

**IAL****INTERNATIONAL APPROVALS
LABORATORIES****EMC EMISSIONS - TEST REPORT (Full)**

Test Report No.	BC400145-1	Issue Date:	Monday Nov 22, 2004
Model / Serial No.	Tag Trakker 2/ SN: TT2R000112		
Product Type	Wireless RFID reader		
Client	Morrison Engineering		
Manufacturer	Infoclip LLC		
License holder	Infoclip LLC		
Address	1860 Lefthand Circle Longmont, CO 80534		
Test Criteria Applied	FCC CFR47 Part 15.209		
Test Result	PASS		
Test Project Number	BC400145-1	RADIO FREQUENCY DEVICES	
References			
Total Pages			
Including			
Appendices:	25		
<i>Todd Seeley</i>	<i>Robert Cresswell</i>		
Reviewed By : Todd Seeley	Approved By : Robert Cresswell		

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Lab Code: 200624-0

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STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty for Conducted Emissions in the frequency range of 150kHz – 30MHz is calculated to be $\pm 2.30\text{dB}$ and for Radiated Emissions is calculated to be $\pm 3.60\text{dB}$ in the frequency range of 30MHz – 200MHz and $\pm 3.38\text{dB}$ in the frequency range of 200MHz – 1000MHz.

EUT Received Date: 3-May-2004

Testing Start Date: 3-May-2004

Testing End Date: 11-May-2004

The actual test distance for the FCC Part 15.209 testing was conducted at 10m for the fact that the device was being tested to EN55022 Class B from 30 MHz to 1000 MHz (meets/exceeds the FCC Part 15.209 & 109B limits) The data is automatically extrapolated back to the FCC 3m limits and measurements are corrected to better show the compliance to FCC requirements and reduce confusion. A correction factor of 10.54dB is used in cases of 30MHz and up for a difference between 10m and 3m measurement distances. All measurements that are lesser than 30MHz where applicable are accompanied with the fall of measurements and calculations to support the interpolation.

*******Specific Test Clarifications:** The Tag Trakker 2 is a handheld RFID device that incorporates a low frequency passive tag reader and an Aerocomm RF Module for communications of the tag data to a base station. The unintentional emissions was completed with the Tag Trakker 2 fully functional and operational with all it's RF capability utilized. Please see the photos below to see the Blue Tag Trakker 2 and 2 base stations that it was communicating with during test. The base stations and computer within the field in this case are support equipment for the testing that allowed IALabs to verify the full functionality of the Tag Trakker 2 device.

Support Equipment Identification:

USB Connected Base Station Model Numbers: Tag Trakker 2 Serial Base Station

USB Connected Base Station Serial Numbers: TT2B0076

Remote Base Station Model Number: Tag Trakker 2 remote unit

Remote Base Station Serial Number: TT2P0011

Computer Model Number: PP01L

Computer Serial Number: TW-0791UH-12800-0CC-4067

Connections: Serial (USB) Connection from Computer to Base Station

Within the Tag Trakker 2 there was also another bluetooth module that was fully active. The manufacturer has decided not to implement the bluetooth module at this time to the final device.

Modifications required to pass:

NONE

Test Specification Deviations: Additions to or Exclusions from

Test-setup photo(s):
Conducted Emissions

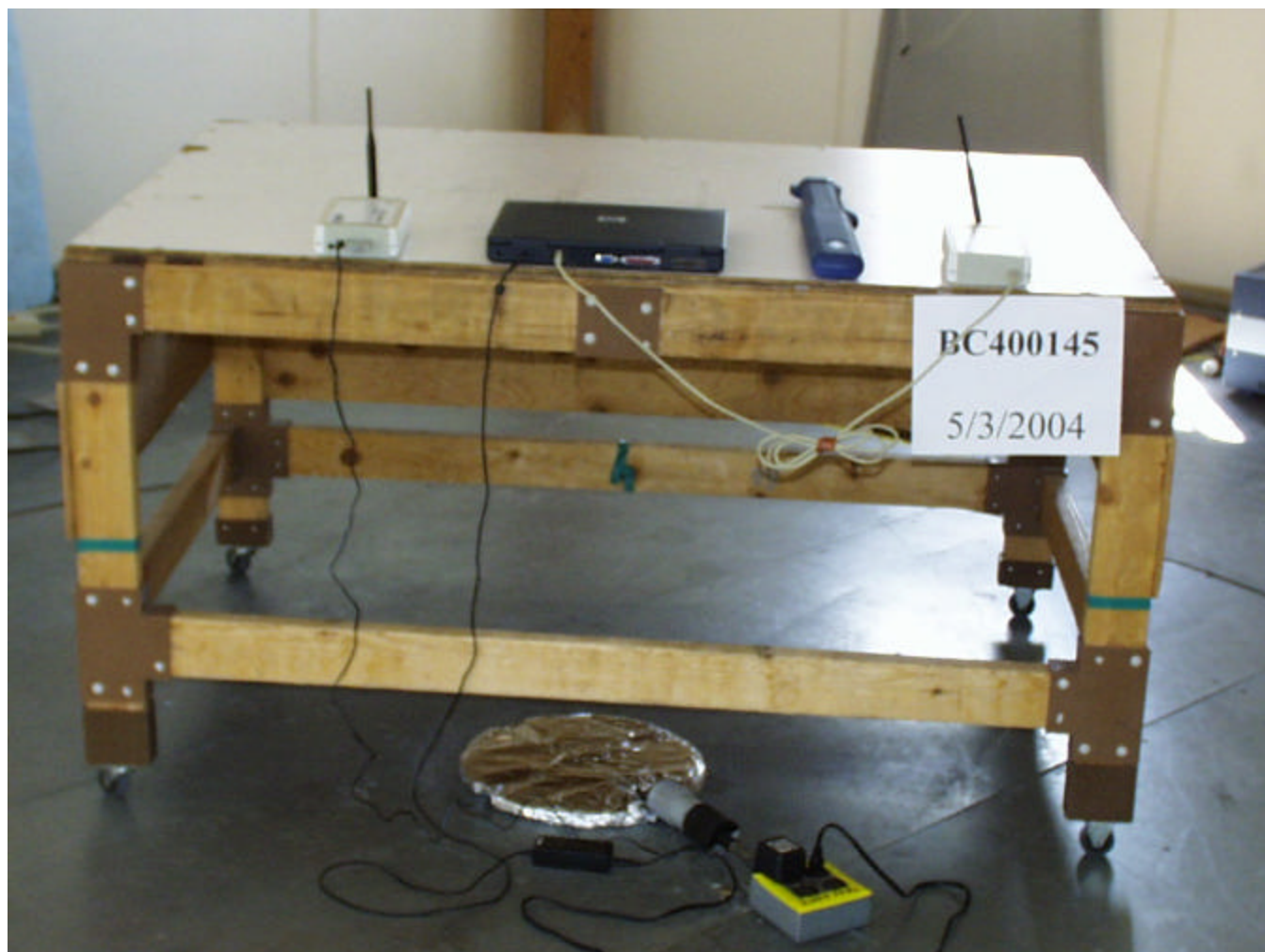
Not applicable Battery Powered Unit

Test-setup photo(s):
Unintentional Radiated Emissions



This photo shows 3 separate products within the test field simultaneously. The product covered by this report is the Blue RFID Reader shown on the table above.

Test-setup photo(s):
Unintentional Radiated Emissions



This photo shows 3 separate products within the test field simultaneously. The product covered by this report is the Blue RFID Reader shown on the table above.

