

## TEST REPORT

**Report Number: 3093766MPK-001**  
**Project Number: 3093766 and 3099689**  
**Report Date: June 9, 2006**

**Testing performed on the**

**Model: GR-3**  
**P/N: 01-050901-01**  
**FCC ID: LCB-050901**

**to**  
**FCC Part 15.247**

**for**  
**Topcon Positioning Systems, Inc.**



A2LA Certificate Number: 1755-01

**Test Performed by:**

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1365 Adams Court  
Menlo Park, CA 94025

**Test Authorized by:**

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Livermore, CA 94551 USA

**Prepared by:**

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David Chernomordik, EMC Technical Manager

**Date:** June 9, 2006

**Reviewed by:**

Ollie Moyrong  
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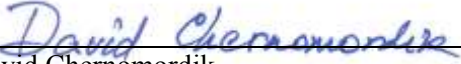
**Date:** June 9, 2006

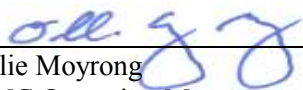
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**Report No. 3093766MPK-001**

<b>Equipment Under Test:</b>	GNSS receiver with GPS, with 900 MHz SS modem and Bluetooth module
<b>Trade Name:</b>	Topcon Positioning Systems
<b>Model No.:</b>	GR-3
<b>Part No.:</b>	01-050901-01
<b>FCC ID:</b>	LCB-050901
<b>Applicant:</b>	Topcon Positioning Systems, Inc.
<b>Contact:</b>	Mr. Kent Mizuide
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<b>Fax number:</b>	925-245-8594
<b>Applicable Regulation:</b>	FCC Part 15, Subpart C
<b>Test Site Location:</b>	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025
<b>Date of Test:</b>	March 14 – June 8, 2006

*We attest to the accuracy of this report:*

  
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David Chernomordik  
EMC Technical Manager

  
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## 1.0 Introduction

The Equipment under Test (EUT) is a composite device with two Spread Spectrum Transceivers operating in the 2.4 GHz and 900 MHz frequency bands.

This report is designed to show compliance of the 900 MHz transceiver with FCC Part 15.247 requirements.

### 1.1 Summary of Tests

TEST	REFERENCE	RESULTS
Max. Output power	15.247(b)	Complies
20 dB Bandwidth	15.247(a)(1)	Complies
Min. Channel Separation	15.247(a)(1)	Complies
Min. Hopping Channels	15.247(a)(1)	Complies
Average Channel Occupancy Time	15.47(a)(1)	Complies
Out-of-band Antenna Conducted Emission	15.247©	Complies
Out-of-Band Radiated Emission (except emissions in Restricted Bands)	15.247©	Not Applicable. The device passed Out-of-band Antenna Conducted Emission
Radiated Emission in Restricted Bands	15.247 (c), 15.205	Complies
RF exposure	15.247(i)	Complies
AC Conducted Emission	15.207	Complies
Radiated Emission from Digital Parts and receiver	15.109	Complies
Antenna Requirement	15.203	Complies

## 2.0 General Description

### 2.1 Product Description

The EUT is a Dual Frequency GNSS receiver with GPS, with 900 MHz Spread Spectrum modem and Bluetooth module. In normal operation the EUT tracks a satellite, receives reference data from a base station via radio modem, and measures the position.

#### Overview of the EUT

<b>Applicant</b>	Topcon Positioning Systems, Inc. 7400 National Drive Livermore, CA 94551 USA
<b>Manufacturer name &amp; address</b>	Topcon Positioning Systems, Inc. 7400 National Drive Livermore, CA 94551 USA
<b>Trade Name &amp; Part No.</b>	GR-3, 01-050901-01
<b>FCC Identifier</b>	LCB-050901
<b>Use of Product</b>	GPS Survey Receiver
<b>Type of Transmission</b>	Spread Spectrum, Frequency Hopping
<b>Rated RF Output</b>	1 W/0.25 W
<b>Frequency Range</b>	902.2 – 927.6 MHz
<b>Number of Channel(s)</b>	128
<b>Data Rate</b>	Up to 57600 bps
<b>Antenna(s) type &amp; Gain</b>	Model: DEXRN902RTN from Antenex, swivel, 1/2 wave, 2.5 dBi The antenna is affixed to the EUT using a reverse TNC connector.
<b>LO Frequencies</b>	LO1: 1172.2 – 1197.6 MHz; LO2: 280.7 MHz

A production version of the sample was received on March 9, 2006 in good condition. As declared by the Applicant, it is identical to production units.

