.0kHz	4.65	4.69	Pass
400	20db 3kHz	5.0kHz	4.65	4.68	Pass
500	20db 3kHz	5.0kHz	4.49	4.57	Pass
1000	20db 3kHz	5.0kHz	3.69	3.79	Pass
1500	20db 3kHz	5.0kHz	3.44	3.44	Pass
2000	20db 3kHz	5.0kHz	4.03	4.07	Pass
2500	20db 3kHz	5.0kHz	3.92	3.95	Pass
3000	20db 3kHz	5.0kHz	3.36	3.41	Pass

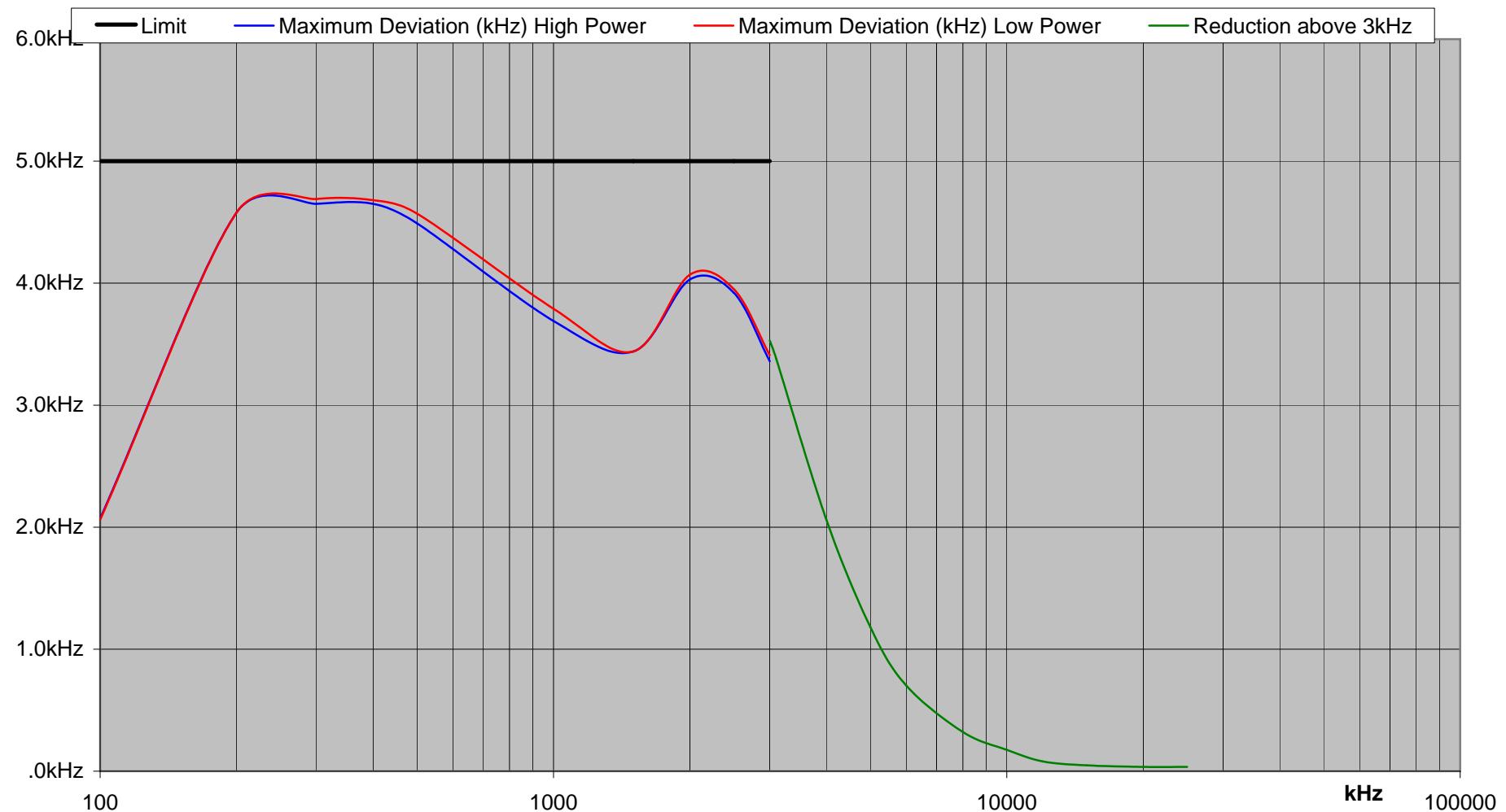
Modulation Frequency	Input Level	Limit	Max Deviation	Pass/Fail
3000	3kHz	3.53	3.530	Pass
3100	3kHz	3.53	3.380	Pass
4000	3kHz	3.53	2.060	Pass
5000	3kHz	3.53	1.180	Pass
6000	3kHz	1.5kHz	0.702	Pass
8000	3kHz	.77kHz	0.321	Pass
10000	3kHz	.46kHz	0.175	Pass
12000	3kHz	.30kHz	0.080	Pass
15000	3kHz	.18kHz	0.048	Pass
20000	3kHz	.09kHz	0.035	Pass
25000	3kHz	.05kHz	0.035	Pass

