EMC MEASUREMENT REPORT (FCC/IC)

FCC PART 15 SUBPART C & IC RSS-210 ISSUE 7

MANUFACTURER / APPLICANT	SENDUM WIRELESS CORPORATION			
DEVICE UNDER TEST (DUT)	BEACON TRANSMITTER FOR TRACKING OFFENDERS			
DEVICE MODEL(S)	BB300			
DEVICE IDENTIFIER(S)	FCC ID:	TS5-EB300	IC:	6234A-EB300
DUT FREQUENCY BAND	314.21 - 314.36 MHz			
DUT OPERATING FREQUENCY	314.285 MHz			
TRANSMITTER OUTPUT POWER	0 dBm			
TRANSMITTER MODULATION	FSK			
TRANSMITTER DUTY CYCLE	0.06 %			
DUT ANTENNA TYPE	Internal Monopole (Transmit Diversity)			
DUT POWER SOURCE	Alkaline Battery Cell (D-size x2)			
APPLICATION TYPE	FCC/IC Certification			
STANDARD(S) & PROCEDURE(S)	FCC 47 CFR	Part 2		
		Part 15.231(e)		
	Industry Canada	RSS-210 Issue 7		
		RSS-Gen Issue 2		
	ANSI	C63.4-2003		
FCC DEVICE CLASSIFICATION	Part 15 Low Power Communication Device Transmitter (DXX)			
IC DEVICE CLASSIFICATION	Low-power Licence-exempt Radiocommunication Device (Categ. 1)			
DATE(S) OF EVALUATION(S)	November 20, 2009			
TEST REPORT SERIAL NO.	111209TS5-T993-E15F			
TEST REPORT REVISION NO.	Revision 1.0	Initial Release	November 27, 2009	
TEST REPORT SIGNATORIES	Jon Hughes	Test Report Writer	Celltech Labs Inc.	
	Sean Johnston	EMC Lab Manager	Celltech Labs Inc.	
TEST LAB AND LOCATION	Celltech Compliance Testing and Engineering Lab			
	21-364 Lougheed Road, Kelowna, B.C. V1X 7R8 Canada			
TEST LAB CONTACT INFO.	Tel.: 250-765-7650		Fax: 250-765-7645	
	info@celltechlabs.com		www.celltechlabs.com	
TEST LAB ACCREDITATION(S)	ISO/IEC 17025:2005 (A2LA Test Lab Certificate No. 2470.01)			

DECLARATION OF COMPLIANCE
ELECTROMAGNETIC COMPATIBILITY

Test Lab Information	**Name**	**CELLTECH LABS INCORPORATED**
	Address	21-364 Lougheed Road, Kelowna, British Columbia V1X 7R8 Canada
Test Lab Registration No.(s)	**FCC**	714830
	IC	3874A-1
Applicant Information	**Name**	**SENDUM WIRELESS CORPORATION**
	Address	4500 Beedie Street, Burnaby, British Columbia V5J 5L2 Canada
Standard(s) & Procedure(s)	**FCC**	47 CFR Part 2; 15.231(e)
	IC	RSS-210 Issue 7; RSS-Gen Issue 2
	ANSI	C63.4-2003
Device Classification(s)	**FCC**	Part 15 Low Power Communication Device Transmitter (DXX)
	IC	Low-power Licence-exempt Radiocommunication Device (Category 1)
Application Type	**FCC/IC**	New Certification
Device Identifier(s)	**FCC ID:**	TS5-EB300
	IC:	6234A-EB300
Device Under Test (DUT)	Beacon Transmitter for Tracking Offenders	
Device Model(s) Tested	BB300	
Test Sample Serial No.(s)	#2 (O/B and Emissions Tests) - Identical Prototype	
	#5 (Duty Cycle Measurement) - Identical Prototype	
Transmit Frequency Band	314.21 - 314.36 MHz	
Transmit Operating Frequency	314.285 MHz	
Max. RF Output Power Tested	0 dBm	
Modulation Type(s)	FSK	
Max. Transmit Duty Cycle	0.06 % (8.85ms on-time / 14s off-time)	
Antenna Type(s) Tested	Internal Monopole (Transmit Diversity)	
Antenna Gain Specification	-5 dBi	
Power Source(s) Tested	Alkaline Battery (D-size x2)	

This wireless device has demonstrated compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in FCC 47 CFR Rule Part 2 and Rule Part 15.231(e); Industry Canada RSS-210 Issue 7 and RSS-Gen Issue 2; and ANSI C63.4-2003.

