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MRT AU9-AIS / AU10
RTCM 11901.1:2012 Test Report

Annex E - AIS Type MSLD System
E.7 Physical Radio Tests

25 November 2013

Product:	MRT AU9-AIS / AU10 dual-band personal Man Overboard (MOB) Alerting Unit (AU)
Manufacturer:	Marine Rescue Technology Marshall House Zarya Court, Grovehill Road Beverley, East Yorkshire HU17 0JG
Serial Number(s):	972418880, 972412430
Date tested:	28 October 2013 and 5 November 2013
Standards Tested to:	RTCM Standard 11901.1:2012 "For Maritime Survivor Locating Devices (MSLD)" – Annex E : "AIS Type MSLD System"
Summary:	The sample tested met the requirements after modification.
Tested by:	T.P.Jarvis
Report Author:	T.P.Jarvis

Project: MT242-RP1 STATUS: Issued

1.1 Manufacturer Information

MRT AU9-AIS / AU10

The AU10 (formerly know as the AU9-AIS) is a dual-operation personal MOB Alerting Unit (AU) transmitting on 121.5 MHz SAR frequency, whilst simultaneously sending GPS position information on maritime AIS channels AIS1 & AIS2.

(i) Ports: (1) Antenna cable (260+260mm).

(ii) EUT Software version: V1.64

1.2 Notes relating to the assessment

Sample MMSI=972418880 was supplied with the antenna replaced by a 50Ω SMA test port for conducted measurements. Sample MMSI=972412430 was unmodified for radiated measurements.

1.3 Variations

During tests that require a preconditioned battery equivalent to use in the MSLD for a period of 12 hours, note that a DC power source was used instead. These tests were repeated with the voltage stepped between the maximum operating voltage and the lowest operating voltage specified by the manufacture in steps of 0.5 V.

Maximum battery voltage	7.0 V
Nominal battery voltage	6.0 V
Lowest operating battery voltage	5.0 V

1.4 Summary of Compliance

The sample met the requirements following modification.

1.5 Modifications

Modification state 0 comprises no modifications and firmware version 2.07

Modification state 1 comprises:

(i) C22=C23=470p to decrease TX BT-Product,
(ii) C84=330p for s/w with CP2=0.63mA
(iii) C18=22p ,C17=18p,
(iv) Firmware update to V2.10

1.6 Results Table

Clause	Test	Appendix /note	Mod State	Result
E.7.1.1.1	Frequency Error	A	1	PASS
E.7.2	Conducted Power	B	1	PASS
E.7.3	Radiated Power	901.4 mW EIRP	0	PASS
E.7.3.1.4	Modulation spectrum slotted transmission	C	1	PASS
E.7.4	Transmitter test sequence and modulation accuracy	D	1	PASS
E.7.5	Transmitter output power versus time function	E	1	PASS
E.7.6	Spurious emissions	F	0	PASS

Signed 25 November 2013:

T.P.Jarvis BSc CEng MIEE MIEEE

A Appendix: Frequency Error

AIS1 161.975 MHz		
Temp °C	Battery	F_{offset} KHz
-20.9	7.00	-0.260
-20.9	6.50	-0.220
-20.9	6.00	-0.200
-20.9	5.50	-0.200
-20.9	5.00	-0.190
-20.9	4.50	-0.190
-20.9	4.00	-0.200
-20.9	3.50	no TX
19.6	7.00	0.080
19.6	6.50	0.050
19.6	6.00	0.050
19.6	5.50	0.040
19.6	5.00	0.050
19.6	4.50	0.060
19.6	4.00	0.060
19.6	3.50	no TX
55.0	7.00	0.090
55.0	6.50	0.090
55.0	6.00	0.090
55.0	5.50	0.080
55.0	5.00	0.080
55.0	4.50	0.080
55.0	4.00	0.070
55.0	3.50	no TX

AIS2 162.025 MHz		
Temp °C	Battery	F_{offset} KHz
-20.9	7.00	-0.210
-20.9	6.50	-0.190
-20.9	6.00	-0.170
-20.9	5.50	-0.150
-20.9	5.00	-0.160
-20.9	4.50	-0.160
-20.9	4.00	-0.170
-20.9	3.50	no TX
19.7	7.00	0.110
19.7	6.50	0.100
19.7	6.00	0.100
19.7	5.50	0.080
19.7	5.00	0.080
19.7	4.50	0.080
19.7	4.00	0.100
19.7	3.50	no TX
55.0	7.00	0.090
55.0	6.50	0.080
55.0	6.00	0.090
55.0	5.50	0.100
55.0	5.00	0.070
55.0	4.50	0.090
55.0	4.00	0.070
55.0	3.50	no TX

Table A.1 – Frequency Offset[1]

NOTE[1]: Although the manufacturer lowest operating battery voltage is set at 5.0V the frequency error test was performed until the EUT stopped transmitting altogether.

B Appendix: Conducted Power

AIS1 161.975 MHz		
Temp °C	Battery	Conducted Power dBm
-20.9	7.00	29.51
-20.9	6.50	29.43
-20.9	6.00	29.23
-20.9	5.50	28.98
-20.9	5.00	28.58
19.6	7.00	30.01
19.6	6.50	29.78
19.6	6.00	29.55
19.6	5.50	29.24
19.6	5.00	28.69
55.0	7.00	29.72
55.0	6.50	29.47
55.0	6.00	29.19
55.0	5.50	28.74
55.0	5.00	28.06

AIS2 162.025 MHz		
Temp °C	Battery	Conducted Power dBm
-20.9	7.00	29.54
-20.9	6.50	29.49
-20.9	6.00	29.26
-20.9	5.50	29.01
-20.9	5.00	28.66
19.7	7.00	30.01
19.7	6.50	29.78
19.7	6.00	29.55
19.7	5.50	29.23
19.7	5.00	28.68
55.0	7.00	29.67
55.0	6.50	29.49
55.0	6.00	29.19
55.0	5.50	28.76
55.0	5.00	28.08

