EMI TEST REPORT

Report Number: 3066399.FCC90
Project Number: 3066399

Testing performed on the:

Public Safety Pool & Industrial/Business Transmitter

Model: TXF-RC

To:
FCC Part 90

For:

Spectronic Denmark A/S

FCC ID: QKE-INCA-TXA

Issue Date: April 27, 2005

Test Performed by:	Test Authorized by:
Intertek – ETL SEMKO	Spectronic Denmark A/S
70 Codman Hill Road	Skindbjergvej 44
Boxborough, MA 01719	DK-8500, Grenaa, Denmark

Prepared by: _____ Date: 4/27/05
Nicholas Abbondante

Reviewed by: _____ Date: 4-27-2005
Roland W. Gubisch

1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of:

Company: Spectronic Denmark A/S
Contact: John Herlev
Telephone: 011 45 863-87-222
Fax: 011 45 863-87-704
Email: jhe@spectronic-denmark.com

1.2 Equipment Under Test

Equipment Type: Transmitter
Model Number(s): TXF-RC
Serial number(s): 671270B1
Manufacturer: Spectronic Denmark A/S
EUT receive date: 10/20/2004
EUT received condition: Good
Test start date: 03/21/2005
Test end date: 03/28/2005

The channels tested represent the lowest frequency and highest frequency channels the device will be programmed to transmit at, as well as a channel between the low and high channels to facilitate low, mid, and high channel testing. The channels referenced in this report apply to the Public Safety Pool version of the transmitter, however, the transmitter is also capable of transmitting on channels allocated for use in the Industrial/Business Pool. The Public Safety Pool channels selected are 150.775, 157.450, and 173.39625 MHz. The Industrial/Business Pool channels selected are 150.815, 157.750, and 173.39625 MHz. Results of the Public Safety Pool testing are representative of both that pool and transmitter performance in the Industrial/Business Pool.

1.3 Test Plan Reference: Tested according to the standard listed and TIA-603.

1.4 Test Configuration

1.4.1 Cables:

Cable	Shielding	Connector	Length (m)	Qty.
DC Mains Cable	None	Metal/360	0.5	2

1.4.2 Support Equipment:

Name: None, equipment tested stand-alone
Model No.:
Serial No.:

1.5 Mode(s) of Operation:

The EUT was activated from fresh batteries during all tests, and was transmitting during testing.

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 90		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
RF Output Power FCC §2.1046, §90.217(b)	Output power must be less than 120 mW.	Pass
Emissions Designator, Occupied Bandwidth FCC §2.1049, §90.207, §90.217(b)	The sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the fundamental output power.	Pass
Emissions Mask Compliance FCC §2.1051, §90.217(b)	The transmit waveform must comply with the 90.217(b) emissions mask.	Pass
Modulation Limiting FCC §2.1047	The transmitter must show limiting of modulation deviation across combinations of increasing input voltage and audio frequency.	Pass
Frequency Stability FCC §2.1055, §90.217(b)	The sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the fundamental output power.	Pass
Spurious Emissions FCC §2.1051, §2.1053, §90.217(b)	Spurious emissions must be attenuated by at least 30 dB below the fundamental output power.	Pass

3.0 Test Results: Pass

3.1 Test Standard: FCC §2.1046, §90.205(d)

3.2 Test: RF Output Power

The transmitter was operated at nominal power. The field strength of emissions was recorded and converted to ERP by replacing the EUT with a signal generator and transmit antenna and recording the power level required to duplicate each emission. The EUT was investigated in 3 orthogonal axes, and the configuration which generated the highest emissions was tested.

3.3 Maximum Test Disturbance Parameters: RF output power must not exceed 120 mW (20.8 dBm).

Test Date: 03/21/2005 **Test Engineer Initials:** NNA **Date:** 4/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** DWA **Date:** 4-27-05

3.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
BAR2	Mannix	0ABA116	BAR2	07/02/2005
LOG2	EMCO	3142	9711-1223	12/13/2005
ANT4A	Compliance Design	B100	3317	09/13/2005
ANT4B	Compliance Design	B200	3245	09/13/2005
ANT4C	Compliance Design	B300	3352	09/13/2005
HEW62	Hewlett Packard	83620A	3213A01244	01/25/2006
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006
CBLSHF101	Sucoflex	104PE	CBLSHF101	06/07/2005