I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results and statements contained in this report pertain only to the device(s) evaluated.

This report shall not be reproduced partially or in full without the prior written approval of Celltech Labs Inc.

Test Report Approved By	Sean Johnston	**Sean Johnston**	**Celltech Labs Inc.**

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FIGURES

TEST SUMMARY

Referenced Standard(s):		FCC CFR Title 47 Part 15 Subpart C				
Appendix	**Description of Test**	**Procedure Reference**	**Limit Reference**	**Test Start**	**Test End**	**Result**
A	Transmission Time / Silent period between transmission	ANSI C63.4-2003	15.231(e)	Nov 20	Nov 20	Pass
B	Occupied Bandwidth	ANSI C63.4-2003	15.23(c)	Nov 20	Nov 20	Pass
C	Field Strength of Fundamental	ANSI C63.4-2003	15.231(e)	Nov 20	Nov 20	Pass
C	Field strength of harmonics and spurious	ANSI C63.4-2003	15.231(e)	Nov 20	Nov 20	Pass
Referenced Standard(s):		**Industry Canada RSS-210 Issue 7**				
Appendix	**Description of Test**	**Procedure Reference**	**Limit Reference**	**Test Start**	**Test End**	**Result**
A	Transmission Time / Silent period between transmission	ANSI C63.4-2003	A1.1.5	Nov 20	Nov 20	Pass
B	Occupied Bandwidth	ANSI C63.4-2003	A1.1.3	Nov 20	Nov 20	Pass
C	Field Strength of Fundamental	ANSI C63.4-2003	A1.1.5	Nov 20	Nov 20	Pass
C	Field strength of harmonics and spurious	ANSI C63.4-2003	A1.1.5	Nov 20	Nov 20	Pass

REVISION LOG

Revision	Description	Implemented By	Implementation Date
1.0	Initial Release	Jonathan Hughes	Nov 27, 2009

SIGNATORIES

Prepared By		Reviewed By		Date
	Jonathan Hughes / Report Writer		Sean Johnston / Lab Manager	Nov 27, 2009

1.0 SCOPE

This report outlines the measurements made and results collected during electromagnetic emissions testing of the Sendum Wireless Corporation Model: BB300 Beacon Transmitter for Tracking Offenders. The measurement results were applied against the applicable EMC requirements and limits outlined in the technical rules and regulations set forth in the Federal Communication's Commission Code of Federal Regulations Title 47 Part 15 Subpart C and Industry Canada Radio Standards Specification RSS-210 Issue 7 and RSS-Gen Issue 2.

2.0 REFERENCES

2.1 Normative References

ANSI/ISO 17025:2005	General Requirements for competence of testing and calibration laboratories
IEEE/ANSI C63.4-2003	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CFR Title 47 Part 15C	Code of Federal Regulations Title 47: Telecommunication Part 15C: Intentional Radiators
IC Spectrum Management & Telecommunications Policy	Radio Standards Specification RSS-210 Issue 7 - Low-Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment RSS-Gen Issue 2 - General Requirements and Information for the Certification of Radiocommunication Equipment

3.0 PASS/FAIL CRITERIA

Unless otherwise noted in the Appendices, the pass/fail criteria is the limit set forth in the reference standards. The DUT is considered to have passed the requirements if the data collected during the described measurement procedure is no greater than the specified limits as defined. The pass/fail statements made in this report only apply to the unit tested.

4.0 FACILITIES AND ACCREDITATIONS

The facilities used in collecting the test results outlined in this report are located at 21-364 Lougheed Road, Kelowna, British Columbia, Canada V1X 7R8. The radiated emissions site conforms to the requirements set forth in ANSI C63.4 and is filed and listed with the FCC under Test Firm Registration Number 714830 and Industry Canada under Test Site File Number IC 3874A-1.