Table B.1 – Conducted Power

C Appendix: Modulation spectrum slotted transmission

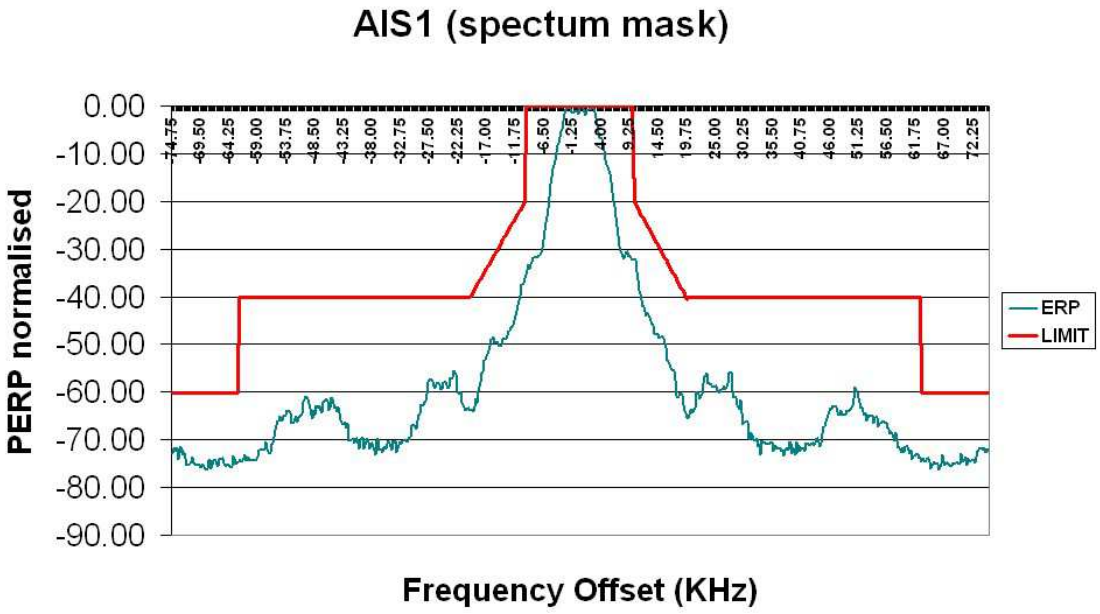

Figure C.1 – Spectrum AIS1 @ -20°C

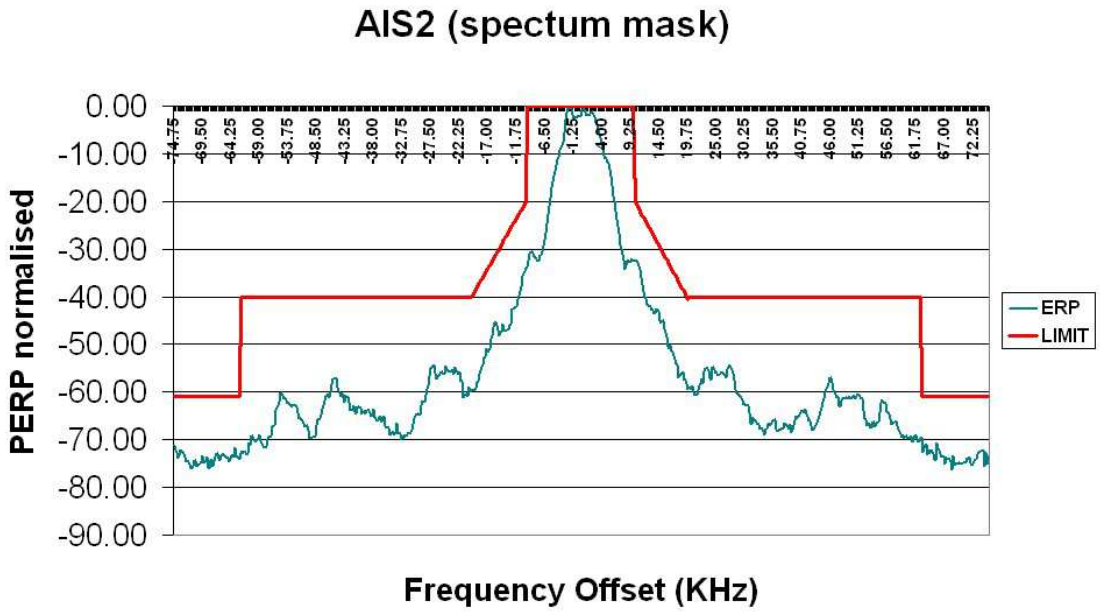

Figure C.2 – Spectrum AIS2 @ -20°C

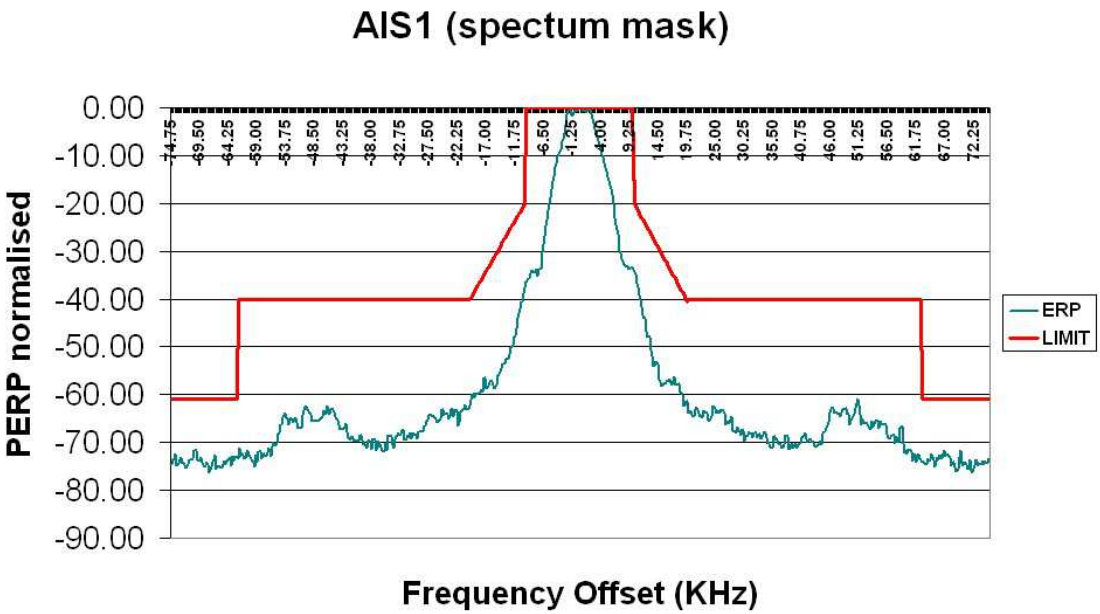

Figure C.3 – Spectrum AIS1 @ +20°C

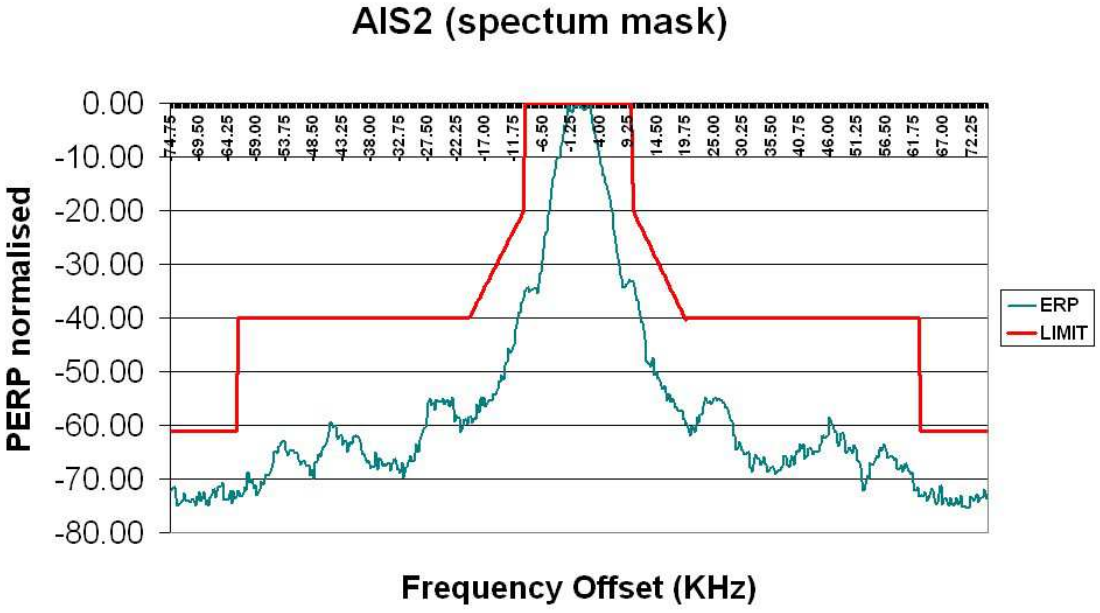