Test-setup photo(s):
Intentional Radiated Emissions



Test-setup photo(s):
Intentional Radiated Emissions



Appendix A

Test Data Sheets
and
Test Equipment Used

Unintentional Emission per FCC CFR47 Part 15.209

Radiated Electromagnetic Unintentional Emissions

Test Report #:	BC400145 Run 01	Test Area:	Pinewood Site 1 (3m)	Temperature:	22	°C
Test Method:	FCC Part 15.209	Test Date:	06-May-2004	Relative Humidity:	29	%
EUT Model #:	Tag Trakker 2 Reader	EUT Power:	DC 9.6 V	Air Pressure:	81	kPa
EUT Serial #:	TT2R000112					
Manufacturer:	InfoClip LLC					
EUT Description:	Tag Reading Data Handling System					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV/m)	(m) (DEG)	FCC Part 15.209 Qp	FCC Part 15.209 Av
Testing was completed from 9kHz to 25GHz						
No emissions found other than the following maximized emissions.						
All the following signals are maximized						
The following signals are the highest from a previous full baseline						
horizontal and vertical were both checked, horizontal is worst case						
414.75	52.1 Qp	2.2 / 15.5 / 28.0	41.9	H / 1.0 / 43.0	-4.1	N/A
414.75	52.7 Pk	2.2 / 15.5 / 28.0	42.5	H / 1.0 / 43.0	-3.5	N/A
506.92	45.1 Qp	2.3 / 18.1 / 28.4	37.2	H / 1.7 / 51.0	-8.8	N/A
506.92	45.7 Pk	2.3 / 18.1 / 28.4	37.8	H / 1.7 / 51.0	-8.2	N/A
433.19	49.4 Qp	2.2 / 16.3 / 28.1	39.8	H / 1.0 / 61.0	-6.2	N/A
433.19	51.0 Pk	2.2 / 16.3 / 28.1	41.4	H / 1.0 / 61.0	-4.6	N/A
488.49	44.4 Qp	2.3 / 17.5 / 28.4	35.8	H / 1.0 / 55.0	-10.2	N/A
488.49	45.2 Pk	2.3 / 17.5 / 28.4	36.7	H / 1.0 / 55.0	-9.3	N/A
451.62	47.6 Qp	2.3 / 16.5 / 28.2	38.2	H / 1.0 / 80.0	-7.8	N/A
451.62	48.0 Pk	2.3 / 16.5 / 28.2	38.5	H / 1.0 / 80.0	-7.5	N/A
525.36	47.5 Qp	2.3 / 17.9 / 28.4	39.3	H / 2.0 / 47.0	-6.7	N/A
525.36	49.2 Pk	2.3 / 17.9 / 28.4	41.0	H / 2.0 / 47.0	-5.0	N/A

Radiated Electromagnetic Unintentional Emissions

Test Report #:	BC400145 Run 01	Test Area:	Pinewood Site 1 (3m)	Temperature:	22	°C
Test Method:	FCC Part 15.209	Test Date:	06-May-2004	Relative Humidity:	29	%
EUT Model #:	Tag Trakker 2 Reader	EUT Power:	DC 9.6 V	Air Pressure:	81	kPa
EUT Serial #:	TT2R000112					
Manufacturer:	InfoClip LLC					
EUT Description:	Tag Reading Data Handling System					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB\m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC Part 15.209 Qp	DELTA2 (dB) FCC Part 15.209 Av
Changing to the Horn Antenna, Vertical						
Checking from 1-4 GHz						
0 degrees						
no emissions detected						
90 degrees						
no emissions detected						
180 degrees						
no emissions detected						
270 degrees						
no emissions detected						
the following readings are noise floor measurements, for reference only						
1000.00	33.2 Av	2.2 / 24.9 / 37.1	23.2	V / 1.0 / 0.0	N/A	-30.8
4000.00	31.7 Av	5.7 / 33.0 / 37.1	33.3	V / 1.0 / 0.0	N/A	-20.7
Changing to Horizontal polarization						
0 degrees						
2385.76	39.3 Av	3.8 / 28.9 / 37.3	34.8	H / 1.0 / 0.0	N/A	-19.2
2476.90	38.6 Av	4.0 / 29.1 / 36.9	34.8	H / 1.0 / 0.0	N/A	-19.2
2551.94	41.8 Av	4.1 / 29.2 / 37.5	37.6	H / 1.0 / 0.0	N/A	-16.4
90 degrees						
2626.90	41.2 Av	4.2 / 29.4 / 36.9	37.9	H / 1.0 / 0.0	N/A	-16.1
2642.15	41.1 Av	4.2 / 29.5 / 36.8	37.9	H / 1.0 / 0.0	N/A	-16.1

Radiated Electromagnetic Unintentional Emissions

Test Report #: BC400145 Run 01	Test Area: Pinewood Site 1 (3m)	Temperature: 22 °C
Test Method: FCC Part 15.209	Test Date: 06-May-2004	Relative Humidity: 29 %
EUT Model #: Tag Trakker 2 Reader	EUT Power: DC 9.6 V	Air Pressure: 81 kPa
EUT Serial #: TT2R000112		
Manufacturer: InfoClip LLC		
EUT Description: Tag Reading Data Handling System		
Notes:		