5.0 GENERAL INFORMATION

5.1 Applicant Information

Company Name	**SENDUM WIRELESS CORPORATION**
Address	4500 Beedie Street
	Burnaby, BC V5J 5L2
	Canada

5.2 DUT Description

Device Type	Beacon Transmitter for Tracking Offenders	
Device Model(s) Tested	BB300	
Test Sample Serial No.(s)	#2 (O/B and Emissions Tests) - Identical Prototype	
	#5 (Duty Cycle Measurement) - Identical Prototype	
Device Identifier(s)	**FCC ID:**	TS5-EB300
	IC:	6234A-EB300
RF Output Power Tested	0 dBm	
Power Source Tested	Alkaline Battery (D-size x2)	
Antenna Type Tested	Two monopole antennas printed on PCB to provide antenna diversity	
Antenna Gain Specification	-5.0 dBi	

5.3 Mode(s) of Operation Tested

Transmit Frequency Range	314.285 MHz (+/- 75 kHz)
Transmitter Test Frequency	314.285 MHz
Transmitter Test Mode(s)	Test mode #1: Tx set to continuously transmit the modulated signal. RF switched between the two antennas at a rate of 18ms, to allow simultaneous radiated testing of both antennas. Test mode#2: Tx set to transmit at the intended duty cycle of 0.06%, with the on time set to 8.85 ms and the period set to 14.6 s
Modulation Type(s)	FSK

5.4 Modification(s)

None

Appendix A **Transmission Time / Silent Period Between Transmission**

A.1 REFERENCES	
Normative Reference Standard	FCC CFR 47 §15.231(e); IC RSS-210 Issue 7
Procedure Reference	ANSI C63.4:2003

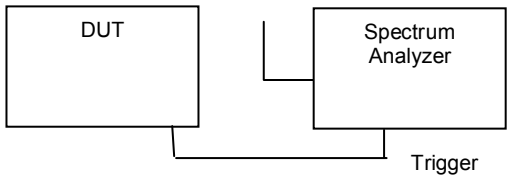
A.2 LIMITS	
§15.231(e) IC RSS-210 A1.1.5	Devices operated under the provisions of this section shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than 1 second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

A.3 ENVIRONMENTAL CONDITIONS	
Temperature	25 +/- 5 ºC
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

ASSET NUMBER	MANUFACTURER	MODEL	DESCRIPTION	CAL DUE
00015	Agilent	E4408B	Spectrum Analyzer	23Apr10

A.4 SETUP DRAWING

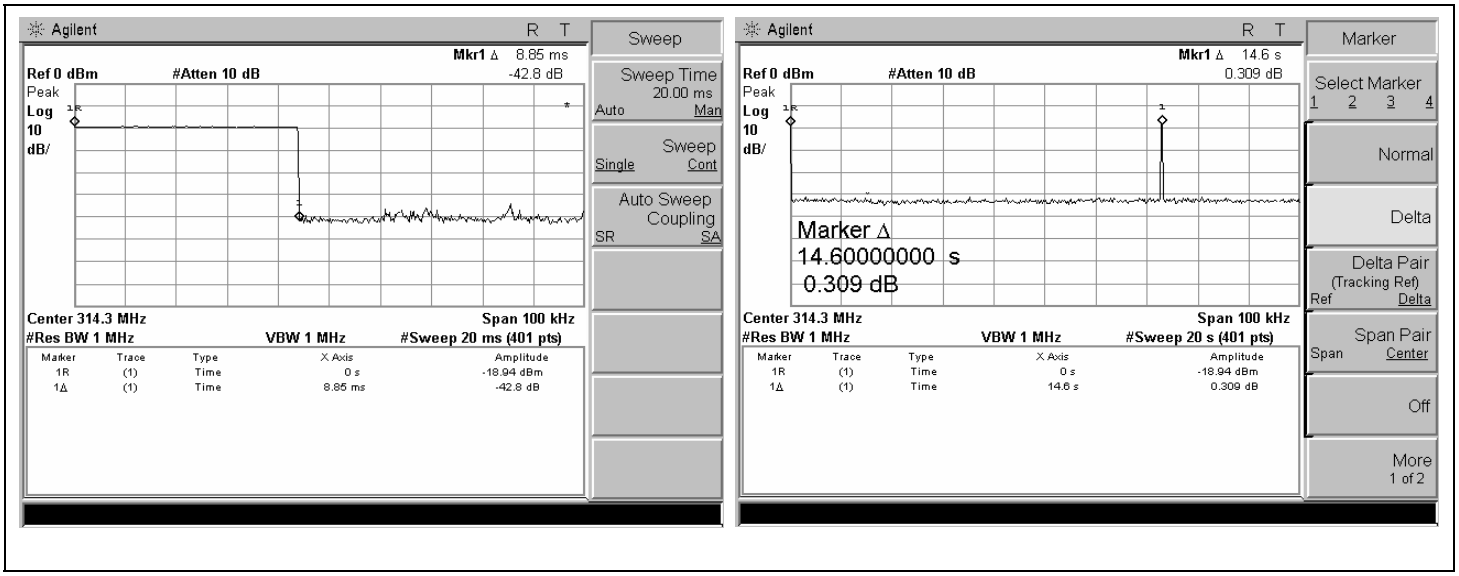
Figure A.4 -1 - Setup Drawing – Transmission Time / Silent Period Between Transmission