Figure C.4 – Spectrum AIS2 @ +20°C

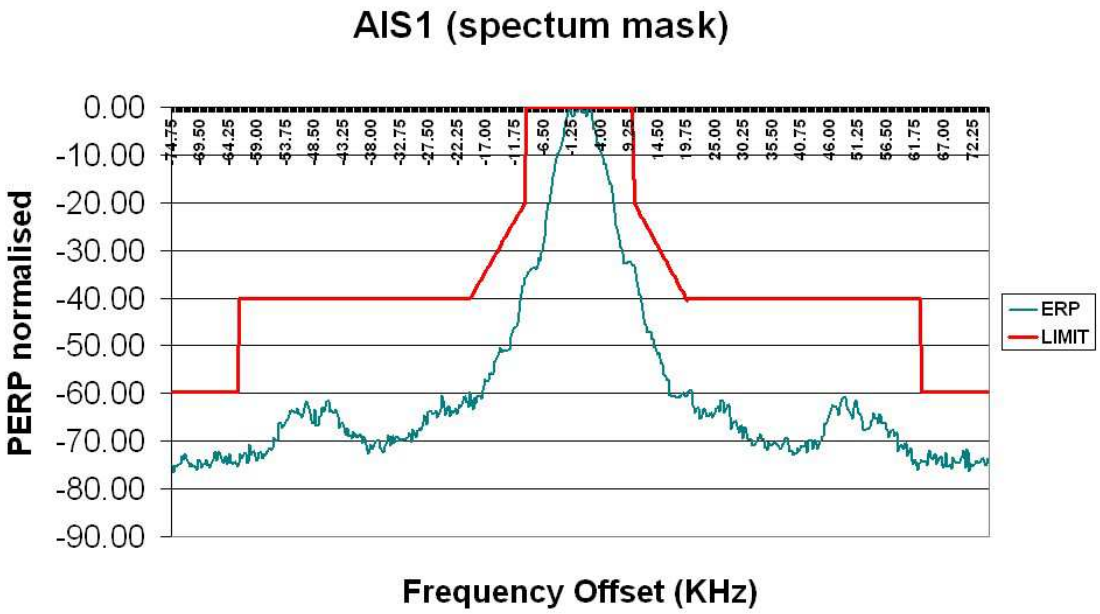

Figure C.5 – Spectrum AIS1 @ +55°C

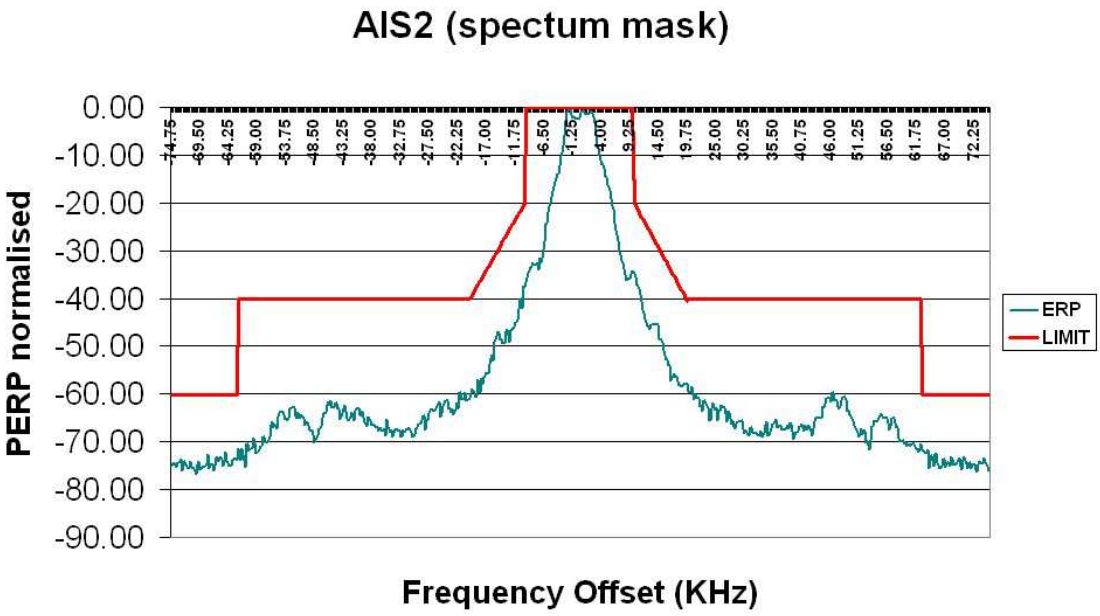

Figure C.6 – Spectrum AIS2 @ +55°C

D Appendix: Transmitter test sequence and modulation accuracy

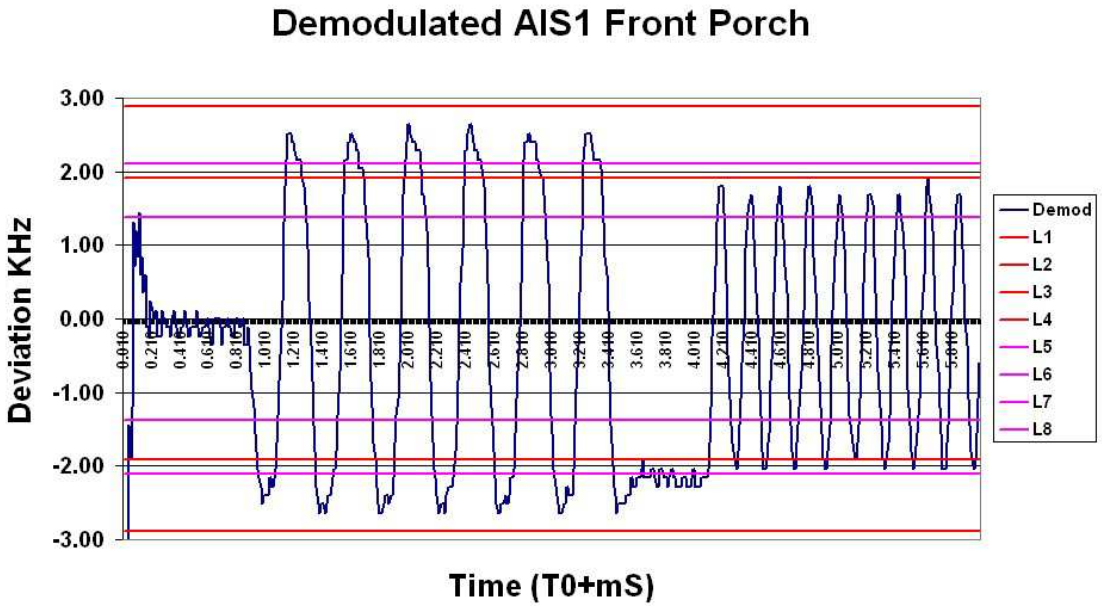

Figure D.1 – Test sequence TM1, AIS1 @ -20°C

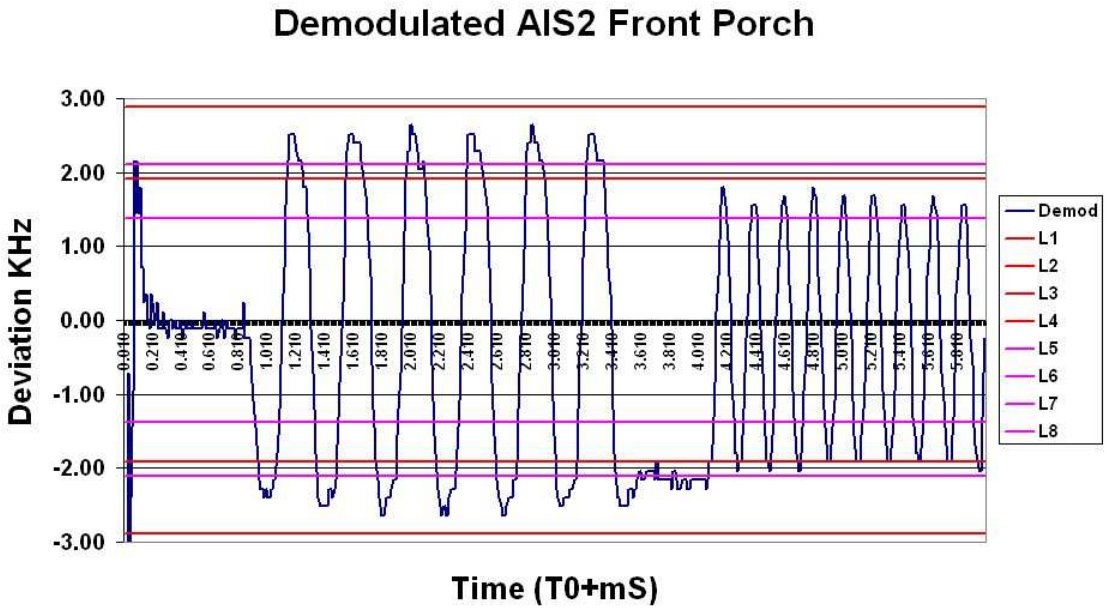