3.5 Test Results:

Frequency (MHz)	Description	ERP Value (dBm)	ERP Limit (dBm)
150.775	Public Safety Pool Radio	11.6	20.8
157.450	Public Safety Pool Radio	9.8	20.8
173.396	Public Safety Pool Radio	5.4	20.8

4.0 Test Results: Pass

4.1 Test Standard: FCC §2.1049, §90.207, §90.217(b)

4.2 Test: Emissions Designator, Occupied Bandwidth

The transmitter was operated at nominal power and connected to a spectrum analyzer. The resolution bandwidth was set to 1 MHz and a display line was placed at the peak of the emission. A max hold function was then used with resolution bandwidth of 100 Hz and video bandwidth of 300 Hz, and using the marker-delta method, markers were placed at frequencies which were 30 dB down from the display line above and below the transmit frequency. The frequency difference between the two markers is the emission bandwidth. 30 dB bandwidth was measured because the requirements state that any emission within 30 dB of the limit must fall within 25 kHz of the frequency of operation.

4.3 Maximum Test Disturbance Parameters: The sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the fundamental output power.

Test Date: 03/24/2005 **Test Engineer Initials:** NNM **Date:** 4/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** PWJ **Date:** 4-27-05

4.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006

4.5 Test Results:

Frequency (MHz)	Description	Value kHz	Bandwidth Limit kHz
150.775	Public Safety Pool Radio	15.33	50
157.450	Public Safety Pool Radio	15.41	50
173.396	Public Safety Pool Radio	20.22	50

The device utilizes frequency modulation to encode digital voice signals with a 20 dB necessary bandwidth of 15.33 kHz, so the emissions designator is 15K3F1E.

The maximum drift observed during the frequency stability test, found in section 7, was 0.35 kHz. The maximum 30 dB bandwidth measured was 20.22 kHz. The combination of the two would not cause the 30 dB down points on the emission waveform to drift beyond the limit of 25 kHz offset from the assigned frequency.

5.0 Test Results: Pass

5.1 Test Standard: FCC §2.1051, §90.217(b)

5.2 Test: Emissions Masks

The EUT was connected to a spectrum analyzer, and using a 300 Hz RBW over a 150 kHz span, the trace data was collected and plotted versus the required emissions mask. The power used as a reference was obtained by first setting the spectrum analyzer to 1 MHz RBW and recording the conducted power, since the mask data was obtained via a conducted measurement. The radiated output power measurements obtained using the substitution method were not used as the antenna gain is not quantified and the radiated power is not directly comparable to the conducted power.

5.3 Maximum Test Disturbance Parameters: The transmit waveform must comply with the 90.217(b) emissions mask.

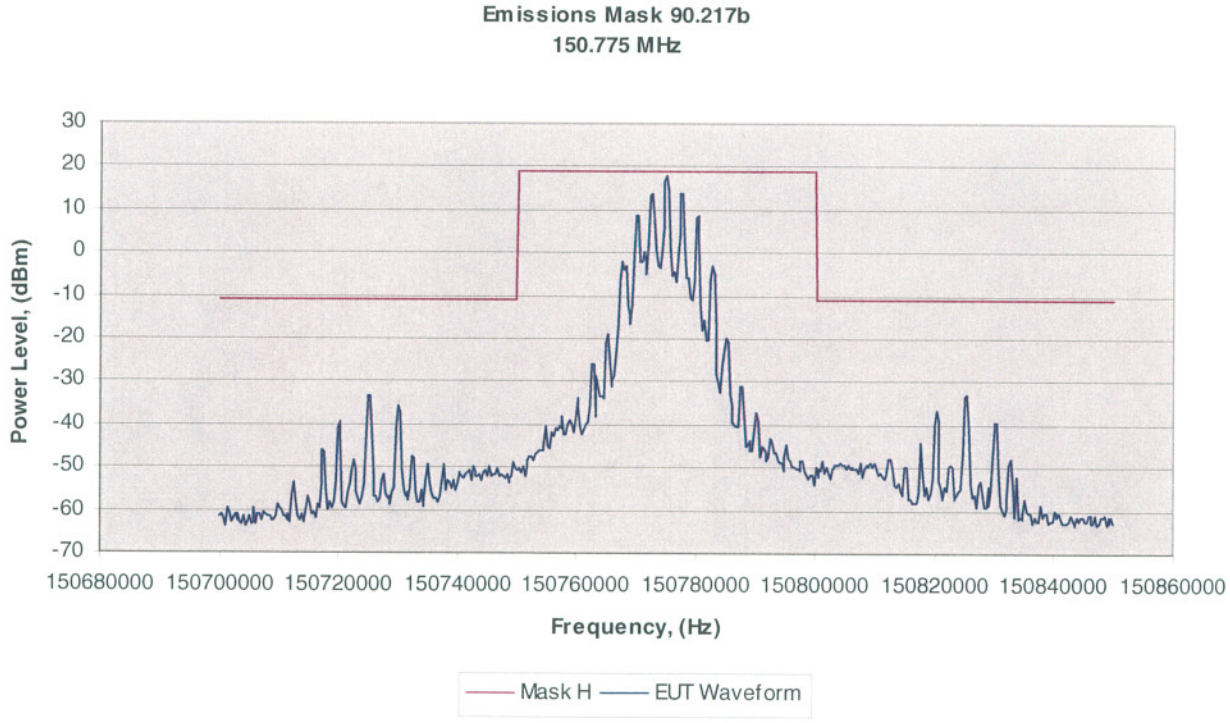
Test Date: 03/24/2005
Test Engineer: Nicholas Abbondante

Test Engineer Initials: NNA **Date:** 4/27/05
Reviewer Initials: RWB **Date:** 4-27-05

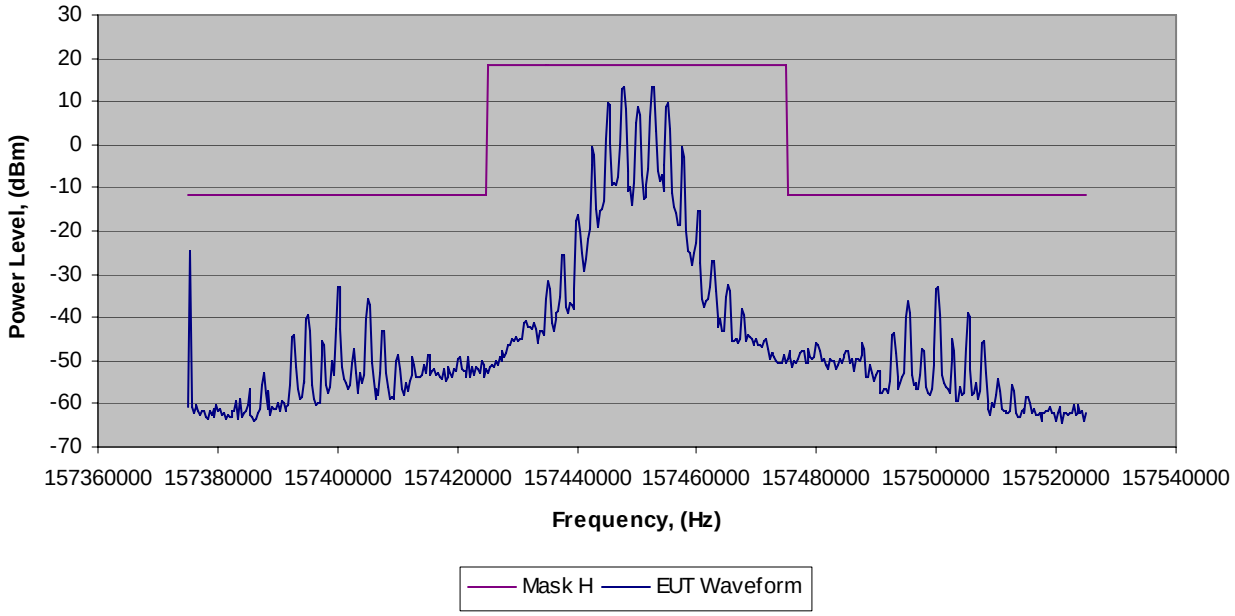
5.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
ROS001	Rohde & Schwarz	FSEK-30	100225	06/04/2005

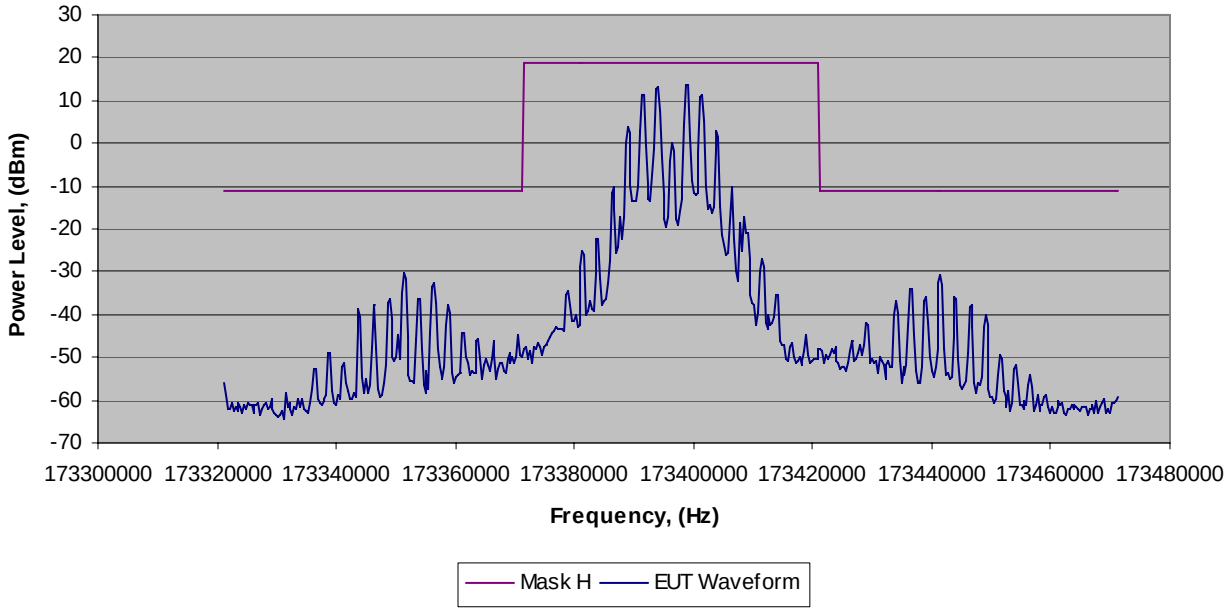
5.5 Test Results:



Emissions Mask 90.217b
157.450 MHz



Emissions Mask 90.217b
173.39625 MHz



6.0 Test Results: Pass

6.1 Test Standard: FCC §2.1047

6.2 Test: Modulation Limiting

The EUT was activated from nominal power and set to transmit on a channel in the 150-174 MHz band. A 2500 Hz audio tone was injected into the EUT at a level 16 dB above that which produces 50% modulation. The amplitude was held constant while the injected audio frequency was set to 300, 500, 1000, 2500, and 3125 Hz. For each injection frequency, the corresponding modulation deviation was recorded. This measurement was then repeated for an injection amplitude 20 dB above the starting level, as well as 20, 40, and 60 dB below the starting level.

6.3 Maximum Test Disturbance Parameters: The transmitter must show modulation limiting across combinations of increasing voltage or audio frequency.

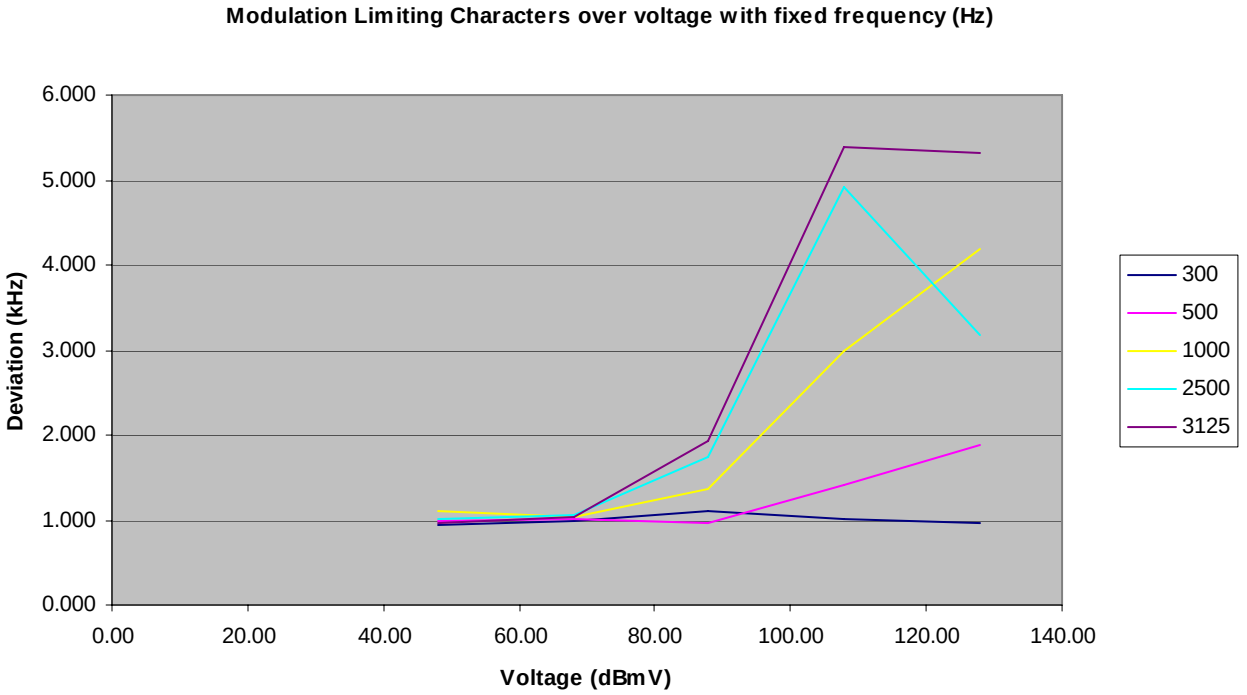
Test Date: 03/24/2005 **Test Engineer Initials:** NR **Date:** 4/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWB **Date:** 4-27-05

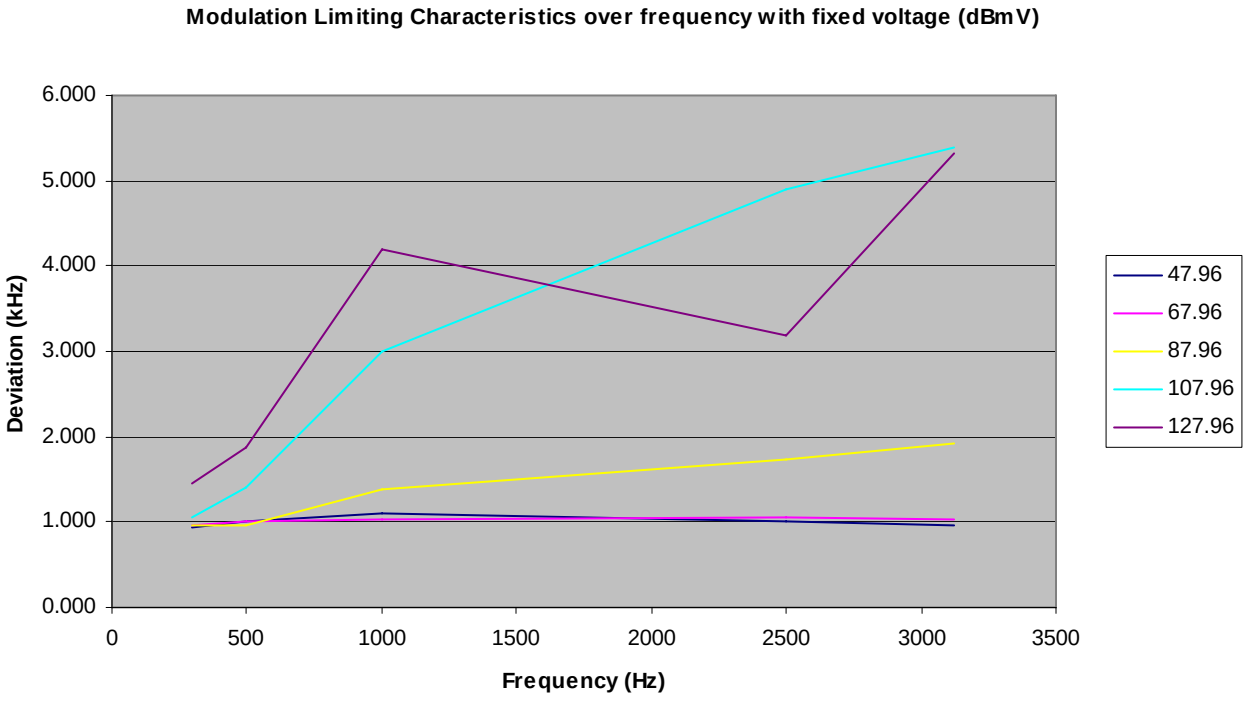
6.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
HEW64	Hewlett Packard	8920B	US36141447	01/24/06

6.5 Test Results:

Modulation Power mV	Frequency 1 Modulation Deviation (kHz) by Injection Signal (Hz) 300	500	1000	2500	3125
0.25	0.932	0.998	1.103	1.016	0.965
2.50	0.957	1.002	1.025	1.052	1.030
25.00	0.956	0.956	1.375	1.737	1.932
250.00	1.060	1.413	2.994	4.909	5.387
2500.00	1.456	1.872	4.197	3.187	5.322


Modulation Limiting Characters over voltage with fixed frequency (Hz)
Deviation (kHz)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Voltage (dBmV)
300
500
1000
2500
3125


Modulation Limiting Characteristics over frequency with fixed voltage (dBmV)
Deviation (kHz)
6.000
5.000
4.000
3.000
2.000
1.000
0.000
0
500
1000
1500
2000
2500
3000
3500
Frequency (Hz)
47.96
67.96
87.96
107.96
127.96

7.0 Test Results: Pass

7.1 Test Standard: FCC §2.1055, §90.217(b)

7.2 Test: Frequency Stability

The EUT was placed inside a temperature chamber and the temperature was varied from –30 to +50 degrees Celsius. At ten degree intervals readings of the transmit frequency were made using a spectrum analyzer. The EUT was powered from a fresh battery. For frequency stability over voltage, the EUT was powered by a DC power supply with output voltage verified with a digital multimeter. Readings were taken at the nominal voltage and at the battery operating endpoint which is 3 volts.

7.3 Maximum Test Disturbance Parameters: The sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the fundamental output power.

Test Date: 03/28/2005 & 4/21/2005 **Test Engineer Initials:** NA **Date:** 4/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** DWL **Date:** 4-27-05

7.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
FLU3	Fluke	8062A	6673001	05/04/2005
SA0001	Hewlett Packard	8591E	3308A01445	07/23/2005
SAF187	Bryant Manufacturing	TH-5S	1207	04/06/2006

7.5 Test Results:

Temp celsius	Freq MHz	Deviation MHz	% Deviation
-30	157.44978	-0.0001	-6.351E-05
-20	157.45013	0.00025	0.0001588
-10	157.44973	-0.00015	-9.527E-05
0	157.44998	0.0001	6.351E-05
10	157.44973	-0.00015	-9.527E-05
20	157.44988	0	0
30	157.4498	-8E-05	-5.081E-05
40	157.44995	7E-05	4.446E-05
50	157.44975	-0.00013	-8.257E-05
Voltage			
6V	173.39625	0	0
3V	173.3959	-0.00035	-0.0002018

The maximum drift observed during the test was 0.35 kHz. The maximum 30 dB bandwidth measured, found in section 4, was 20.22 kHz. The combination of the two would not cause the 30 dB down points on the emission waveform to drift beyond the limit of 25 kHz offset from the assigned frequency.

8.0 Test Results: Pass

8.1 Test Standard: FCC §2.1051, §2.1053, §90.217(b)

8.2 Test: Spurious Emissions

The transmitter was operated at nominal power. The field strength of emissions was recorded and converted to EIRP above 1 GHz and ERP below 1 GHz by replacing the EUT with a signal generator and transmit antenna and recording the power level required to duplicate each emission. For EIRP measurements, the absolute power is reported. For ERP measurements, the absolute power into a dipole required to duplicate the emission is reported. The EUT was investigated in 3 orthogonal axes, and the configuration which generated the highest emissions was tested.

8.3 Maximum Test Disturbance Parameters: Spurious emissions must be attenuated below the fundamental output power by at least 30 dB.