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB\m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC Part 15.209 Qp	DELTA2 (dB) FCC Part 15.209 Av
180 degrees						
2385.94	39.6 Av	3.8 / 28.9 / 37.3	35.1	H / 1.0 / 0.0	N/A	-18.9
2551.91	43.9 Av	4.1 / 29.2 / 37.4	39.8	H / 1.0 / 0.0	N/A	-14.2
2626.84	43.8 Av	4.2 / 29.4 / 36.9	40.5	H / 1.0 / 0.0	N/A	-13.5
2642.13	41.2 Av	4.2 / 29.5 / 36.8	38.1	H / 1.0 / 0.0	N/A	-15.9
270 degrees						
2642.14	42.8 Av	4.2 / 29.5 / 36.8	39.6	H / 1.0 / 0.0	N/A	-14.4
Maximized emissions, Horizontal, from 1-4 GHz						
2626.95	47.1 Av	4.2 / 29.4 / 36.9	43.8	H / 1.1 / 256.0	N/A	-10.2
Changing to the 4-8 GHz amp						
Horizontal						
Full turntable rotation, horizontal, from 4-8 GHz						
no emissions detected other than the harmonics of the fundamental which will be measured on a separate run.						
vertical						
no emissions detected, vertical, from 4-8 GHz						
Changing to the 8-18 GHz amp						
Vertical						
Full turntable rotation 8-18 GHz, no emissions detected						

Radiated Electromagnetic Unintentional Emissions

Test Report #: BC400145 Run 01	Test Area: Pinewood Site 1 (3m)	Temperature: 22 °C
Test Method: FCC Part 15.209	Test Date: 06-May-2004	Relative Humidity: 29 %
EUT Model #: Tag Trakker 2 Reader	EUT Power: DC 9.6 V	Air Pressure: 81 kPa
EUT Serial #: TT2R000112		
Manufacturer: InfoClip LLC		
EUT Description: Tag Reading Data Handling Sysytem		
Notes:		

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	FCC Part 15.209 Qp	FCC Part 15.209 Av
Horizontal						
Full turntable rotation, no emissions from 8-18 GHz						
Horizontal						
Full turntable rotation, no emissions from 18-25 GHz						
Vertical						
Full turntable rotation, no emissions from 18-25 GHz						

Radiated Electromagnetic Unintentional Emissions

Test Report #:	BC400145 Run 01	Test Area:	Pinewood Site 1 (3m)	Temperature:	22	°C
Test Method:	FCC Part 15.209	Test Date:	06-May-2004	Relative Humidity:	29	%
EUT Model #:	Tag Trakker 2 Reader	EUT Power:	DC 9.6 V	Air Pressure:	81	kPa
EUT Serial #:	TT2R000112					
Manufacturer:	InfoClip LLC					
EUT Description:	Tag Reading Data Handling Sysytem					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	FCC Part 15.209 Qp	FCC Part 15.209 Av
***** Measurement Summary *****						
414.75	52.7 Pk	2.2 / 15.5 / 28.0	42.5	H / 1.0 / 43.0	-3.5	N/A
433.19	51.0 Pk	2.2 / 16.3 / 28.1	41.4	H / 1.0 / 61.0	-4.6	N/A
525.36	49.2 Pk	2.3 / 17.9 / 28.4	41.0	H / 2.0 / 47.0	-5.0	N/A
451.62	48.0 Pk	2.3 / 16.5 / 28.2	38.5	H / 1.0 / 80.0	-7.5	N/A
506.92	45.7 Pk	2.3 / 18.1 / 28.4	37.8	H / 1.7 / 51.0	-8.2	N/A
488.49	45.2 Pk	2.3 / 17.5 / 28.4	36.7	H / 1.0 / 55.0	-9.3	N/A
2626.95	47.1 Av	4.2 / 29.4 / 36.9	43.8	H / 1.1 / 256.0	N/A	-10.2
2551.91	43.9 Av	4.1 / 29.2 / 37.4	39.8	H / 1.0 / 0.0	N/A	-14.2
2642.14	42.8 Av	4.2 / 29.5 / 36.8	39.6	H / 1.0 / 0.0	N/A	-14.4
2385.94	39.6 Av	3.8 / 28.9 / 37.3	35.1	H / 1.0 / 0.0	N/A	-18.9
2476.90	38.6 Av	4.0 / 29.1 / 36.9	34.8	H / 1.0 / 0.0	N/A	-19.2
4000.00	31.7 Av	5.7 / 33.0 / 37.1	33.3	V / 1.0 / 0.0	N/A	-20.7
1000.00	33.2 Av	2.2 / 24.9 / 37.1	23.2	V / 1.0 / 0.0	N/A	-30.8