Figure D.2 – Test sequence TM1, AIS2 @ -20°C

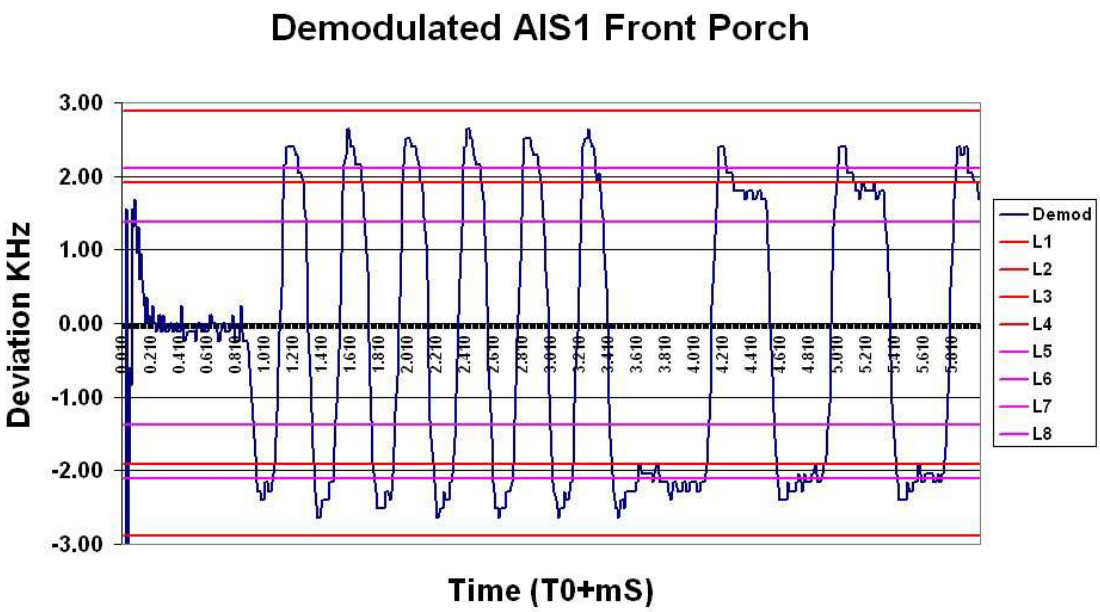

Figure D.3 – Test sequence TM2, AIS1 @ -20°C

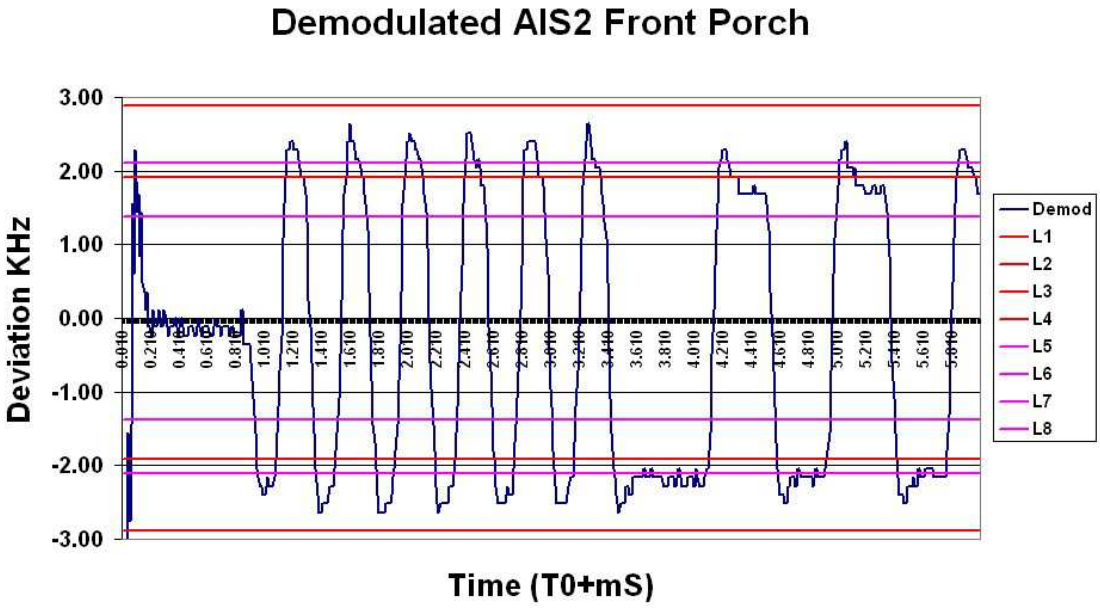

Figure D.4 – Test sequence TM2, AIS2 @ -20°C

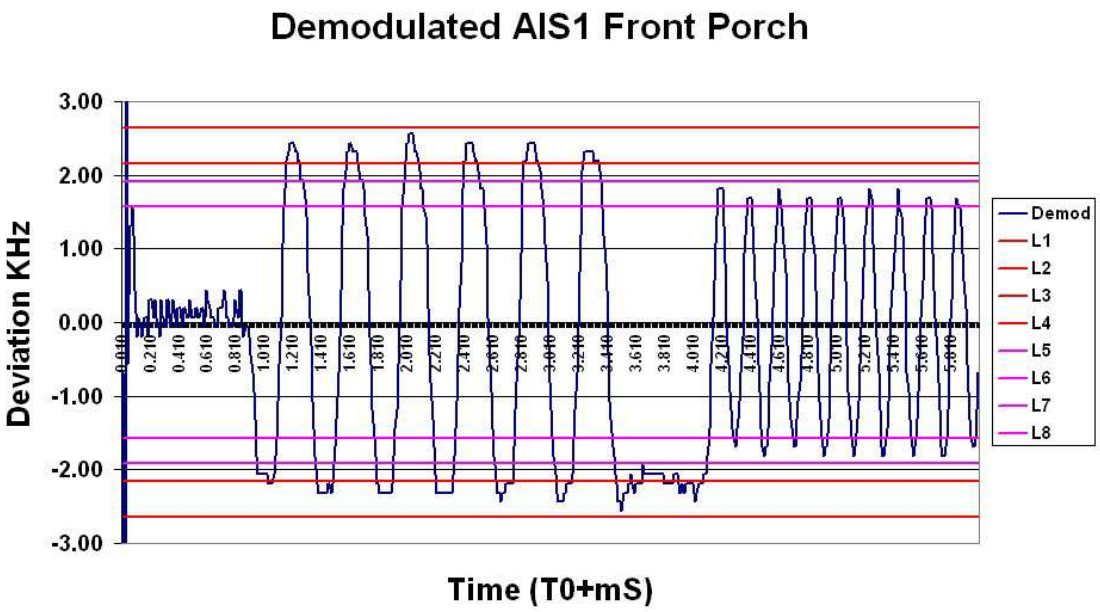

Figure D.5 – Test sequence TM1, AIS1 @ +20°C

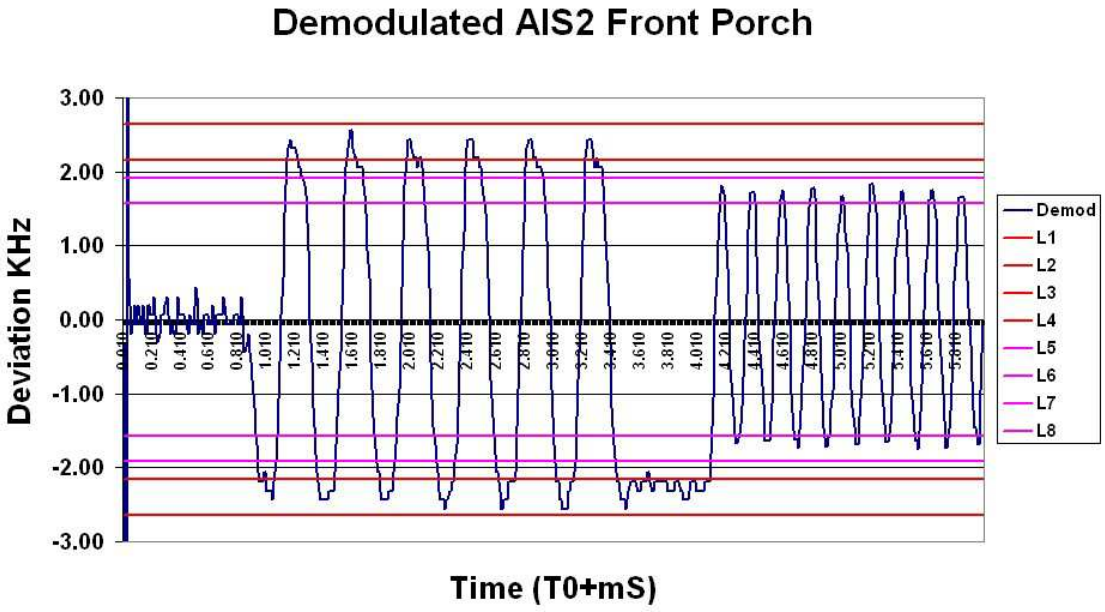

