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AN RADIO TEST REPORT

FOR

THIRD MILLENNIUM SYSTEMS Ltd

ON

PRX60

DOCUMENT NO.TRA-012604-47-00-A

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TRaC Wireless Test Report	**:** TRA-012604-47-00-A
Applicant	**:** Third Millennium Systems Ltd
Apparatus	**:** PRX60
Specification(s)	**:** CFR47 Part 15 & RSS-210
Purpose of Test	**:** Certification
FCCID	**:** UTJRX60
Authorised by	**:** 
	: Radio Product Manager
Issue Date	**:**13th May 2013
Authorised Copy Number	**:** *PDF*

Total number of pages: 39

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Contents

Section 1: Introduction

1.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests Requested By

This testing in this report was requested by :

Third Millennium Systems Ltd
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1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 12th – 18 April 2013:

PRX60 RFID contactless proximity reader PCB assembly.

The RX60 RFID contactless proximity readers PCB assembly is contained in the following model variants; RX160, RX260 and RX460. All the referenced variants incorporate identical hardware.

1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

Test Type	Title 47 of the CFR: Part 15 Subpart (c)	RSS-210	Measurement standard	Result
Spurious Emissions Radiated <1000MHz	15.209	RSS-Gen 7.2.5	ANSI C63.10:2009	Pass
Spurious Emissions Radiated >1000MHz	15.209	RSS-Gen 7.2.5	ANSI C63.10:2009	N/A
AC Power conducted emissions	15.207	RSS-Gen 7.2.4	ANSI C63.10:2009	Pass
Intentional Emission Frequency	15.209 & 15.225(a)	A2.6 & RSS-Gen 7.2.5	ANSI C63.10:2009	Pass
Intentional Emission Field Strength	15.209 & 15.225(a)	A2.6 & RSS-Gen 7.2.5	ANSI C63.10:2009	Pass
Intentional Emission Band Occupancy	15.215 (c)	RSS-Gen 4.6	ANSI C63.10:2009	Pass
Frequency Stability	15.225	RSS-Gen 4.7	ANSI C63.10:2009	Pass
Unintentional Radiated Spurious Emissions	Subpart (b) 15.109	RSS-Gen 6.1	ANSI C63.10:2009	Pass
Antenna Arrangements Integral:	15.203	RSS-Gen 7.1.2	-	Pass
Antenna Arrangements External Connector	15.204	RSS-Gen 7.1.2	-	N/A
Restricted Bands	15.205	RSS-Gen 7.2.2	-	Pass
Maximum Frequency of Search	15.33	RSS-Gen 4.9	-	Pass
Extrapolation Factor	15.31(f)	RSS-Gen 7.2.7	-	Pass

Abbreviations used in the above table:

ANSI C 63.10:2009 is outside the scope of the laboratories UKAS accreditation.

CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions
ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, “Pass” indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2: Measurement Uncertainty

2.1 Measurement Uncertainty Values

For the test data recorded in accordance with note (iii) of Section 2.1 the following measurement uncertainty was calculated:

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Power Meter) = **1.08dB**
Uncertainty in test result (Spectrum Analyser) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Frequency Counter) = **0.113ppm**
Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,
Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,
Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result – Up to 8.1GHz = **3.31dB**
Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**
Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**
Uncertainty in test result – Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%,**
Uncertainty in Amplitude measurement = **0.82%**

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3: Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A: Formal Emission Test Results

Abbreviations used in the tables in this appendix:

Spec	: Specification
Mod	: Modification
EUT	: Equipment Under Test
SE	: Support Equipment
L	: Live Power Line
N	: Neutral Power Line
E	: Earth Power Line
Pk	: Peak Detector
QP	: Quasi-Peak Detector
Av	: Average Detector
CDN	: Coupling & decoupling network

ALSR	: Absorber Lined Screened Room
OATS	: Open Area Test Site
ATS	: Alternative Test Site
Ref	: Reference
Freq	: Frequency
MD	: Measurement Distance
SD	: Spec Distance
Pol	: Polarisation
H	: Horizontal Polarisation
V	: Vertical Polarisation

A1 Transmitter Intentional Emission Radiated – 15.209

Carrier power was verified with the EUT transmitting Test Details:	
Regulation	Part15 Subpart (c) 15.209 & RSS-Gen, RSS-Gen 7.2.5
Measurement standard	ANSI C63.10:2009
EUT sample number	S06
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19
Photographs (Appendix F)	1

FREQ. (kHz)	MEASUREMENT DISTANCE Meters	MEASUREMENT Rx. READING (dBµV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (µV/m)
124.69	1	94.30	104.70	0.302
124.69	3	69.60	80.00	0.302
Limit value @ fc		19.21 µV/m @ 300meters		
Band occupancy @ -20 dBc		f lower	f higher	
		124.4855769 kHz	125.0560897 kHz	
		570.512821 Hz		
Band occupancy @ -99%		f lower	f higher	
		124.6875641 kHz	124.7548718 kHz	
		67.307692 Hz		

Notes:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc = Average 200Hz bandwidth
3 When battery powered the EUT was powered with new batteries
4 Limit value of 2400/F(kHz) as per 15.209
5 Extrapolation <30 MHz 40dB/decade as per 15.31(f)(2) & RSS Gen 7.2.7
6 3 – 300 metre extrapolation 80 dB
7 1 – 3 metre extrapolation 24.7dB as measured
8 1 – 300 metre extrapolation 104.7 dB (80dB + 24.7dB)

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.10:2009
2 Measuring distances 1m & 3m
3 EUT 0.8 metre above ground plane
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded

A2 Transmitter Intentional Emission Radiated – 15.225(a)

Carrier power was verified with the EUT transmitting Test Details:	
Regulation	Part15 Subpart (c) 15.225(a), RSS-210 A2.6
Measurement standard	ANSI C63.10:2009
EUT sample number	S06
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19
Photographs (Appendix F)	1

FREQ. (MHz)	MEASUREMENT DISTANCE Meters	MEASUREMENT Rx. READING (dBµV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (µV/m)
13.56	1	93.40	63.30	31.989
13.56	3	70.10	40.00	31.989
Limit value @ fc		15848 µV/m @ 30meters		
Band occupancy @ -20 dBc		f lower	f higher	
		13.49910256 MHz	13.61448717 MHz	
		115.384606 kHz		
Band occupancy @ 99%		f lower	f higher	
		13.07923077 MHz	13.99269231 MHz	
		913.461539 kHz		

Notes:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc = Quasi Peak 10
3 When battery powered the EUT was powered with new batteries
4 Extrapolation <30 MHz 40dB/decade as per 15.31(f)(2) & RSS Gen 7.2.7
5 3 – 300 metre extrapolation 80 dB (40dB/decabe) as per 15.31(f)(2)
6 1 – 3 metre extrapolation 24.7dB as measured
7 1 – 300 metre extrapolation 104.7 dB (80dB + 24.7dB)

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.10:2009
2 Measuring distances 1m & 3m
3 EUT 0.8 metre above ground plane
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded

A3 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric filed emission test applies to all spurious emissions and harmonics emissions. The EUT was set to transmit as required.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site : [ ] 3m alternative test site : [X]

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details:	
Regulation	Part 15 Subpart (c) Clause 15.209, RSS-Gen 7.2.5
Measurement standard	ANSI C63.10:2009
Frequency range	9kHz – 1GHz
EUT sample number	S06
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19
Photographs (Appendix F)	1

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below:

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBµV/m)	EXTRAP FACT (dB)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1	40.70	21.4	0.8	12.0	-	34.1	-	50.70	100
2	67.80	16.4	1.0	5.0	-	22.4	-	13.18	100
3	162.75	15.4	1.7	9.7	-	26.8	-	21.88	150
4	325.45	10.5	2.5	13.9	-	26.9	-	22.13	200
5	352.60	11.0	2.7	14.7	-	28.5	-	26.61	200
6	393.25	8.1	2.8	15.7	-	26.6	-	21.38	200
7	528.85	10.2	3.2	17.3	-	30.7	-	34.28	200
8	542.40	13.9	3.2	17.9	-	35.0	-	56.23	200
9	556.00	7.3	3.3	19.0	-	29.6	-	30.20	200
10	691.55	7.6	3.7	18.9	-	30.2	-	32.36	200
11	718.70	2.9	3.8	19.4	-	26.1	-	20.18	200

Notes:

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10:2009: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
4 For Frequencies below 1 GHz, RBW= 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak	RBW= 1MHz, VBW ≥ RBW
Average	RBW= 1MHz, VBW ≥ RBW

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.209 for all emissions:

Frequency of emission (MHz)	Field strength μV/m	Measurement Distance m	Field strength dBμV/m
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (kHz
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

(a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation}\,(\text{dB}) = 20\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

(b) The levels may have been rounded for display purposes.

(c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels	✓			
Effect of Position of EUT cables & samples on emission levels	✓			

(i) Parameter defined by standard and / or single possible, refer to Appendix D
(ii) Parameter defined by client and / or single possible, refer to Appendix D
(iii) Parameter had a negligible effect on emission levels, refer to Appendix D
(iv) Worst case determined by initial measurement, refer to Appendix D

A4 Power Line Conducted Emissions

Preview power line conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector.

Test Details:	
Regulation	Part 15 Subpart (c) Clause 15.207, RSS-Gen 7.2.4
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S06 & S10
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	2

The worst-case power line conducted emission measurements are listed below:

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	13.56	Neutral	59.84	50	+9.84	Note 1
Antenna Replaced by dummy load						
2	13.56	Neutral	28.45	50	-21.55	Pass

Note 1 Measurements at FC can be performed with the antenna replaced by a dummy load if required.

Results measured using the quasi-peak detector compared to the quasi–peak limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	13.56	Neutral	60.07	60	+0.07	Note 1
Antenna Replaced by dummy load						
2	13.56	Neutral	28.45	30	-31.55	Note 1

Note 1 Measurements at FC can be performed with the antenna replaced by a dummy load if required.

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207 & RSS-Gen 7.2.4):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dBμV	
	Quasi-peak	Average
0.15 to 0.5	66 to 56[2]	56 to 46[2]
0.5 to 5	56	46
5 to 30	60	50

Notes:
1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

(a) The levels may have been rounded for display purposes.