Intentional Emission per FCC CFR47 Part 15.209<30MHz

Radiated Electromagnetic Intentional Emissions

Test Report #:	BC400145 Run 01	Test Area:	Pinewood Site 1 (3m)	Temperature:	22	°C
Test Method:	FCC Part 15.209	Test Date:	06-May-2004	Relative Humidity:	29	%
EUT Model #:	Tag Trakker 2 Reader	EUT Power:	DC 9.6 V	Air Pressure:	81	kPa
EUT Serial #:	TT2R000112					
Manufacturer:	InfoClip LLC					
EUT Description:	Wireless RFID reader					
Notes:						

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

FREQ	LEVEL	CABLE / ANT / PREAMP	Final Corrected	POL / HGT / AZ	Measured Site Roll-off per Decade	Final	Limit @ applicable distance	DELTA 300m	DELTA 30m
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV)	(dBuV)	(dB)	(dB)
0.134	91.2 Pk	0.0 / 10.5 / 0.0	101.7	V / 1.0 / 17.0	116.4	-14.7	25.1	-39.8	N/A
0.134	90.1 Qp	0.0 / 10.5 / 0.0	100.6	V / 1.0 / 17.0	116.4	-15.8	25.1	-40.9	N/A
268.70 kHz, no emission detected									
403.05 kHz, no emission detected									
537.4 kHz no emission detected									
671.75 kHz , no emission detected									
806.1 kHz, no emission detected									
940.45 kHz, no emission detected									
1.0748 MHz, no emission detected									
1.20915 MHz, no emission detected									
1.34350 MHz, no emission detected									
Checking unintentional, from 17.1776 MHz, to 30 MHz									
no signal detected at 17.1776 MHz									
checked the 29.491 MHz clock, no emission detected									
no other emissions detected from 9 kHz to 30 MHz									

Project Report

Begin Date: 5/3/2004 **End Date:** 5/12/2004

Technician Karen Parker

Project: BC400145

Capital Asset ID	Manufacturer	Model #	Serial #	Description	Test Performed	Service Type	Service Date	Service Due
6	Hewlett-Packard	8594E	3223A00145	Spectrum Analyzer	R Radiated Emissions	For Cal	1/16/2004	1/16/2005
106	TENSOR	4105	2020	Ridged Guide Antenna 1-18GHz	R Radiated Emissions	For Cal	7/11/2003	7/11/2004
135	EMCO	3146	9402-3775	Log Periodic Antenna (200-1000MHz)	R Radiated Emissions	For Cal	9/10/2003	9/10/2004
171	Hewlett-Packard	85662A	1928A01169	Spectrum Analyzer - Display Section	R Radiated Emissions	For Cal	1/21/2004	1/21/2005
172	Hewlett-Packard	8566B	2430A00759	Spectrum Analyzer	R Radiated Emissions	For Cal	1/21/2004	1/21/2005
189	EMCO	3109	9801-3142	Bicon Antenna 30 - 300 MHz	R Radiated Emissions	For Cal	9/9/2003	9/9/2004
201	Hewlett-Packard	11975A	2738A01557	Amplifier	R Radiated Emissions	For Cal	10/3/2002	10/3/2004
202	Avantek	AWT-18037	1002	RF Pre-Amplifier (8-18 GHz)	R Radiated Emissions	For Ver	4/7/2004	4/7/2005
203	Avantek	AFT97-8434-10F	1007	RF Pre-Amplifier (4-8 GHz)	R Radiated Emissions	For Ver	4/7/2004	4/7/2005
204	Hewlett-Packard	11970K	2332A01280	Harmonic Mixer	R Radiated Emissions	For Cal	10/5/2002	10/5/2005
213	Mini-Circuits Lab	ZHL-42	N052792-2	Amplifier	R Radiated Emissions	For Ver	6/20/2003	6/20/2004
248	Hewlett-Packard	8447F	3113A05545	9 kHz- 1.3GHz Pre Amp	R Radiated Emissions	For Ver	6/5/2003	6/5/2004
195	EMCO	6502	9205-2738	Magnetic loop	R Radiated Emissions	For Cal	6/2/2003	6/2/2004