Figure D.6 – Test sequence TM1, AIS2 @ +20°C

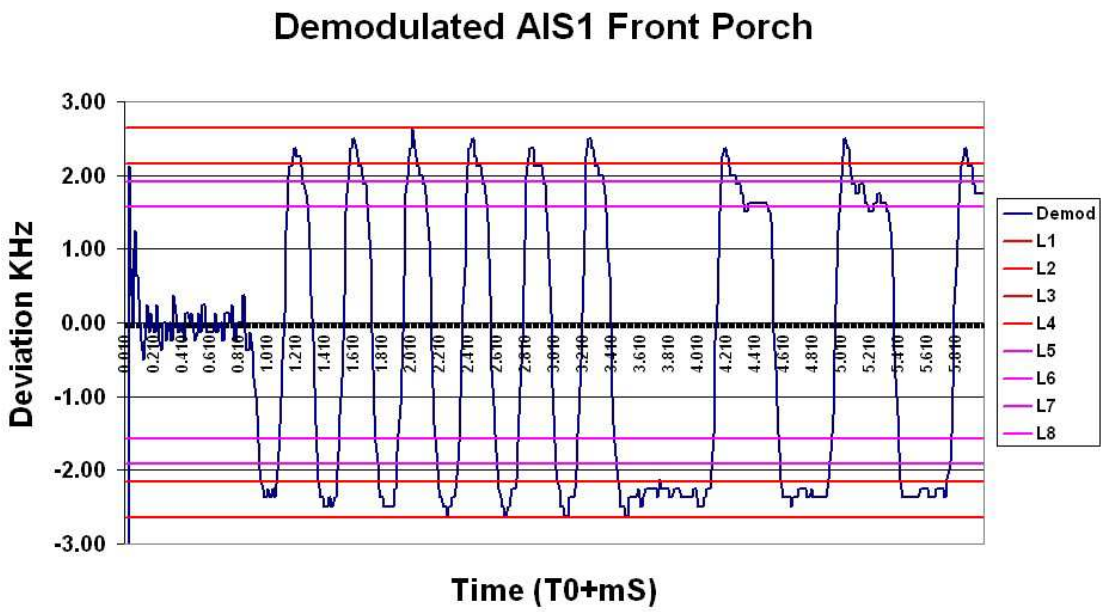

Figure D.7 – Test sequence TM2, AIS1 @ +20°C

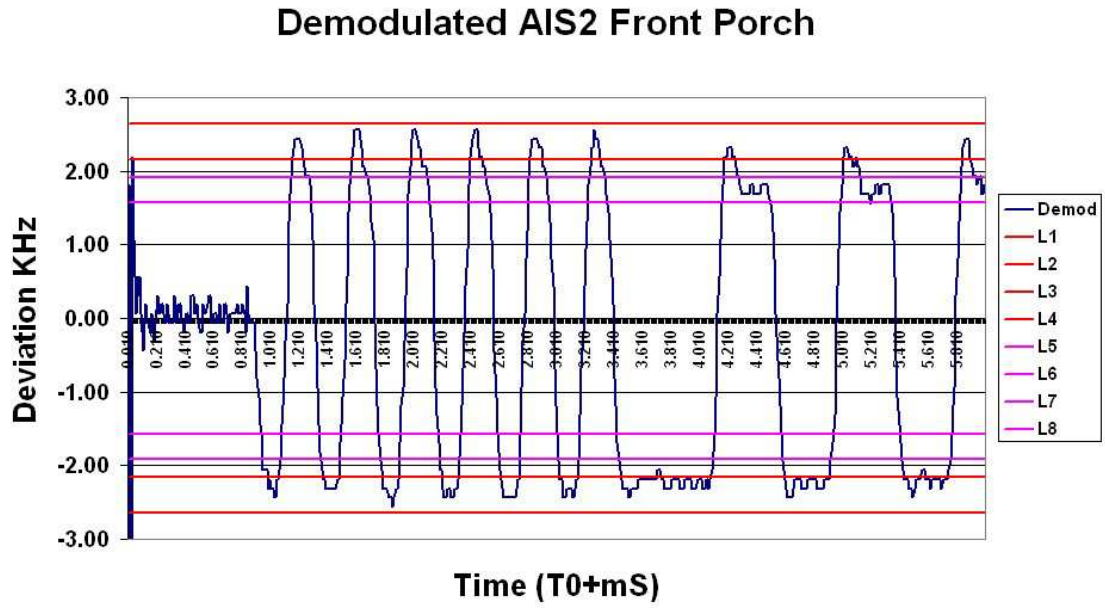

Figure D.8 – Test sequence TM2, AIS2 @ +20°C

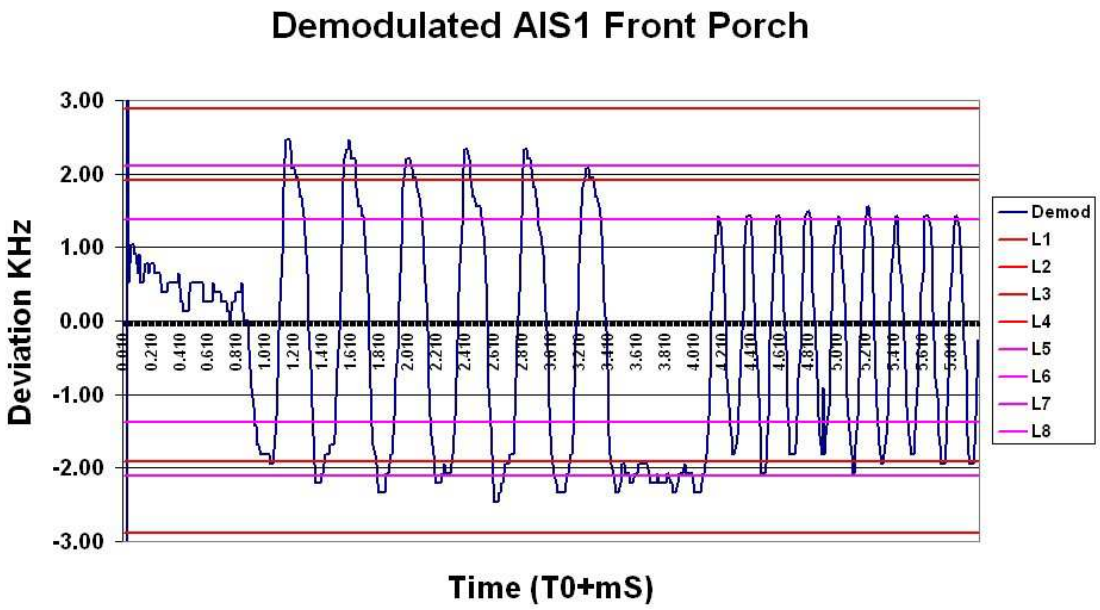

Figure D.9 – Test sequence TM1, AIS1 @ +55°C

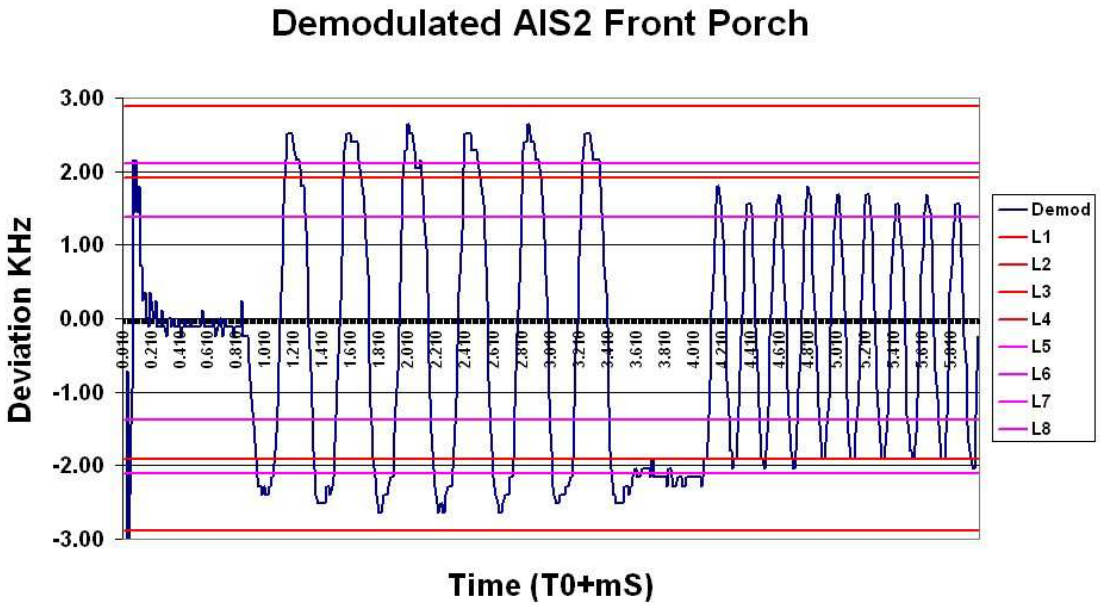

Figure D.10 – Test sequence TM1, AIS2 @ +55°C