Test start date: March 14, 2006

Test end date: June 8, 2006

### 2.2 Related Submittal(s) Grants

The FCC Part 15.247 Application for FHSS transmitter, operating in the 2.4-2.4835 GHz band, is filed simultaneously with the same FCC ID.

### 2.3 Test Methodology

Radiated and AC Line conducted emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “**Data Sheet**” of this Application. All other measurements were made in accordance with the procedures described in DA 00-705.

### 2.4 Test Facility

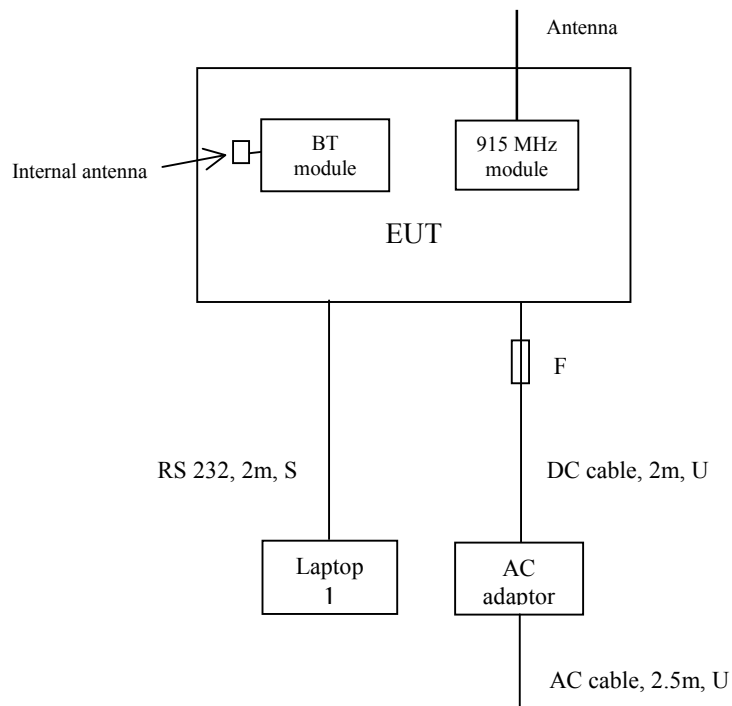
The open area test site and conducted measurement facility used to collect the radiated data is site 1 located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC.

### 3.0 System Test Configuration

#### 3.1 Support Equipment

Item #	Description	Model No.
1	Compaq Laptop	Armada E 500

#### 3.2 Block Diagram of Test Setup



AC adaptor: model PSA-30U-120, P/N 22-034101-01

<b>S</b> = Shielded	<b>F</b> = With Ferrite
<b>U</b> = Unshielded	<b>m</b> = Length in Meters

### 3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT is attached to peripherals and they are connected and operational (as typical as possible). The EUT is wired to transmit full power. During testing, all cables are manipulated to produce worst case emissions.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

In normal operation the EUT may be powered from internal battery or from AC mains using an AC/DC adapter. When the adapter is used, the internal battery is charging. The “charging mode” requires additional cables to be connected to the EUT. The worst case radiated emissions is considered to be in this mode. Therefore, radiated and conducted emission measurements were performed in the charging mode.

### 3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing is “Topsurv for FC-100” which is allowed to exercise the various system components in a manner similar to a typical use.

### 3.5 Mode of Operation During Test

The transmitter was tested in test mode (simulating the normal operation as a Base) which allows to control the device from a computer (laptop). With hopping disable, the EUT was setup to transmit continuously at the lowest, middle, and highest channels (frequencies). Some tests were performed with hopping enabled. In addition, the EUT was tested in the receiving mode, setup on the middle channel (simulating the normal operation as a Rover).

During the testing the Baud rate was set to 57600 b/s, and the Link rate was set to 9600 b/s as it uses in normal operation.

The Transmitter has two output power options: 1 W and 0.25 W. Tests were performed for 1 W setting as a worst-case configuration.

### 3.6 Modifications Required for Compliance

No modifications were installed by Intertek during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Topcon prior to compliance testing).



#### 4.0 Measurement Results

##### 4.1 Conducted Output Power at Antenna Terminals FCC 15.247(b)(1)

###### Requirement

For systems operating in the 902 – 928 MHz band employing at least 50 hopping channels, the maximum peak output power is 1 watt (30 dBm), for systems employing less than 50 hopping channels – 0.25 W (24 dBm). If transmitting antennas of directional gain greater than 6 dBi are used the peak output power shall be reduced by the amount in dB that the directional gain of the antennas exceeds 6 dBi.

###### Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer. The attenuation of the external attenuator and cable loss was added to the spectrum analyzer reading as Rev Lev OFFSET to obtain the power at the EUT antenna terminal.

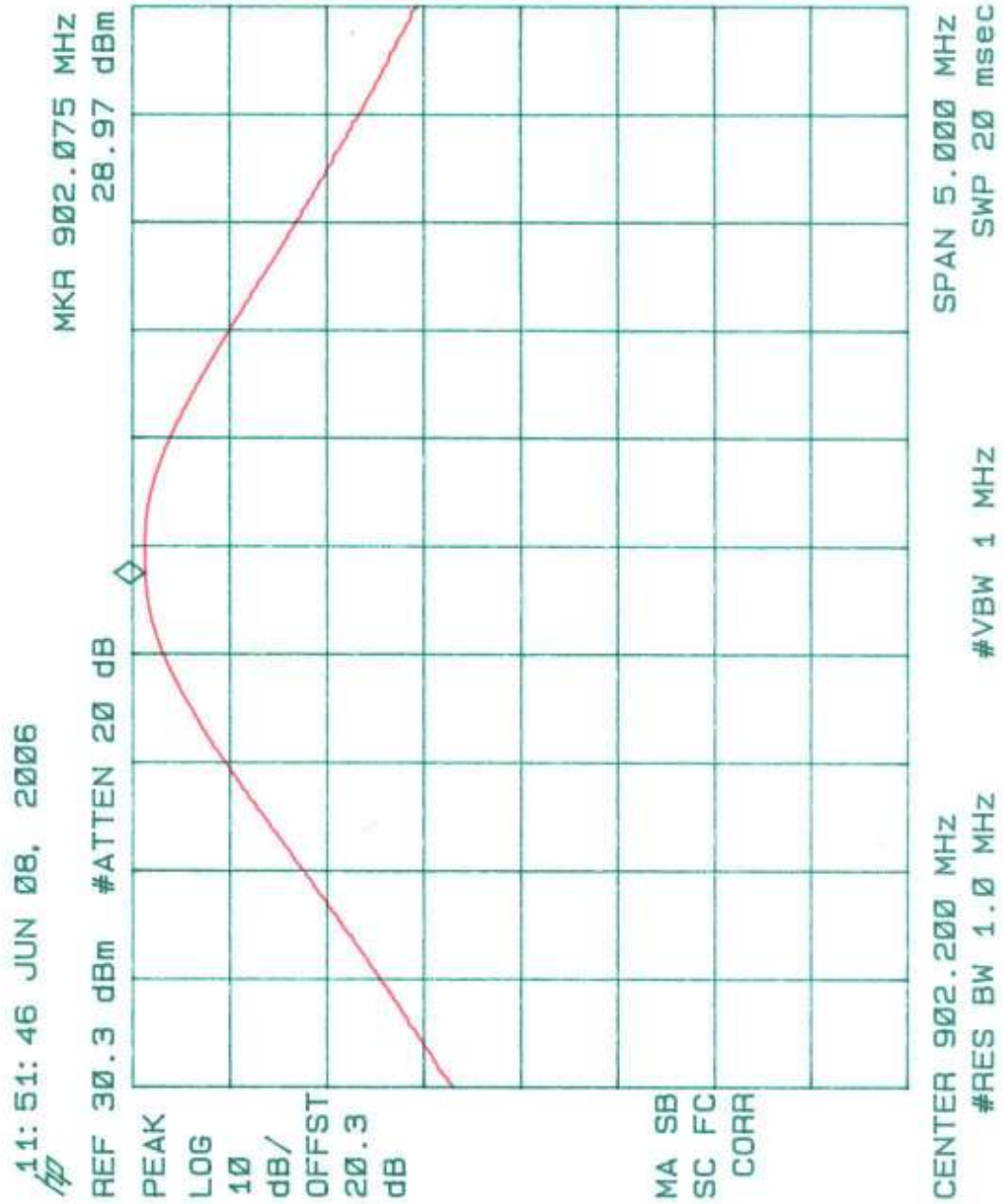
###### Test Results

Frequency, MHz	Data rate, baud	Output Power, dBm	Output Power, W	Plot
902.2	57600	29.0	0.794	1.1
915.0	57600	28.8	0.759	1.2
927.6	57600	28.7	0.741	1.3

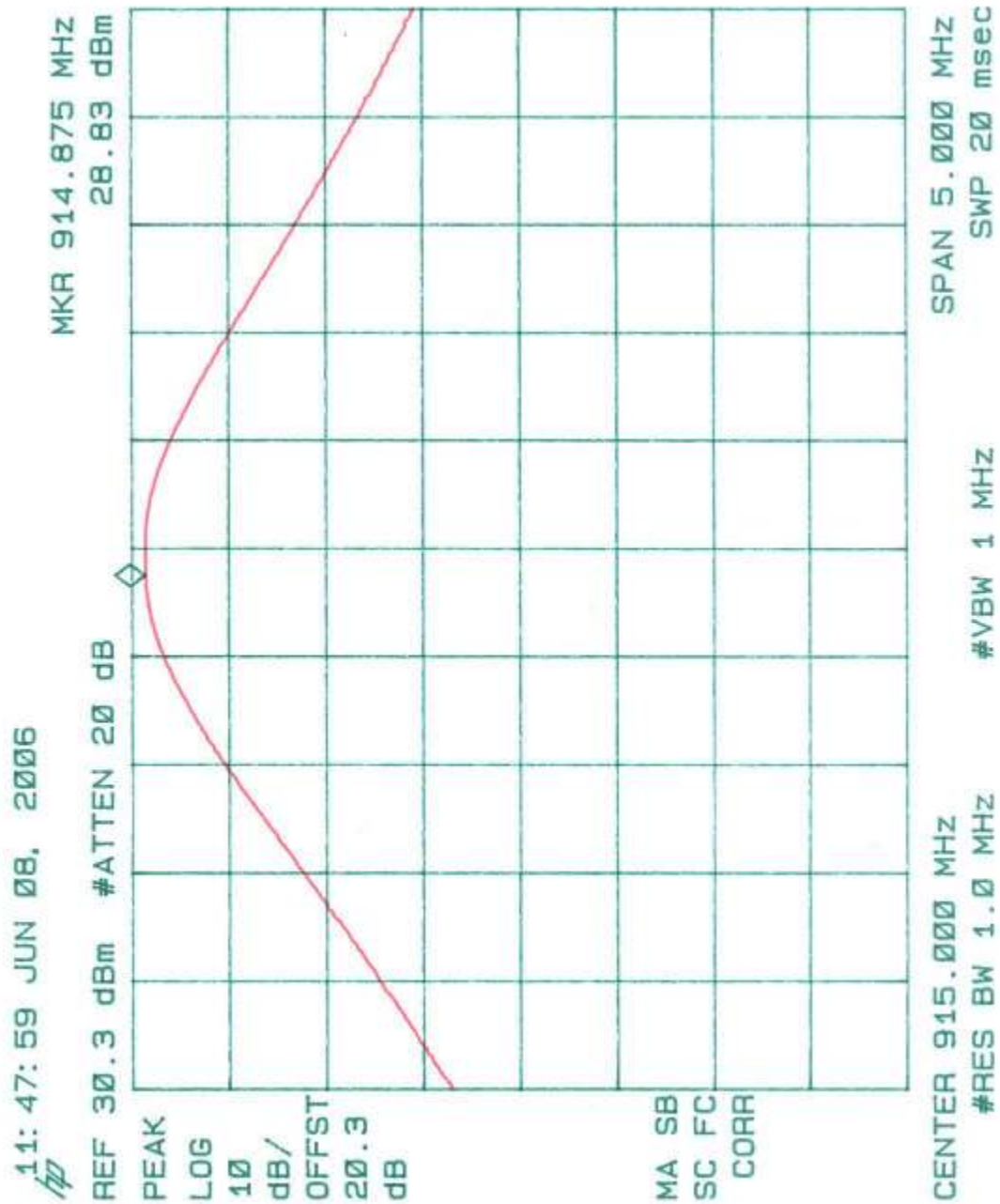
Notes: 1. Hopping function was disabled during the test.  
2. The EUT's antenna has less than 6 dBi gain.

Refer to attached plots 1.1-1.3.

Plot 1.1



Plot 1.2



Plot 1.3



#### 4.2 Hopping Channel 20-dB Bandwidth FCC 15.247(a)(ii)(iii)

##### Requirements

For systems operating in the 902 - 928 MHz band employing at least 50 hopping channels, the maximum 20-dB bandwidth of the hopping channel is 250 kHz. Systems may utilize hopping channels whose 20-dB bandwidth is greater than 250 kHz provided the system use at least 25 hopping channels.

The maximum allowed 20-dB bandwidth of the hopping channel is 500 kHz.

##### Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer. The spectrum analyzer resolution bandwidth was set to approximately 1% of the 20-dB Bandwidth. The 20-dB Bandwidth was measured by using the DELTA MARKER function of the analyzer.

##### Test Results

<b>Frequency, MHz</b>	<b>Data rate, baud</b>	<b>20-dB channel bandwidth kHz</b>	<b>Plot</b>
902.2	57600	137.0	2.1
902.2	9600	137.0	2.2
915.6	57600	137.0	2.3
915.6	9600	137.0	2.4
927.6	57600	137.0	2.5
927.6	9600	137.0	2.6

Note: Hopping function was disabled during the test.

Refer to attached plots 2.1-2.6.

Plot 2.1



Comment: 20-dB bandwidth, 57600 baud  
Date: 14.MAR.2006 14:34:37

Plot 2.2



Comment: 20-dB bandwidth, 9600 baud  
Date: 14.MAR.2006 14:37:10

Plot 2.3



Comment: 20-dB bandwidth, 57600 baud  
Date: 14.MAR.2006 14:41:39



Plot 2.4



Comment: 20-dB bandwidth, 9600 baud  
Date: 14.MAR.2006 14:44:32

Plot 2.5



Comment: 20-dB bandwidth, 57600 baud  
Date: 14.MAR.2006 14:47:49

Plot 2.6



Comment: 20-dB bandwidth, 9600 baud  
Date: 14.MAR.2006 14:50:40

#### 4.3 Hopping Channel Carrier Frequency Separation FCC Ref: 15.247(a)(1)

##### Requirements

Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20-dB bandwidth, whichever is greater.

##### Procedure

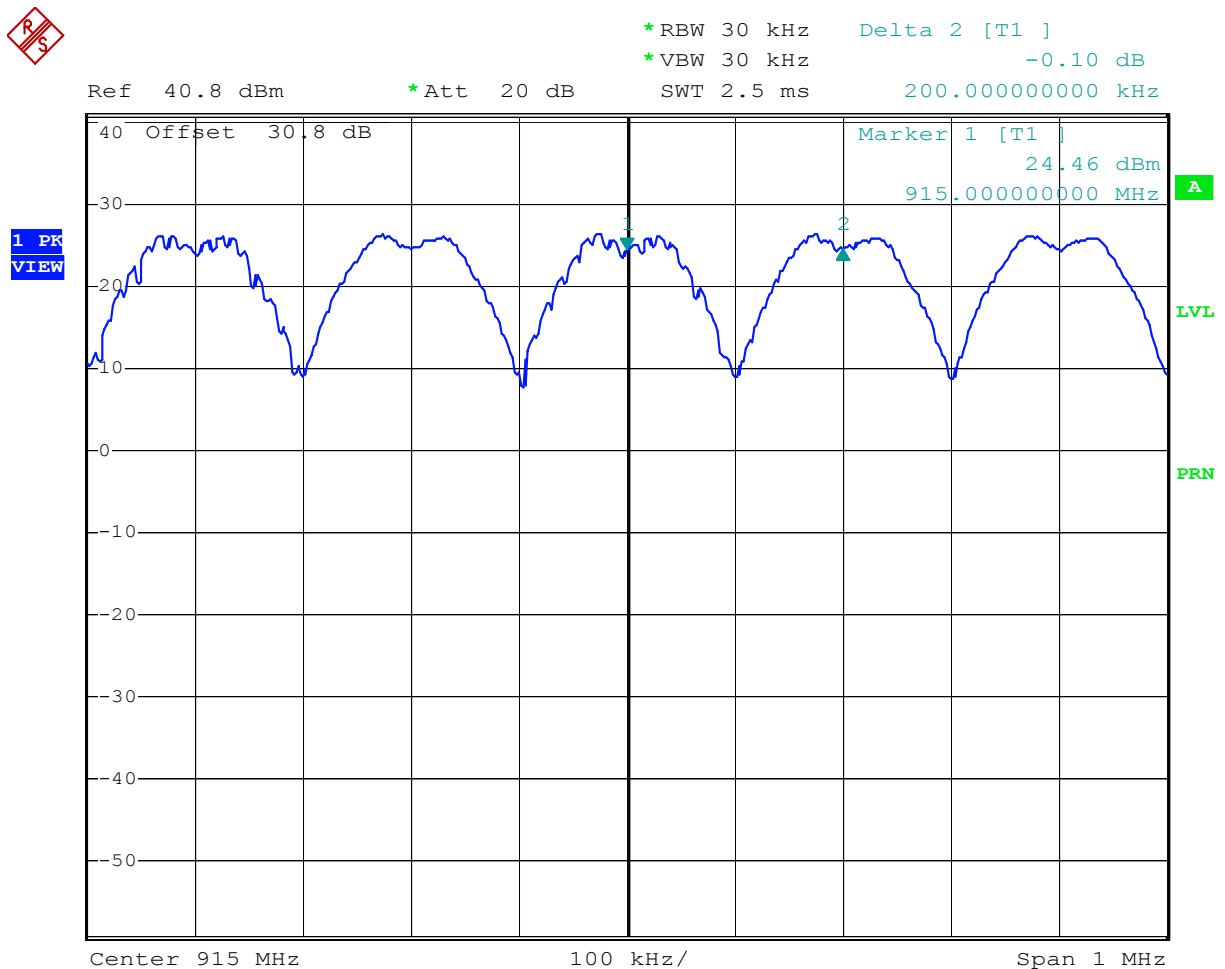
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit.

##### Test Results

Refer to the attached spectrum analyzer plot # 3.1 for the test result.

The channel separation is 200 kHz.

Plot 3.1



Comment: Carrier frequency separation, hopping enable, 57600 baud  
 Date: 15.MAR.2006 10:43:08

4.4 Number of Hopping Channels  
FCC Ref: 15.247(a)(1)(i&ii)

Requirements

Systems operating in the 902 – 928 MHz band shall use at least 50 hopping channels having the 20-dB bandwidth less than 250 kHz, and at least 25 hopping channels having the 20-dB bandwidth of 250 kHz or greater.