Test Procedure:

1) Couple the final radio frequency output signal to the input of a spectrum analyzer. This can be performed by a radiated, direct connect or a “near-field” coupling method. The signal received must be of sufficient level to adequately trigger the spectrum analyzer swept display.
2) Adjust the center frequency of the spectrum analyzer to the center of the RF signal.
3) Set the spectrum analyzer for ZERO SPAN.
4) Determine the total “on time” for one pulse train.
5) Determine the total period.

Test Results:



Carrier Frequency (MHz)	Transmission Time (msec)	Limit (msec)	Result
314.285	8.85	1000	Pass
Carrier Frequency (MHz)	**Silent period between Transmission (sec)**	**Limit (sec)**	**Result**
314.285	14.6	10	Pass

Duty Cycle: (8.85/1000)/14.6 x 100% = 0.06%

Appendix B **Occupied Bandwidth**

B.1 REFERENCES

Normative Reference Standard	FCC CFR 47 §15.231(c); IC RSS-210
Procedure Reference	ANSI C63.4

B.2 LIMITS

§15.231(c) IC RSS-210 A1.1.3	The bandwidth of the emission shall be no wider that 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier. For the purpose of Section A1.1, the 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70-900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

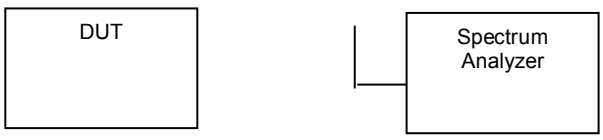
B.3 ENVIRONMENTAL CONDITIONS

Temperature	25 +/- 5 ºC
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

ASSET NUMBER	MANUFACTURER	MODEL	DESCRIPTION	CAL DUE
00015	Agilent	E4408B	Spectrum Analyzer	23Apr10

B.4 SETUP DRAWING

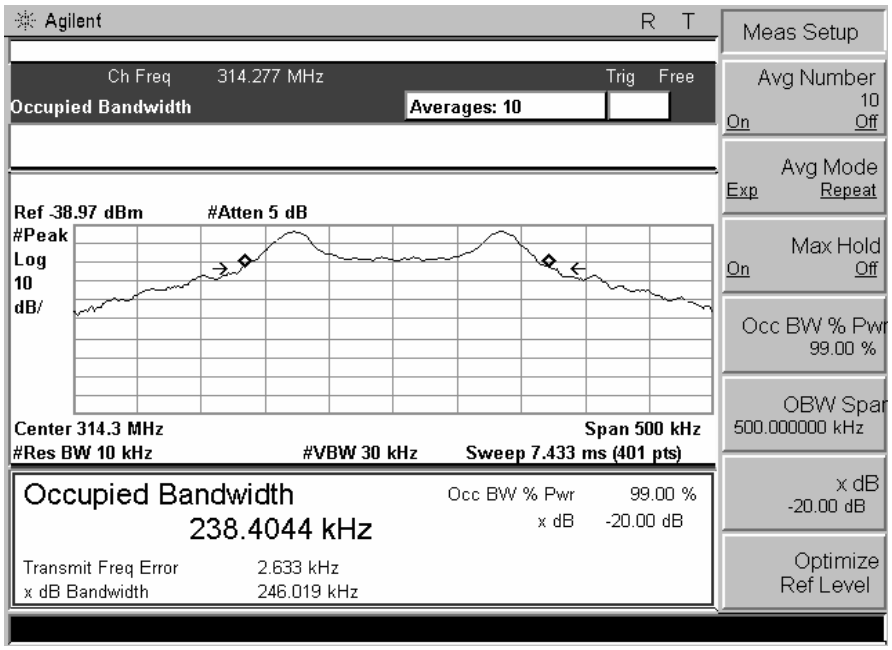
Figure B.4-1 - Setup Drawing – Occupied Bandwidth