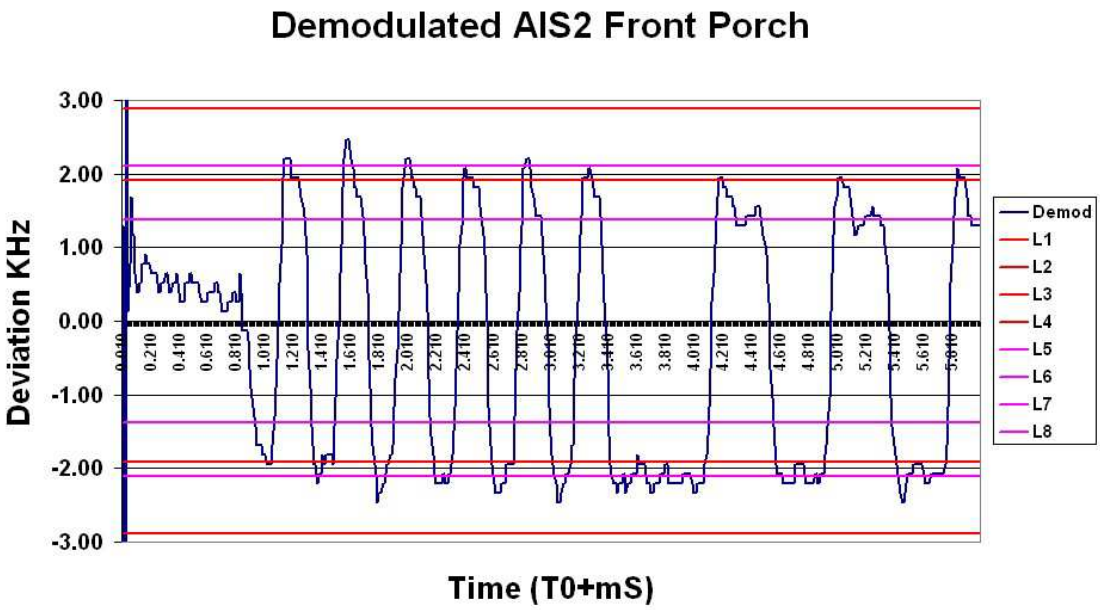

Figure D.11 – Test sequence TM2, AIS2 @ +55°C

E Appendix: Transmitter output power versus time function

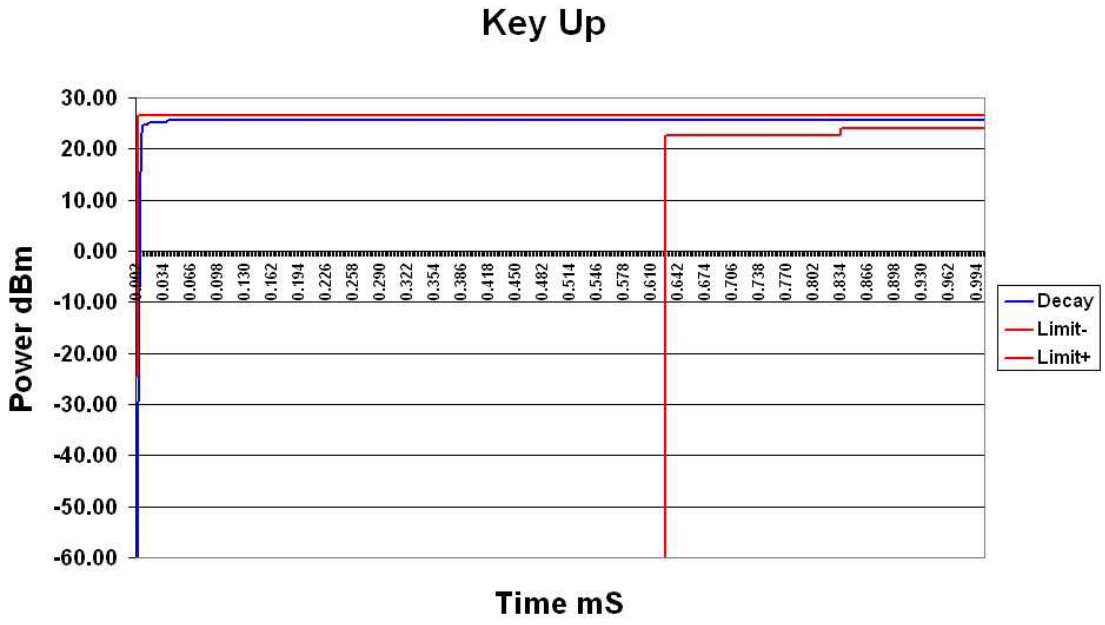

Figure E.1 – Key-up power sequence (1 mS)

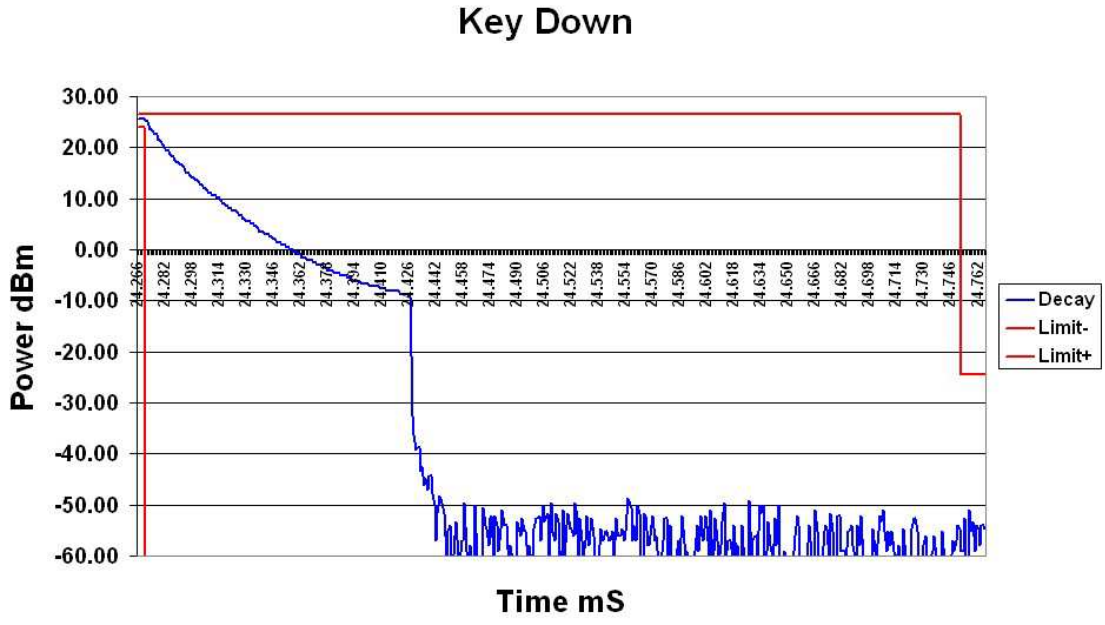

Figure E.2 – Key-down power sequence (500 μS)

Appendix F: Spurious Emissions (Transmitting)

Frequency MHz	Spurious µW (Vertical)	Spurious µW (Horizontal)
324	0.292	0.046
486	0.090	0.013
648	0.028	0.027
810	0.082	0.047
972	0.057	0.083

Figure F.1 – Harmonics of carrier (Quasi-peak)

Note: All the emissions above 1 GHz were transient in nature and gave no appreciable QP reading.

G Appendix: Test Equipment Used

	Item	Serial
1	Advantest R3265 Spectrum Analyser	35060047
2	Marconi 2965 Radio Test Set	132702/040
3	RadioCAD RC015-2 Pre-amplifier	#0002
4	ETS Biconical Antenna #3109	#3261
5	ETS Log-Periodic Antenna 3148	0004-1165
6	EMCO EM-6961 double-ridged horn antenna	
7	LEC Special Projects –50 to +150 °C environmental chamber	
8	Comar AIS-3R receiver	207644

Table B.1 – Test equipment used

<ENDS>