(b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		

(i) Parameter defined by standard and / or single possible, refer to Appendix C
(ii) Parameter defined by client and / or single possible, refer to Appendix C
(iii) Parameter had a negligible effect on emission levels, refer to Appendix C
(iv) Worst case determined by initial measurement, refer to Appendix C

A5 Frequency Stability

Test Details:	
Regulation	Part 15 Subpart (c) Clause 15.225, RSS-Gen 4.7
Measurement standard	ANSI C63.10
EUT sample number	S01
Modification state	0
SE in test environment	N/A
SE isolated from EUT	N/A
EUT set up	Refer to Appendix C

Vnom (Vdc)	Temperature (°C)	Frequency (MHz)	Deviation (kHz)	Limit = ± 0.01% = ±1.3562kHz
+12.0Vdc	+20 °C	13.56015064	-	-
+12.0Vdc	+55 °C	13.56016346	0.0128	Pass
+12.0Vdc	-20 °C	13.56016987	0.0192	Pass
Voltage (Vdc) 85% - 115%	**Temperature (°C)**	**Frequency (MHz)**	**Deviation (kHz)**	**Limit = ± 0.01% = 1.3562kHz**
85% = 10.20	+20 °C	13.56015064	0.0000	Pass
115% = 13.80	+20 °C	13.56015064	0.0000	Pass

Appendix B: Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

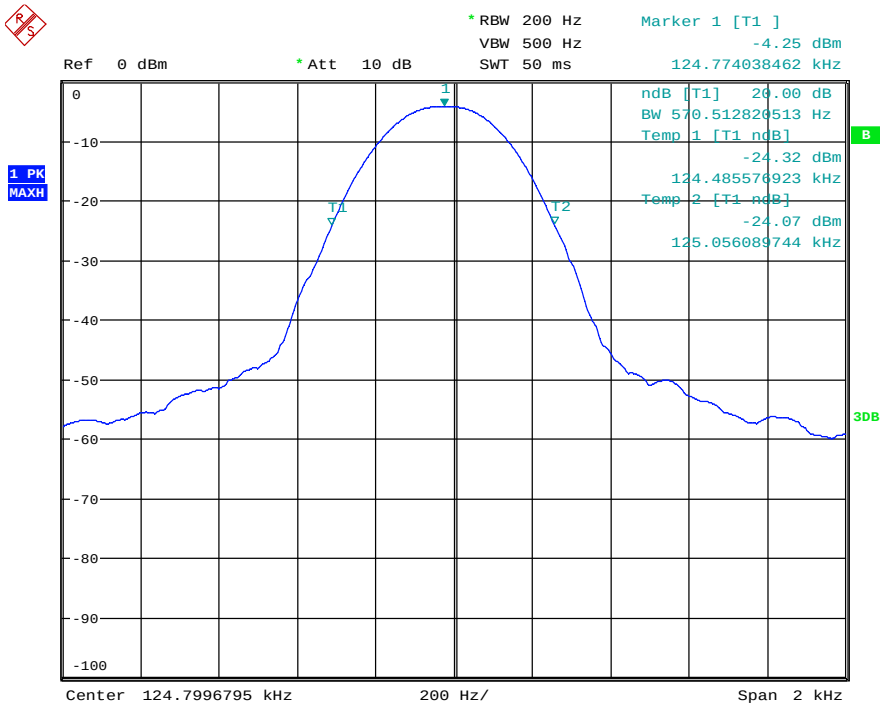
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

(b) The time and date on the plots do not necessarily equate to the time of the test.

(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

(d) Appendix C details the numbering system used to identify the sample and its modification state.

(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



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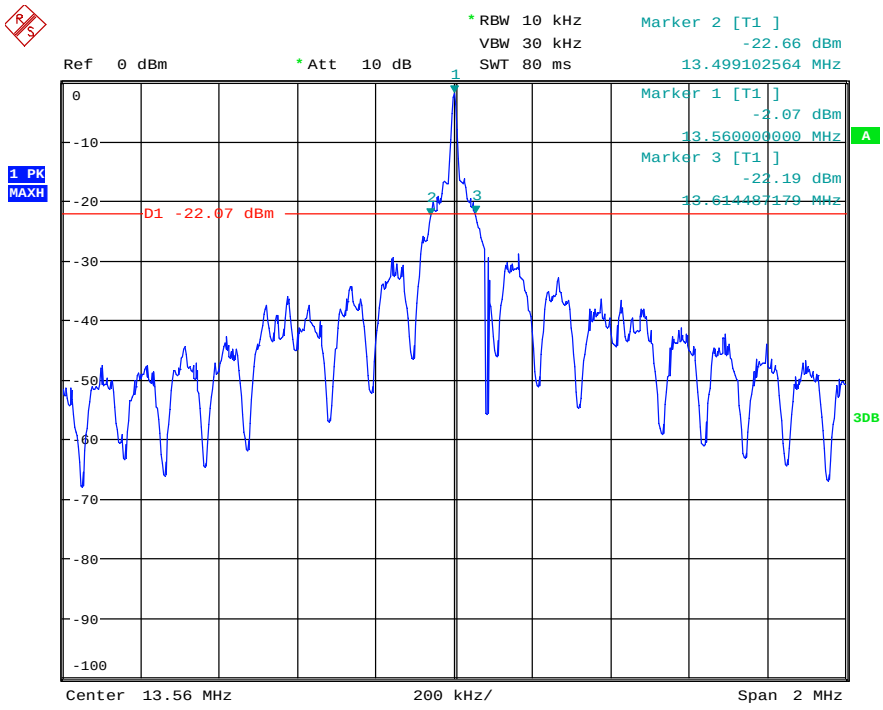
124.96 kHz - 20dB Bandwidth