Test Procedure:

1) The span range for the SA display shall be between two times and five times the OBW.
2) The nominal IF filter bandwidth (3 dB RBW) is should be approximately 1 percent to 5 percent of the OBW, unless otherwise specified, depending on the applicable requirement.
3) The dynamic range of the SA at the selected RBW is more than 10 dB below the target "dB down" (attenuation) requirement, i.e., if the requirement calls for measuring the -20 dB OBW, the SA noise floor at the selected RBW should be at least 30 dB below the largest measured value on the display.
4) Supply the DUT voltage, or install a new or fully charged battery in the DUT. Turn the DUT on and set it to any convenient frequency within its operating range. Set a reference level on the measuring instrument at any location that will allow measuring the specified bandwidth.
5) Supply the DUT with modulation
6) Perform occupied bandwidth measurement function on the E4408B spectrum analyzer.

Test Results:



Carrier Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result	Remark
314.285	238.4	785.7	Pass	99% Occupied bandwidth
Carrier Frequency (MHz)	**Emission Bandwidth (kHz)**	**Limit (kHz)**	**Result**	**Remark**
314.285	246.0	785.7	Pass	The point 20dB down from the modulated carrier

Note: Limit = Fundamental frequency x 0.25% = 314.285 x 0.25% = 785.7 kHz

Appendix C **Field Strength of the Fundamental and Spurious Emissions**

C.1 REFERENCES

Normative Reference Standard	FCC CFR 47 §15.231(e); §15.209; IC RSS-210
Procedure Reference	ANSI C63.4:2003

C.2 LIMITS

§15.231(e)
IC RSS-210
A1.1.5

TX Emission Limits (FCC §15.231(e))

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emission (microvolts/meter)
40.66–40.70	1,000	100
70–130	500	50
130–174	500 to 1,500[1]	50 to 150[1]
174–260	1,500	150
260–470	1,500 to 5,000[1]	150 to 500[1]
Above 470	5,000	500
[1]Linear interpolations		

C.3 ENVIRONMENTAL CONDITIONS

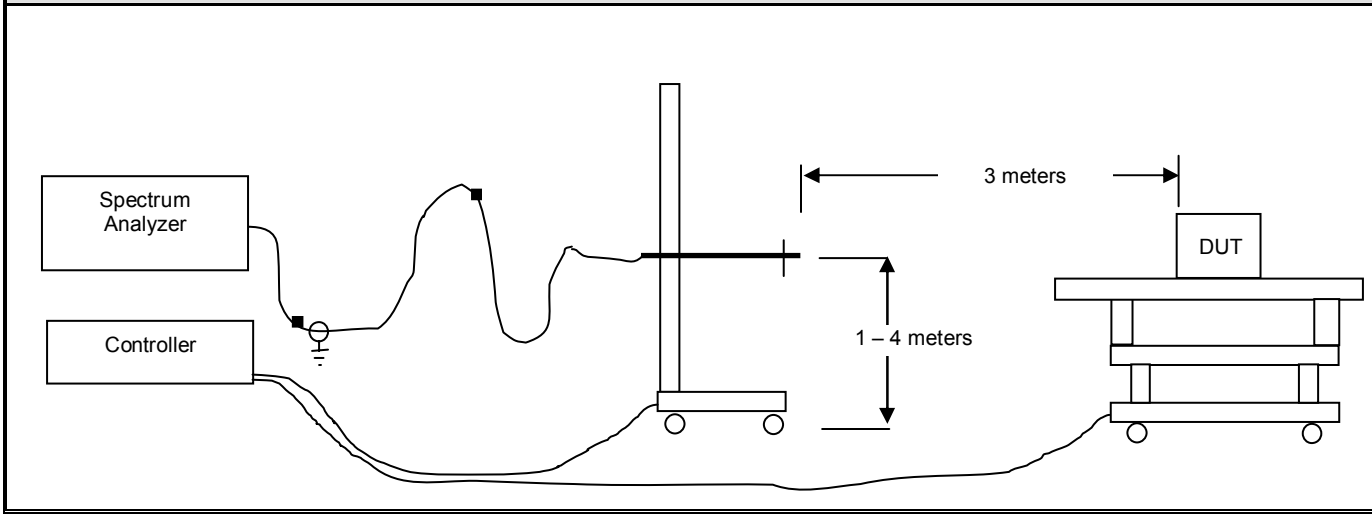
Temperature	25 +/- 5 ºC
Humidity	40 +/- 10 %
Barometric Pressure	101 +/- 3 kPa

