Intertek ETL SEMKO

TEST REPORT

Report Number: 3050037-43-01
Project Number: 3050037
December 17, 2003

Testing performed on the
Base Station Tranceiver
Model Number: BTS4000
FCCID: MZKBTS4000-1900
to

FCC Part 24 Subpart E
RSS-133

For
Airnet Communications Corporation

Test Performed by:	Test Authorized by:
Intertek 1950 Evergreen Blvd, Suite 100 Duluth, GA 30096	Airnet Communications Corporation 3950 Dow Road Melbourne, Florida 32934

Prepared by: _____ Date: DECEMBER 18, 2003
Jeffrey D. Hiday, Senior Project Engineer - EMC

Reviewed by: _____ Date: 12/18/03
David J. Schramm, Team Leader - EMC

TABLE OF CONTENTS

Executive Summary

Testing performed for: Airnet Communications Corporation

Equipment Under Test: BTS4000, Base Station Tranceiver

FCC RULE	IC RULE RSS-133	DESCRIPTION OF TEST	RESULT	PAGE
§2.1046	§5.4, §6.2	RF Power Output	Passed	10
§2.1049	§5.6	Emission Limitation, Occupied Bandwidth	Passed	11
§2.1051 §24.238(a)	§6.3	Out of Band Emissions at Antenna Terminals	Passed	15
§2.1053	§6.3	Field Strength of Spurious Radiation	Passed	19
§15.107	ICES-003	Power Line Conducted Emissions	Passed	23
§2.1055, §24.235	§7	Frequency Stability		25
§2.1091, §2.1093	§8	Specific Absorption Rate	N/S	See Note [1]
§15.109	§9	Receiver Spurious Emissions	Passed	27

N/S: This test was not under scope of this evaluation

[1] Specific Absorption Rate testing was not under the scope of this evaluation.

1 JOB DESCRIPTION

1.1 Client information

The Base Station Tranceiver has been tested at the request of

Company:	Airnet Communications Corporation 3950 Dow Road Melbourne, Florida 32934
Name of contact:	Joe McAllister
Telephone:	321.676.6700
Fax:	321.757.0624

1.2 Test plan reference:

Tests were performed to the following standards:

- FCC Part 24 Subpart E rules for an intentional radiator
- RSS-133 2 GHz Personal Communications Services

1.3 Equipment Under Test (EUT)

Product	**Base Station Tranceiver**
EUT Model Number	BTS4000
EUT Serial Number	Indoor ENG#1, Outdoor ENG#2
Whether quantity (>1) production is planned	Quantity production is planned.
Cellular Phone standards	GSM (PCS)
Type(s) of Emission	250KGXW
RF Output Power	2 dBm
Frequency Range	1930 - 1990 CDMA (PCS)
Receiver L.O. frequency	2047.4 MHz at channel 810
External input	[ ] Audio [X] Digital Data

EUT receive date: December 8, 2003

EUT receive condition: The EUT was received in good condition with no apparent damage.

Test start date: December 9, 2003

Test completion date: December 11, 2003

The test results in this report pertain only to the item tested.

The EUT is a GSM base station operating in the PCS band.

1.3.1 System Support Equipment

Table 1-1 contains the details of the support equipment associated with the Equipment Under Test.

Table 1-1: System Support Equipment

Description	Manufacturer	Model Number	Serial Number	FCC ID number
DC Supply	HP	HP 6683A	3619A-00205	NA
RF Terminator	JFW	50FH-030-300-2	AN27	NA
RF Terminator	JFW	50FH-030-300-2	AN28	NA
RF Terminator	JFW	50FH-030-300-2	AN28	NA
RF Terminator	JFW	50T-069-2	01061	NA
Support PC	Dell	Dimension XPS	03378	NA
GPS Receiver	Airnet	05483-001 A0	AN0340GPS0011	NA
Amplifier 1	JRC	NAH-1961	K000398	CKE JHU-1961
Amplifier 2	JRC	NAH-1961	K000399	CKE JHU-1961
Amplifier 3	JRC	NAH-1961	K000400	CKE JHU-1961
Amplifier 4	JRC	NAH-1961	K000492	CKE JHU-1961

1.3.2 Cables associated with EUT

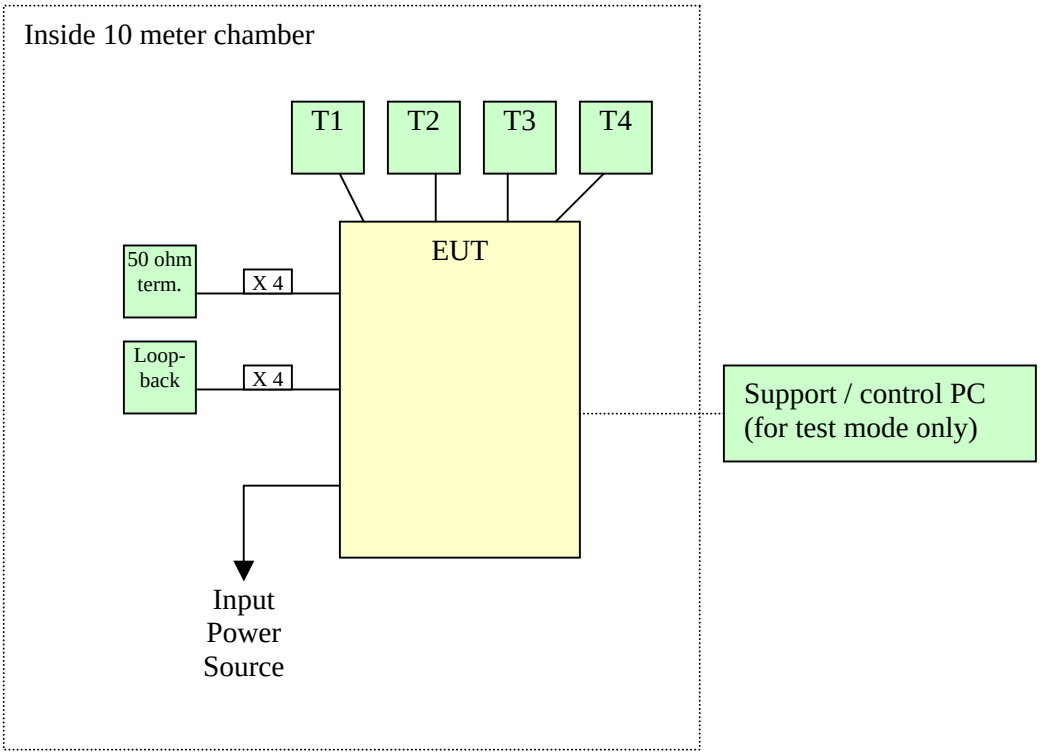
Table 1-2 contains the details of the cables associated with the EUT.

Table 1-2: Interconnecting cables between modules of EUT

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
DC Power (Indoor configuration)	25’	None	None	EUT	DC supply
AC Power (Outdoor configuration)	25’	None	None	EUT	AC power source
Sector A TX/RX1	12’	Coax	None	EUT	T1
Sector B TX/RX1	12’	Coax	None	EUT	T2
Sector C TX/RX1	12’	Coax	None	EUT	T3
Sector D TX/RX1	12’	Coax	None	EUT	T4
Sector A RX1	12’	Coax	None	EUT	50 ohm termination
Sector B RX2	12’	Coax	None	EUT	50 ohm termination
Sector C RX3	12’	Coax	None	EUT	50 ohm termination
Sector D RX4	12’	Coax	None	EUT	50 ohm termination
T1/E1 A	25’	None	None	EUT	Loopback
T1/E1 B	25’	None	None	EUT	Loopback
TMA Power	25’	None	None	EUT	Loopback
Alarm	25’	None	None	EUT	Loopback

1.3.3 System Block Diagram

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.



1.3.4 Mode(s) of operation

The EUT was powered from 208 Vac / 60 Hz / 2 phase for outdoor unit and 27 Vdc for the indoor unit..

1.4 Modifications required for compliance

No modifications were implemented by Intertek.

1.5 Related Submittal(s) Grants

A similar product was previously granted under FCCID: MZKBPU3000-1900.

2 TEST FACILITY

The ITS-Duluth site is located at 1950 Evergreen Blvd., Suite 100, Duluth, Georgia. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

This site is on file with the FCC.

The Industry Canada file number for this site is IC 2077.

3 RF POWER OUTPUT

CFR 47 §2.1046

RSS-133 §6.2

3.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the power meter reading.

Tests were performed at three frequencies (low, middle, and high channels) and on all power levels, which can be setup on the transmitters.

The spectrum analyzer bandwidth settings were set to 1 MHz or greater.

3.2 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
Spectrum Analyzer	HP	8595E	3249A00243	12/2/04
Atennuator	Weinschel Corp	48-40-34	BK5886	07/03/2004

3.3 Test Results

Table 3-1 RF Power Output

EUT Mode	Frequency MHz	Channel	Measured Power dBm
GSM PCS	1930.20	512	1.1
GSM PCS	1960.00	661	2.0
GSM PCS	1989.80	810	0.3

4 EMISSION LIMITATIONS, OCCUPIED BANDWIDTH

CFR 47 §2.1049, RSS-133 §5.6

4.1 Test Procedure

The transmitter was connected to a spectrum analyzer. The 99% bandwidth function of the spectrum analyzer was used to measure occupied bandwidth.

