



MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

September 8, 2004

Benefon Oyj
Meriniitynkatu 11
24101 Salo Finland

Dear Petri Aarnio,

Enclosed is the EMC test report for compliance testing of the Benefon Oyj, Benefon Trackbox. The Benefon Oyj, Benefon Trackbox was tested to the requirements of the FCC Certification rules under Title 47 of the CFR Part 24 Subpart E for Broadband PCS Devices.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,

MET LABORATORIES, INC.

Christina M. Karlhoff
Documentation Department

Reference: (\Benefon Oyj\ EMC15743A-FCC)

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DOC-EMC709 9/2/2004



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914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

Electromagnetic Compatibility Criteria Test Report

For the

**Benefon Oyj
Benefon Trackbox**

Tested under

**FCC Certification Rules
Title 47 of the CFR, Part 24 Subpart E for Broadband PCS Devices**

MET Report: 15743A-FCC

September 8, 2004

Prepared For:

**Benefon Oyj
Meriniitynkatu 11
24101 Salo Finland**

**Prepared By:
MET Laboratories, Inc.
Baltimore, MD 21230**



Benefon Oyj
Benefon Trackbox
FCC ID: QFPTGP78AB

CFR Title 47 Part 24 Subpart E

Electromagnetic Compatibility Criteria Test Report

For the

Benefon Oyj
Benefon Trackbox

Tested Under

FCC Certification Rules
Title 47 of the CFR, Part 24 Subpart E for Broadband PCS Devices

A handwritten signature in blue ink, appearing to read "K. Mehaffey".

Kevin A. Mehaffey
Electromagnetic Compatibility Lab

A handwritten signature in blue ink, appearing to read "Christina M. Karlhoff".

Christina M. Karlhoff
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 Subpart E of the FCC Rules under normal use and maintenance.

A handwritten signature in blue ink, appearing to read "Liming Xu".

Liming Xu
Electromagnetic Compatibility Lab



Benefon Oyj
Benefon Trackbox
FCC ID: QFPTGP78AB

CFR Title 47 Part 24 Subpart E

Report Status Sheet

Revision	Report Date	Reason for Revision
&	September 8, 2004	Initial Issue.



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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
d	Measurement Distance
dB	Deci Bels
dBμV	Deci-Bels above one micro Volt
dBμV/m	Deci-Bels above one micro Volt per meter
DC	Direct Current
DCF	Distance Correction Factor
E	Electric Field
EUT	Equipment Under Test
e.i.r.p	equivalent isotropically radiated power
f	Frequency
FCC	Federal Communications Commission
GHz	Giga Hertz
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kV	kilo Volt
LISN	Line Impedance Stabilization Network
MHz	MegaHertz
RF	Radio Frequency
RMS	Root-Mean-Square
V/m	Volts per meter



1. Requirements Summary

Reference	Description	Compliance
2.1046; Part 24 Subpart E §24.232 (a), (c)	RF Power Output	Complies
2.1047 (a)	Modulation Characteristics	Complies
2.1049	Occupied Bandwidth	Complies
2.1051; 24.238 (a)	Spurious Emissions at Antenna Terminals	Complies
2.1051; 24.238 (b)	Spurious Emissions at Antenna Terminals Frequency Block Edges	Complies
2.1053; 24.238 (a)	Radiated Spurious Emissions	Complies
2.1055 (a) (1)	Frequency Stability Over Temperature Variations	Complies
2.1055 (d) (2)	Frequency Stability Over Battery Power	Complies

Table 1 Requirements Summary of EMC Part 24 Compliance Testing



2. Equipment Configuration

2.1. Overview

An EMC evaluation to determine compliance of the Benefon Oyj, Benefon Trackbox with the requirements of Part 24 Subpart E, was performed. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the Benefon Oyj, Benefon Trackbox. Benefon Oyj should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Benefon Trackbox has been **permanently** discontinued.

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 24 Subpart E, in accordance with Benefon Oyj, purchase order number 916675. All tests were conducted using measurement procedure *ANSI C63.4-1992*.

Type of Submission/Rule:	Part 24 Original Filing
Model(s) Tested:	Benefon Trackbox
Model(s) Covered:	Benefon Trackbox
EUT Specifications:	Primary Power: 10 to 30 Vdc
	FCC ID QFPTGP78AB
	Type of Emissions: 243KGXW
	RF Power Output: 0.85 Watts EIRP: 0.8 Watts (1850.2 MHz) 0.8 Watts (1879.8 MHz) 0.85 Watts (1909.8 MHz)
	Equipment Frequency Range: 1850.2 MHz to 1909.8 MHz
	Frequency Stability: + / - 50 Hz
Analysis:	The results obtained relate only to the item(s) tested.
Evaluated by:	Liming Xu
Date(s):	September 8, 2004



2.2. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave.. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

2.3. Description of Test Sample

The Benefon Trackbox, Equipment Under Test (EUT) for the remainder of this document, is powered from a 10 to 30 Vdc supply.

Benefon Trackbox can be used anywhere there is PCS1900 network coverage, to manage valuable assets in different lines of businesses including everything from construction to car and boat rentals. The Benefon Trackbox can be used to protect any work related machinery, equipment or other property by tracking their exact location and when necessary, helping to recover stolen property. In the transportation business Benefon Trackbox can help in the tracking and management of vehicles, freight and staff. The information Benefon Trackbox records can be analysed and used to help improve delivery times and cut costs. Listen-in function enables monitoring of sounds and voices around the device.

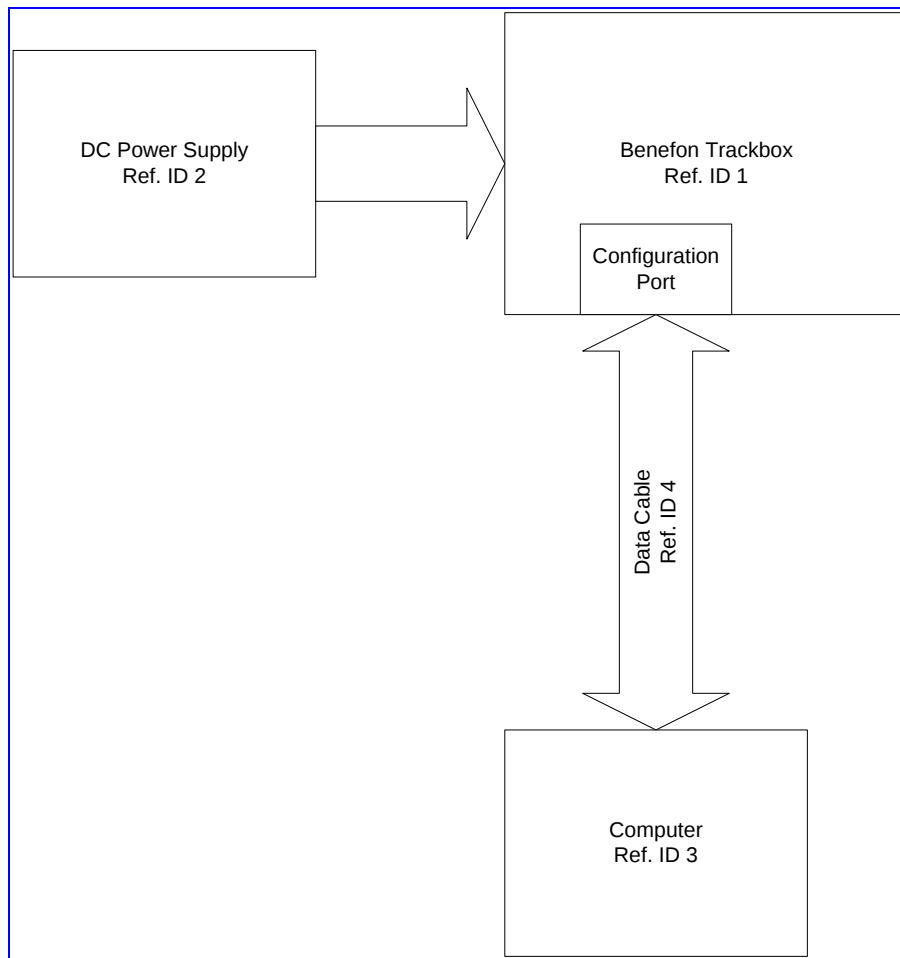


Figure 1. Block Diagram of Test Configuration



2.4. Mode of Operation

In normal operation the device sends and receives SMS messages. With a special SMS message also a speech connection can be established for monitoring sounds and voices around the device via the internal microphone in the device. For simulating normal operation SMS messages can be sent and speech connection established by connecting the device to a computer with RS232 data cable and using standard AT commands in a computer terminal application. The terminal settings are:

- 19200 bits per second
- 8 data bits
- None parity
- 1 stop bit
- Hardware flow control

2.5. Modifications

2.5.1. Modifications to EUT

No modifications were made to the EUT.

2.5.2. Modifications to Test Standard

No modifications were made to the test standard.

2.6. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Benefon Oyj upon completion of testing.



3. Electromagnetic Compatibility Criteria for Broadband PCS Devices (Part 24 Subpart E)

3.0. RF Power Output

Test Requirement(s): § 2.1046 Measurements required: RF power output:

§ 2.1046 (a)

§ 2.1046 (b)

§ 2.1046 (c)

§ 24.232 (b): Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

Test Procedures: The EUT was installed on a 0.8 m high wooden table (See Photograph 1). As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by a PCS GSM, modulated signal.

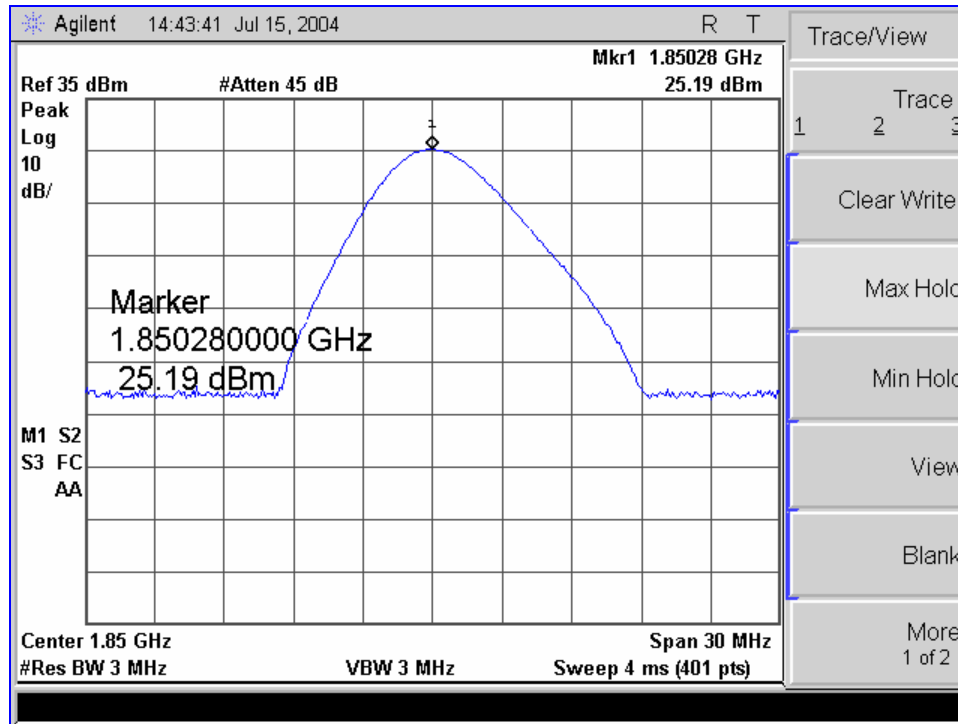
Test Results: The EUT complied with the requirement(s) of this section. The EUT conducted power does not exceed limit at the carrier frequency.

Test Engineer(s): Liming Xu

Test Date(s): 07/15/2004



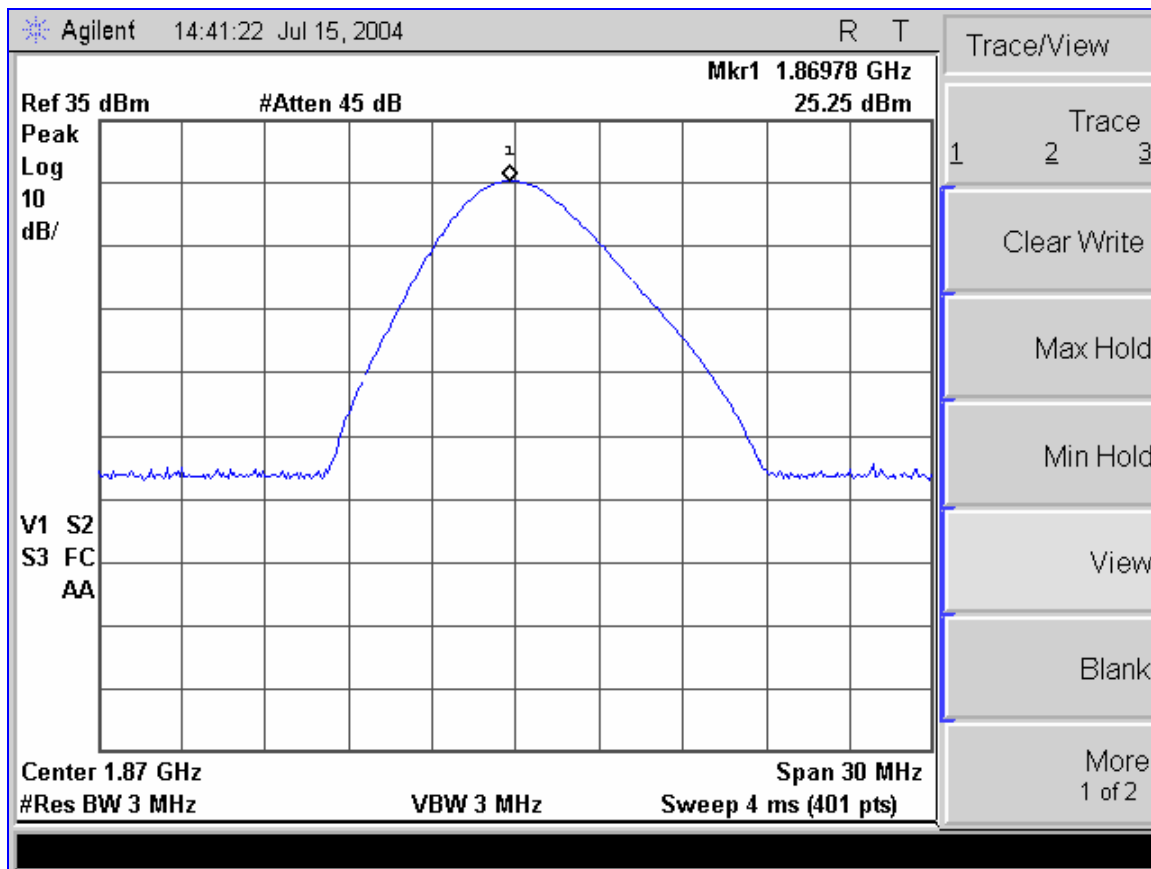
RF Power Output Test Results



Gain of Antenna P = 25.19 + 3.9 (Cable and Splitter loss) = 29.09 dBm at Low channel



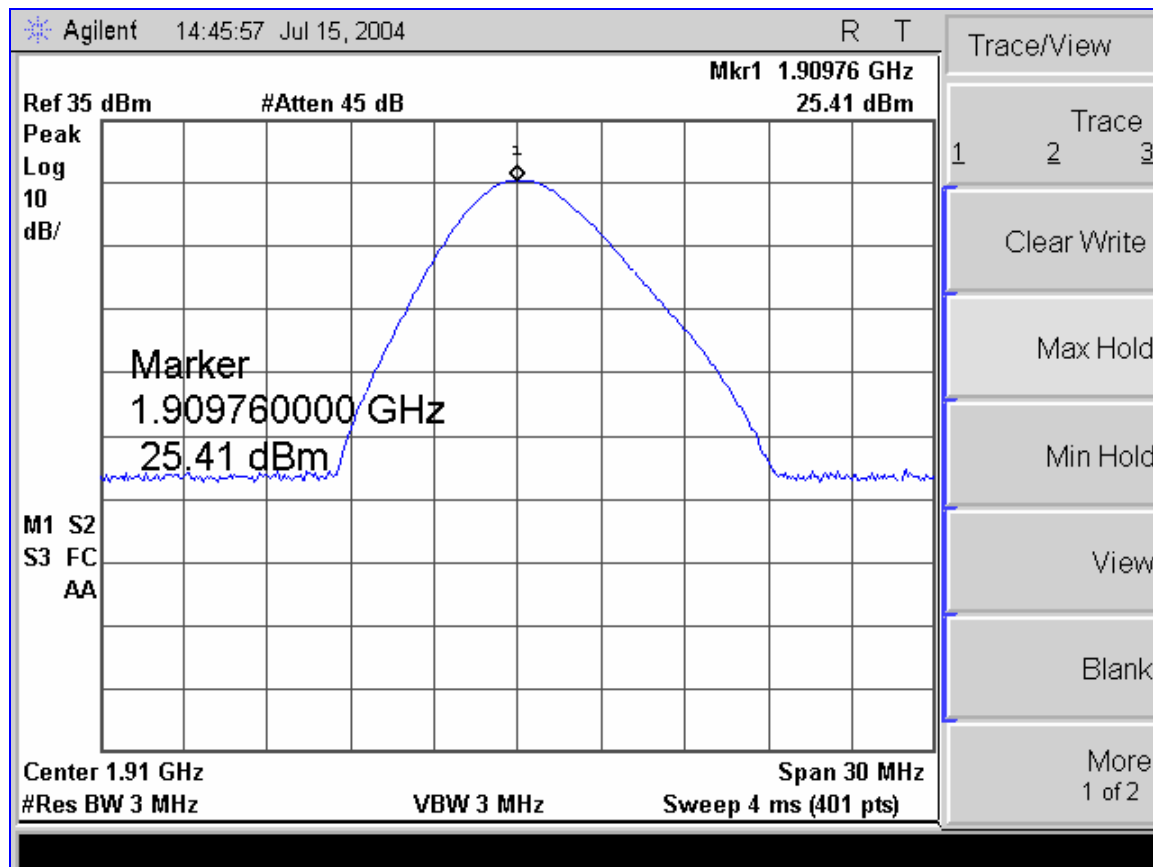
RF Power Output Test Results



$$P = 25.25 + 3.9 \text{ (Cable and Splitter loss)} = 29.15 \text{ dBm at middle channel}$$



RF Power Output Test Results



$$P = 25.41 + 3.9 \text{ (Cable and Splitter loss)} = 29.31 \text{ dBm at High channel}$$



MPE limit Calculation for Benefon Trackbox

Benefon 1900 band
Power = 0.85 Watts conducted

Antenna gain = 2 dBi and the Numerical gain: $G = 1.6$

The MPE calculation for Benefon ($P = 0.85$ Watts ; $G = 1.6$) @ 0.2 meters:

$$\begin{aligned} S_p &= PG/4\pi R^2 = (0.85 \times 1.6)/4\pi \times 0.04 \\ &= (0.85 \times 1.6)/0.5 \text{ W/m}^2 @ 0.2 \text{ meters} \\ &= 2.72 \text{ W/m}^2 @ 0.2 \text{ meters} \end{aligned}$$

- * S_p is power density in W/m^2
- * P is 0.85 Watts conducted to antenna port
- * $G = 1.6$ antenna numerical gain
- * R = distance to the center of the antenna (0.2 meters)

*The power density $S_p = 2.72 \text{ W/m}^2 @ 0.2 \text{ meters}$

The $10 \text{ W/m}^2 @ 1900 \text{ MHz}$ is MPE limit averaged over a 30 minute period for General Population Exposure.



Benefon Oyj
Benefon Trackbox
FCC ID: QFPTGP78AB

Electromagnetic Compatibility
Criteria for Broadband PCS Devices
CFR Title 47 Part 24 Subpart E

Benefon Trackbox Part 24 Test Setup



Photograph 1. EUT Test Setup Photos for Part 24 - Broadband PCS Devices



3.1. Modulation Characteristics

Test Requirement(s): § 2.1047 Measurements required: Modulation characteristics

§ 2.1047 (a):

Test Procedures: The EUT uses GMSK modulation. In GMSK modulation, voice or data information is digitized and coded into a bit stream. Modulation plots were taken in order to give a detailed explanation of the modulation scheme used in the EUT of the PCS system.

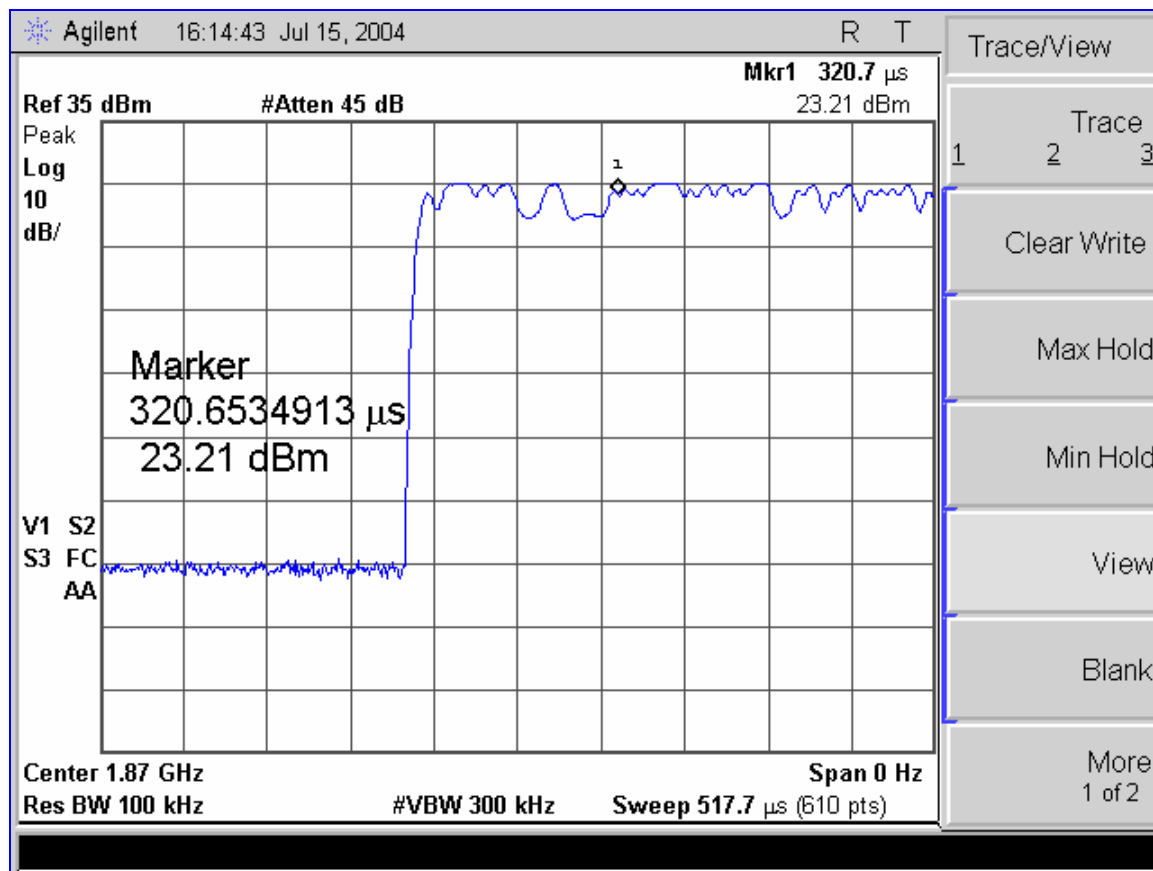
Test Results: The EUT complied with the requirement(s) of this section. The following plot(s) illustrate a detailed explanation of the modulation scheme used in the EUT of the PCS system.

Test Engineer(s): Liming Xu

Test Date(s): 07/15/2004



3.2. Modulation Characteristics Test Results





3.3. Occupied Bandwidth

Test Requirement(s): § 2.1049 Measurements required: Occupied bandwidth

Test Procedures: As required by §2.1049 of CFR 47, occupied bandwidth measurements were made on the EUT. The EUT was configured to transmit a PCS GMSK modulated carrier signal. Using an IF bandwidth of 10 kHz, the test engineer determined the occupied bandwidth of the emission at the center of the selectable channel range and recorded the detailed measurements as plotted data.

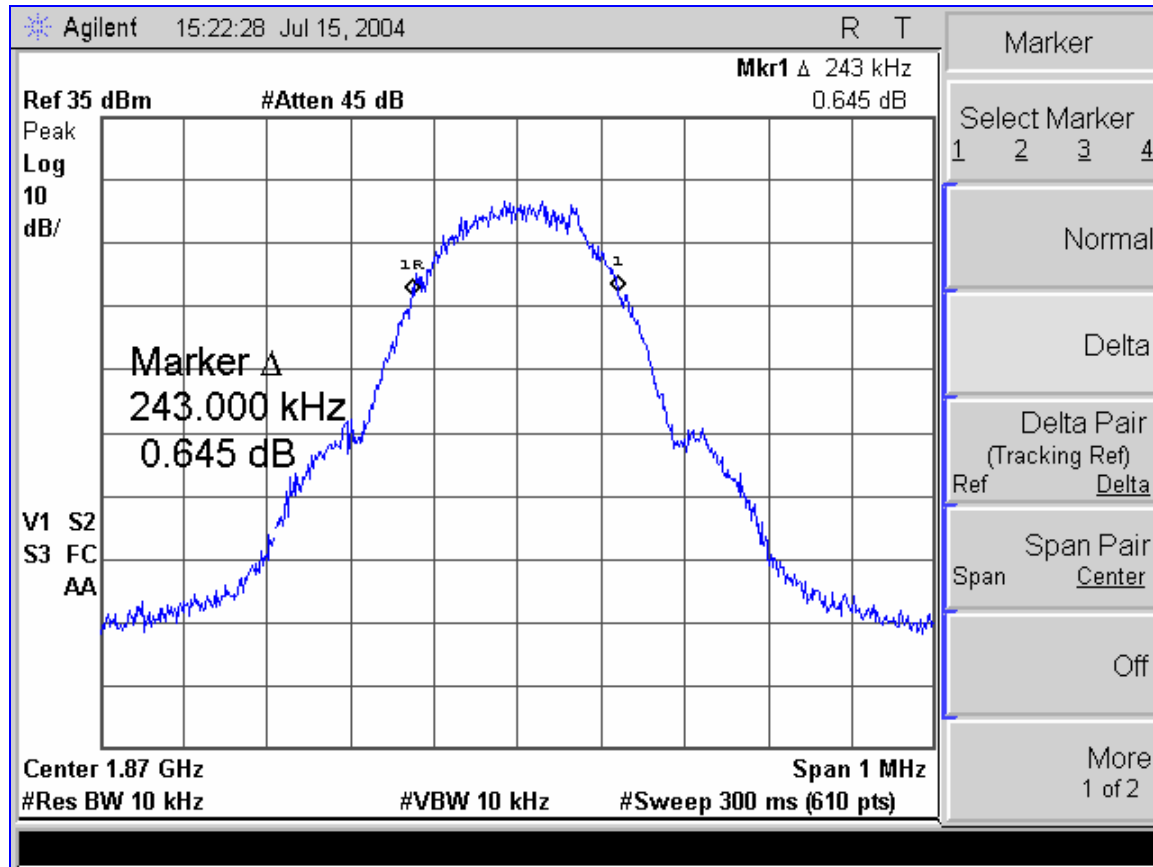
Test Results: The EUT complied with the requirement(s) of this section.

Test Engineer(s): Liming Xu

Test Date(s): 07/15/2004



Occupied Bandwidth Test Results





3.4. Spurious Emissions

3.4.1. Spurious Emissions at Antenna Terminals

Test Requirement(s): § 2.1051 Measurements required: Spurious emissions at antenna terminals

§ 24.238 Emission limitations for Broadband PCS equipment

§ 24.238 (a)

Test Procedures: As required by 47 CFR 2.1051, spurious emissions at antenna terminal measurements were made at the RF output terminals using a 50 Ω attenuation and spectrum analyzer set for a 100 kHz bandwidth. The RBW of 100 kHz was used to investigate and search for spurious emissions; any spurious emissions found with this technique were re-measured with the appropriate 1 MHz RBW. This test was performed with digitally modulated carrier signals, and the EUT was adjusted for continuous transmission on frequencies across the operating band. The frequency spectrum was investigated from 9.0 KHz to 20.0 GHz. For measuring emissions above 2 GHz, a high-pass filter was used to eliminate the fundamental transmit frequency to prevent possible saturation effects on the front end of the spectrum analyzer.

Test Results: The EUT complied with the requirement(s) of this section.

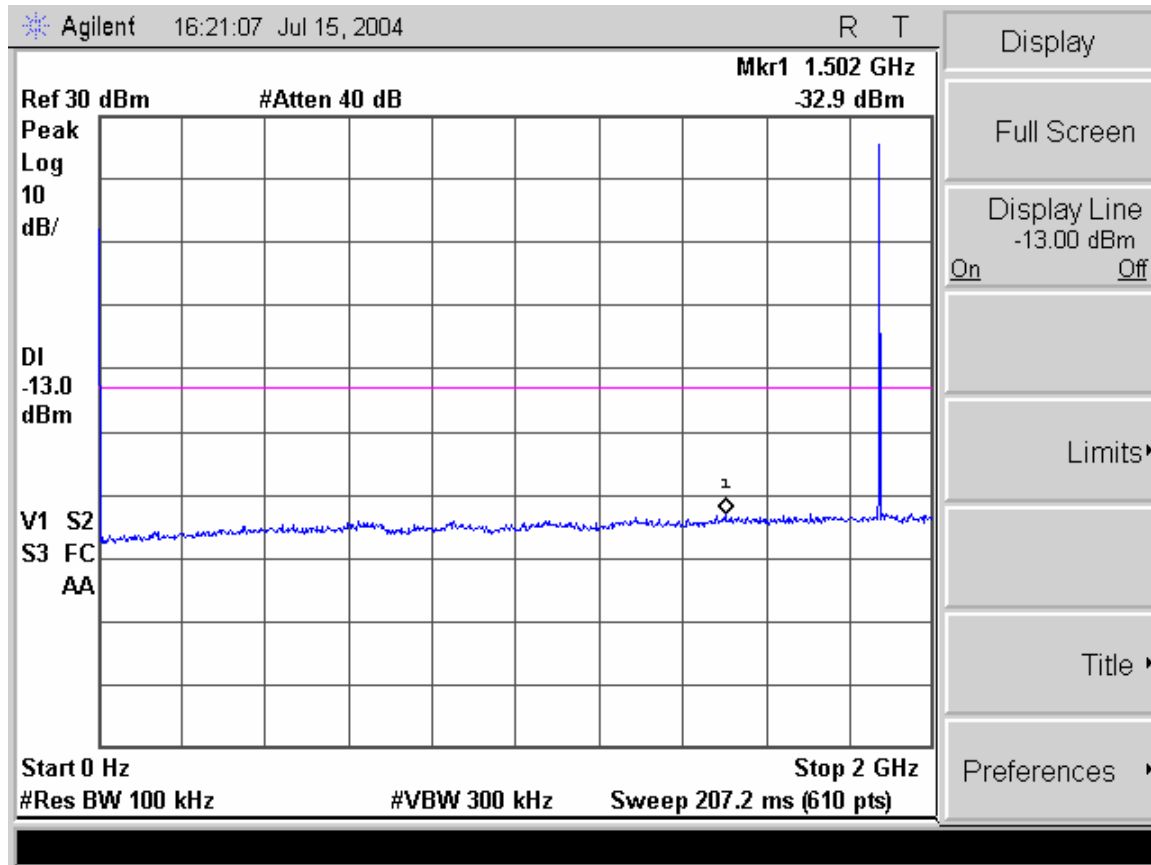
Test Engineer(s): Steven J. Peronnet

Test Date(s): 08/23/2004



Spurious Emissions at Antenna Terminals Test Results

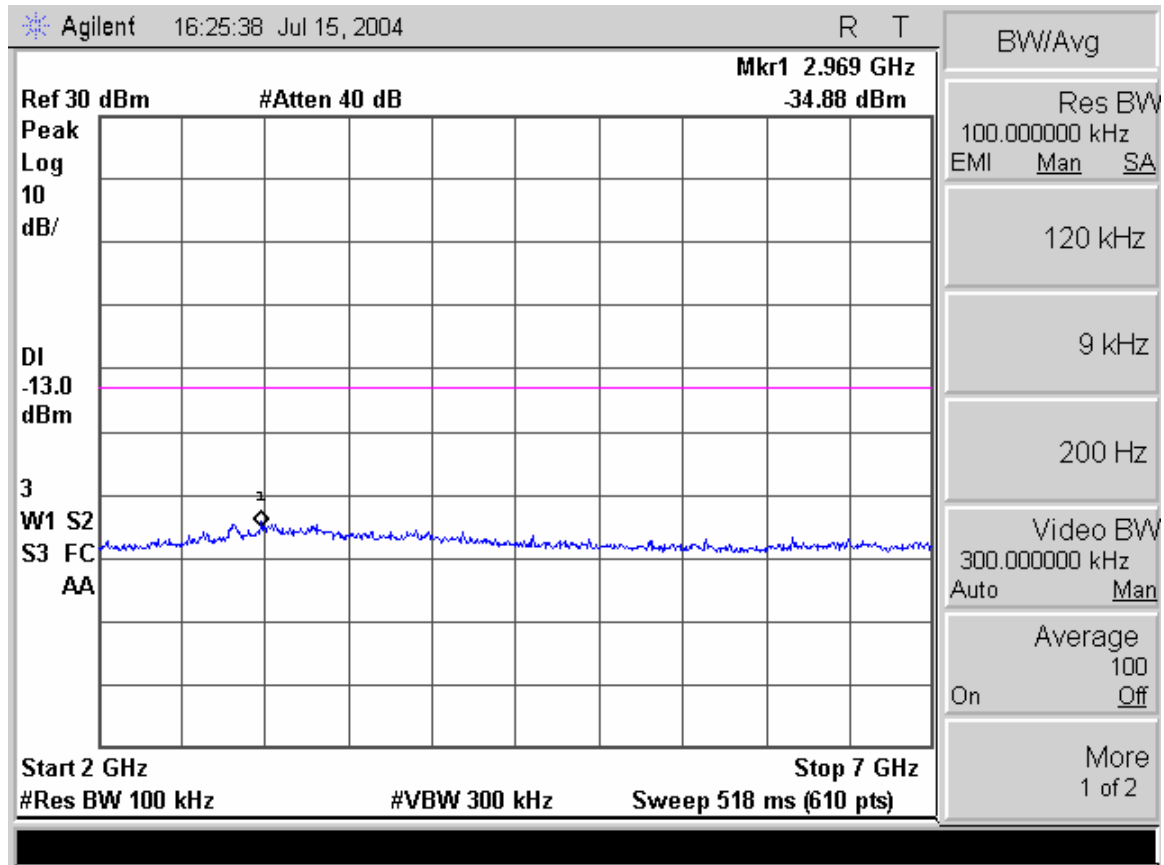
Conducted Spurious Emissions Measurements, Test Data Plots





Spurious Emissions at Antenna Terminals Test Results

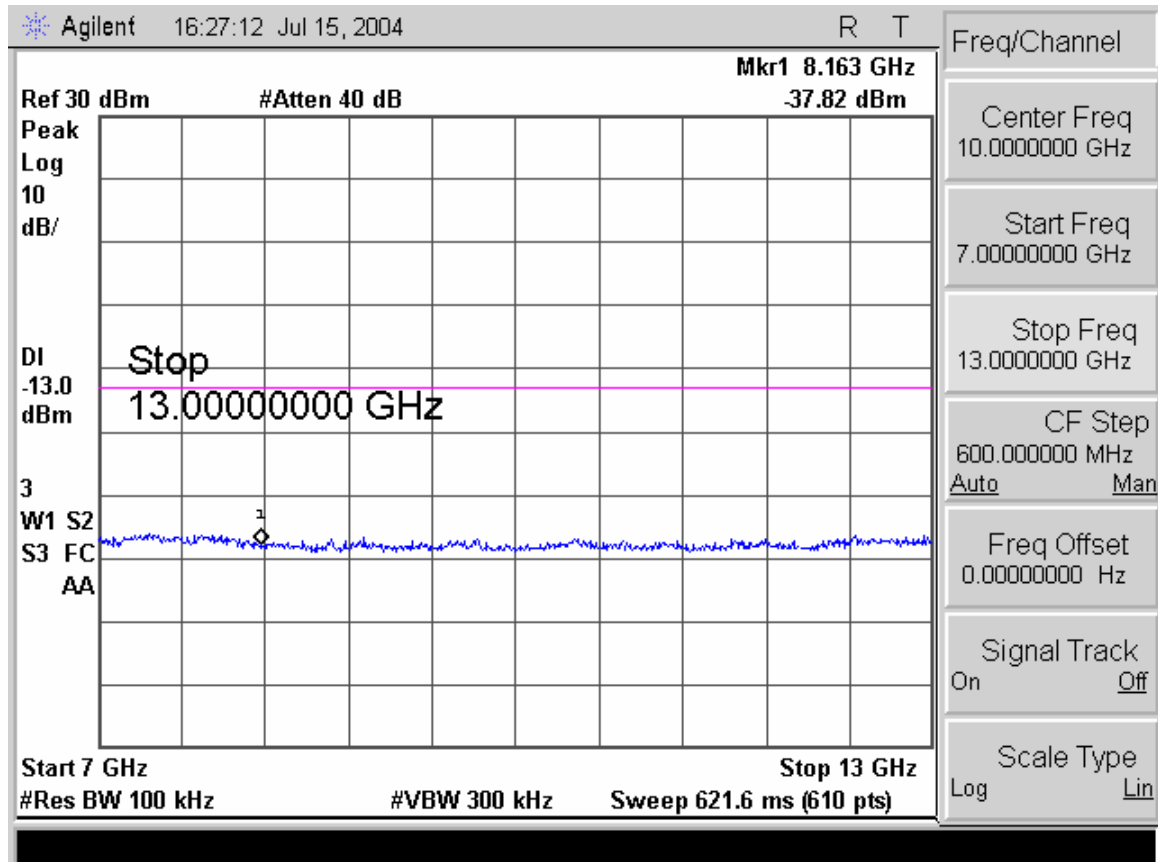
Conducted Spurious Emissions Measurements, Test Data Plots





Spurious Emissions at Antenna Terminals Test Results

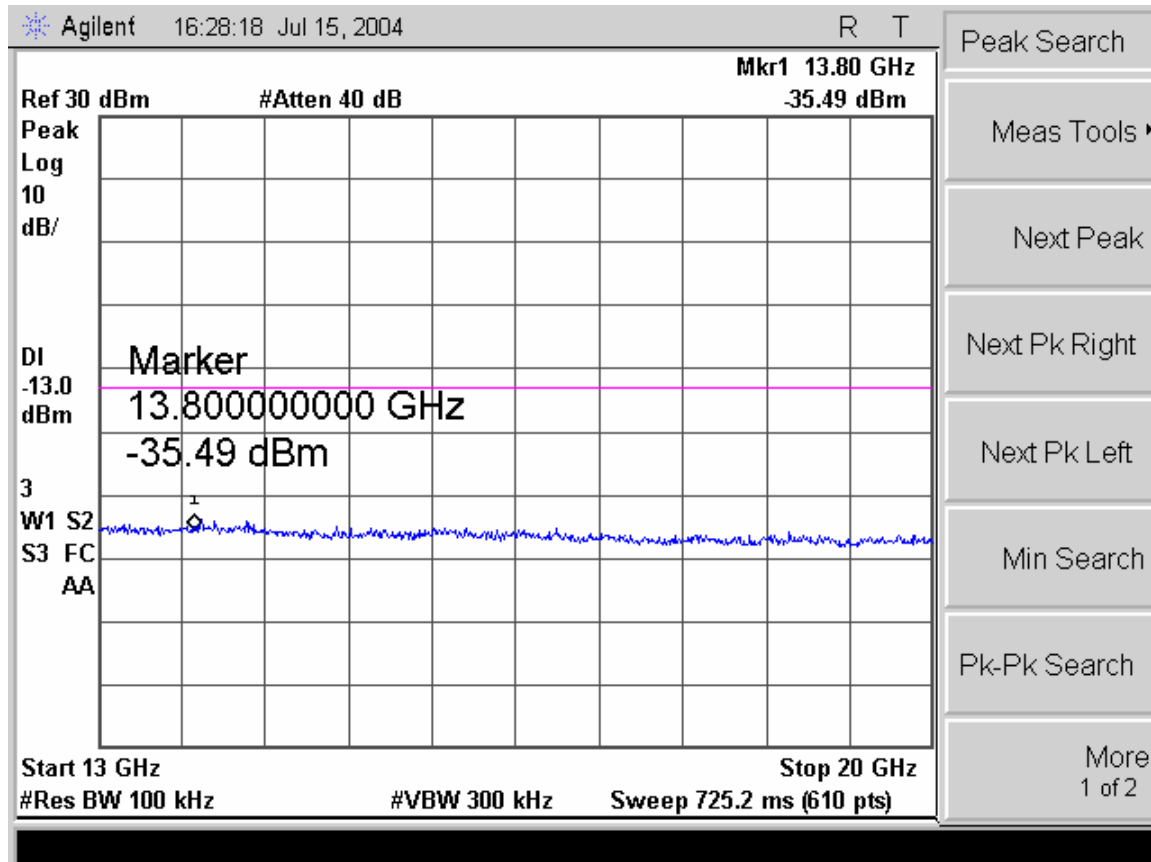
Conducted Spurious Emissions Measurements, Test Data Plots





Spurious Emissions at Antenna Terminals Test Results

Conducted Spurious Emissions Measurements, Test Data Plots





3.4.2. Spurious Emissions at Antenna Terminal Frequency Block Edges

Test Requirement(s): § 2.1051 Measurements required: Spurious emissions at antenna terminals

24.238 Emission limitations for Broadband PCS equipment
§ 24.238 (b)

Test Procedures: As recommended in FCC Part 24, greater than or equal to 1% of emission spectrum bandwidth was chosen to measure the peak of any emission inside the 1.0 MHz frequency band adjacent to each frequency block edge. All other frequencies were measured using a 3 KHz RBW. The unit was exercised using signal types required by §2.1049.

Test Results: The EUT complied with the requirement(s) of this section. Modulation products outside of this band are attenuated at least $43 + 10 \log(P)$ below the level of the modulated carrier.

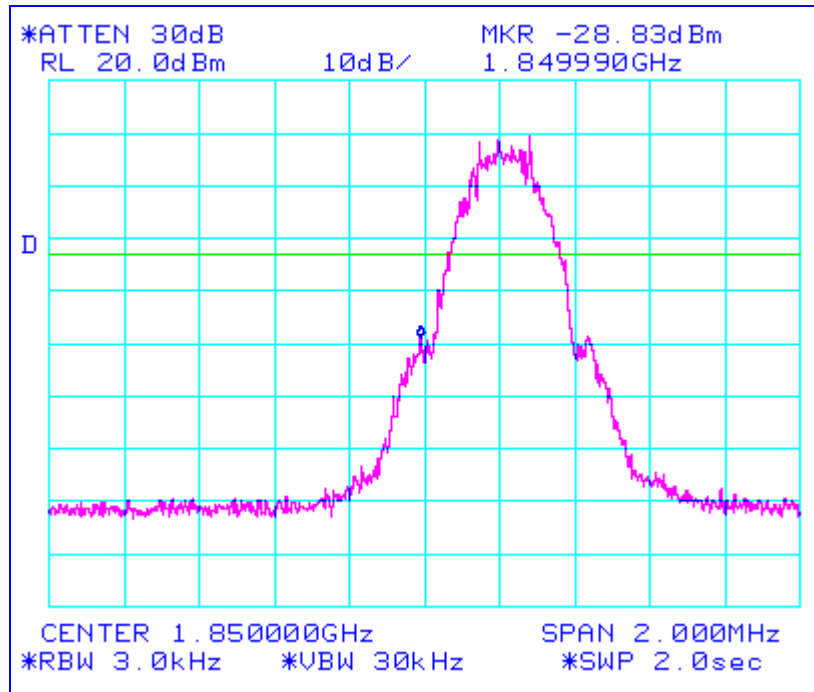
Test Engineer: Liming Xu

Test Date(s): 07/15/2004



Spurious Emissions at Antenna Terminal Frequency Block Edges Test Results

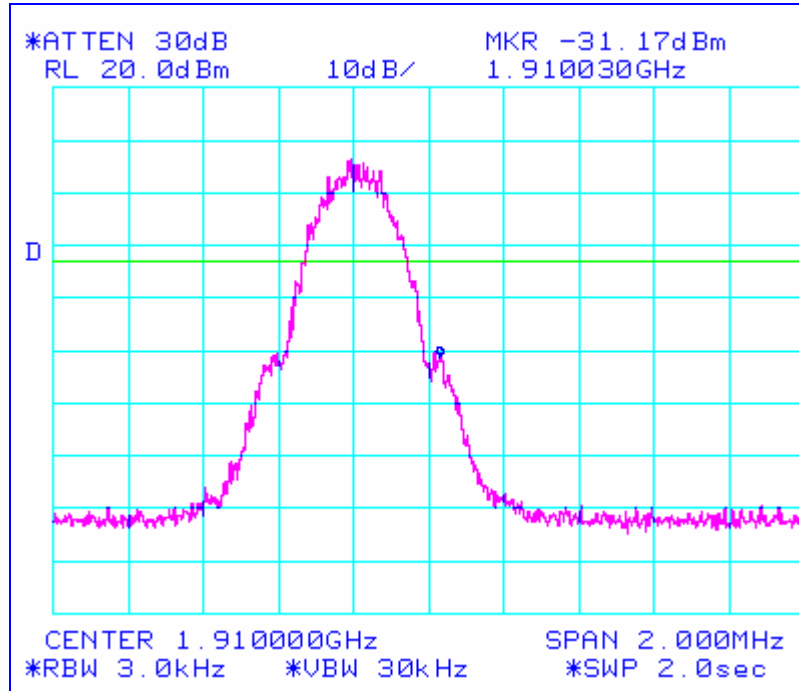
Spurious Emissions (Block Edges) Test Data Plots





Spurious Emissions at Antenna Terminal Frequency Block Edges Test Results

Spurious Emissions (Block Edges) Test Data Plots





3.4.3. Radiated Spurious Emissions

Test Requirement(s): § 2.1053 Measurements required: Field strength of spurious radiation.

§ 2.1053 (a)

§ 2.1053 (b)

§ 24.238 Emission limitations for Broadband PCS equipment

§ 24.238 (a)

Test Procedures: As required by §2.1053, field strength of spurious radiation measurements were made in accordance with the general procedures of 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*". Preliminary radiated emission measurements were performed inside a shielded chamber with all digital signal generators on and terminated. The frequency list from the preliminary measurements was used as a guide for making final measurements in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). The unit was scanned over the frequency range of the lowest system oscillator value to 20 GHz. The Radiated Spurious Emissions Limit is obtained by the following:

Based on an output power (as measured at the output of the amplifier) of 0.85 watts:

$$P_o = 0.85 \text{ W}$$

-the radiated power level of all spurious emissions must be attenuated by at least $43 + 10\log(P_o)$ below P_o , yielding:

$$P_o - [43 + 10\log(P_o)] = -13\text{dBm}$$



Test Results: The EUT complied with the requirement(s) of this section.

Radiated Spurious Emissions Measurements at 1 m distance

Frequency (GHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna Height (m)	Uncorrected Amplitude (dBuV)	ACF (dB) (+)	System Gain (dB) (-)	DCF (dB) (-)	Corrected Amplitude (dBuV)	dBc Limit (dBuV)*	Margin (dB)
3.700	0	H	1.00	47.20	32.66	30.20	0.00	49.66	94.00	-44.34
3.700	0	V	1.00	48.53	32.78	30.20	0.00	51.11	94.00	-42.89
5.550	0	H	1.00	50.33	35.80	31.30	0.00	54.83	94.00	-39.17
5.550	0	V	1.00	50.17	35.62	31.30	0.00	54.49	94.00	-39.51
7.401	0	H	1.00	49.17	37.66	28.50	0.00	58.33	94.00	-35.67
7.401	0	V	1.00	49.67	37.64	28.50	0.00	58.81	94.00	-35.19
9.250	0	H	1.00	51.33	39.20	26.75	0.00	63.78	94.00	-30.22
9.250	0	V	1.00	48.50	39.15	26.75	0.00	60.90	94.00	-33.10
11.100	0	H	1.00	47.83	40.34	27.06	0.00	61.11	94.00	-32.89
11.100	0	V	1.00	47.00	40.36	27.06	0.00	60.30	94.00	-33.70
12.950	0	H	1.00	47.83	41.67	27.10	0.00	62.40	94.00	-31.60
12.950	0	V	1.00	44.67	41.95	27.10	0.00	59.52	94.00	-34.48

Notes: * - dBc = $P_o - [43 - 10 \log(P_o)] = -13 \text{ dBm} = 94 \text{ dBuV}$

Test Engineer: Liming Xu

Test Date(s): 07/15/2004



3.4.4. Radiated Emissions -Substitution Equivalent Isotropic Radiated Power (E.I.R.P.)

Test Requirements: CFR 47 Part 24

Test Procedures: The EUT was installed on a 0.8 m high wooden table inside a shielded enclosure. An antenna was placed 1 meter from the EUT and measurements were made for frequencies and amplitude of field strengths in three channel settings (Low, Mid and High). Radiated measurements were made on the EUT. For EIRP Substitution method, the EUT was replaced with a horn antenna, which was driven by a signal generator, whose level was adjusted to obtain the same level as received via the radiated method. EIRP is calculated by adding the gain of the horn antenna to the level on the signal generator. Measurements were made according to the Substitution Method of *ANSI/TIA/EIA-603-A*.

Test Results: The EUT complied with the requirement(s) of this section. Measurement were made with the Benefon GSM PCS1900MHz (Trackbox).

Frequency (MHz) Channel	Conducted Level (dBm)	EIRP (dBm)	EIRP (Watts)
1850. CH 512	29.09	28.7	0.8
1870 CH 610	29.15	28.9	0.8
1910 CH 810	29.31	29.1	0.85

Test Engineer: Liming Xu

Test Date(s): 07/15/2004



3.5. Frequency Stability over Temperature Variations

Test Requirement(s): § 2.1055 Measurements required: Frequency stability

§ 2.1055 (a)

Test Procedures: As required by §2.1055(a)(1) of CFR 47, frequency tolerance measurements were made over the temperature range of -30°C to +50°C. The frequency measurements were made using direct input to a spectrum analyzer. Climatic control was accomplished using an environmental simulation chamber. The temperature was first lowered to -30°C and then raised hourly in 10° increments. The unit remained in the chamber during temperature transitions and during the measurement process.

Test Results: The EUT complied with the requirement(s) of this section. Frequency tolerance of carrier signal: +/- 0.0001% for a temperature variation from - 30°C to + 50°C at normal supply voltage.

Test Engineer(s): Liming Xu

Test Date(s): 08/26/2004



Frequency Stability over Temperature Variations Test Results

Carrier Frequency Deviations Due to Temperature Instability

Temperature (°C)	Carrier Frequency (GHz) Channel	Frequency Deviation (Hz)	Deviation Limit (kHz)
-30	1.879,788,9xx *	50	± 1.88
-20	1.879,788,9xx *	50	± 1.88
-10	1.879,788,9xx *	50	± 1.88
0	1.879,788,9xx *	50	± 1.88
+10	1.879,788,9xx *	50	± 1.88
+20	1.879,788,9xx *	50	± 1.88
+30	1.879,788,9xx *	50	± 1.88
+40	1.879,788,9xx *	50	± 1.88
+50	1.879,788,9xx *	50	± 1.88

Notes: * - The frequency deviation (+/-50 Hz) can only affect the two least significant numbers of the carrier frequency.



Frequency Stability over Voltage Variations

Test Requirement(s): § 2.1055 Measurements required: Frequency stability

§ 2.1055 (d)(2)

Test Procedures: As required by §2.1055(d)(2) of CFR 47, frequency tolerance measurements were made changes in the supply voltage to the EUT from 85% to 115% of the nominal supply voltage using a variable transformer to vary the AC supply. The frequency measurements were made using direct input to a spectrum analyzer. Frequency tolerance of carrier signal: $\pm 0.0001\%$ for a variation in primary voltage from 85% to 115% of the rated supply.

Test Results: The EUT complied with the requirement(s) of this section.

Test Engineer(s): Liming Xu

Test Date(s): 08/26/2004



Frequency Stability over Voltage Variations

Carrier Frequency Deviations Due to Voltage Variation

Percentage of Rated Supply	AC Voltage (V)	Carrier Frequency (MHz)	Frequency Deviation (Hz)	Deviation Limit (kHz)
85%	187	1.879,788,9xx *	50 *	± 1.88
100%	220	1.879,788,9xx *	50 *	± 1.88
115%	253	1.879,788,9xx *	50 *	± 1.88

Notes: * - The frequency deviation is less than 50 Hz; there is no detectable frequency variation when the frequency counter was set to 50Hz resolution.



4. Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSS Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: Unintentional Conducted Emissions			Test Date(s): 07/14/2004		
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4212	LISN; SWITCH	SOLAR ELECTRONICS CO	9252-R-24-BNC	10/06/2003	10/06/2004
1T4156	SPECTRUM ANALYZER; EMC	HEWLETT PACKARD	8594EM	05/03/2004	05/03/2005
1T4382	SHIELD ROOM 6	FIL-SHIELD	N/A	12/12/2003	12/12/2004
Test Name: Unintentional Radiated Emissions			Test Date(s): 08/23/2004		
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4409	EMI RECEIVER	RHODE & SCHWARS	ESP17	04/08/2004	04/08/2005
1T4300	SHIELD ROOM 1	EMC TEST SYSTEMS	NONE	05/03/2003	04/03/2006
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	04/22/2004	04/22/2005
1T4414	MICROWAVE PRE-AMPLIFIER	AH SYSTEMS	PAM-0118	07/09/2004	07/09/2005
1T4316	SPECTRUM ANALYZER	HEWLETT PACKARD	8564E	04/05/2004	04/05/2005
1T2511	ANTENNA; HORN	EMCO	07/11/1908	07/14/2004	07/14/2005
1T4323	HARMONIC MIXER	HEWLETT PACKARD	11970K	See Note	
Test Name: PCS Device Testing			Test Date(s): 07/15/2004		
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4351	SPECTRUM ANALYZER	AGILENT	E 7405A	08/21/2004	08/21/2005
1T2665	HORN ANTENNA	EMCO	3115	03/12/2004	03/12/2005
1T4302	EMI RECEIVER	HEWLETT PACKARD	8546A	10/06/2004	10/06/2005
1T4409	EMI RECEIVER	RHODE & SCHWARS	ESP17	04/08/2004	04/08/2005
1T4300	SHIELD ROOM 1	EMC TEST SYSTEMS	NONE	05/03/2003	04/03/2006
1T4303	ANTENNA; BILOG	SCHAFNER - CHASE EMC	CBL6140A	04/22/2004	04/22/2005
1T4414	MICROWAVE PRE-AMPLIFIER	AH SYSTEMS	PAM-0118	07/09/2004	07/09/2005
1T4316	SPECTRUM ANALYZER	HEWLETT PACKARD	8564E	04/05/2004	04/05/2005
1T2511	ANTENNA; HORN	EMCO	07/11/1908	07/14/2004	07/14/2005
1T4323	HARMONIC MIXER	HEWLETT PACKARD	11970K	See Note	

Notes: Functionally verified test equipment is verified using calibrated instrumentation at the time of testing.



5. Compliance Information

5.0. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
 - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
 - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.



- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing;*
 - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
 - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
 - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.



The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.¹ *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

¹ In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.



§ 2.948 Description of measurement facilities.

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
 - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
 - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
 - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
 - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.



5.1. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

- (1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

- (2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

- (3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- (4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.
- (5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

- (a) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



6. Appendix I

The following data, in conjunction with FCC Part 24 testing, demonstrates compliance with RSS-133 Issue 2 Rev.1 November 1999.

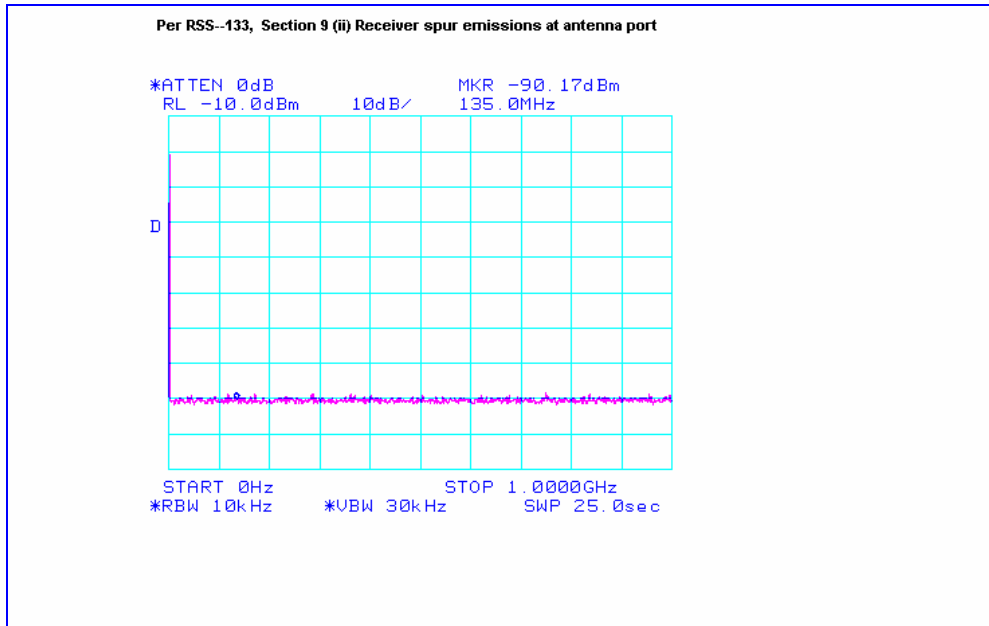


Figure 2. Receiver spurious emissions at antenna port – 0 Hz – 1 GHz

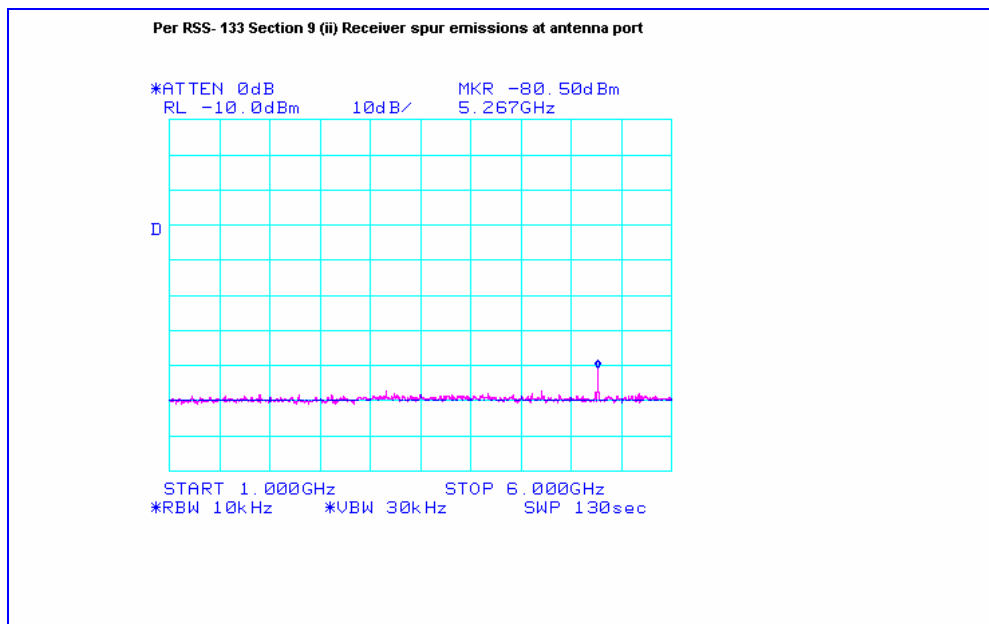


Figure 3. Receiver spurious emissions at antenna port – 1 GHz – 6 GHz