C.4 EQUIPMENT LIST

ASSET NUMBER	MANUFACTURER	MODEL	DESCRIPTION	CAL DUE
00051	HP	8566B	Spectrum Analyzer RF Section	09Apr10
00049	HP	85650A	Quasi-peak Adapter	09Apr10
00047	HP	85685A	RF Preselector	09Apr10
00072	EMCO	2075	Mini-mast	n/a
00073	EMCO	2080	Turn Table	n/a
00071	EMCO	2090	Multi-Device Controller	n/a
00030	HP	83017A	Microwave system amplifier	n/a
00015	Agilent	E4408B	Spectrum Analyzer	23Apr10
00050	Chase	CBL-6111A	Bilog Antenna	15Mar10
00055	EMCO	3121C	Dipole Antenna	04Apr10
00034	ETS	3115	Double Ridged Guide Horn	03Apr10

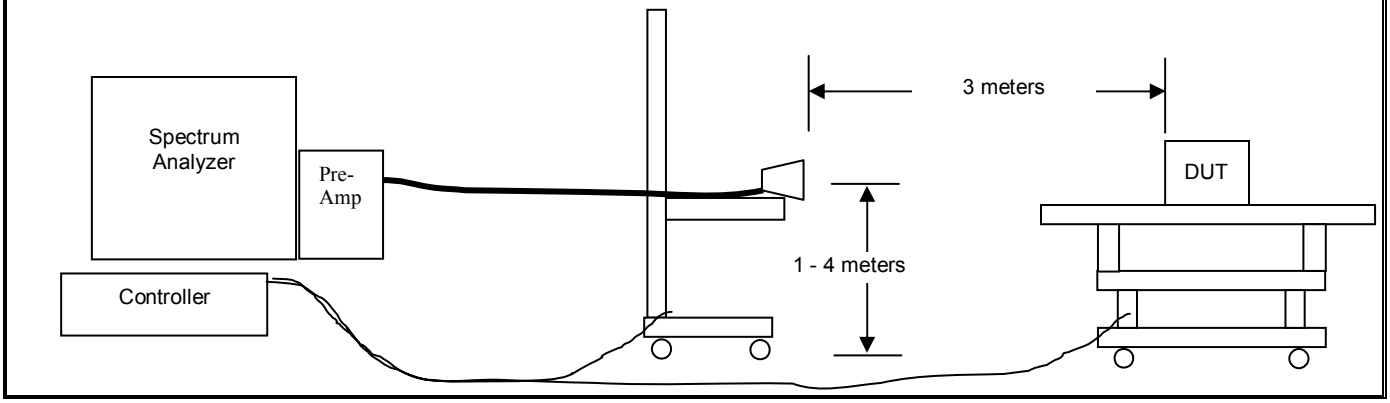
C.5 SETUP DRAWING

Figure C.5-1 - Setup Drawing – Field Strength of the Fundamental



C.6 SETUP DRAWING

Figure C.6-1 - Setup Drawing – Radiated TX Spurious Emissions



Procedure for determining the average value of pulsed emissions (ANSI C63.4:2003)

When the average value of the pulsed emissions from an DUT must be determined, the average can be found by measuring the peak pulse amplitude and determining the duty cycle correction factor of the pulse modulation. The duty cycle correction factor δ may be expressed in terms of dB as

δ (dB) = 20log(δ)

This correction factor can then be applied to the peak pulse amplitude to find the average. This correction is applied for all emissions including the fundamental and harmonics. The duty cycle correction is determined as follows:

a) Couple the final radio frequency output signal to the input of a spectrum analyzer. This can be performed by a radiated, direct connect or a “near-field” coupling method. The signal received must be of sufficient level to adequately trigger the spectrum analyzer swept display.
b) Adjust the center frequency of the spectrum analyzer to the center of the RF signal
c) Set the spectrum analyzer for ZERO SPAN
d) Adjust the SWEEP TIME to obtain at least a 100 ms period of time on the horizontal display axis of the spectrum analyzer.
e) Set the TRIGGER on the spectrum analyzer to capture the greatest amount of “on time” for pulse train length less than 100 ms, or the greatest amount of “on time” in 100 ms for pulse train length greater than 100 ms.
f) Determine the total “on time” for one pulse train (or 100 ms).
g) The duty cycle correction factor is the total “on time” divided by the period of the pulse train (or 100 ms)