Limits:

Maximum permissible frequency deviation less than <5 khz

Complies: Yes

Transmitter AF Limiting Characteristic

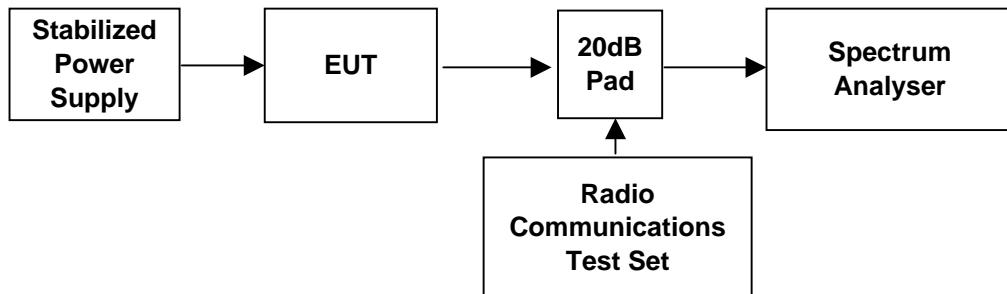


SECTION 3 Transmitter Occupied Bandwidth

Specification: CFR47 2.1049(c)(1)

Test Equipment Used: 6, 7, 9, 21, 22, 26, 27

Measurement Procedure



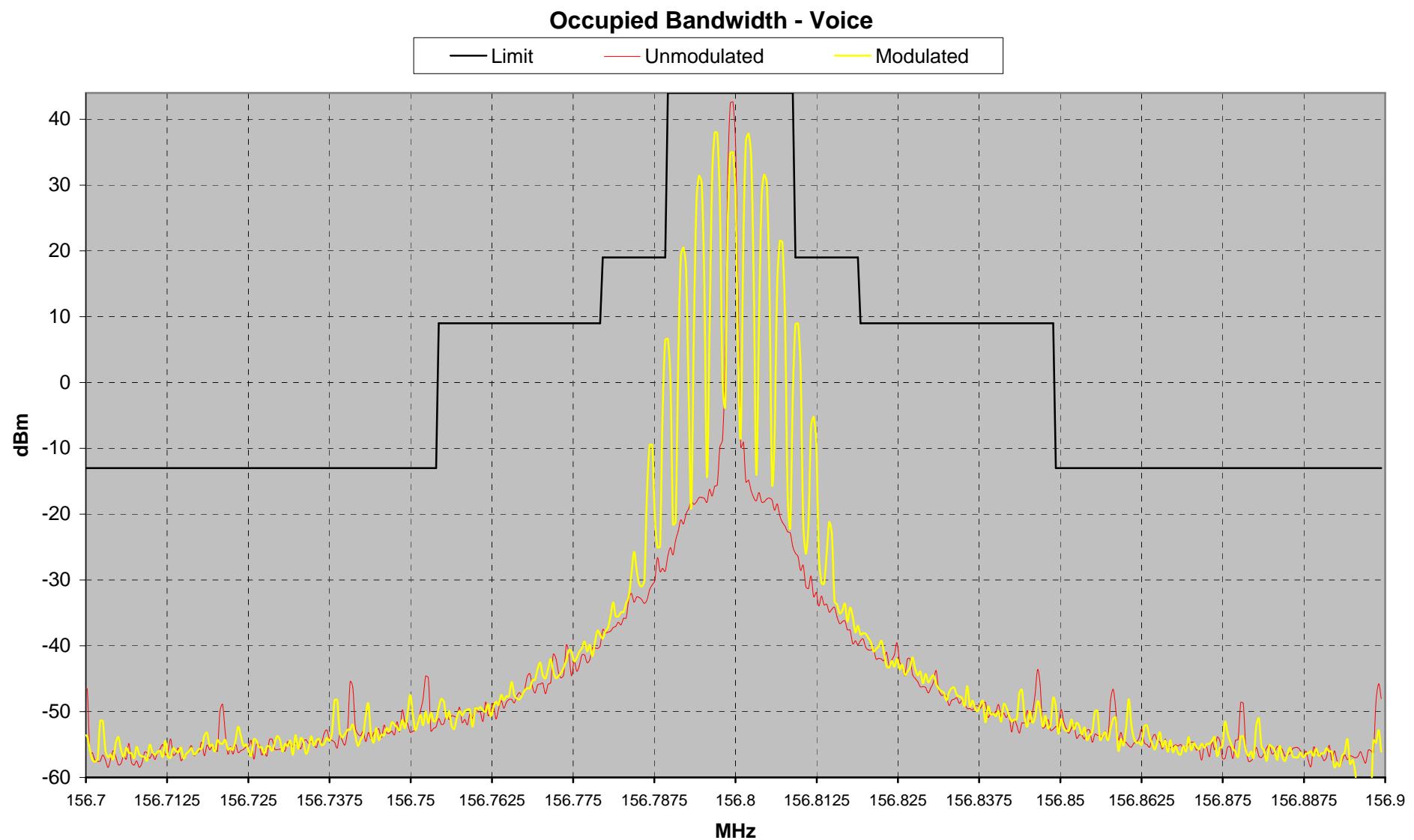
The EUT is connected to a regulated power supply set to the nominal supply voltage. The antenna socket is connected via a 20dB power attenuator to a spectrum analyser. The modulation is supplied from the radiocommunications test set. The AF input level is adjusted to give 50% modulation at 2.5kHz and then increased by 16dB. The reference level of the analyser is adjusted to the level of the unmodulated carrier. The resulting spectrum is then plotted with both modulation on and off. The test is repeated on channel 70 with DSC modulation.

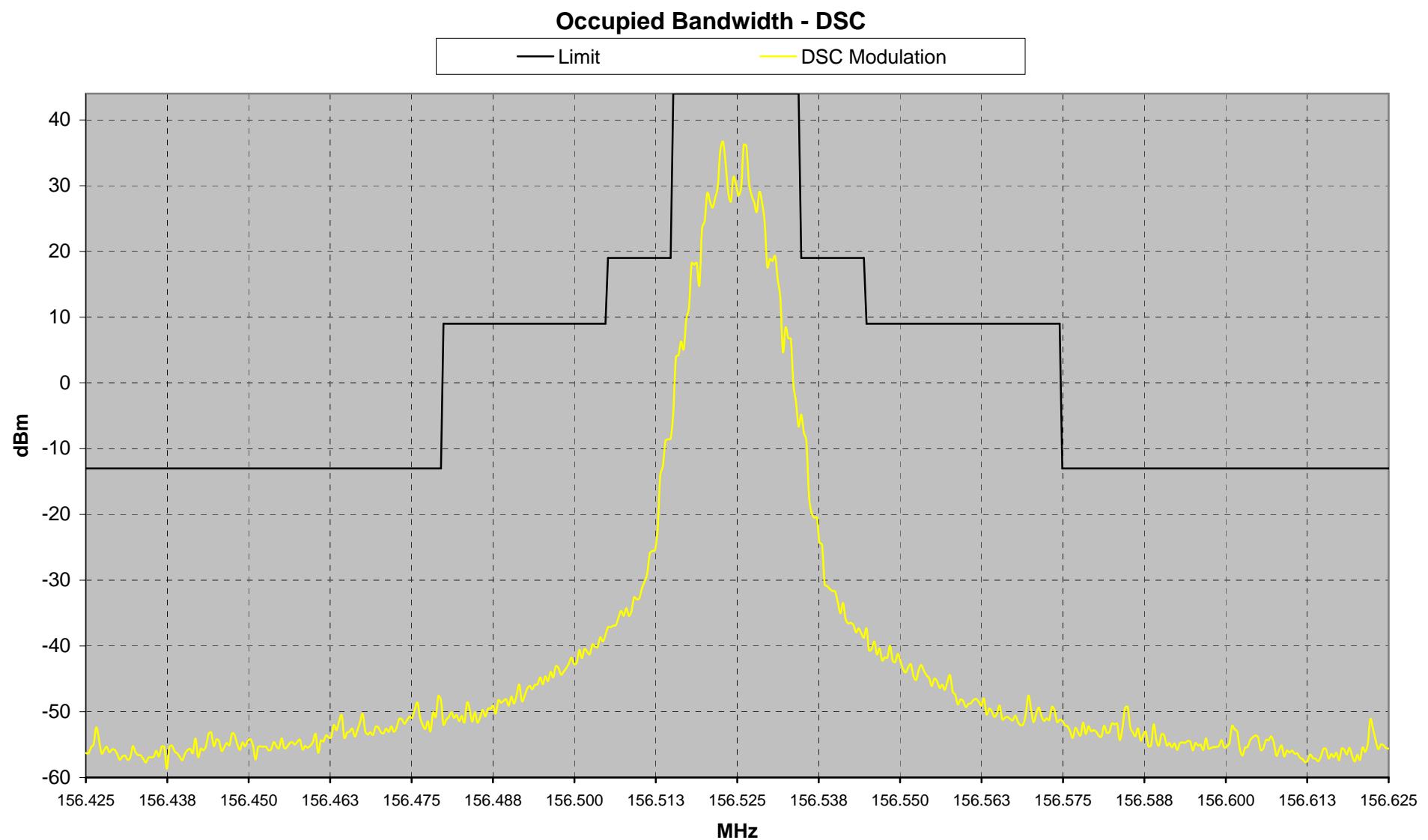
Results can be found in the charts on the next two pages.