4.2 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
Spectrum analyzer	HP	8593E	3249A00243	12/2/2004

4.3 Test Results

EUT Mode	Frequency MHz	Channel	Occupied Bandwidth kHz
GSM PCS	1930.40	512	240
GSM PCS	1960.00	661	243
GSM PCS	1989.60	810	243

Figure 4-1: 99% Bandwidth measurement, Channel 512

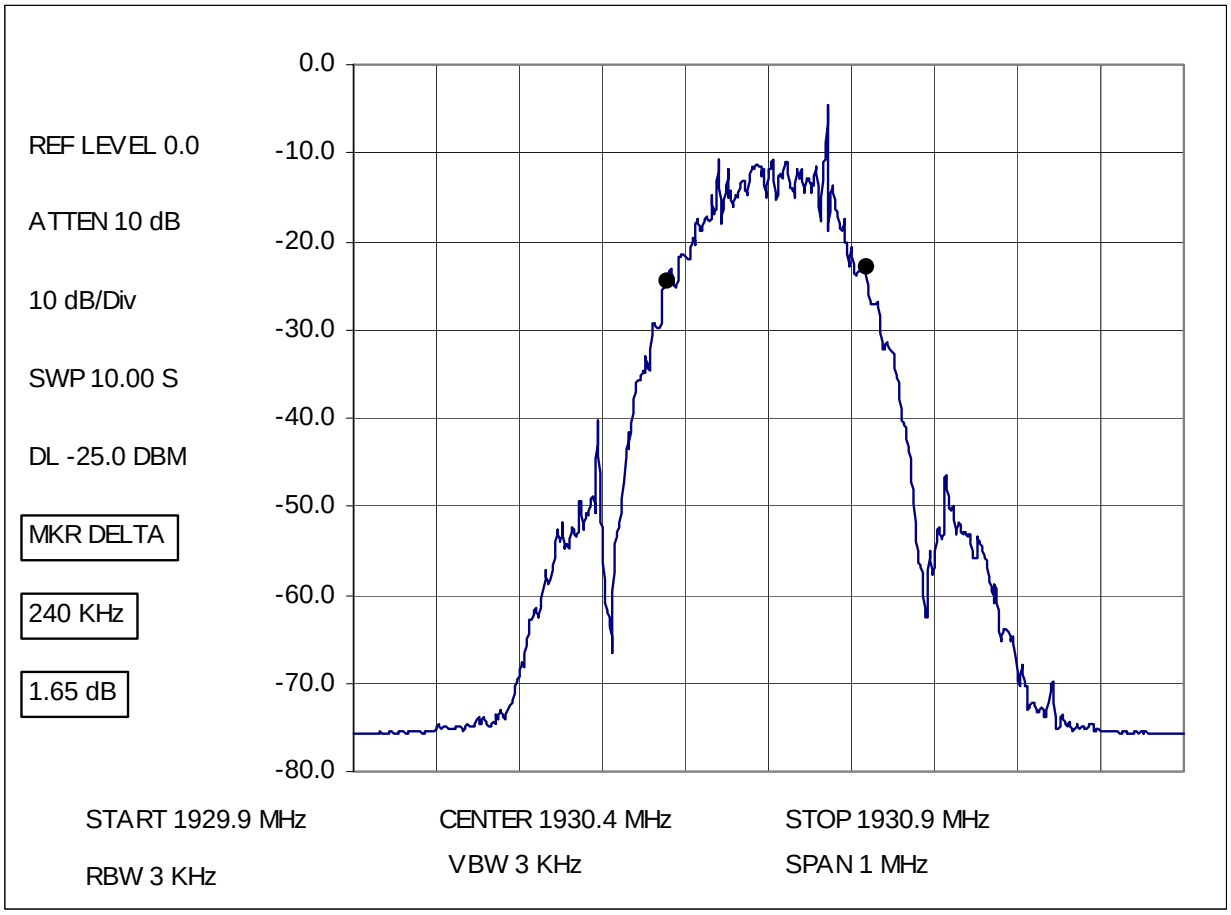


Figure 4-2: 99% Bandwidth measurement, Channel 661

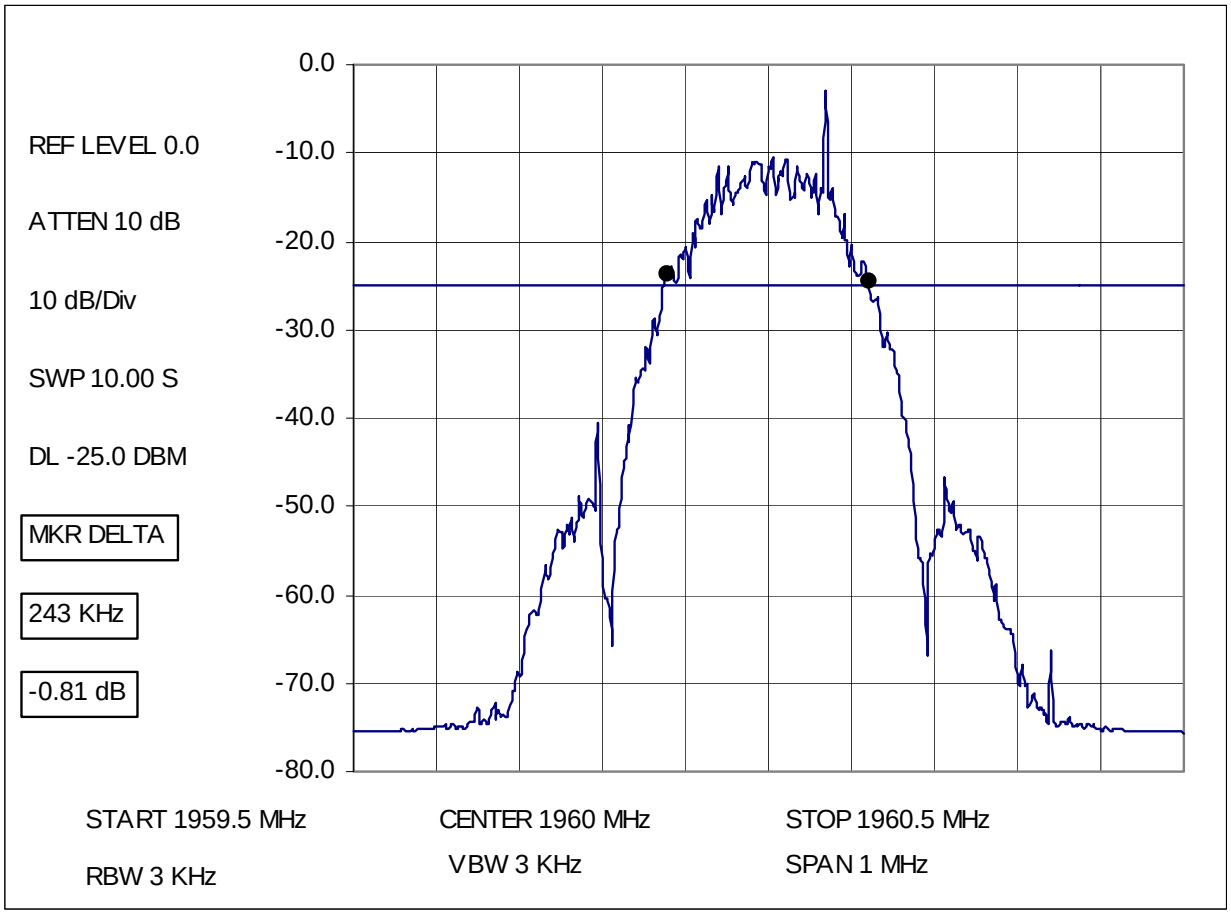
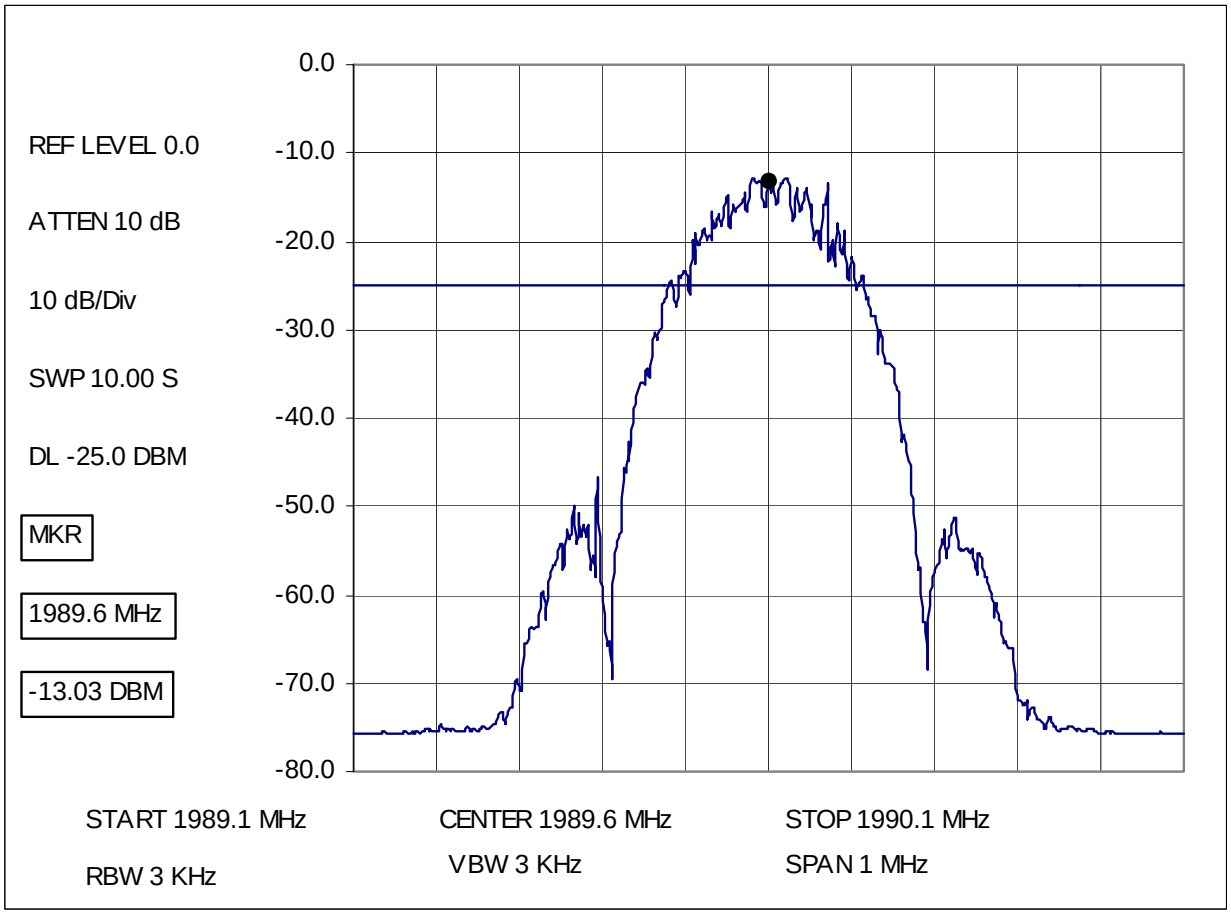


Figure 4-3: 99% Bandwidth measurement, Channel 810



5 OUT OF BAND EMISSION AT ANTENNA TERMINALS

CFR 47 §2.1047, 24.238(a) and RSS-133

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

5.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set to 1 MHz (or to 1% of the bandwidth in the 1MHz bands adjacent to the band edges). Sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

If the transceiver can transmit simultaneously on multiple channels, an intermodulation test must also be performed. Two carriers are brought up at maximum power at the low end of the band and one is brought up at the maximum power at the high end of the band. Sweeps were taken to show there are no intermodulation products outside the band. Inside the band, the bandwidth settings were 3 kHz. Outside the band, the bandwidth settings were 1 MHz.

5.2 Test Eqiupment

Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
Spectrum analyzer	HP	7405	US40240235	11/12/2004

5.3 Test Results

Table 5-1: Summary of test result locations

Location	Mode (Band)	Channel	Description
	GSM 1900	512	Conducted spurious emissions, 30MHz to 20 GHz
	GSM 1900	661	Conducted spurious emissions, 30MHz to 20 GHz
	GSM 1900	810	Conducted spurious emissions, 30MHz to 20 GHz
	GSM 1900	512	Emissions within 1 MHz of band edge
	GSM 1900	810	Emissions within 1 MHz of band edge

Figure 5-1: Out of band emissions at antenna terminals, Channel 513

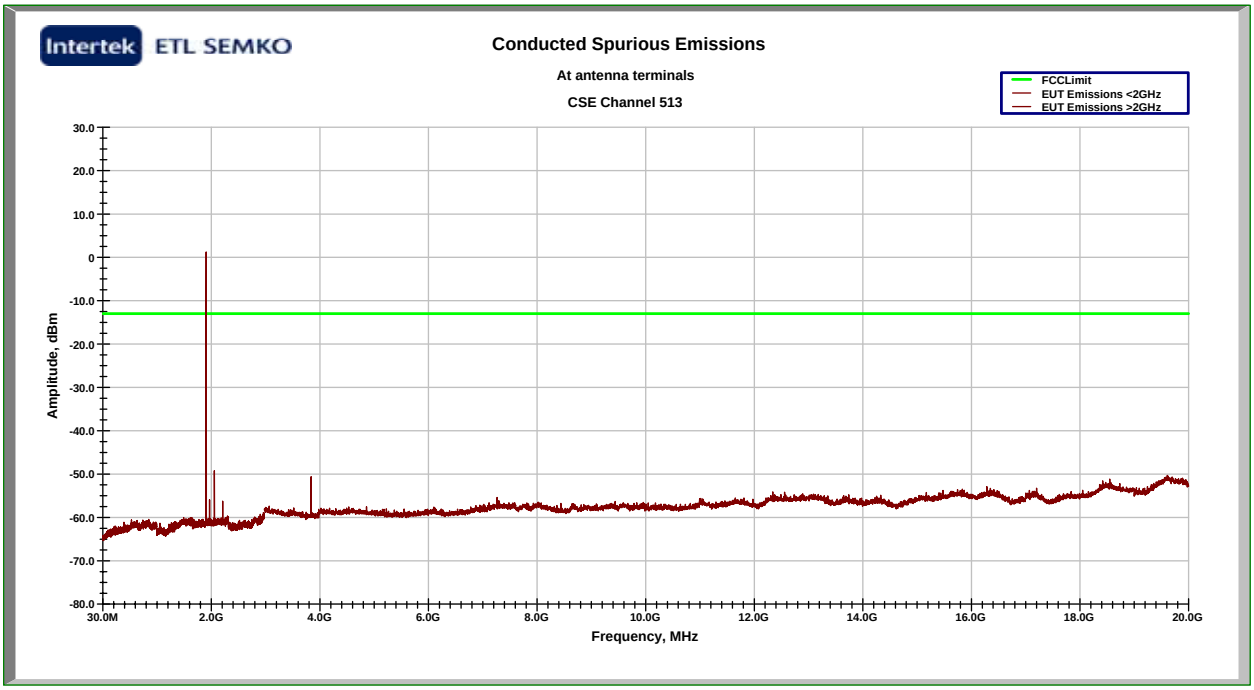


Figure 5-2: Out of band emissions at antenna terminals, Channel 661

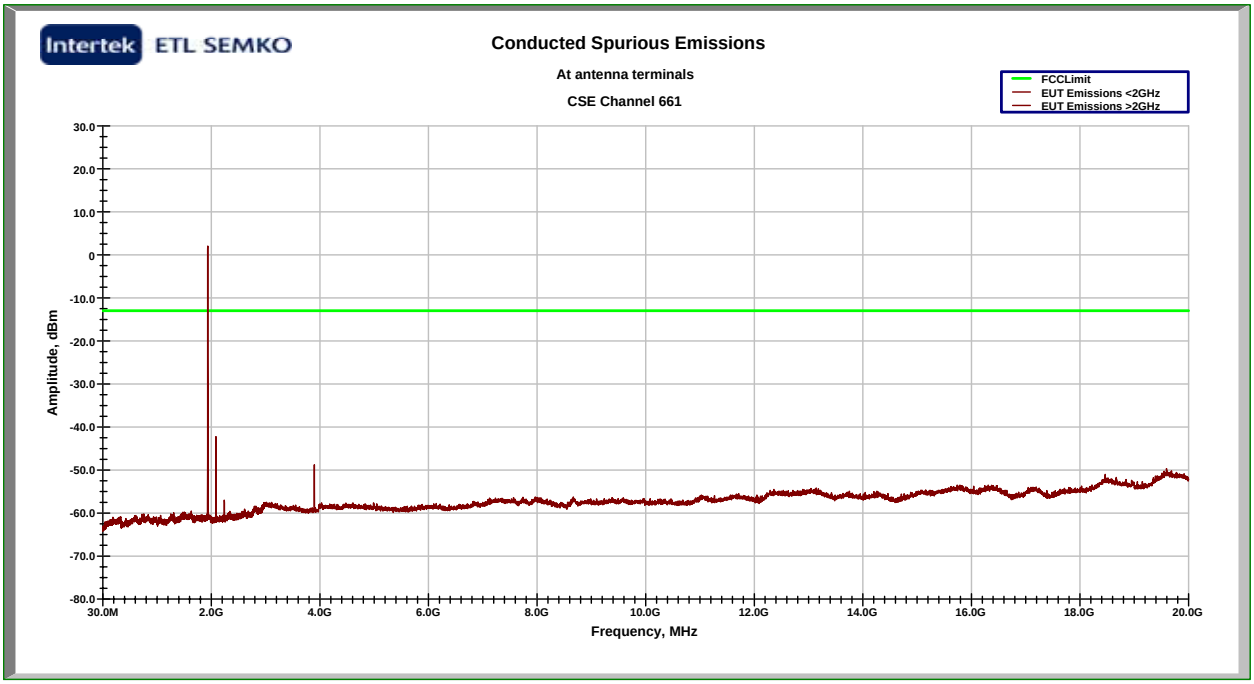


Figure 5-3: Out of band emissions at antenna terminals, Channel 809

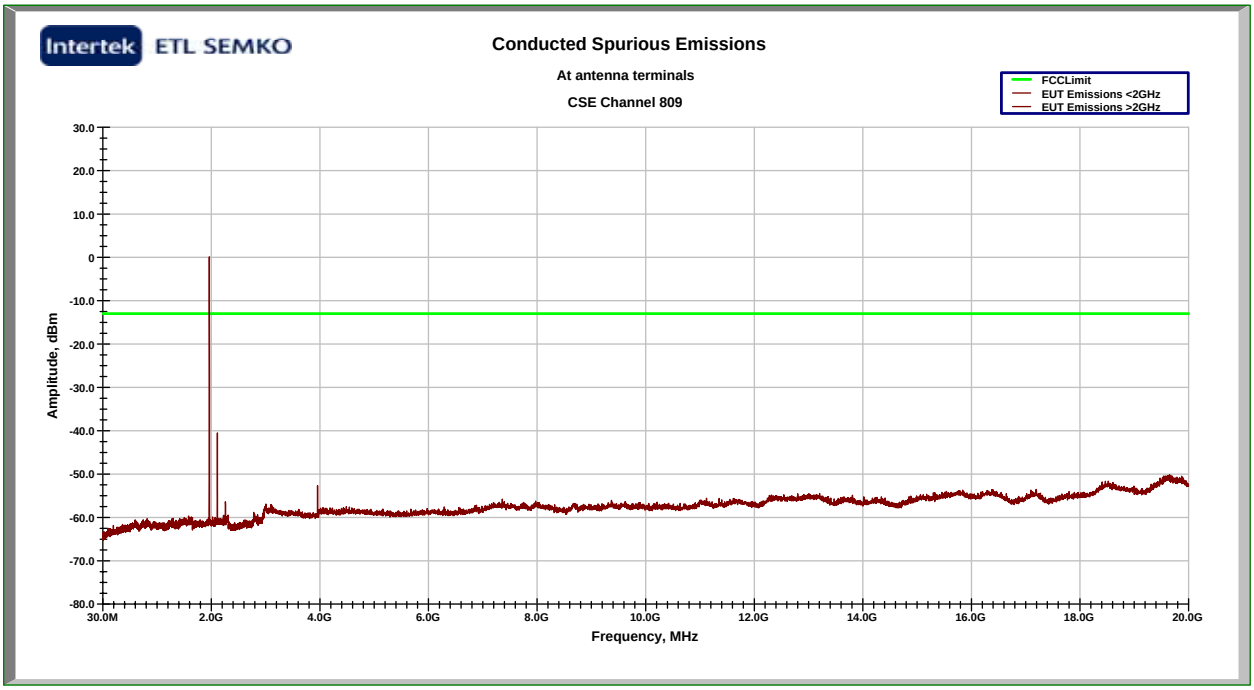


Figure 5-4: Emissions within 1 MHz of Bandedge, Channel 512

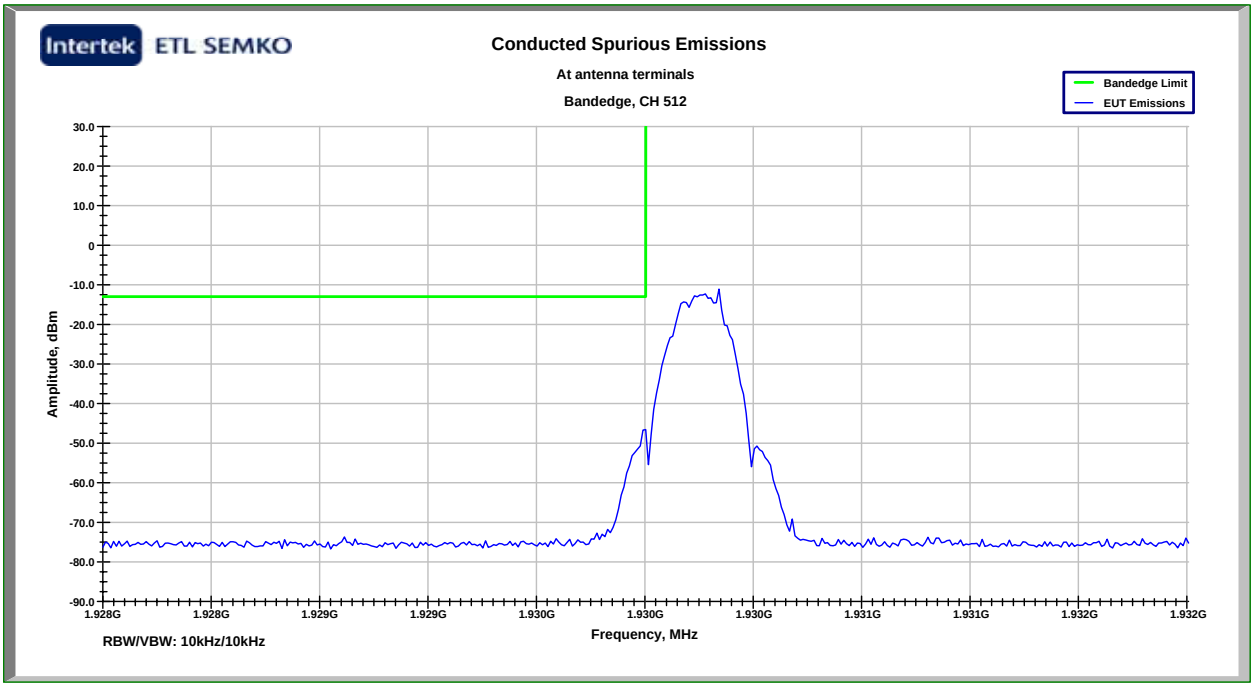


Figure 5-5: Emissions within 1 MHz of Bandedge, Channel 810

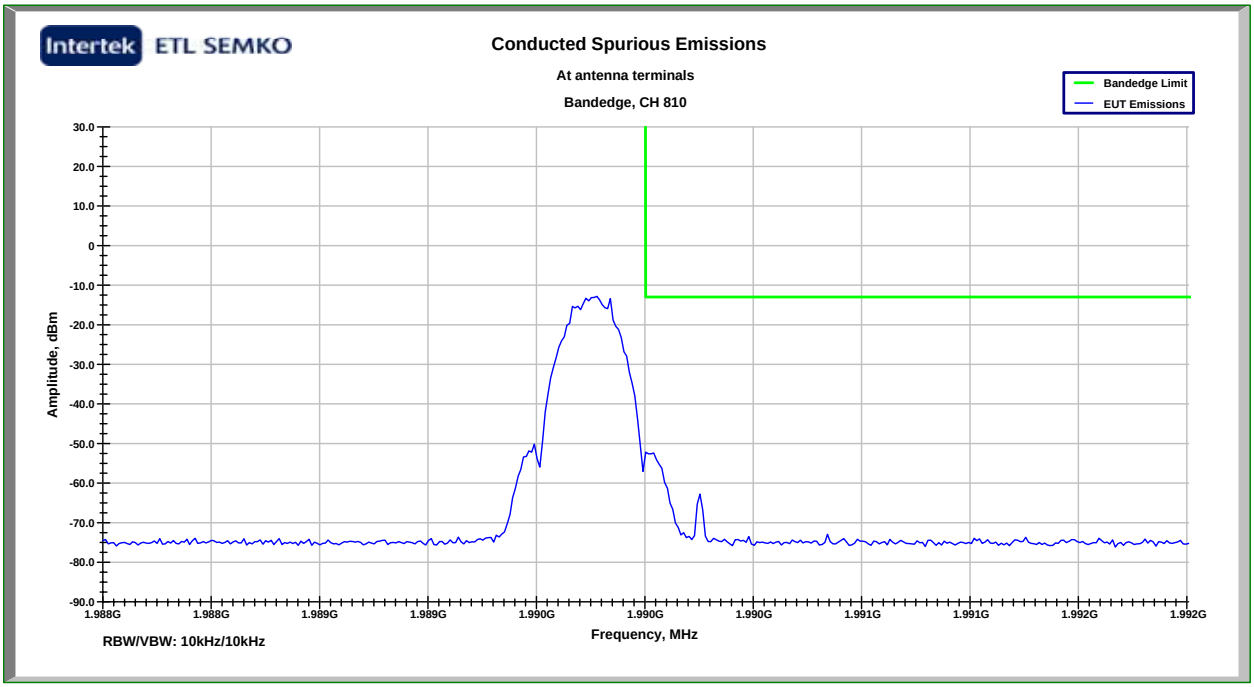
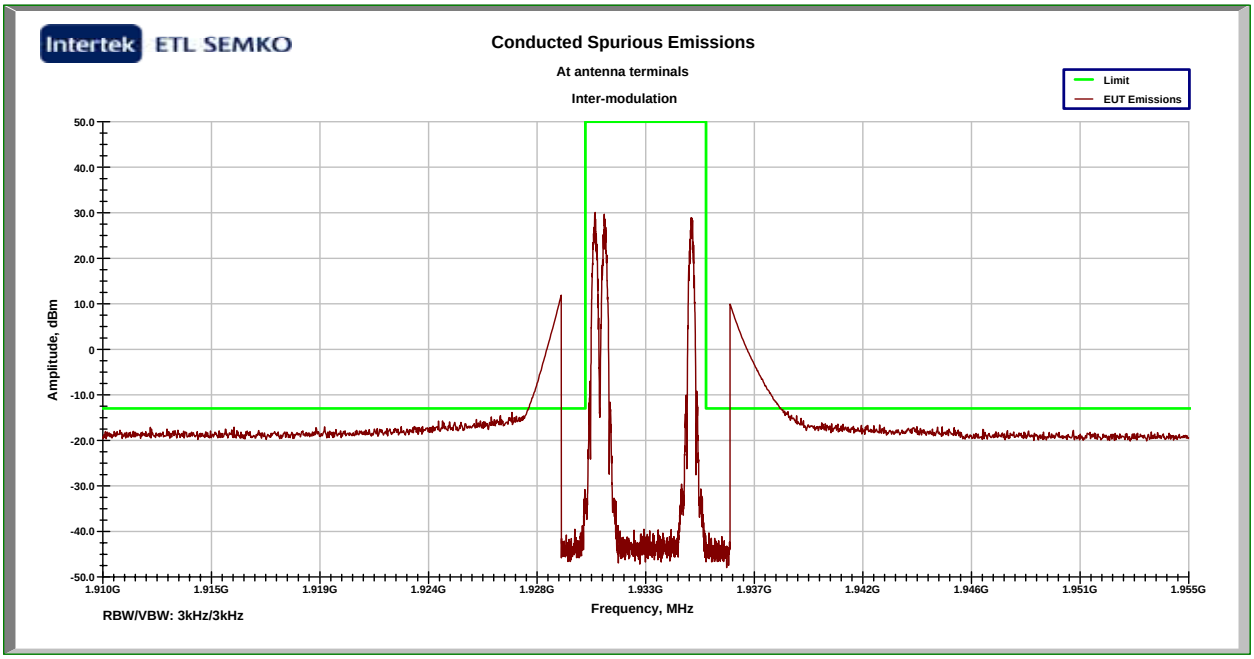


Figure 5-6: Intermodulation plot



6 FIELD STRENGTH OF SPURIOUS RADIATION

CFR 47 §2.1053

6.1 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The EUT set to operate at maximum power; was connected through a certified amplifier; and was terminated into a non-radiating coaxial load.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequencies (low, middle, and high channels). Once spurious emissions were identified and within 20 dB of the limit, the power of the emission was determined using the substitution method.

6.2 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
Spectrum analyzer	Agilent	4705	US40240235	11/12/04
Pre-amplifier	HP	8449B	3008A00989	04/02/2004
Pre-amplifier	Miteq	JS4-00102600-29-7P	793880	08/19/2004
Bi-Log Antenna	Chase	CBL6112B	2622	08/19/2004
Horn Antenna	EMCO	3115	9208-3919	03/04/2003
Horn Antenna	EMCO	3116	9310-2222	03/06/2004

6.3 Test Results

There were no emissions within 20 dB of the limit. The limit does not apply to the fundamental frequency of the EUT.

Figure 6-1: Field strength of spurious radiation, Indoor Enclosure, Channel 513

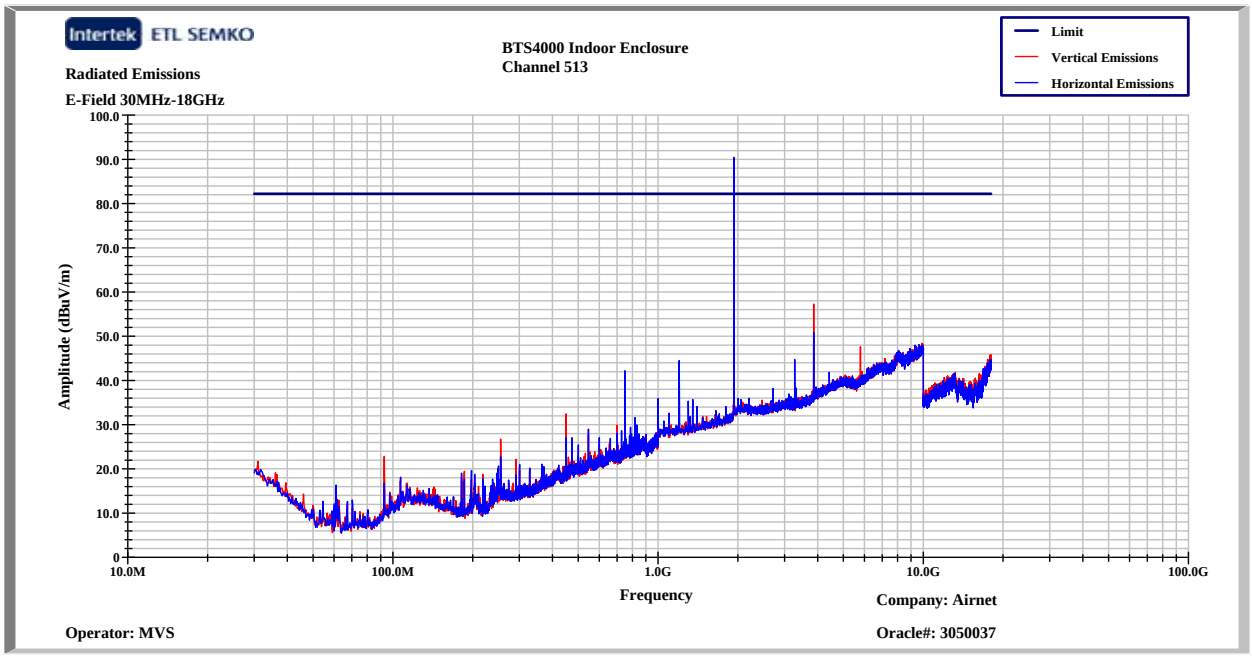


Figure 6-2: Field strength of spurious radiation, Indoor Enclosure, Channel 661

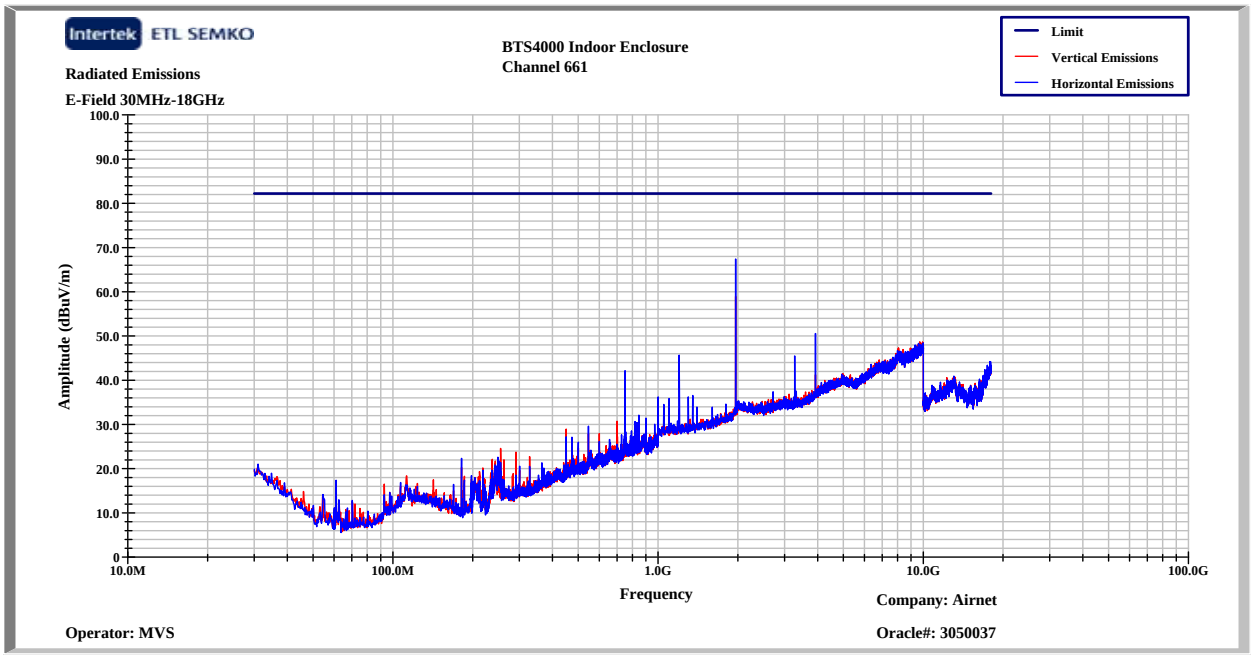


Figure 6-3: Field strength of spurious radiation, Indoor Enclosure, Channel 809

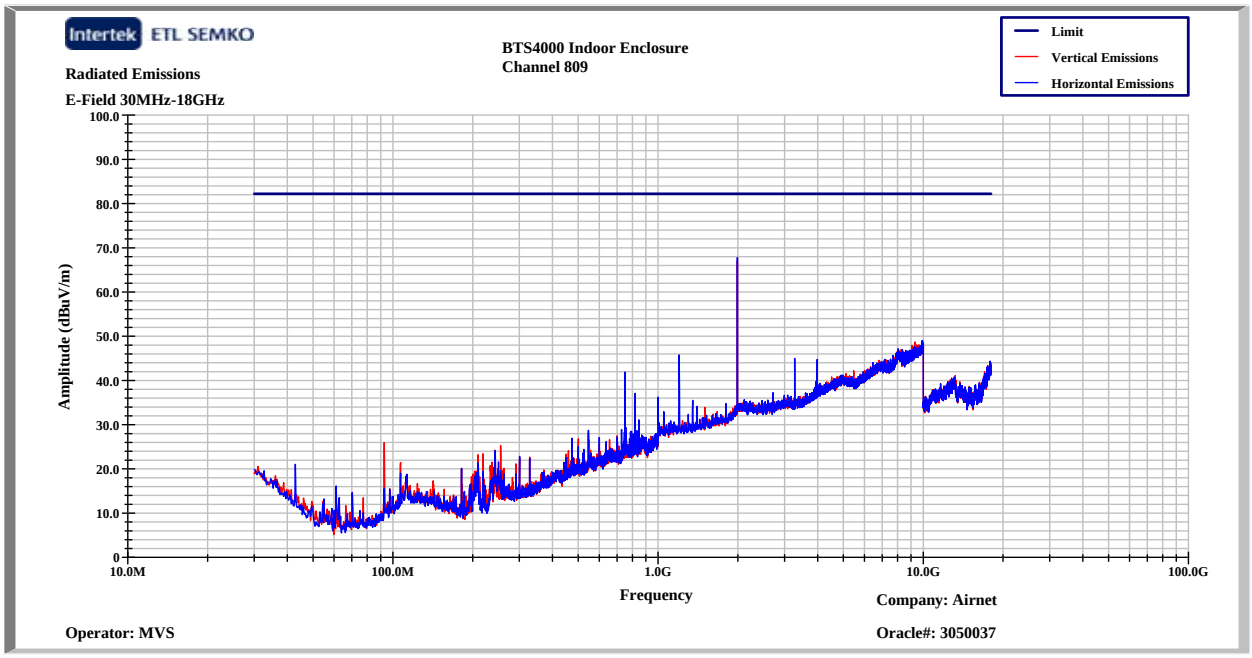


Figure 6-4: Field strength of spurious radiation, Outdoor Enclosure, Channel 513

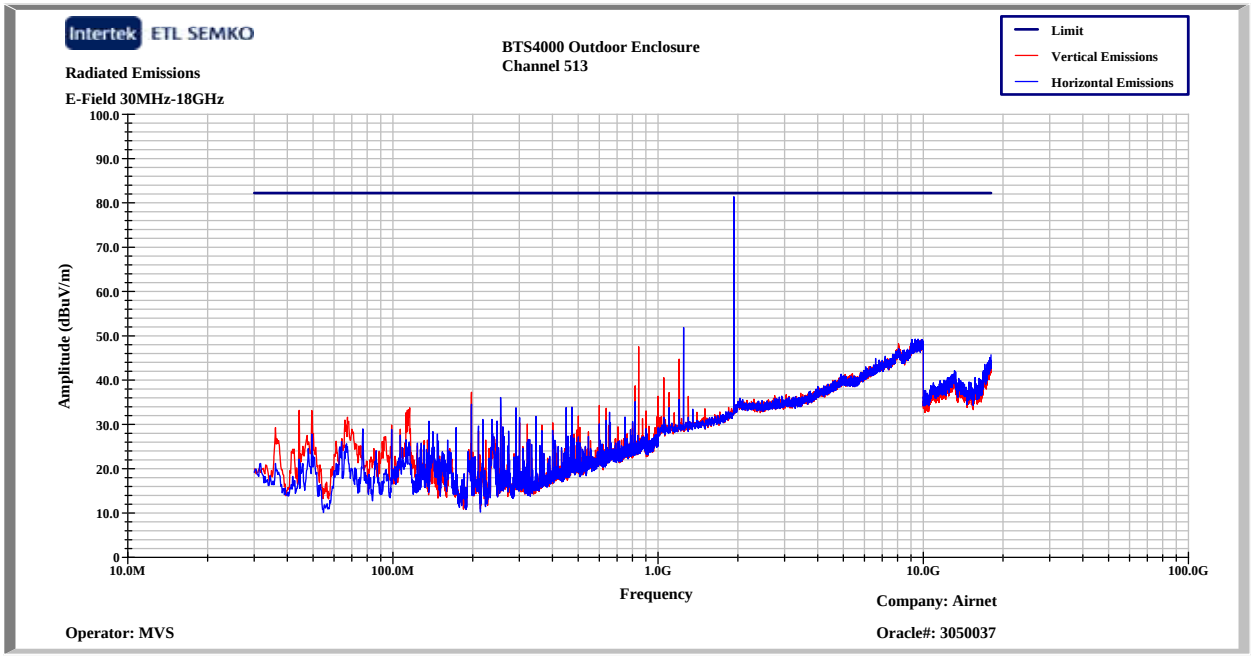


Figure 6-5: Field strength of spurious radiation, Outdoor Enclosure, Channel 661

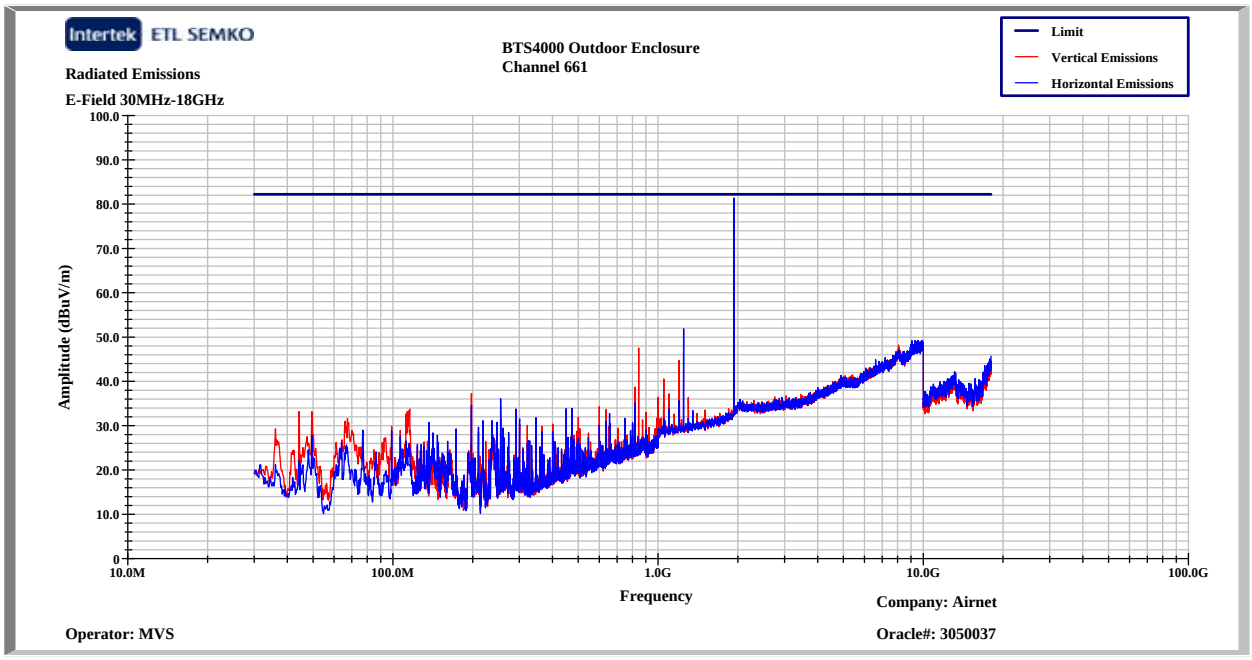
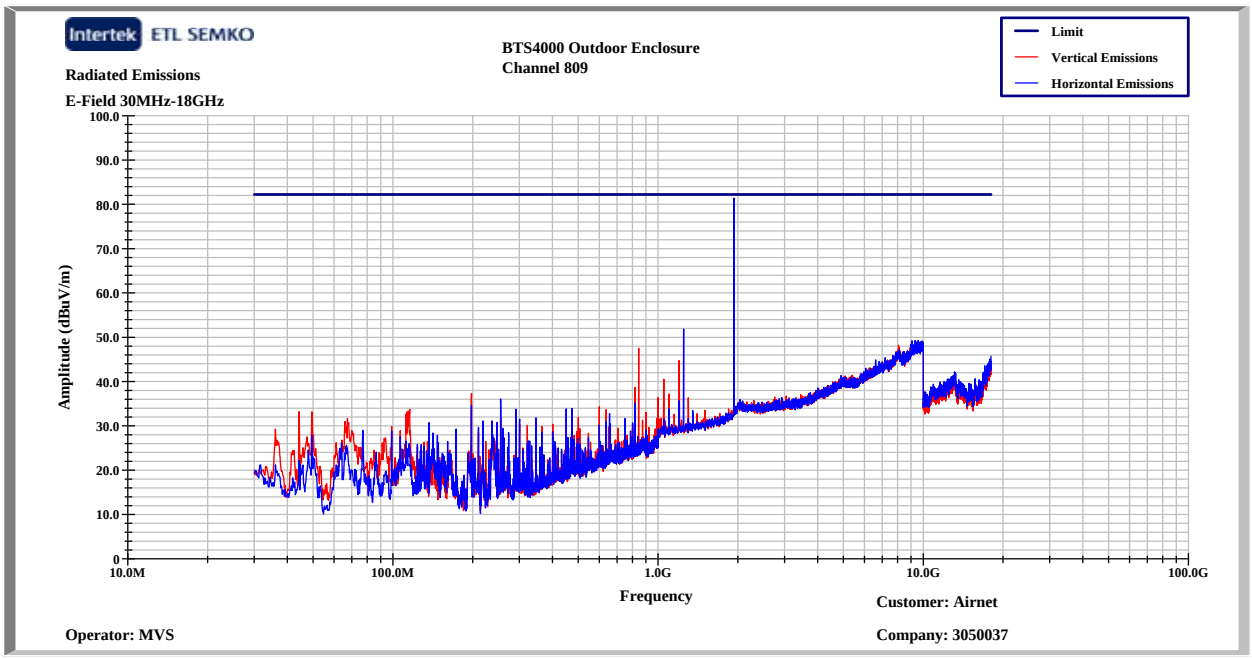


Figure 6-6: Field strength of spurious radiation, Outdoor Enclosure, Channel 809



7 POWER LINE CONDUCTED EMISSIONS

CFR 47 §15.207, ICES-003

7.1 Test Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

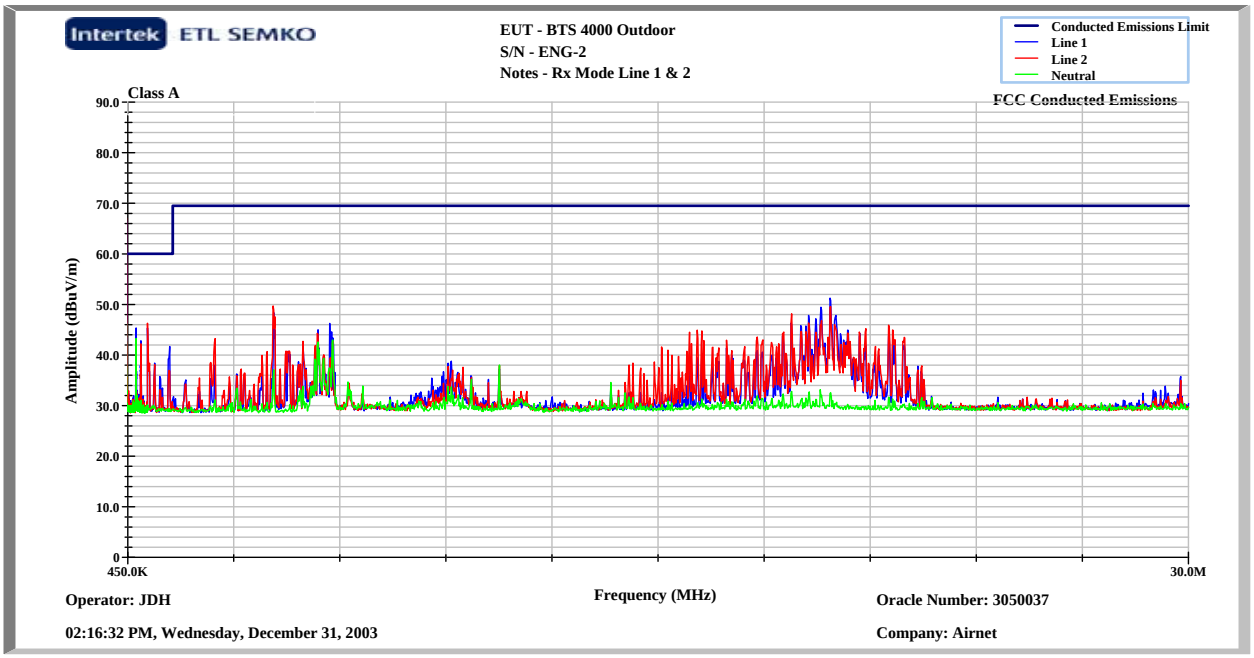
Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4: 2001.

7.2 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
Spectrum analyzer	Agilent	4705	US40240235	11/12/04
Pre-amplifier	HP	8449B	3008A00989	04/02/2004
Pre-amplifier	Miteq	JS4-00102600-29-7P	793880	08/19/2004
Bi-Log Antenna	Chase	CBL6112B	2622	08/19/2004
Horn Antenna	EMCO	3115	9208-3919	03/04/2003
Horn Antenna	EMCO	3116	9310-2222	03/06/2004
EMI Receiver	HP	8546A	3410A00173	04/02/2004
Preselector section	HP	85460A	3348A00203	04/02/2004

7.3 Test Results



8 FREQUENCY STABILITY

CFR 47 §2.1055, RSS-133 §7

8.1 Test Procedure

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency-measuring device via feedthrough attenuators. The EUT was placed inside the temperature chamber. The DC leads, RF output cable, and control cable exited the chamber through an opening made for that purpose.

After the temperature stabilized for approximately 20 minutes, the transmitter was activated, and the frequency output was recorded.

An external variable DC power supply was connected to the power terminals of the equipment under test. The voltage was set to 115% of the nominal value and the frequency error was recorded. This procedure was repeated for 100% and 85% of the nominal voltage.

The measured frequency shall not depart from the carrier by more than 1ppm.

8.2 Test Equipment

Description	Manufacture	Model #	S/N	Cal due Date
Spectrum Analyzer	Rohde & Schwarz	FSEA-30	DE31231	07/01/04
Thermal Chamber	Thermotron	F-110-CHV-25-25	7162	09/05/04
DC Power Supply	HP	HP6683A	3619A-00205	02/20/04

8.3 Test Results

Figure 8-1: Frequency error vs. Temperature

Temperature (°C)	Channel 661 Frequency Error ppm
+60	
+50	0.023
+40	0.012
+30	0.006
+20	0.008
+10	0.007
0	0.009
-10	0.009
-20	0.008
-30	0.008

Figure 8-2: Frequency error vs. DC Supply voltage

DC Supply Volts	Channel 661 Frequency Error ppm
31.05	0.008
27 (nominal)	0.010
22.95	0.007

9 RECEIVER SPURIOUS EMISSIONS

CFR 47 §15.109, RSS-133 §9

9.1 Test Procedure

Radiated emissions

Measurements were conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 10000 MHz. The measuring receiver met the requirements of Section One of CISPR 16 and the measuring antenna correlated to a balanced dipole.

Measurements of the radiated field were made with the antenna located at a distance of 3 meters from the EUT.

The antenna was adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth was varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) was varied during the measurements to find the maximum field-strength readings.

The floor standing EUT was placed on a horizontal metal ground plane and isolated from the ground plane by up to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4: 2001 and ICES-003.

Conducted emissions at receiver port

Measurements were conducted over the frequency range of 30 MHz to 20 GHz. The spectrum analyzer met the requirements of Section One of CISPR 16.

The “receive only” port of the transceiver was connected to a spectrum analyzer. The resolution bandwidth of the spectrum analyzer was set to 10 kHz. Sufficient scans were taken to show the emissions, if any, up to 10th harmonic.

9.2 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration Due Date
Spectrum analyzer	Agilent	4705	US40240235	11/12/2004
Pre-amplifier	HP	8449B	3008A00989	04/02/2004
Bi-Log Antenna	Chase	CBL6112B	2622	08/19/2004
Horn Antenna	EMCO	3115	9208-3919	03/04/2003

9.3 Test Results

Figure 9-1: Receiver spurious emissions, indoor enclosure, channel 513

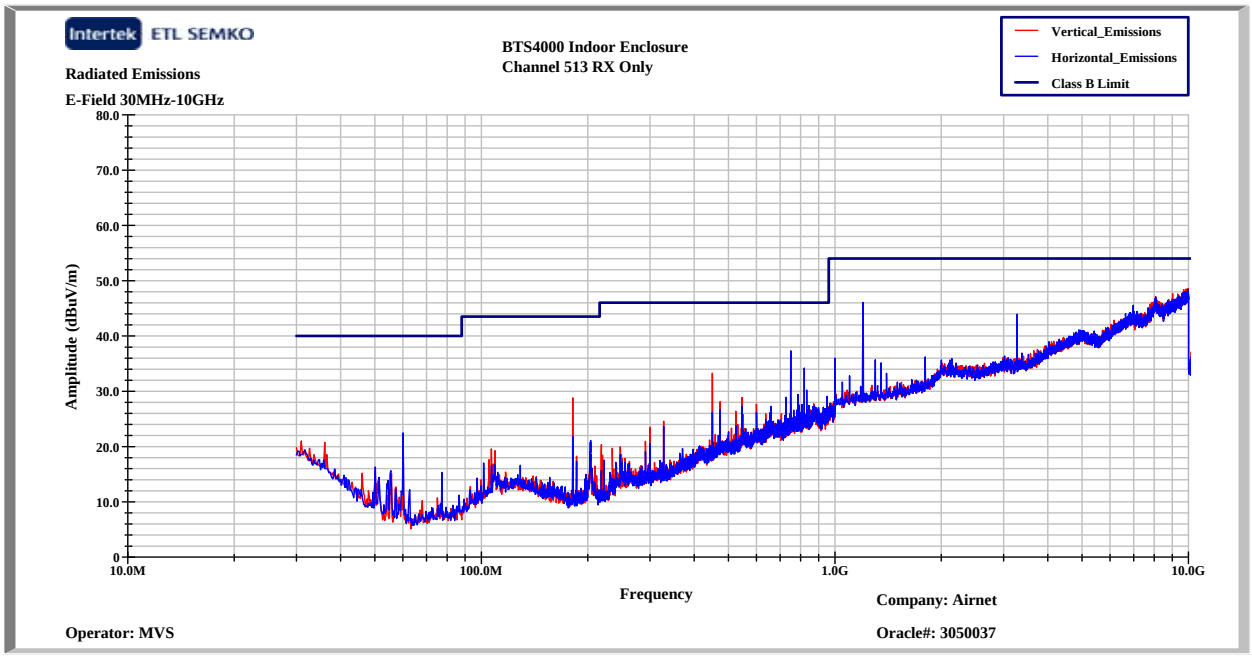


Figure 9-2: Receiver spurious emissions, indoor enclosure, channel 661

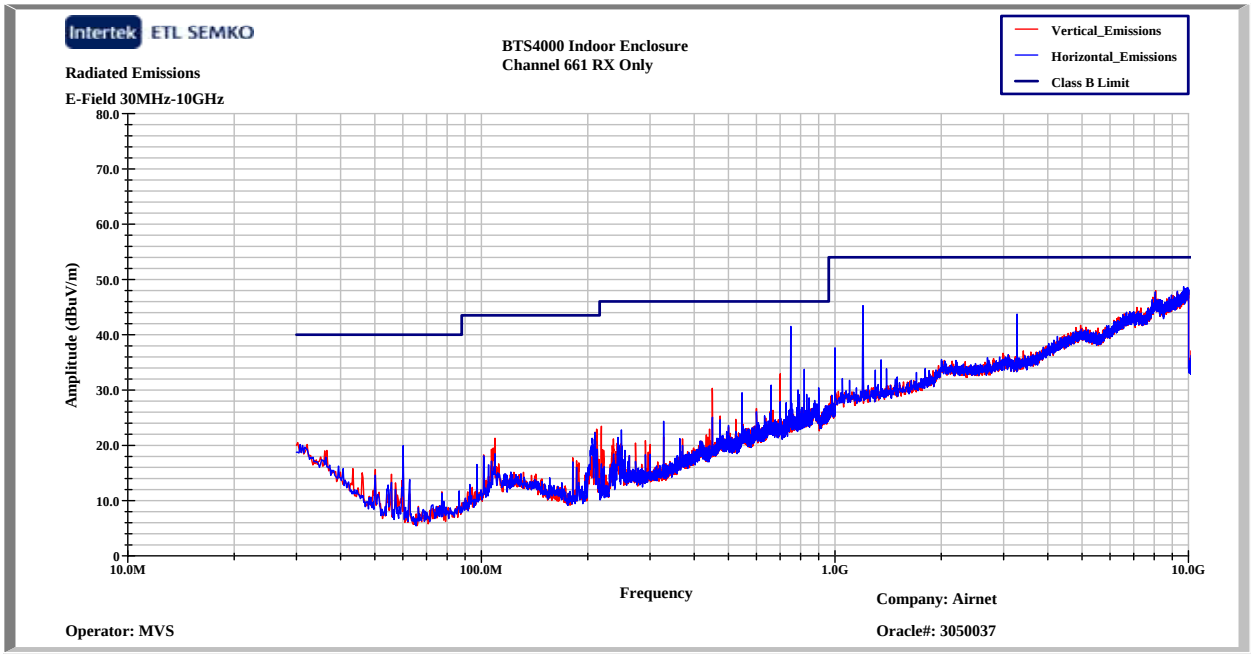


Figure 9-3: Receiver spurious emissions, indoor enclosure, channel 809

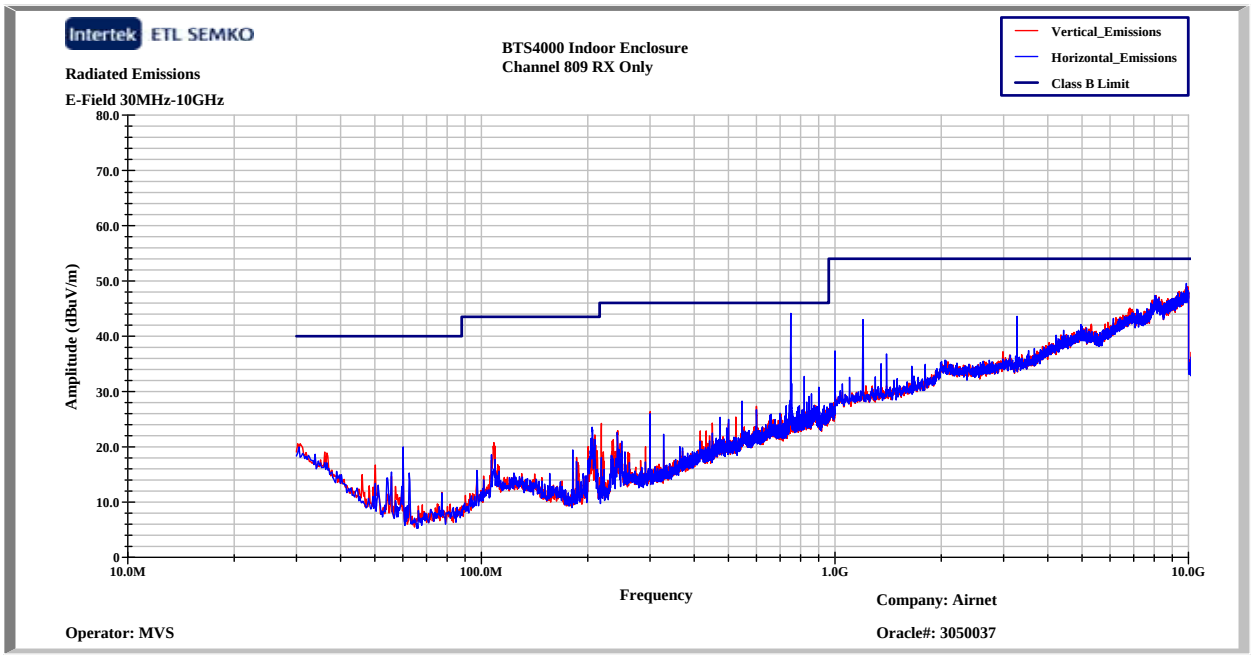


Figure 9-4: Receiver spurious emissions, outdoor enclosure, channel 513

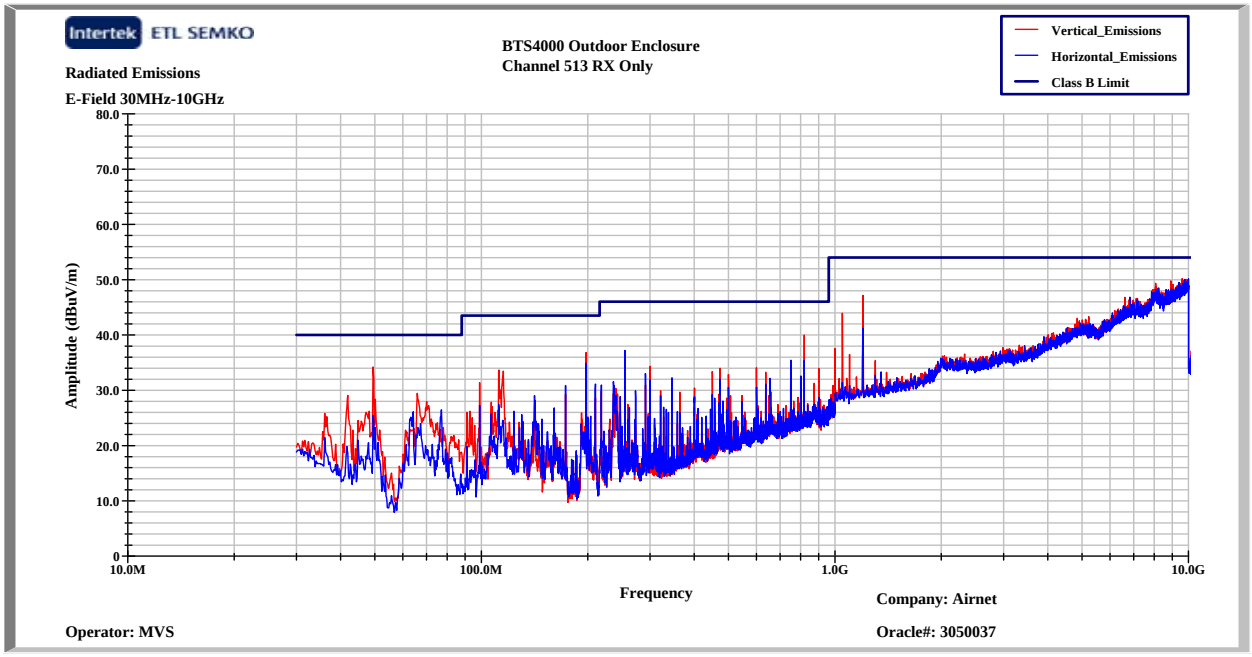


Figure 9-5: Receiver spurious emissions, outdoor enclosure, channel 661

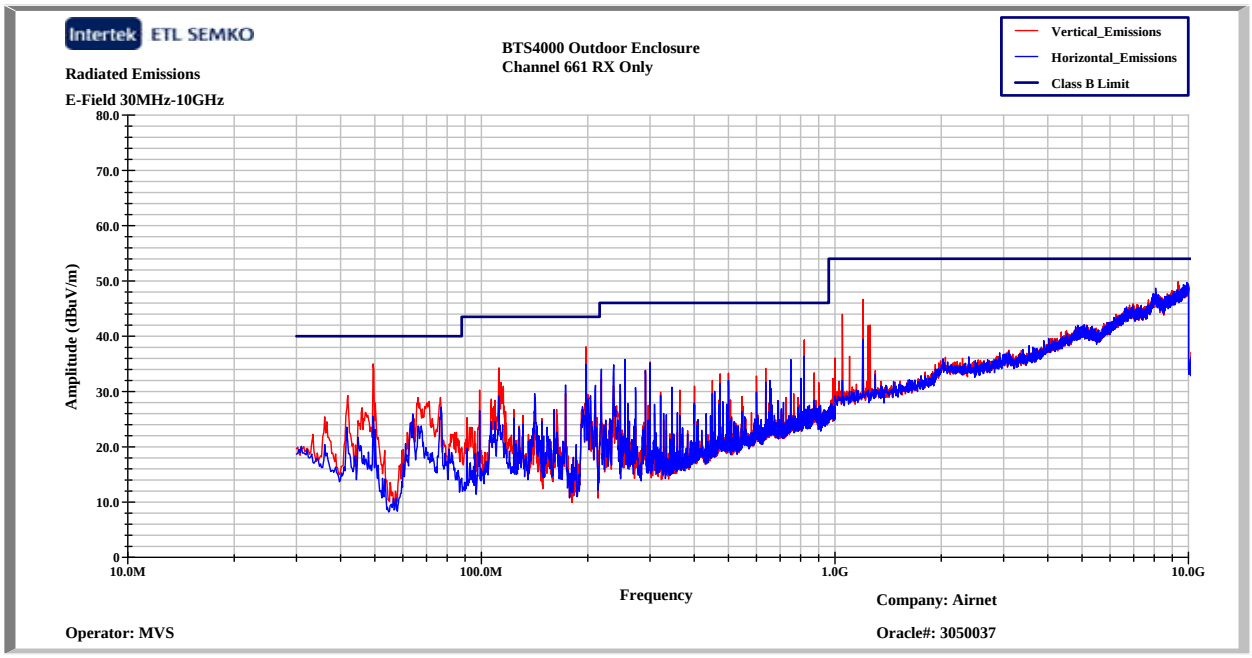


Figure 9-6: Receiver spurious emissions, outdoor enclosure, channel 809

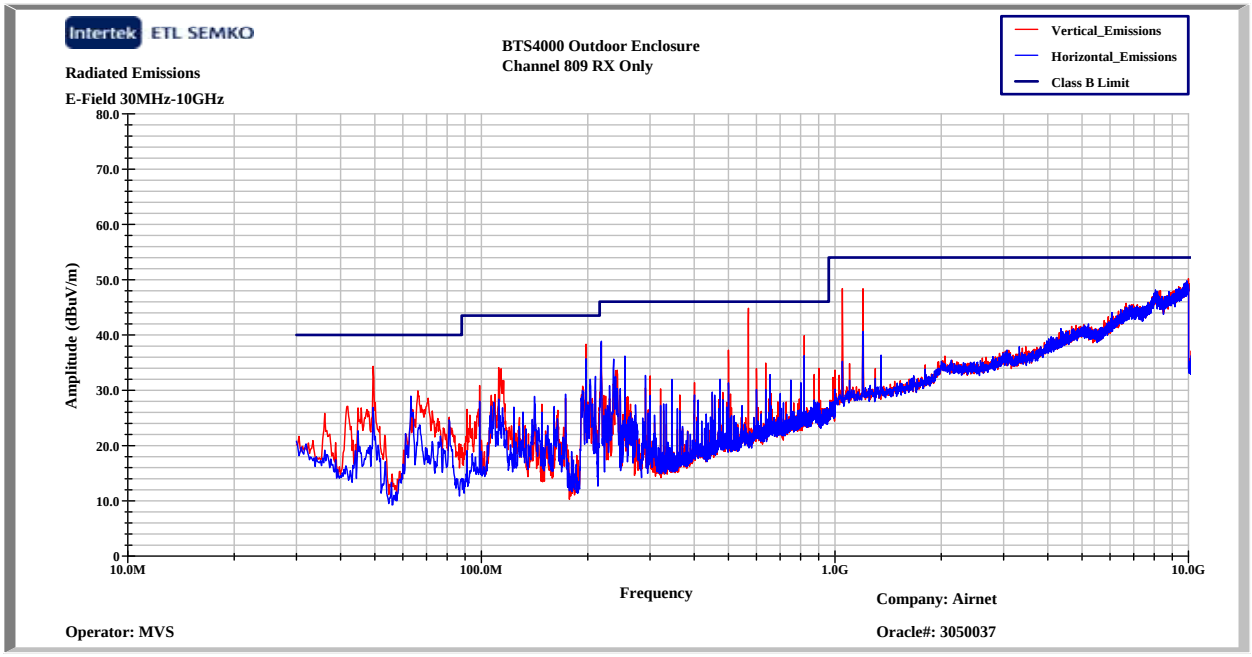


Figure 9-7: Receiver spurious emissions at RX port

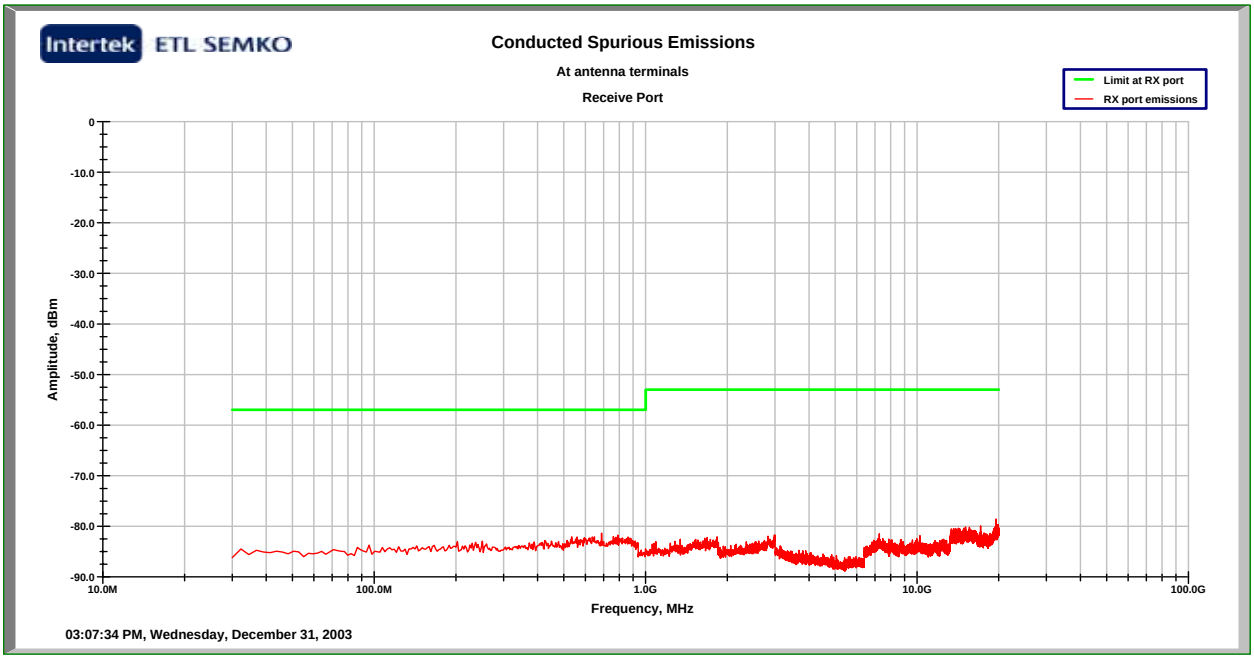


Table 9-1: Measured Data, Indoor enclosure, Channel 513

Client: Airnet Communications Corp.
Model Number: BTS4000 Indoor
Project Number: 3050037
Tested By: MVS
Date: 12/9/03
Frequency Range (MHz): 30MHz-1GHz
Input power: 27VDC
Notes: Receive mode emissions - Channel 513

Receiver: HP 8546A
Antenna: Chase 2622
Cables: E01+TW3+E02
Preamp: HP 8447D
Limit: FCC15 Class B-3m
Test Distance (m): 3
Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**
H	60.000	39.7	6.5	1.2	26.2	21.2	40.0	-18.9
V	181.245	36.7	10.8	2.1	26.0	23.6	43.5	-19.9
V	450.000	39.0	17.0	3.0	26.0	33.0	46.0	-13.0
H	750.000	41.4	20.6	4.1	26.7	39.4	46.0	-6.7
H	818.990	36.7	21.3	4.3	26.7	35.6	46.0	-10.4
H	1000.000	31.76	22.6	4.8	26.7	32.5	54.0	-21.6

Table 9-2: Measured Data, Outdoor enclosure, Channel 809

Client: Airnet Communications Corp.
Model Number: BTS4000 Outdoor
Project Number: 3050037
Tested By: MVS
Date: 12/10/03
Frequency Range (MHz): 30MHz-1GHz
Input power: 208VAC/60Hz
Notes: Receive mode CH-809

Receiver: HP 8546A
Antenna: Chase 2622
Cables: E01+TW3+E02
Preamp: HP 8447D
Limit: FCC15 Class B-3m
Test Distance (m): 3
Modifications for compliance (y/n): n

A	B	C	D	E	F	G	H	I
Ant. Pol. (V/H)	**Frequency MHz**	**Reading dB(uV)**	**Antenna Factor dB(1/m)**	**Cable Loss dB**	**Pre-amp Factor dB**	**Net dB(uV/m)**	**3m Limit dB(uV/m)**	**Margin dB**
V	49.410	49.8	8.7	1.1	26.2	33.4	40.0	-6.6
V	111.970	44.8	13.2	1.6	26.0	33.6	43.5	-9.9
V	197.615	51.2	10.7	2.1	26.0	37.9	43.5	-5.6
H	218.395	52.8	10.5	2.2	26.0	39.5	46.0	-6.5
H	568.710	20.4	19.3	3.5	26.7	16.5	46.0	-29.5
V	819.000	39.8	20.8	4.3	26.7	38.2	46.0	-7.8