Test Results:
Tp = 14.6 s therefore Tp = 100ms
Ton = 8.85 ms
δ (dB) = 20 Log(8.85/100) = -21.1 dB

Test Procedure: As described in ANSI C63.4:2003

Test Results:

Fundamental										
Frequency [MHz]	Antenna Pol. V/H	DUT Orientation	E-Field [dBuV]	δ (dB) [dB]	Corrected E-Field [dBuV]	Limit [dBuV]	Limit Peak [dBuV]	Margin [dB]	Margin Peak [dB]	Result
314.5	V	X	80.30	-21.1	59.2	67.6	87.6	8.4	7.3	Pass
314.5	H	X	78.90	-21.1	57.8	67.6	87.6	9.8	8.7	Pass
314.5	V	Y	75.10	-21.1	54.0	67.6	87.6	13.6	12.5	Pass
314.5	H	Y	87.30	-21.1	66.2	67.6	87.6	1.4	0.3	Pass
314.5	V	Z	85.70	-21.1	64.6	67.6	87.6	3.0	1.9	Pass
314.5	H	Z	85.60	-21.1	64.5	67.6	87.6	3.1	2.0	Pass
Spurious Emissions										
628.6	V	X	30.2	-21.1	9.1	47.6	67.6	38.5	37.4	Pass
628.6	H	Y	37.7	-21.1	16.6	47.6	67.6	31.0	29.9	Pass
942.9	V	X	41.0	-21.1	19.9	47.6	67.6	27.7	26.6	Pass
942.9	H	Y	42.0	-21.1	20.9	47.6	67.6	26.7	25.6	Pass
1257	V	X	nf	-21.1	--	47.6	67.6	--	--	Pass
1257	H	Y	nf	-21.1	--	47.6	67.6	--	--	Pass
*1572	V	X	47.5	-21.1	26.4	47.6	67.6	21.2	20.1	Pass
*1572	H	Y	46.5	-21.1	25.4	47.6	67.6	22.2	21.1	Pass
1886	V	X	nf	-21.1	--	47.6	67.6	--	--	Pass
1886	H	Y	nf	-21.1	--	47.6	67.6	--	--	Pass
*2200	V	X	46.4	-21.1	25.3	47.6	67.6	22.3	21.2	Pass
*2200	H	Y	46.4	-21.1	25.3	47.6	67.6	22.3	21.2	Pass
2514	V	X	nf	-21.1	--	47.6	67.6	--	--	Pass
2514	H	Y	nf	-21.1	--	47.6	67.6	--	--	Pass
*2828	V	X	42.9	-21.1	21.8	47.6	67.6	25.8	24.7	Pass
*2828	H	Y	44.5	-21.1	23.4	47.6	67.6	24.2	23.1	Pass
3143	V	X	42.3	-21.1	21.2	47.6	67.6	26.4	25.3	Pass
3143	H	Y	45.4	-21.1	24.3	47.6	67.6	23.3	22.2	Pass

Remarks:

1) E-Field = Antenna Factor + Cable Loss + Meter Reading – Amp Gain
2) Peak Limit = Average Limit + 20dB
3) All DUT Orientations investigate, only highest reported for spurious emissions.
4) nf indicates emission not detectable above noise floor.
5) Remark "*" means restricted band
6) All emissions in the 30-1000 MHz band were investigated with only spurious emissions frequencies being detectable above the noise floor.
7) DUT orientations: x = Vertical, Y = Side, Z=Side rotated 90º

Example Calculations:

Margin Calculation: Margin = Limit – (Corrected E-Field)
Example Calculation of the Limit @ Low Channel 314.285MHz
260-470 MHz: FS (microvolts/m) = (16.6667 x 314.285) - 2833.3333 = 2404.76
Limit (dBuV) = 20 Log(2404.55) = 67.6 dBuV

END OF DOCUMENT