Limits:

Maximum limit defined in CFR47 part 80.211(l)

Complies: Yes



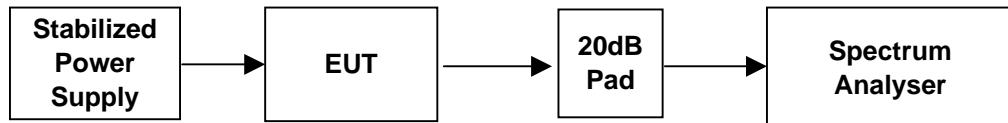


SECTION 3 Transmitter Spurious emission conducted to the antenna

Specification: CFR47 2.1051

Test Equipment Used: 7, 9, 21, 22, 26, 27

Measurement Procedure



The EUT is connected to a regulated power supply set to the nominal supply voltage. The antenna socket is connected via a 20dB power attenuator to a spectrum analyser.

With the transmitter keyed, a search is done for conducted emissions. The levels of the highest of these are measured and tabulated below.

Note: to avoid harmonics produced by non linearities in the spectrum analyser, a calibrated bandstop filter is inserted between the attenuator and the spectrum analyser, tuned to the transmitter carrier frequency.

Frequency of Spurious Emissions (MHz)	156.800MHz		Pass / Fail
	Low Power	High Power	
134.95	1.0nW	0.2nW	Pass
178.65	0.1nW	0.0nW	Pass
313.600	26.0nW	46.0nW	Pass
470.400	3.0nW	79.0nW	Pass
627.200	1.0nW	11.0nW	Pass
784.000	3.0nW	9.0nW	Pass
940.800	2.8nW	24.0nW	Pass
1097.600	0.2nW	3.0nW	Pass
1254.400	0.3nW	0.2nW	Pass
1411.200	4.0nW	21.0nW	Pass
1568.000	19.0nW	50.9nW	Pass
1724.800	0.0nW	0.4nW	Pass
1881.600	0.2nW	0.9nW	Pass

Limits:

	250.0nW
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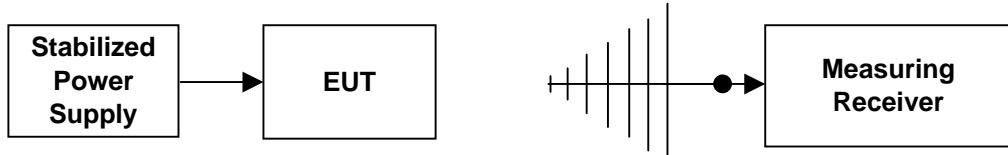
Complies: Yes

SECTION 3 Transmitter Audio Frequency Response

Specification: CFR47 2.1051

Test Equipment Used: 7, 9, 13, 28, 29, 32

Measurement Procedure



The EUT is connected to a power supply and placed in an anechoic, screened chamber. The measuring antenna is placed at a distance of three metres and connected to a measuring receiver.

Under the control of the measurement software a scan is carried out from 30MHz to 1GHz.

Results from this test can be found at section 13, Plots 1 - 8 and table 1 showing all measured radiated transmitter spurious emissions in the required test frequency

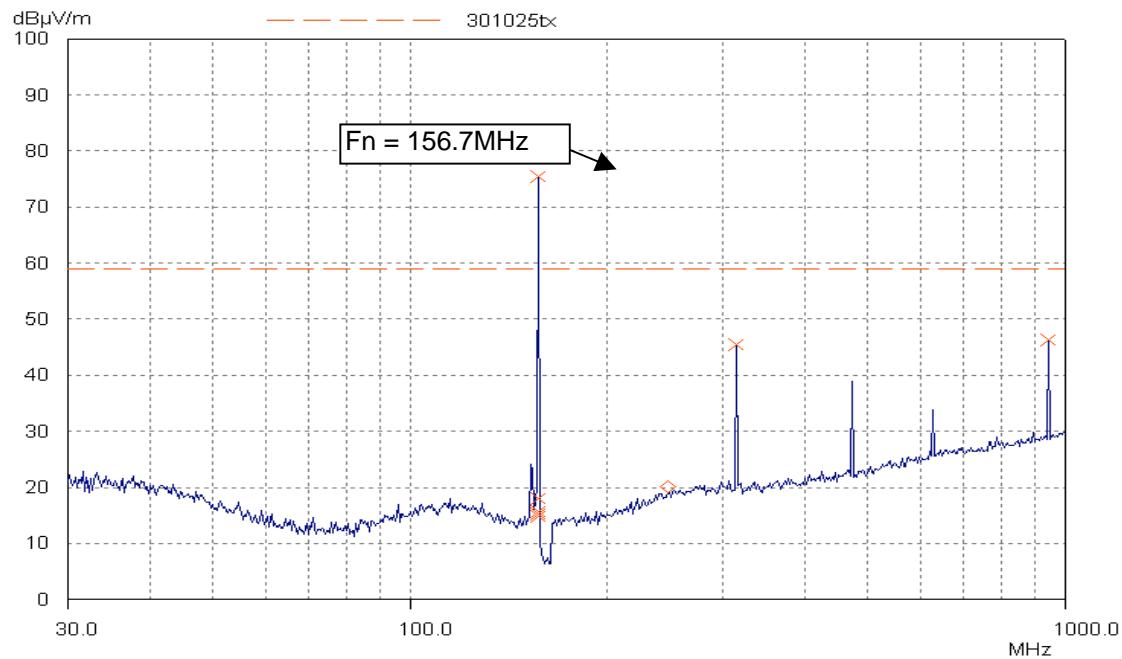
Limits:

	250.0nW
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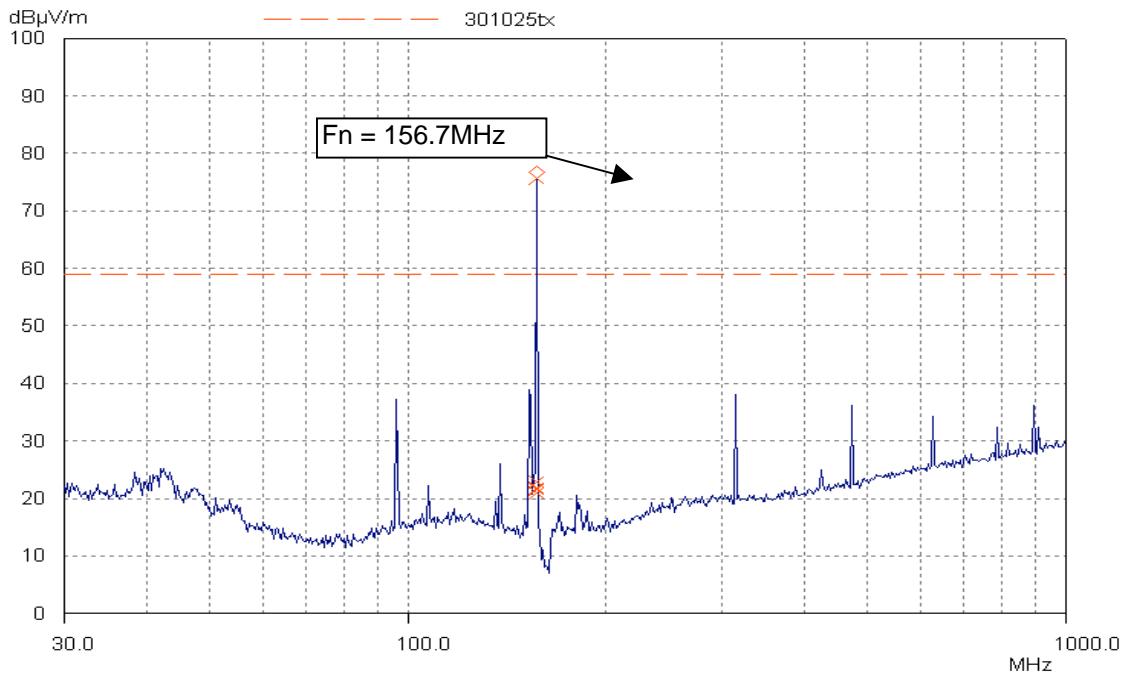
Complies: Yes

SECTION 4 MEASUREMENT SCAN RESULTS

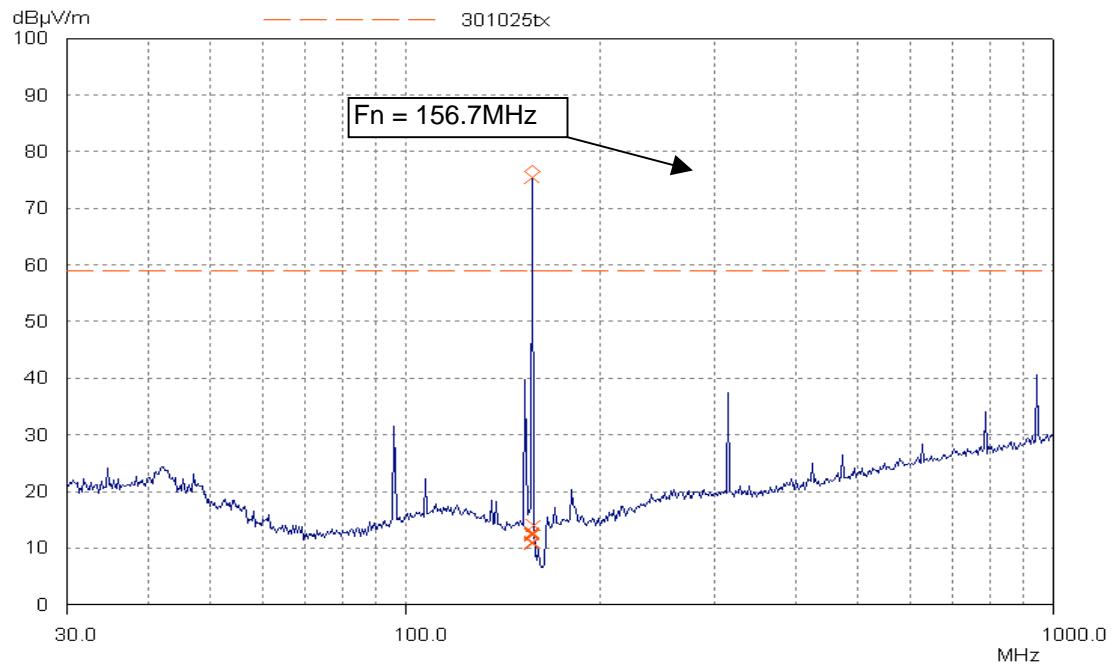
PLOT 1 Transmitter (25W Front Face) Radiated Emissions in Vertical Polarisation