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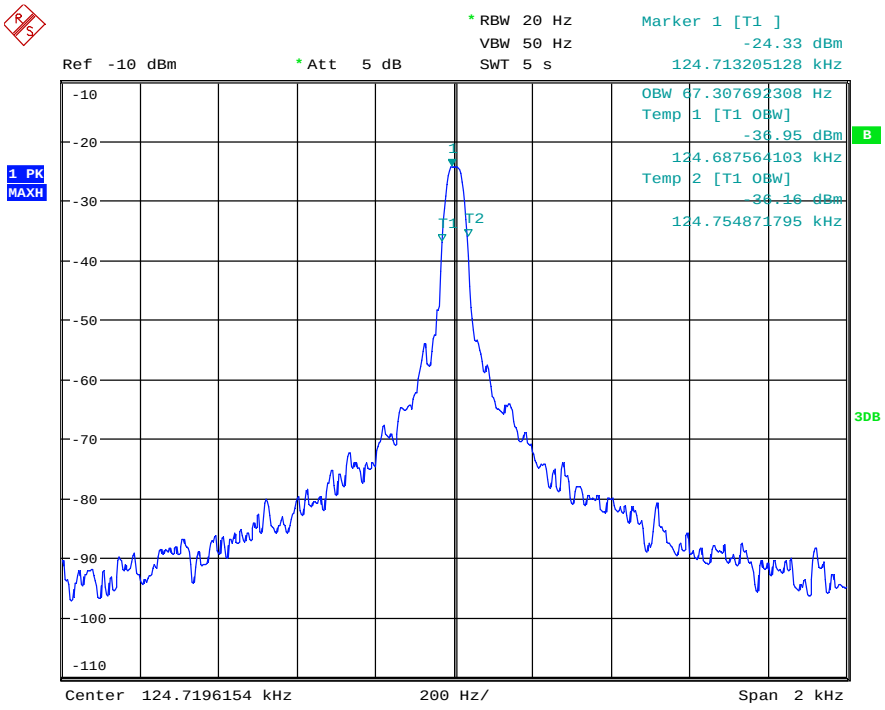
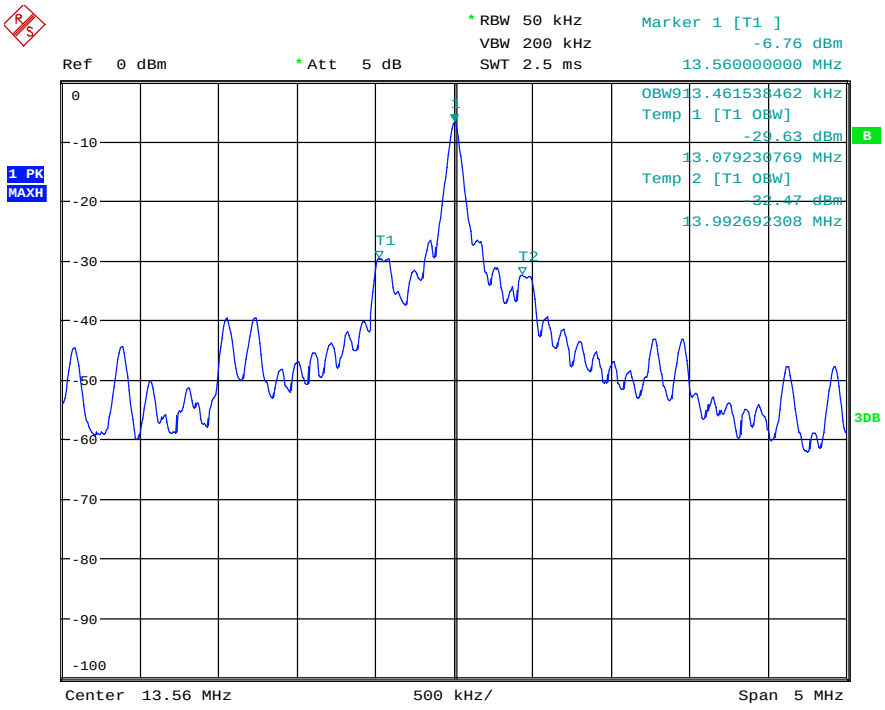
13.56 MHz - 20dB Bandwidth