Appendix B

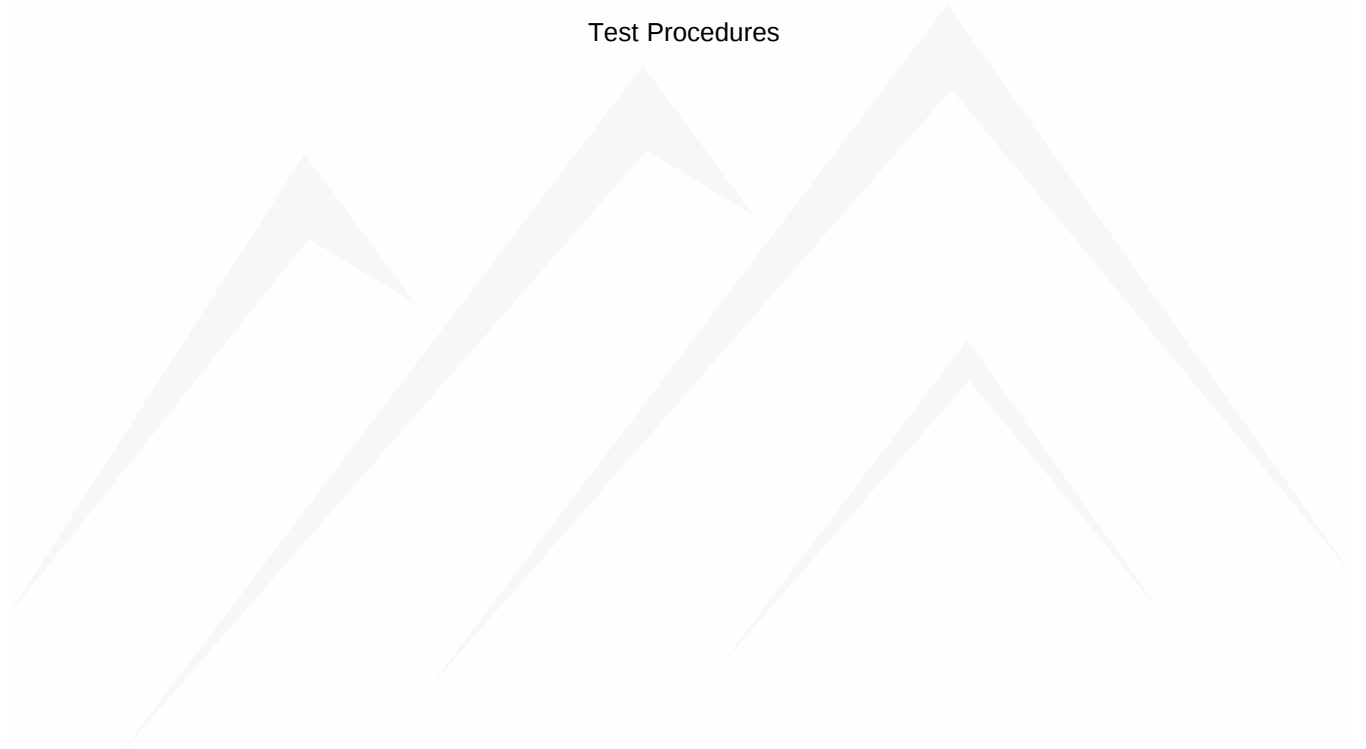
Test Plan and Constructional Data Form

Appendix C

Measurement Protocol

And

Test Procedures



MEASUREMENT PROTOCOL

GENERAL INFORMATION

Test Methodology

Conducted and radiated emission testing is performed according to the procedures in ANSI C63.4 & CNS13438.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the applicable limit.

To convert between dB μ V and μ V, the following conversions apply:

- $\text{dB}\mu\text{V} = 20(\log \mu\text{V})$
- $\mu\text{V} = \text{Inverse log}(\text{dB}\mu\text{V}/20)$

RADIATED EMISSIONS

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the applicable limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example: At a Test Frequency of 30 MHz, with a peak reading on the spectrum analyzer or measuring receiver of 14 dBmV:

Measured Level	+	Transducer & Cable Loss factor	=	Corrected Reading	Specification Limit	-	Corrected Reading	=	Delta Specification
(dB μ V)		(dB)		(dB μ V/m)	(dB μ V/m)		(dB μ V/m)		
14.0		14.9		28.9	40.0		28.9		-11.1

DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 22GHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees.

Radiated Emissions Diagram:

