



Test Report:
ATEMC000048

Applicant:
Arrista Technologies Inc.
5-55 Henlow Bay
Winnipeg, MB, CA
R3Y 1G4



Equipment Under Test (EUT):
iDEN
Bi-Directional Signal Amplifier

MODEL:
CR300

FCC ID:
P35SH2U64GG

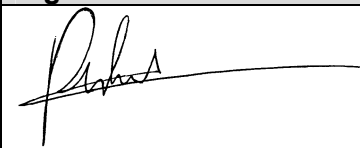
IN ACCORDANCE WITH:
FCC PART 2,
FCC PART 90, SUBPART I & S
Private Land Mobile Radio Service

TEST LAB PERSONNEL:

Test Performed by:	Date	Signature
Paul Eberling, CNA	June 2, 2004	
Brent Griffiths	June 2, 2004	

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APPROVALS:

Date	Name	Title	Signature
June 2, 2004	Roman Wroczynski	Director Development Test	

Applicant: Arrista Technologies Inc.
Equipment: iDEN Signal Amplifier

Table of Contents

1.	General Information	4
1.1.	Test Facilities Description	4
1.1.1.	Internal Facilities	4
1.1.2.	Radiated Emissions Test Site	4
1.2.	Purpose	4
1.3.	Test Methodology	4
1.4.	Test Equipment list	4
1.5.	Equipment Under Test Description	6
1.6.	General Equipment Specification	6
1.6.1.	Power Supply Specifications.....	6
1.6.2.	Uplink.....	6
1.6.3.	Downlink	7
1.6.4.	EUT Functional Block Diagram	Error! Bookmark not defined.
1.7.	Deviations	7
1.8.	Test Schedule Description	7
1.9.	Test Result Summary	7
2.	Test Results	9
2.1.	RF Power Output	9
2.1.1.	SPECIFICATION REQUIREMENT:.....	9
2.1.2.	MEASUREMENT PROCEDURE:	9
2.1.3.	TEST RESULTS:	9
2.1.4.	MEASUREMENT DATA:	9
2.2.	Emissions Limitations	10
2.2.1.	SPECIFICATION REQUIREMENT:.....	10
2.2.2.	MEASUREMENT PROCEDURE:	11
2.2.3.	TEST RESULTS:	11
2.3.	Conducted Spurious Emissions at Antenna Terminals	14
2.3.1.	SPECIFICATION REQUIREMENT:.....	14
2.3.2.	MEASUREMENT PROCEDURE	14
2.3.3.	TEST RESULTS	15
2.3.4.	Plot Data	15
2.4.	Field Strength of Emissions	15
2.4.1.	SPECIFICATION REQUIREMENT:.....	15
2.4.2.	MEASUREMENT PROCEDURE:	16
2.4.3.	TEST RESULTS:	17
2.4.4.	MEASUREMENT DATA; 806 – 824 MHz Range:.....	17
3.	Appendix A: Test Set-up Diagrams	18
4.	Appendix B: Pictures of EUT	19

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Table of Figures

Radiated Test Equipment.....	4
Equipment Under Test	Error! Bookmark not defined.
Results Summary	8
Up-Link RF Power Output	9
Down-Link RF Power Output.....	9
Up-Link IMD Results	13
Down-Link IMD Results.....	13
Set-up for Output Power, Occupied Bandwidth and Conducted Emissions Testing.....	18
Set-up for Radiated Emissions in 3-meter Semi Anechoic Chamber	18
EUT Set-up in 3-meter Anechoic.....	19
EUT Set-up for Bench Top, Conducted Emissions, Power Output Testing.	19

Applicant: *Arrista Technologies Inc.*
Equipment: *iDEN Signal Amplifier*

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1. GENERAL INFORMATION

1.1. TEST FACILITIES DESCRIPTION

1.1.1. INTERNAL FACILITIES

Arrista Product Compliance & Test (PCT) laboratory is located at 5-55 Henlow Bay, Winnipeg, Manitoba, Canada at Arrista main facility. The laboratory has test equipment for Electromagnetic Compatibility (EMC) testing i.e. ESD, EFT, Surge, and radiated emissions.

The PCT Laboratory is registered with the FCC and has submitted the information required by Section 2.948 of the FCC Rules for measuring devices. Test equipment used to perform all measurements listed in paragraph 1.4 of this test report.

1.1.2. RADIATED EMISSIONS TEST SITE

Radiated emissions testing was performed in Arrista's semi-anechoic 3m test chamber.

The site consists of a 28'x 20'x 20' shielded chamber with absorptive materials on the walls and ceiling. The floor of the chamber is a raised conductive ground plane and includes a 2 m conductive top turntable. The measuring antenna is mounted on a non-conductive mast, which can be raised between 1 to 4 meters. Measurement equipment is located in the adjacent control room which is a 12' x 12' x 8' shielded structure.

1.2. PURPOSE

This document details the results of the following tests performed by Arrista Technologies Inc. (Arrista) on May 28 – June 4 , 2004 on the SignalReach iDEN Bi-Directional Signal Repeater.

1.3. TEST METHODOLOGY

Arrista performed these tests on a production sample of the product for the purpose of demonstrating compliance with FCC Part 90, Subparts I & S. All conducted and radiated emissions testing were performed according to methods of ANSI C63.4:1992. This test report related only to the item(s) tested.

1.4. TEST EQUIPMENT LIST

All test equipment calibrations are NIST traceable to national standards. All calibration data can be made available on request

Radiated Test Equipment

Description	Manufacture	Model Number	Last Cal Date	Cal Interval
Turntable and Mast Controller	EMCO	2090	N/A	N/A
Antenna Mast	EMCO	2075-2	N/A	N/A

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Equipment: iDEN Signal Amplifier

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Metal Top Turntable	EMCO	2081-2.03	N/A	N/A
Horn Antenna (1-18GHz)	EMCO	3115	01/23/2004	Annual
Bilog EMC Antenna (30-2000MHz)	Schaffner-Chase	CBL61112B	01/29/2004	Annual
3m Semi-Anechoic Chamber	EMC Test Systems	N/A	05/30/2003	3 yrs
Signal Generator	HP/Agilent	E4432B	02/05/2003	2 yrs
Spectrum Analyzer	HP/Agilent	8593E	06/30/2003	Annual
Coaxial Cable	Sucoflex	101PEA-498	01/21/2003	2 yrs
Coaxial Cable	Sucoflex	101PEA-417	01/21/2003	2 yrs
Amplifier 10-4200MHz	Mini-Circuits	ZHL-42W	N/A	N/A
Directional Coupler	Weinschel	1538RA-20	N/A	N/A
6 dB Attenuator	Hewlett-Packard	6dB	N/A	N/A
Desktop Computer	Dell Optiplex	GX110	N/A	N/A

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Equipment: iDEN Signal Amplifier

1.5. EQUIPMENT UNDER TEST DESCRIPTION

The E.U.T. is sold under the following trade name:

SignalReach CR300

The SignalReach™ CR300 Small Office Home Office (SOHO) iDEN band Repeater extends cellular services into buildings, parking garages, tunnels and other poor coverage areas. The CR300 is designed for use with 800MHz iDEN telephones and offers a cost-effective solution for small business and residential applications. The repeater is useful in areas where cellular service is available outside of the building but marginal indoors.

The SignalReach™ CR300 is a stationary device that automatically reradiates signals from the base transmitters without channel translation, for the purpose of improving reliability of existing service by increasing the signal strength in dead spots. This product is designed to operate with iDEN signals from cellular service providers in the Private Land Mobile Radio Service bands.

The repeater contains circuitry to ensure proper operating power levels, as well as including an automatic feedback and detection circuitry that detects poor isolation between the subscriber and donor antennae. In this condition the repeater will adjust it's gain to compensate for the abnormality, and warn the user through a visual indicator LED. The CR300 will enhance the cellular telephone user's experience while complying with cellular network specifications. Linear operation is guaranteed under all conditions.

The product has three RF coaxial connection interfaces, one to an external uplink antenna (not sold with the product) and the other two connect to external downlink antennas (not sold with the product); see [Functional Block Diagram](#). The repeater can be powered by its AC adapter or through the in-building primary subscriber antenna port using an optional power inserter. A green LED indicates when power is applied to the unit.

The CR300 allows up to two indoor antennas to be used without the need of external components. Its auxiliary indoor antenna port allows a second indoor zone to be easily connected.

1.6. GENERAL EQUIPMENT SPECIFICATION

1.6.1. POWER SUPPLY SPECIFICATIONS

Input Voltage: 12 Vdc
Input Current: 1 Amp max

1.6.2. UPLINK

Frequency Range: 806 – 824 MHz
Tunable Bands: Not Applicable
Necessary Bandwidth: Not Applicable
Type of Modulation: Not Applicable

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Equipment: iDEN Signal Amplifier

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Internal/External Data Source: Not Applicable
Emission Designator: F1D (paging), DXW (iDEN)
Output Impedance: 50 Ohms
RF Power Output (rated): Single, leveled, up to 200 mWatts
Number of Channels: Not Applicable
Duty Cycle: Continuous, Linear Class A
Channel Spacing: Not Applicable
Band Selection Duplexer

1.6.3. DOWNLINK

Frequency Range: 851-869 MHz
Tunable Bands: Not Applicable
Necessary Bandwidth: Not Applicable
Type of Modulation: Not Applicable
Local Oscillator: Not Applicable
Emission Designator: F1D (paging), DXW (iDEN)
Output Impedance: 50 Ohms
RF Power Output (rated): Single/Dual; User Selectable; leveled; up to 30mW/port
Number of Channels: Not Applicable
Duty Cycle: Continuous, Linear Class A
Channel Spacing: Not Applicable
Band Selection Duplexer
1st IF: Not Applicable
2nd IF: Not Applicable

1.7. DEVIATIONS

The following deviations from, additions to, or exclusions from the test specifications have been made:

None

1.8. TEST SCHEDULE DESCRIPTION

Testing was performed using the procedures and requirements of CFR 47 Part 2 for type acceptance.

1.9. TEST RESULT SUMMARY

Testing was performed using procedures or criteria contained in the regulatory documents and standards specified below.

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Equipment: *iDEN Signal Amplifier*

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Results Summary

NAME OF TEST	FCC PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	2.1046(a) 90.635(d)	Mobile spec; 7W ERP	230mW	Complies
Emissions Limits:	2.1049(c) 90.210	Mask	Plots	Complies
Conducted Spurious Emission at Antenna Terminals	2.1051 90.669	-13dBm	-29.3dBm,	Complies
Radiated Field Strength of Spurious Emissions	2.1053 90.689	-13dBm	Plots, Tables	Complies
Frequency Tolerance	90.213	1.5ppm	N/A [2]	N/A [2]

Notes:

- [1] Since the EUT does not contain modulation circuitry, modulation testing was not performed.
- [2] Since the EUT is not designed to generate or translate frequencies, and only amplifies the signal it receives, frequency stability was not tested.



2. TEST RESULTS

2.1. RF POWER OUTPUT

Test Type:	RF Output Power
FCC Para No.:	2.1033(c) and 90.635(d)
Tested By:	Paul Eberling
Date:	February 13, 2003

2.1.1. SPECIFICATION REQUIREMENT:

According to § 90.635 (d);
The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

2.1.2. MEASUREMENT PROCEDURE:

The peak power at EUT antenna terminals is measured using the Agilent 8593E spectrum analyzer. See Appendix A; for test set-up.

2.1.3. TEST RESULTS:

Complies

2.1.4. MEASUREMENT DATA:

Up-Link RF Power Output

Port	Freq (MHz)	SA Reading (dBm)	Cable (dB)	Atten (dB)	Result (dBm)	EUT Output Power (W)	Limit (Watts)
Uplink Primary Port	806	19.6	Corrected	Corrected	22.47	0.177	7.0 ERP
	815	19.1	Corrected	Corrected	23.2	0.209	7.0 ERP
	824	16.5	Corrected	Corrected	19.51	0.089	7.0 ERP
Uplink Secondary Port	806	16.6	Corrected	Corrected	23.17	0.207	7.0 ERP
	815	15.9	Corrected	Corrected	23.6	0.229	7.0 ERP
	824	14.2	Corrected	Corrected	19.58	0.091	7.0 ERP

Note:

Attenuation of cable and attenuator is corrected automatically by spectrum analyzer correction function.

Down-Link RF Power Output

Port	Freq (MHz)	SA Reading (dBm)	Cable (dB)	Atten (dB)	Result (dBm)	EUT Output Power (W)	Limit (Watts) ERP
------	------------	------------------	------------	------------	--------------	----------------------	-------------------

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Equipment: iDEN Signal Amplifier



Dn-link Primary Port	851	14.8	Corrected	Corrected	15.93	0.039	7.0
	860	15.0	Corrected	Corrected	16.83	0.048	7.0
	870	13.3	Corrected	Corrected	16.76	0.047	7.0
Dn-link Secondary Port	851	10.7	Corrected	Corrected	15.70	0.037	7.0
	860	13.1	Corrected	Corrected	16.67	0.047	7.0
	870	12.6	Corrected	Corrected	15.83	0.038	7.0

Note:

Attenuation of cable and attenuator is corrected automatically by spectrum analyzer correction function.

See Annex 1 for spectrum analyzer Plot Data.

2.2. EMISSIONS LIMITATIONS

Test Type:	Emissions Limits
FCC Para No.:	2.1033(c), 90.210(g) and 90.691(a)
Tested By:	Paul Eberling
Date:	February 13, 2003

2.2.1. SPECIFICATION REQUIREMENT:

According to § 90.210 (g);

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz up to and including 10 kHz:
 At least $83 \log_{10} (f_d/5)$ decibels.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz up to and including 250 percent of the authorized bandwidth:
 At least $116 \log_{10} (f_d/6.1)$ decibels or $50 + 10 \log_{10} (\text{Unmodulated Carrier Power})$ decibels or 70 decibels, whichever is lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth:
 At least $43 + 10 \log_{10} (\text{Output Power in Watts})$ decibels or 80 decibels, whichever is lesser attenuation.

According to § 90.691 (a);

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10} (f/6.1)$ decibels or $50 + 10 \log_{10} (P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center channel of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

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Equipment: iDEN Signal Amplifier

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ decibels (i.e. -13 dBm) or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

2.2.2. MEASUREMENT PROCEDURE:

A single modulated tone was used to demonstrate its operability in iDEN cell systems. A signal generator was setup to provide a modulated 16-QAM signal. The signal generator output was verified on a spectrum analyzer as shown. The signal generator output was then connected to the EUT cell phone coaxial interface connector. See Appendix A; for test set-up

Agilent Spectrum Analyzer Settings:

RBW: 300Hz
VBW: 1kHz
Span: 100 kHz
Sweep: 20 sec
Mask: DXW (iDEN)

Input Signal Characteristics:

Agilent E4432B Signal Generator
4 Carrier 16-QAM

2.2.3. TEST RESULTS:

Complies

MEASUREMENT DATA:
See Annex 2 for Plot Data.

2.2.3.1. TWO-TONE INTERMODULATION TEST:

Test Type:	Intermodulation Distortion Test
FCC Para No.:	2.1051, 90.210
Tested By:	Paul Eberling
Date:	January 13, 2004

2.2.3.2. SPECIFICATION REQUIREMENT:

According to § 2.1051 (e) *Out of band emissions*.

The mean power of emissions must be attenuated below the mean power of the un-modulated carrier (P) on any frequency twice or more than twice the fundamental frequency by: at least 43+10 log P dB.

Spur limit is defined in the following formula:

$$P_o - (43 + 10\log(P)) \quad [1]$$

According to § 90.210 (g);

(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz up to and including 10 kHz:
At least $83 \log_{10}(f_d/5)$ decibels.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz up to and including 250 percent of the authorized bandwidth:
At least $116 \log_{10}(f_d/6.1)$ decibels or $50 + 10 \log_{10}(\text{Unmodulated Carrier Power})$ decibels or 70 decibels, whichever is lesser attenuation.

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth:
At least $43 + 10 \log_{10}(\text{Output Power in Watts})$ decibels or 80 decibels, whichever is lesser attenuation.

2.2.3.3. MEASUREMENT PROCEDURE:

EUT was subjected to 2 simultaneous RF Carriers with the appropriate type of modulation. Two input signals are equal in level (and can be raised equally), were sent to the EUT. Input level was setup to achieve maximum EUT output power. The signal generator output was verified on a spectrum analyzer as shown in Annex 3. The signal generator output was then connected to the EUT uplink and downlink ports respectively. See Appendix A, for test set-up.

2.2.3.4. TEST RESULTS:

Complies

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Equipment: iDEN Signal Amplifier

2.2.3.5. MEASUREMENT RESULTS

Up-Link IMD Results

Modulation	Freq Fc (MHz)	Channel	Result (dBm)	Limit Absolute (Watts)
iDEN	806	LOW	<-13	-13
	815	MID	<-13	-13
	824	HIGH	<-13	-13

Down-Link IMD Results

Modulation	Freq Fc (MHz)	Channel	Result (dBm)	Limit Absolute (Watts)
iDEN	851	LOW	<-13	-13
	860	MID	<-13	-13
	870	HIGH	<-13	-13

See Annex 3 for Plot Data.

2.3. CONDUCTED SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Type:	Spurious Emissions at Antenna Terminals
FCC Para No.:	2.1051(e), 90.210(g), 90.691(a).
Tested By:	Paul Eberling
Date:	February 27, 2003

2.3.1. SPECIFICATION REQUIREMENT:

§ 2.1051 (e) *Out of band emissions.* The mean power of emissions must be attenuated below the mean power of the un-modulated carrier (P) on any frequency twice or more than twice the fundamental frequency by: at least $43 + 10 \log P$ dB.

§90.210 (g) *Emission Mask G.*

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

§90.691 (a) The mean power of emissions must be attenuated below the mean power of the un-modulated carrier (P) as follows:

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

2.3.2. MEASUREMENT PROCEDURE

A signal generator providing a CW tone at 806, 815, & 824Mhz respectively was connected to the EUT cell phone coaxial interface connector. The output of the EUT was connected to a spectrum analyzer and the emissions spectrum of the EUT was measured from 30MHz to the 10th harmonic of the fundamental of the CW input signal. See Appendix A; Article 61 for test set-up

Agilent Spectrum Analyzer Settings:

RBW: 300kHz < 1GHz, 1MHz > 1GHz

VBW: various

Bandwidth of measurement: 30MHz to 9GHz

Span: various

Sweep: 2 sec

Mask: Cell F1D

Input Signal Characteristics:

CW Frequency: 806, 815 and 824 MHz

CW Power Level: RF level input of the signal to produce maximum EUT output. See Appendix A; for test set-

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Equipment: iDEN Signal Amplifier

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up.

Spur limit is defined in the following formula:

$$P_o - (43 + 10\log P) \quad [1]$$

Using the measured values the limit is calculated below:

$$23 - [43 + 10\log(0.20)] = -13.0 \quad [2]$$

2.3.3. TEST RESULTS

Complies

2.3.4. PLOT DATA

See Annex 4 for Plot Data.

The following plots depict the harmonic emissions for each of the three fundamental frequencies; 806.0, 815.0, 824.0 respectively. A display line shown in each plot indicates the -13.0 dBm limit. Values for each harmonic emission are shown in the table below each plot.

2.4. FIELD STRENGTH OF EMISSIONS

Test Type:	Emissions Limits for Cellular F1D emissions mask (AMPS/TDMA)
FCC Para No.:	2.1053, 90.210(g), 90.691(a)
Tested By:	Paul Eberling
Date:	February 27, 2003

2.4.1. SPECIFICATION REQUIREMENT:

The mean power of emissions must be attenuated below the mean power of the un-modulated carrier on any frequency twice or more than twice the fundamental emission by at least $43 + 10 \log P$. This is equivalent to -13 dBm absolute power.

§90.210 (g) *Emission Mask G.*

(3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

§90.691 (a) The mean power of emissions must be attenuated below the mean power of the un-modulated carrier (P) as follows:

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10\log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than

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Equipment: iDEN Signal Amplifier

37.5 kHz.

2.4.2. MEASUREMENT PROCEDURE:

The EUT is placed in a 3-meter semi anechoic chamber on a wooden table resting on the metal turntable. The EUT is stimulated by a CW tone from a signal generator at three discrete frequencies for each mode of operation. More specifically, 806, 815 and 824 MHz respectively.

The EUT is not designed with an integral antenna nor sold with one, thus for this test, the EUT's output antenna interface coaxial connector is terminated into a coaxial cable with a 50 ohm load attached to it.

The EUT's radiated field strength emissions is measured from 30MHz to the tenth harmonic of the CW input signal. A CISPR 16 compliant receiver is used to for scans between 30MHz to 2GHz. A spectrum analyzer is used for measurements above 2GHz. A calculation follows to convert the spec limit power level (i.e.-13dBm) to an E field measurement limit. See Appendix A; for test set-up

Calculation of field strength limit corresponding to a power limit of -13dBm

An example of attenuation requirement of $43 + 10 \text{ Log } P$ is equivalent to -13 dBm (5×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi \quad [5]$$

For emissions ≤ 1 GHz:

G = 1.64 (Dipole Gain)
P = 10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = 0.016533 \text{ V/m} = 84.4 \text{ dB}\mu\text{V/m @3m} \quad [6]$$

For emissions >1 GHz:

G = 1 (Isotropic Gain)
P = 1×10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = 84.4 - 20 \text{ Log} = 82.3 \text{ dB}\mu\text{V/m @3m} \quad [7]$$

DSI Receiver/Agilent Spectrum Analyzer Settings:

RBW: 120kHz @ $f < 1$ GHz, 1MHz @ $f > 1$ GHz
VBW: various
Bandwidth of measurement: 30MHz to 9GHz
Span: various

Input signal characteristics:

CW RF level input of the signal to produce maximum EUT leveled output

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Equipment: iDEN Signal Amplifier

CW Frequencies: 806, 815, 824 MHz

2.4.3. TEST RESULTS:

Complies

2.4.4. MEASUREMENT DATA; 806 – 824 MHz RANGE:

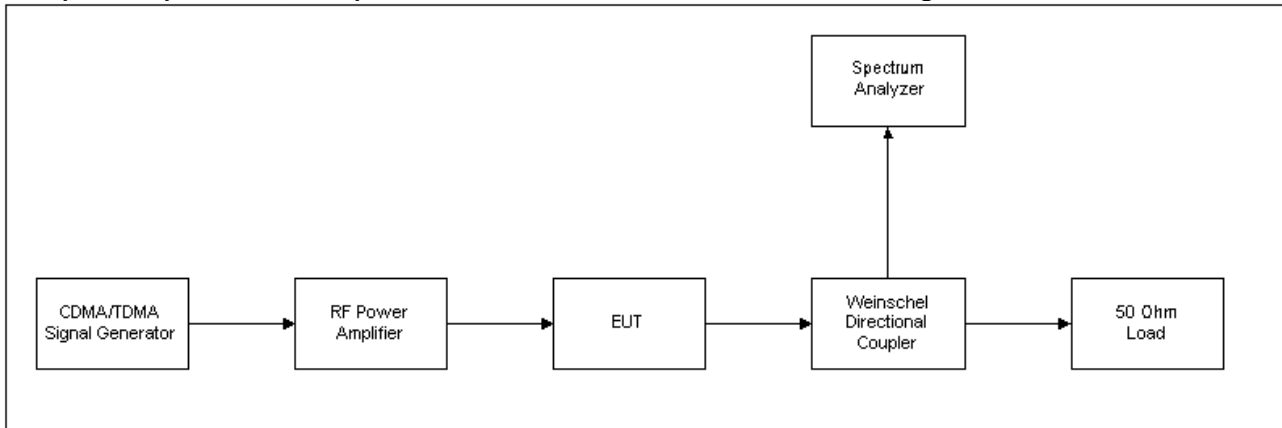
Data was collected using carrier frequencies of 806, 815 and 824 MHz respectively for measurements below 1GHz. Data for measurements taken using a carrier frequency of 815MHz are displayed in following plots. Additional data can be supplied upon request. Measurements above 1GHz are recorded in the following tables, at 806, 815 and 824 MHz respectively. Above frequencies of 1 GHz only harmonic emissions were measurable, all non-harmonic spurious emissions were not measurable, as they were below the noise floor of the instrument. The only signal measurable is the fundamental leakage from the enclosure as shown in the following plots. This is the same desired signal that is intentionally radiated from the antenna normally connected to the unit and thus does not impact system performance and is not considered a radiated spurious emission.

Equipment Under Test is configured as per **Fig 9(c) Test Configuration – Tabletop Equipment Radiated Emissions** in **ANSI C63.4-1992**.

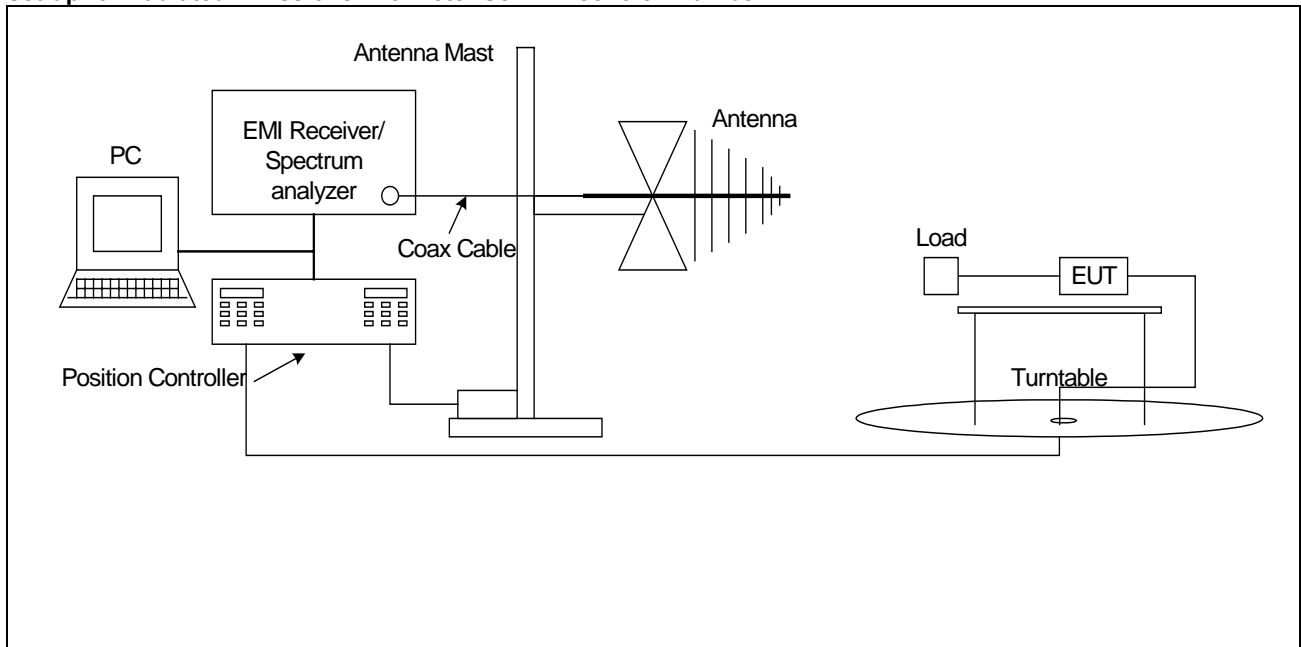
See Annex 4 for Plot Data.

3. APPENDIX A: TEST SET-UP DIAGRAMS

Set-up for Output Power, Occupied Bandwidth and Conducted Emissions Testing



Set-up for Radiated Emissions in 3-meter Semi Anechoic Chamber

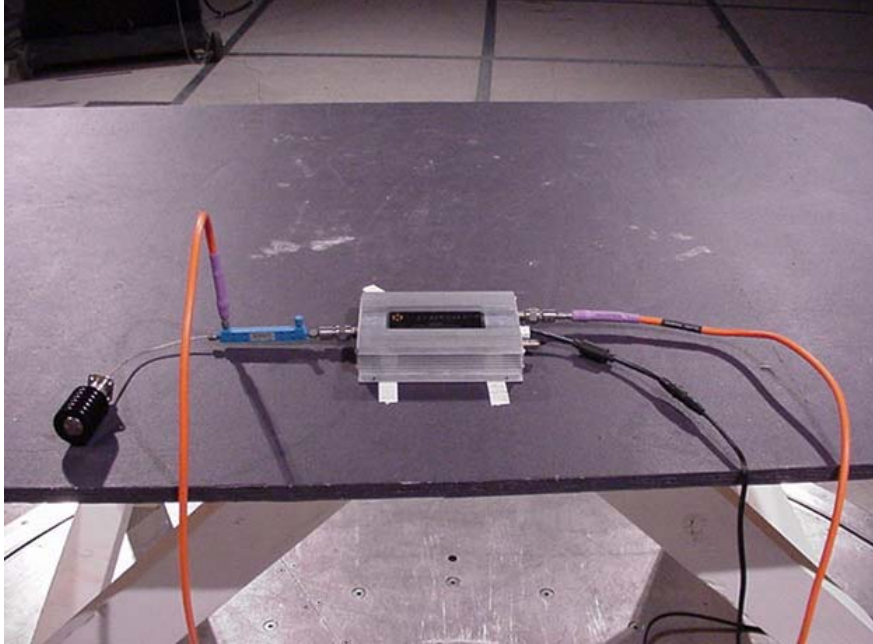


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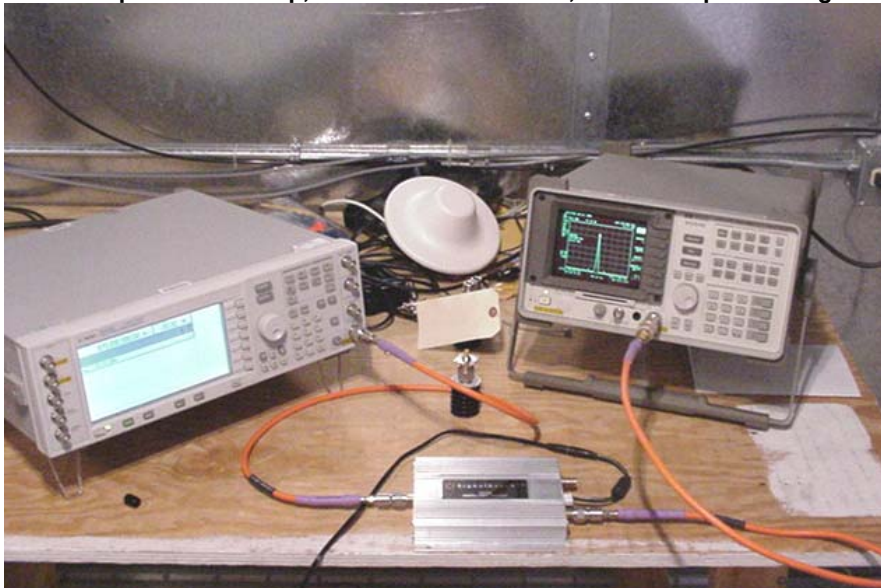
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4. APPENDIX B: PICTURES OF EUT

EUT Set-up in 3-meter Anechoic



EUT Set-up for Bench Top, Conducted Emissions, Power Output Testing.



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