Date: 10.MAY.2013 09:49:14

124.96 kHz – 99% Bandwidth



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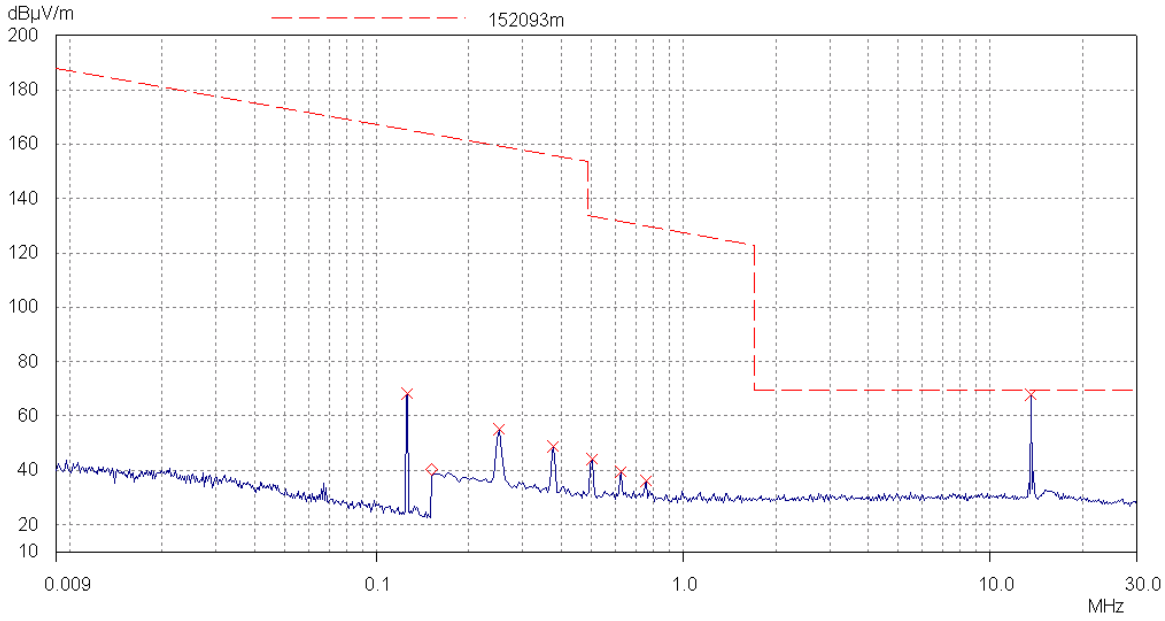
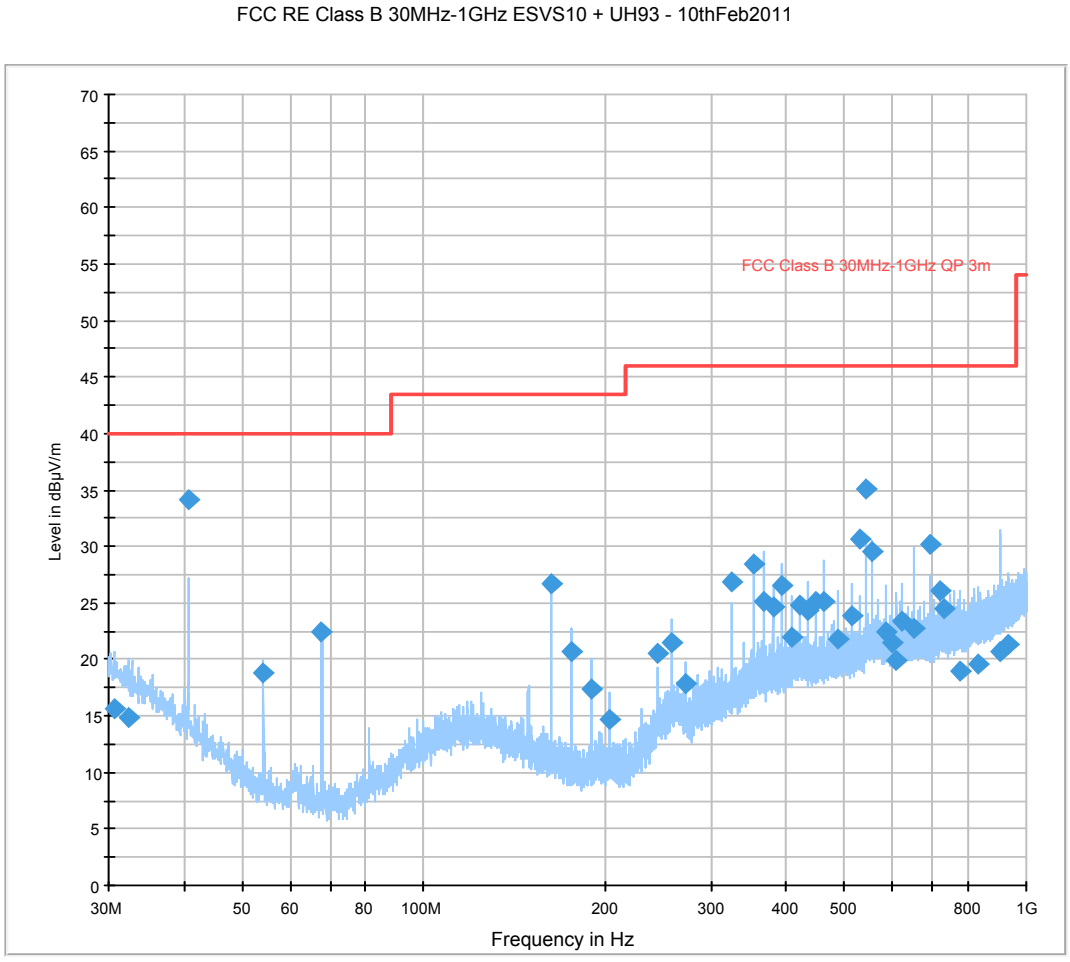
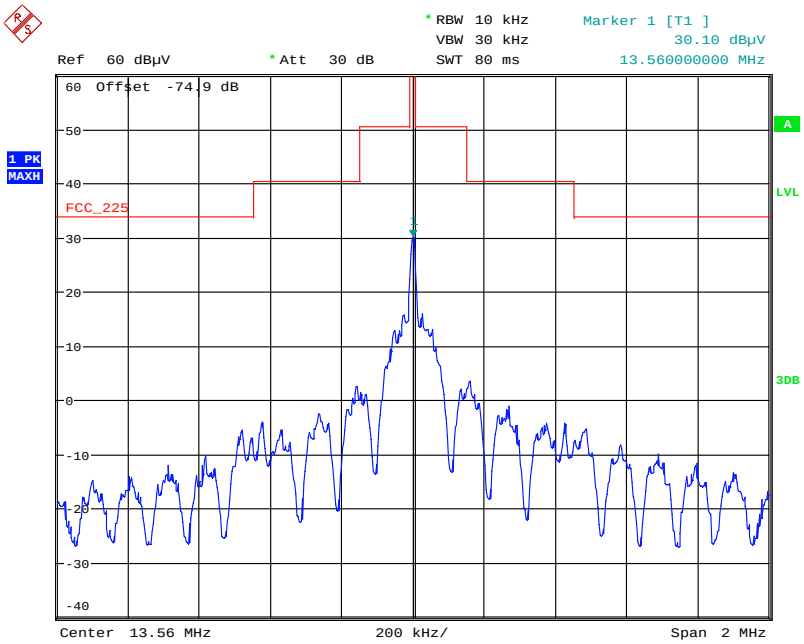
13.56 MHz – 99% Bandwidth