Test Date: 03/21/2005 **Test Engineer Initials:** NNA **Date:** 4/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** PWK **Date:** 4-27-05

8.4 Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
BAR2	Mannix	0ABA116	BAR2	07/02/2005
HORN2	EMCO	3115	9602-4675	09/20/2005
HORN3	EMCO	3115	9610-4980	09/20/2005
LOG2	EMCO	3142	9711-1223	12/13/2005
ANT4A	Compliance Design	B100	3317	09/13/2005
ANT4B	Compliance Design	B200	3245	09/13/2005
ANT4C	Compliance Design	B300	3352	09/13/2005
HEW62	Hewlett Packard	83620A	3213A01244	01/25/2006
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006
CBLSHF101	Sucoflex	104PE	CBLSHF101	06/07/2005
CBLSHF102	Sucoflex	104PE	CBLSHF102	06/07/2005
CBLSHF103	Sucoflex	104PE	CBLSHF103	06/07/2005

8.5 Test Results:

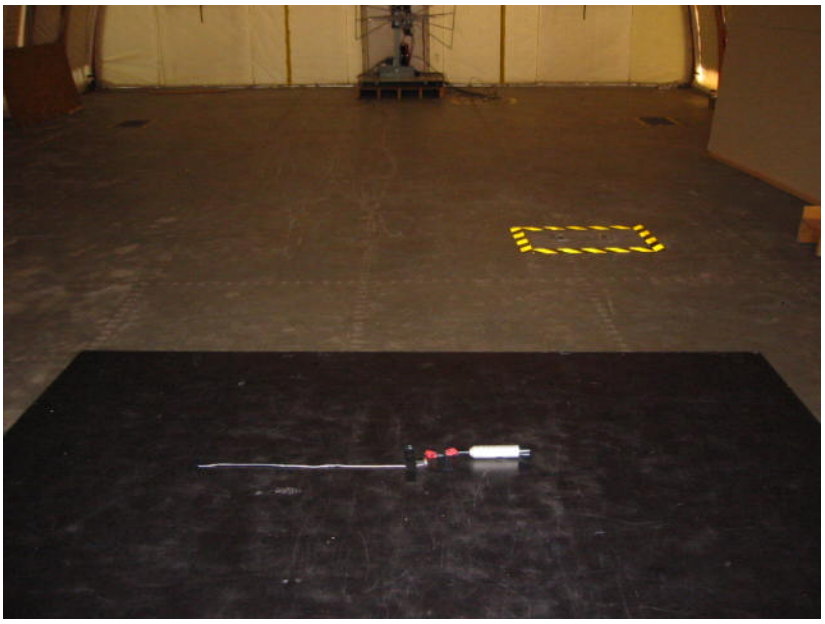
Radiated Emissions / Interference

Company:	Spectronic Denmark A/S			Model #:	TXF-RC
Engineer:	Nicholas Abbondante	Location:	Site 2	Serial #:	671270B1
Project #:	3066399	Pressure:	1001mB	Receiver:	HP 8542E (REC2/RECFL2)
Date:	03/21/05	Temp:	21c	Antenna:	NONE. NONE.
Standard:	FCC Part 90.217	Humidity:	28%	PreAmp:	NONE.
Class:	None	Group:	None	Cable(s):	NONE. NONE.
Limit Distance:	-	meters		Test Distance:	3 & 10 meters
Voltage/Frequency:	6V Battery			Frequency Range:	30 MHz - 2 GHz

Test distance was 10 meters below 1 GHz and 3 meters above 1 GHz
Tx Signal Generator: HEW64 Tx Antenna <1GHz: ANT4 Rx Antenna <1GHz: LOG2
Rx Antenna >1GHz: Horn2 Rx Cable: Cblshf103, Cblshf102 Tx Antenna >1GHz: Horn3 Tx Cable: Cblshf101
Net = Generator Level (0.00 dBm) + (EUT reading - Generator reading) - Cable Loss + Antenna Gain
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	EUT Reading dB(uV)	Generator Reading dB(uV)	Transmit Cable Loss dB	Transmit Antenna Factor dBi	Generator Level dBm	Net dBm	Limit dBm	Margin dB	Bandwidth
PK	H	150.775	88.8	59.2	0.0	2.0	-20.0	11.6	20.8	-9.2	120/300 kHz
PK	H	301.550	17.6	52.3	0.0	0.0	-20.0	-54.7	-18.4	-36.3	120/300 kHz
PK	H	452.325	11.0	47.5	0.0	1.4	-20.0	-55.1	-18.4	-36.7	120/300 kHz
PK	H	603.100	6.6	47.0	0.1	2.2	-20.0	-58.3	-18.4	-39.9	120/300 kHz
PK	H	753.875	0.2	41.3	0.1	2.4	-20.0	-58.8	-18.4	-40.4	120/300 kHz
PK	H	904.650	0.5	31.8	0.0	2.3	-20.0	-49.0	-18.4	-30.6	120/300 kHz
PK	H	1055.425	18.8	50.8	0.2	4.8	-20.0	-47.4	-18.4	-29.0	1/3 MHz
PK	H	1206.200	22.7	43.6	0.2	5.6	-20.0	-35.5	-18.4	-17.1	1/3 MHz
PK	H	1356.975	25.2	43.2	0.2	6.4	-20.0	-31.8	-18.4	-13.4	1/3 MHz
PK	H	1507.750	22.8	46.2	0.3	7.1	-20.0	-36.6	-18.4	-18.2	1/3 MHz
PK	H	157.450	85.6	57.2	0.0	1.4	-20.0	9.8	20.8	-11.0	120/300 kHz
PK	H	314.900	10.6	51.9	0.0	-0.5	-20.0	-61.8	-20.2	-41.6	120/300 kHz
PK	H	472.350	6.0	48.8	0.0	1.0	-20.0	-61.8	-20.2	-41.7	120/300 kHz
PK	H	629.800	3.2	41.0	0.1	2.9	-20.0	-55.0	-20.2	-34.8	120/300 kHz
PK	H	787.250	3.1	42.8	0.1	2.0	-20.0	-57.8	-20.2	-37.6	120/300 kHz
PK	H	944.700	2.2	42.0	0.2	1.7	-20.0	-58.3	-20.2	-38.1	120/300 kHz
PK	H	1102.150	21.0	50.9	0.2	5.1	-20.0	-45.0	-20.2	-24.8	1/3 MHz
PK	H	1259.600	21.9	33.3	0.2	5.9	-20.0	-25.7	-20.2	-5.5	1/3 MHz
PK	H	1417.050	24.8	46.4	0.2	6.6	-20.0	-35.3	-20.2	-15.1	1/3 MHz
PK	H	1574.500	21.2	44.3	0.3	7.2	-20.0	-36.2	-20.2	-16.0	1/3 MHz
PK	H	173.396	80.6	54.9	0.0	-0.3	-20.0	5.4	20.8	-15.4	120/300 kHz
PK	H	346.793	31.6	49.7	0.0	-0.4	-20.0	-38.4	-24.6	-13.8	120/300 kHz
PK	H	520.189	33.7	48.7	0.0	1.2	-20.0	-33.8	-24.6	-9.2	120/300 kHz
PK	H	693.585	16.5	43.0	0.1	2.4	-20.0	-44.2	-24.6	-19.6	120/300 kHz
PK	H	866.981	16.0	42.2	0.2	1.6	-20.0	-44.7	-24.6	-20.1	120/300 kHz
PK	H	1040.378	24.2	51.0	0.2	4.7	-20.0	-42.4	-24.6	-17.8	1/3 MHz
PK	H	1213.774	25.8	42.5	0.2	5.6	-20.0	-31.3	-24.6	-6.7	1/3 MHz
PK	H	1387.170	28.0	45.3	0.2	6.6	-20.0	-30.9	-24.6	-6.3	1/3 MHz
PK	H	1560.566	23.7	45.0	0.3	7.1	-20.0	-34.4	-24.6	-9.8	1/3 MHz
PK	H	1733.963	25.1	37.5	0.3	7.4	-20.0	-25.4	-24.6	-0.8	1/3 MHz

Radiated emissions setup photos



Emissions Site Description:

Site 2C (Middle Site) is a 3m and 10m sheltered emissions measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal ground plane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity is provided for floor-standing equipment. A wooden table 80 cm high is used for tabletop equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the ground plane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical ground plane (2 meter X 2 meter area) is used for line-conducted measurements for tabletop equipment. The vertical ground plane is electrically connected to the reference ground plane.

Measurement Uncertainty:

Note that the measurement uncertainty contained herein is ±4.0 dB for radiated emissions and ±2.0 dB for line-conducted emissions.