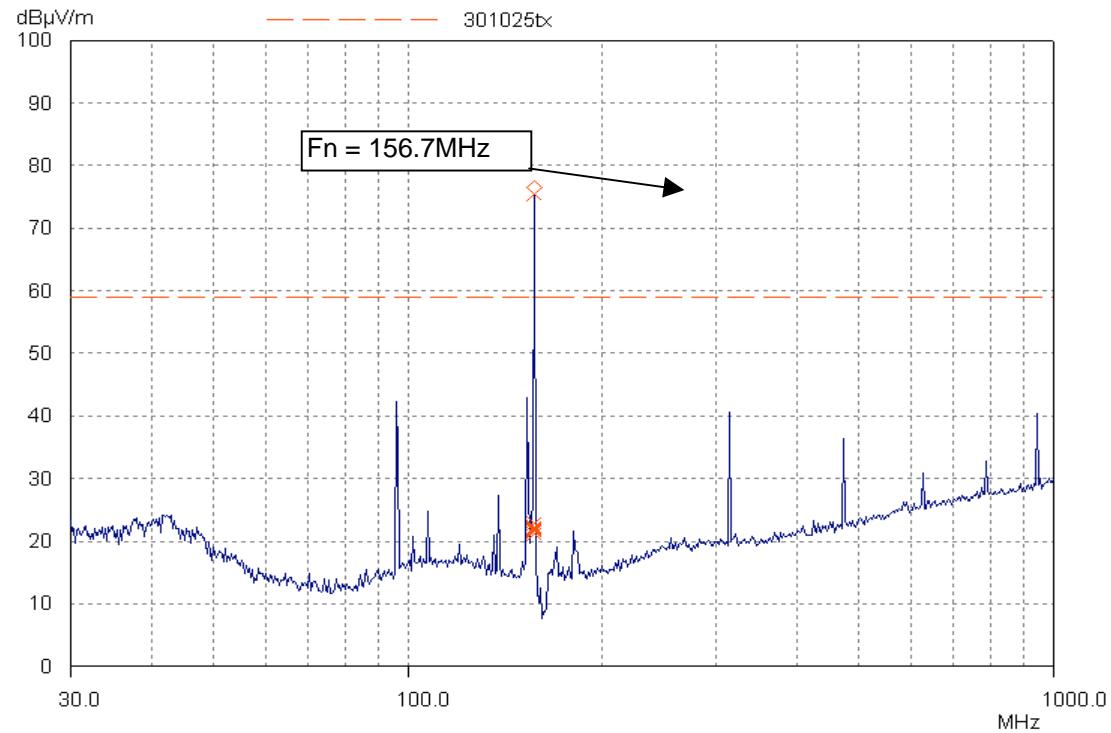
PLOT 2 Transmitter (25W Left Face) Radiated Emissions in Vertical Polarisation



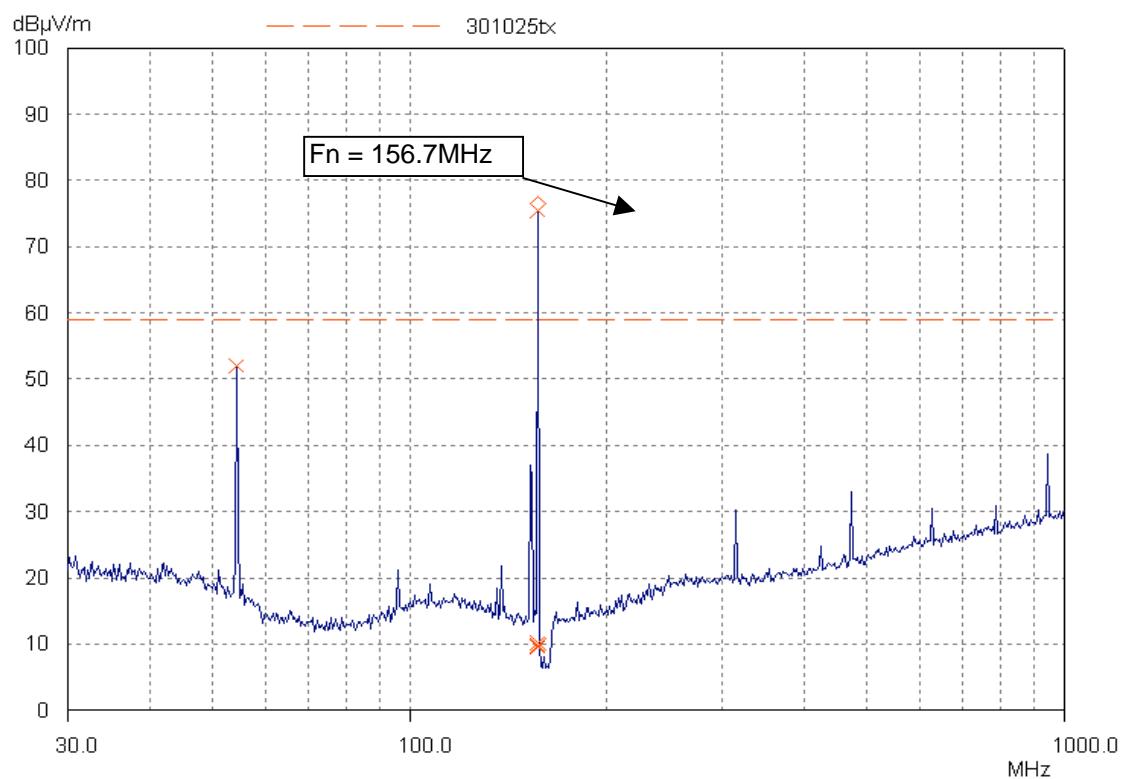
PLOT 3 Transmitter (25w Rear Face) Radiated Emissions in Vertical Polarisation



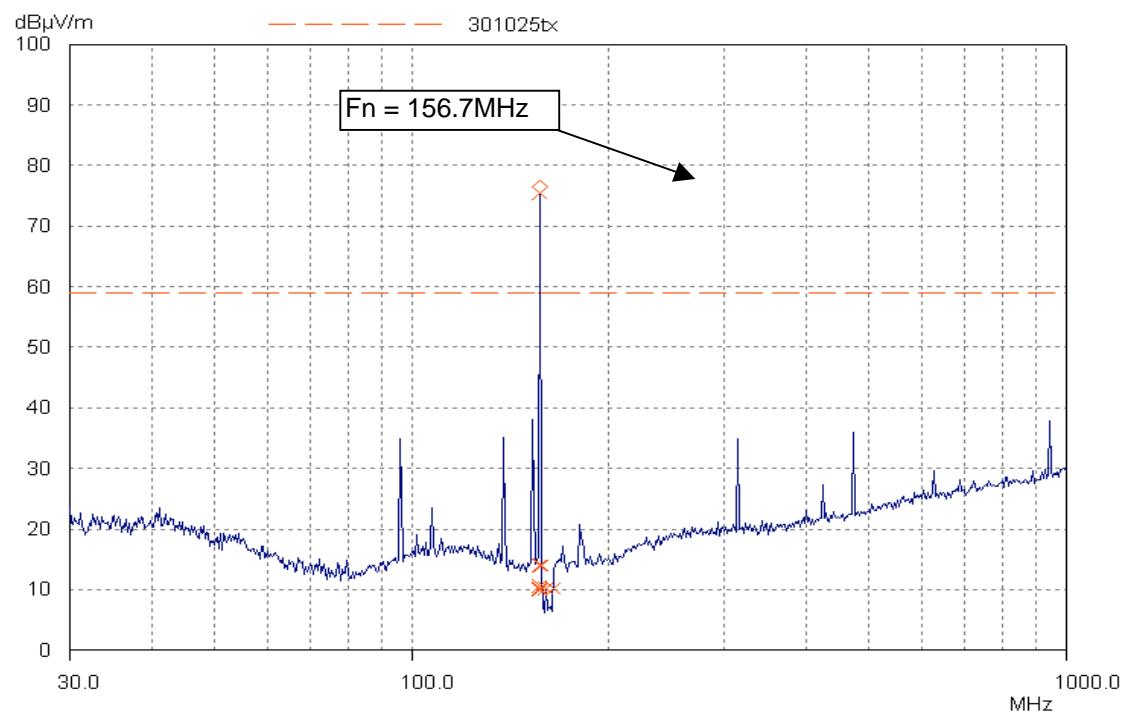
PLOT 4 Transmitter (25w Right Face) Radiated Emissions in Vertical Polarisation



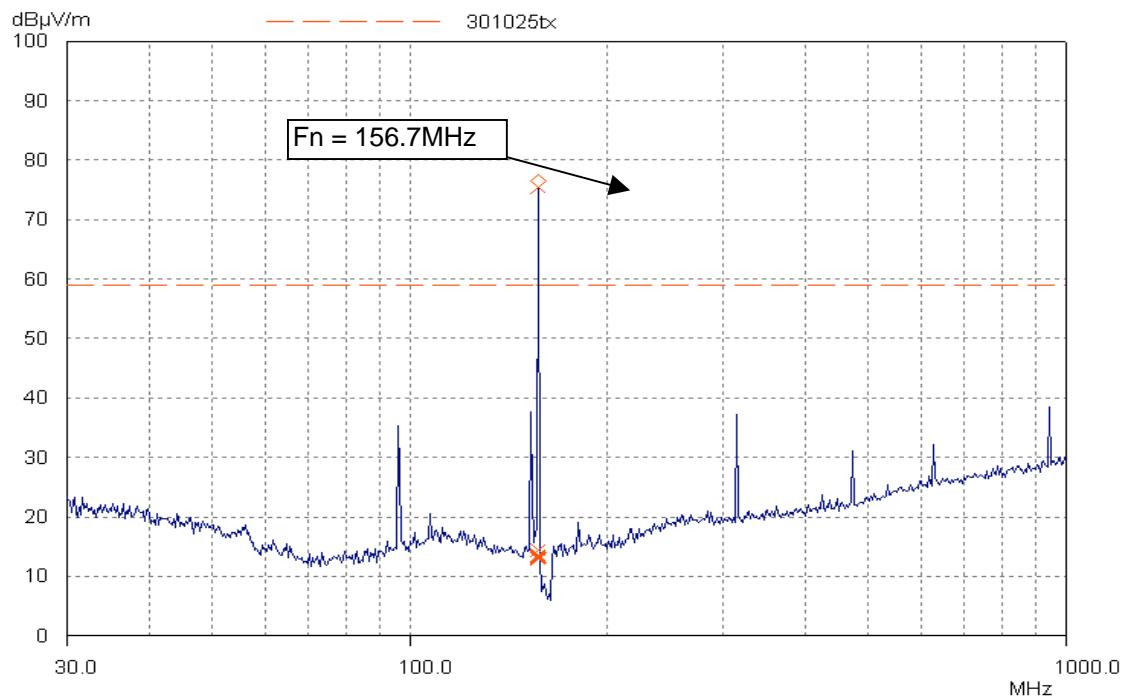
PLOT 5 Transmitter (25w Front Face) Radiated Emissions in Horizontal Polarisation



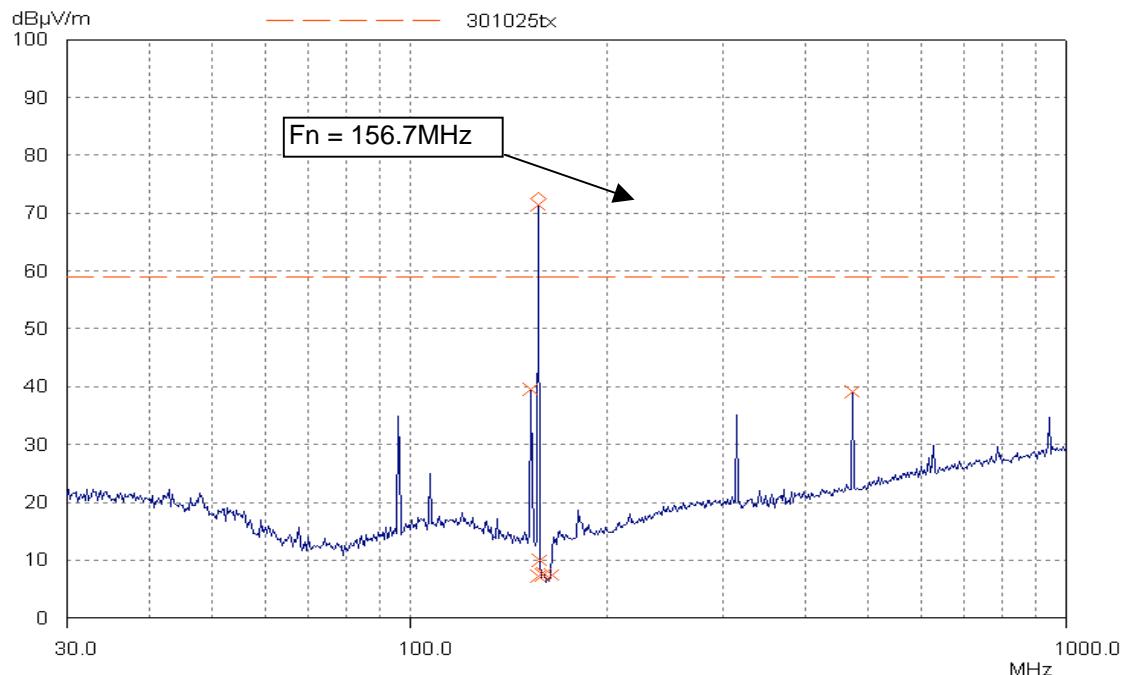
PLOT 6 Transmitter (25w Left Face) Radiated Emissions in Horizontal Polarisation



PLOT 7 Transmitter (25w Rear Face) Radiated Emissions in Horizontal Polarisation



PLOT 8 Transmitter (25w Right Face) Radiated Emissions in Horizontal Polarisation



SECTION 11 EQUIPMENT LIST

ITEM	MANUFACTURE	TYPE	DESCRIPTION	Simrad 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	Cable	PL259 to Bnc Lead	-
22	In - House	Cable	1m Bnc Lead	-
23	ICS	DSC2	GMDSS Controller	Nav 1688
24	In - House	-	Isolation Transformer	TJ0250
25	Castle	GA601	Acoustic Calibrator	Nav 1457
26	In - House	-	Band Pass Filter	TJ0249
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	TJ0248
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