Radiated spurious emissions 9 kHz to 30 MHz



Radiated spurious emissions 30 MHz to 1 GHz


RBW 10 kHz
VBW 30 kHz
SWT 80 ms
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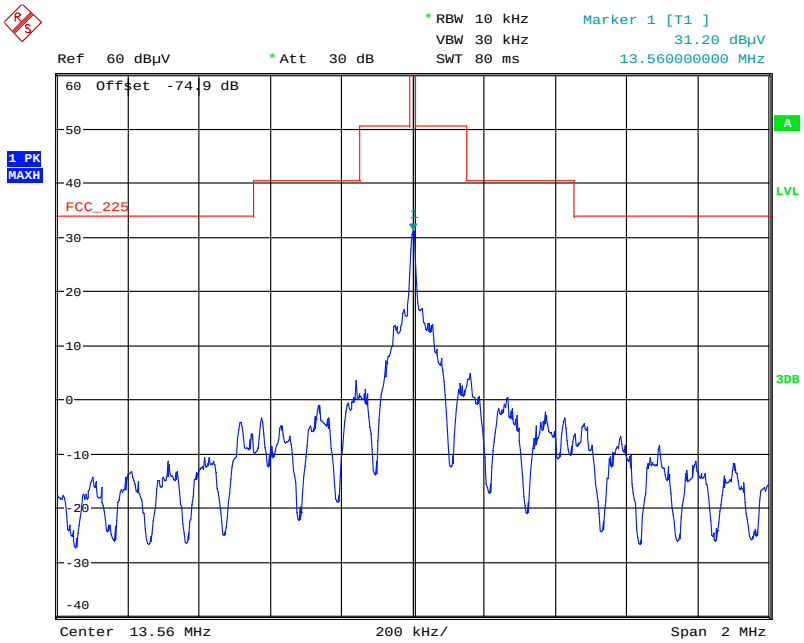
30.10 dBµV
13.560000000 MHz
Ref 60 dBµV
Att 30 dB
60 Offset -74.9 dB
1 PK
MAXH
FCC_225
A
LVL
3DB
Center 13.56 MHz
200 kHz/
Span 2 MHz
Date: 15.APR.2013 14:03:49

Tnom Vnom



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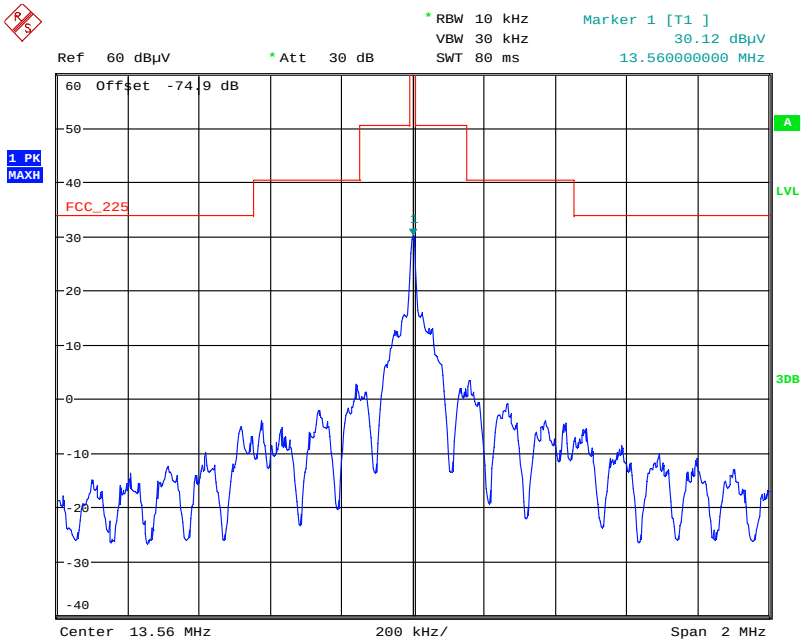
Tmin Vnom



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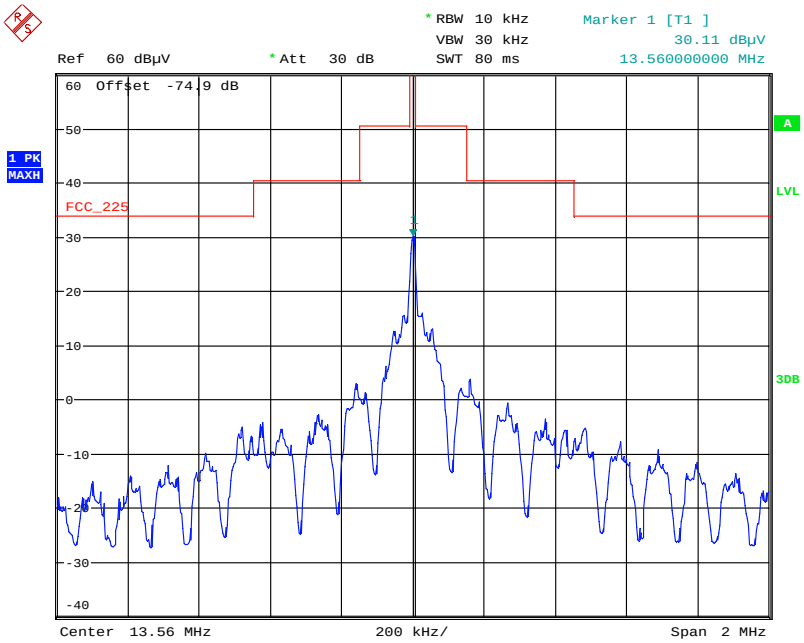
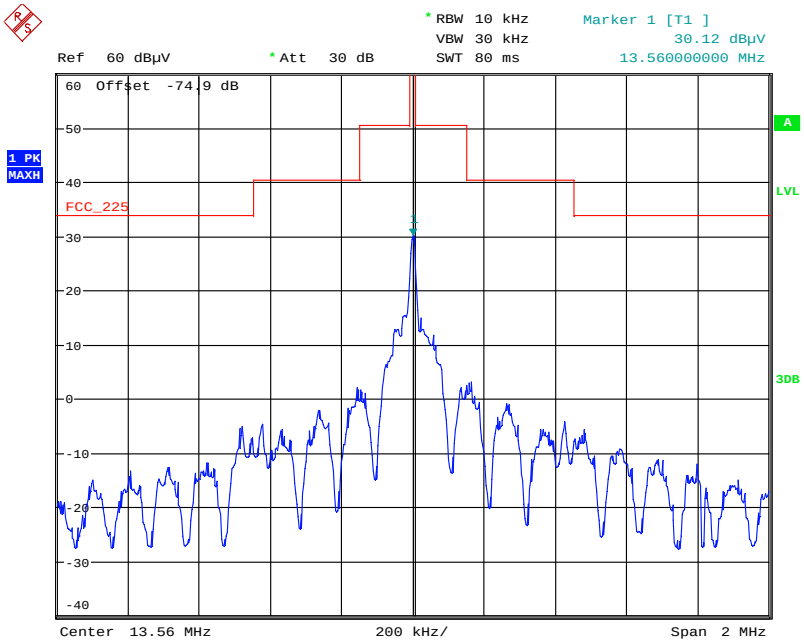
Tmax Vnom



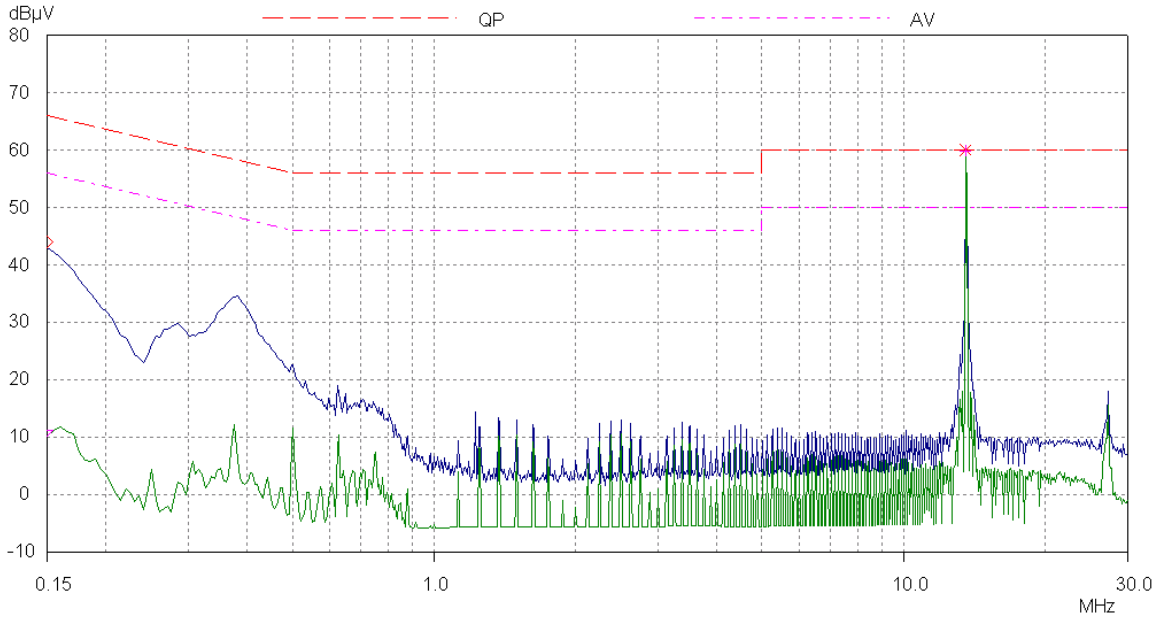
Date: 15.APR.2013 14:06:44

Tnom Vmin

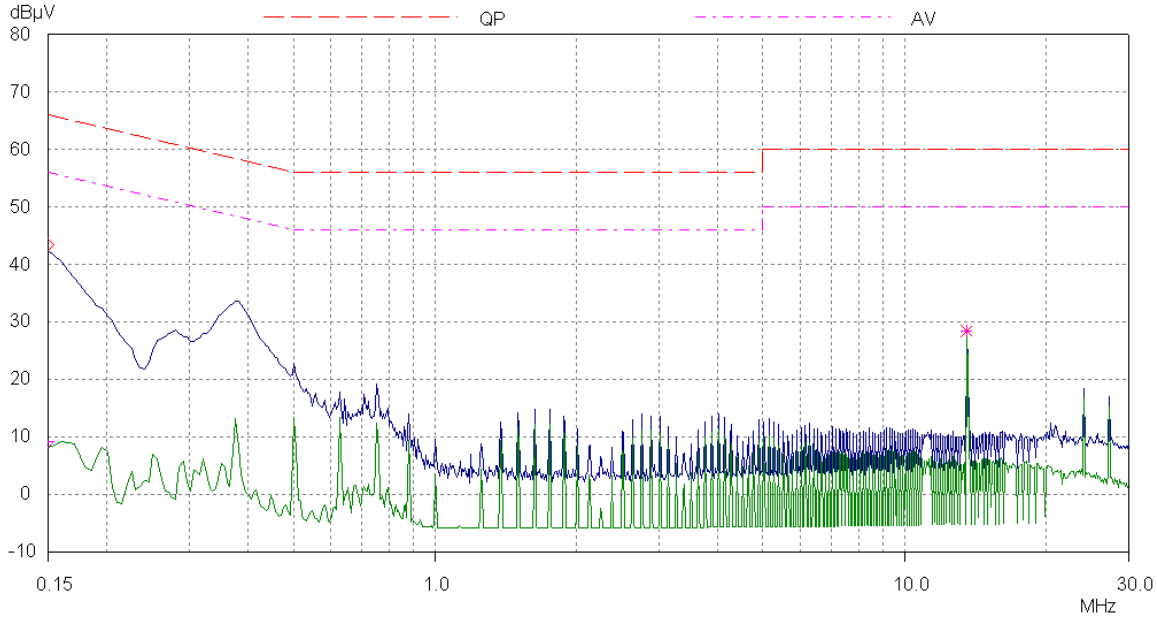


Date: 15.APR.2013 14:08:37

Tnom Vmax



AC Powerline Conducted Emissions



AC Powerline Conducted Emissions – Dummy Load

Appendix C: Additional Test and Sample Details

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx = sample number eg. S01
w = modification number eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

Positioning of cards in a chassis.
Setting of any internal switches.
Circuit board jumper settings.
Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as “single possible configuration”.

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S06	PRX60 – PCB Assembly	None
S10	PRX60 – PCB Assembly – Dummy Load	None

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

Identification	Description

C2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode:
All tests detailed in this report	EUT is actively transmitting either waiting for a tag to be presented or reading a tag as required.

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S06
Tests : All Tests

Port	Description of Cable Attached	Cable length	Equipment Connected
Power	2 wire	1m	PSU

* Only connected during setup.

C5 Details of Equipment Used

TRaC No	Type	Description	Manufacturer	Last Cal	Period	Cal Due
UH093	CBL6112B	Bilog	Chase	20/06/2011	24	20/06/2013
UH187	ESHS10	Receiver	R&S	11/02/2013	12	11/02/2014
UH195	ESH3-Z5.831.5	Lisn	R&S	01/06/2012	12	01/06/2013
UH281	FSU46	Spectrum Analyser	R&S	06/03/2013	12	06/03/2014
L007	hfh2	Loop Antenna	R&S	04/11/2011	24	04/11/2013
L317	ESVS10	Receiver	R&S	09/01/2013	12	09/01/2014
L426	52 Series II	Temperature Indicator	Fluke	29/04/2013	12	29/04/2014
REF976	34405a	Multimeter	Agilent	26/04/2013	12	26/04/2014

Appendix D: Additional Information

No additional information is included within this test report.

Appendix E: Calculation of the duty cycle correction factor

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1MHz and a video Bandwidth of 1MHz the sweep time was set accordingly to capture the pulse train. The transmit pulsewidths and period was measured. A plots of the pulse train is contained in Appendix B of this test report.

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsewidths over the 100ms width with the highest average value. (The duty cycle is the value of the sum of the pulse widths in one period (or 100ms), divided by the length of the period (or 100ms). The duty cycle correction factor was then expressed in dB and the peak emissions adjusted accordingly to give an average value of the emission.

Correction factor dB = 20 x (Log_{10} Calculated Duty Cycle)

Therefore the calculated duty cycle was determined:

The pulse train period was greater than >100ms and in as shown from the plots in contained in appendix B of this test report.

$$\text{Duty cycle} = \frac{\text{the sum of the highest average value pulsewidths over 100ms}}{100\text{ms}}$$

e.g

$$= \frac{7.459ms}{100ms} = 0.07459$$

0.07459 or 7.459%

Correction factor (dB) = 20 x (Log_{10} 0.07459) = -22.54dB

Duty cycle correction may not be applicable.
Unless duty cycle correction is utilised in the results section of this report this section is included for information only

Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

1. Magnetic field emissions arrangement Overview.
2. Magnetic field emissions arrangement Close Up

Photograph 1

Photograph 2

Appendix G: MPE Calculation

OET Bulletin No. 65, Supplement C 01-01

47 CFR §§1.1307 and 2.1091

2.1091 Radio frequency radiation exposure evaluation: mobile devices.

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than 1mW/cm^2 power density limit, as required under FCC rules.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{EIRP}{4\pi R^2} \quad \text{re - arranged} \quad R = \sqrt{\frac{EIRP}{S\ 4\pi}}$$

where:

S = power density
R = distance to the centre of radiation of the antenna
EIRP = EUT Maximum power

Note:

The EIRP measurement was performed using a signal substitution method.

Result

Prediction Frequency (MHz)	Maximum EIRP	Power density limit (S) (mW/cm^2)	Distance (R) cm required to be less than 0.978mW/cm^2
13.56 MHz	0.00002355 mW	0.978	0.0014

OET 65 does not define any requirements below 300kHz
RSS-102 does not define any requirements below 30MHz

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