Procedure

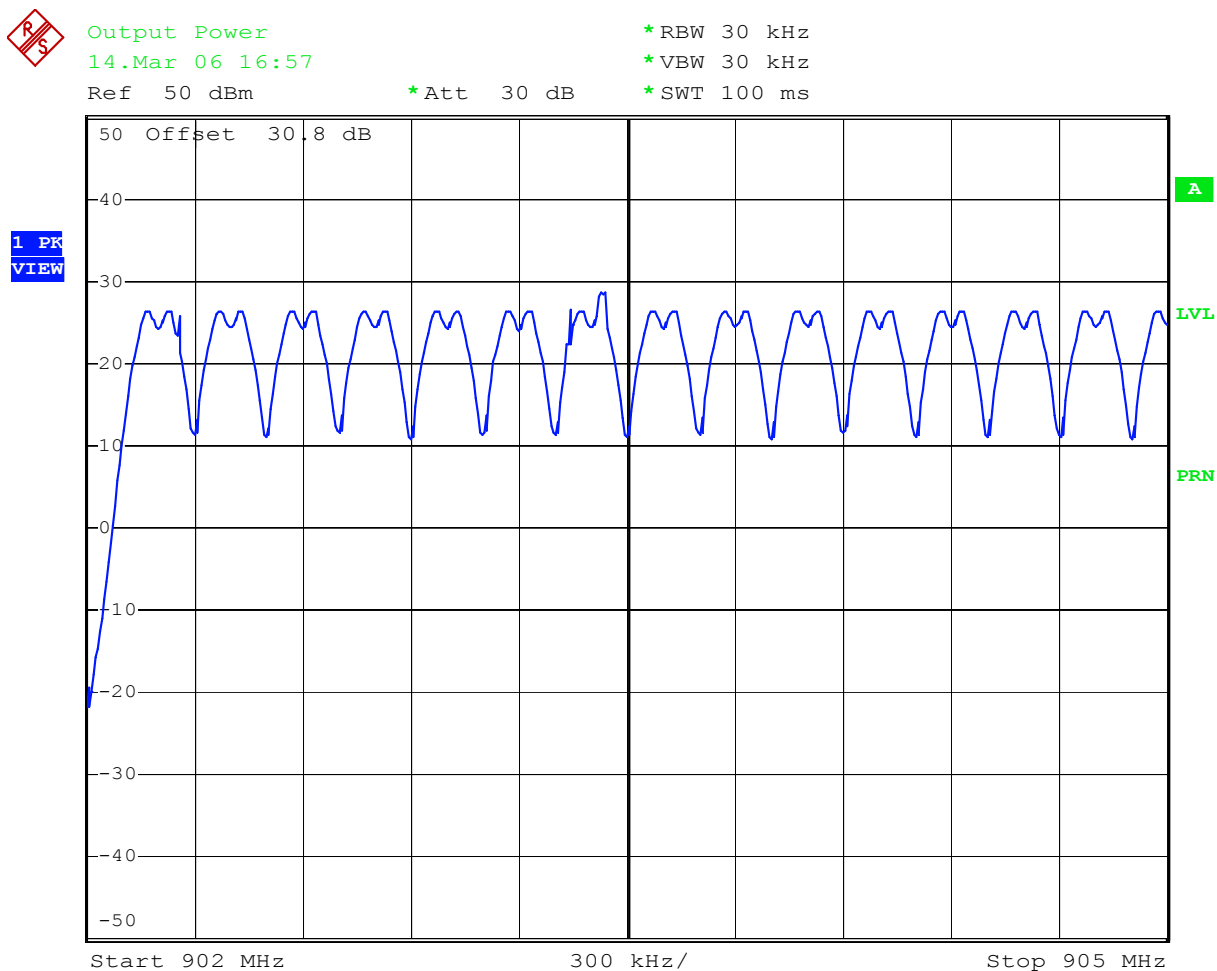
The RF passband of the EUT was divided into 5 approximately equal bands. With the analyzer set to MAX HOLD, readings were taken for 2 - 3 minutes in each band. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Test Results

Number of hopping channels with the bandwidth less than 250 kHz	128
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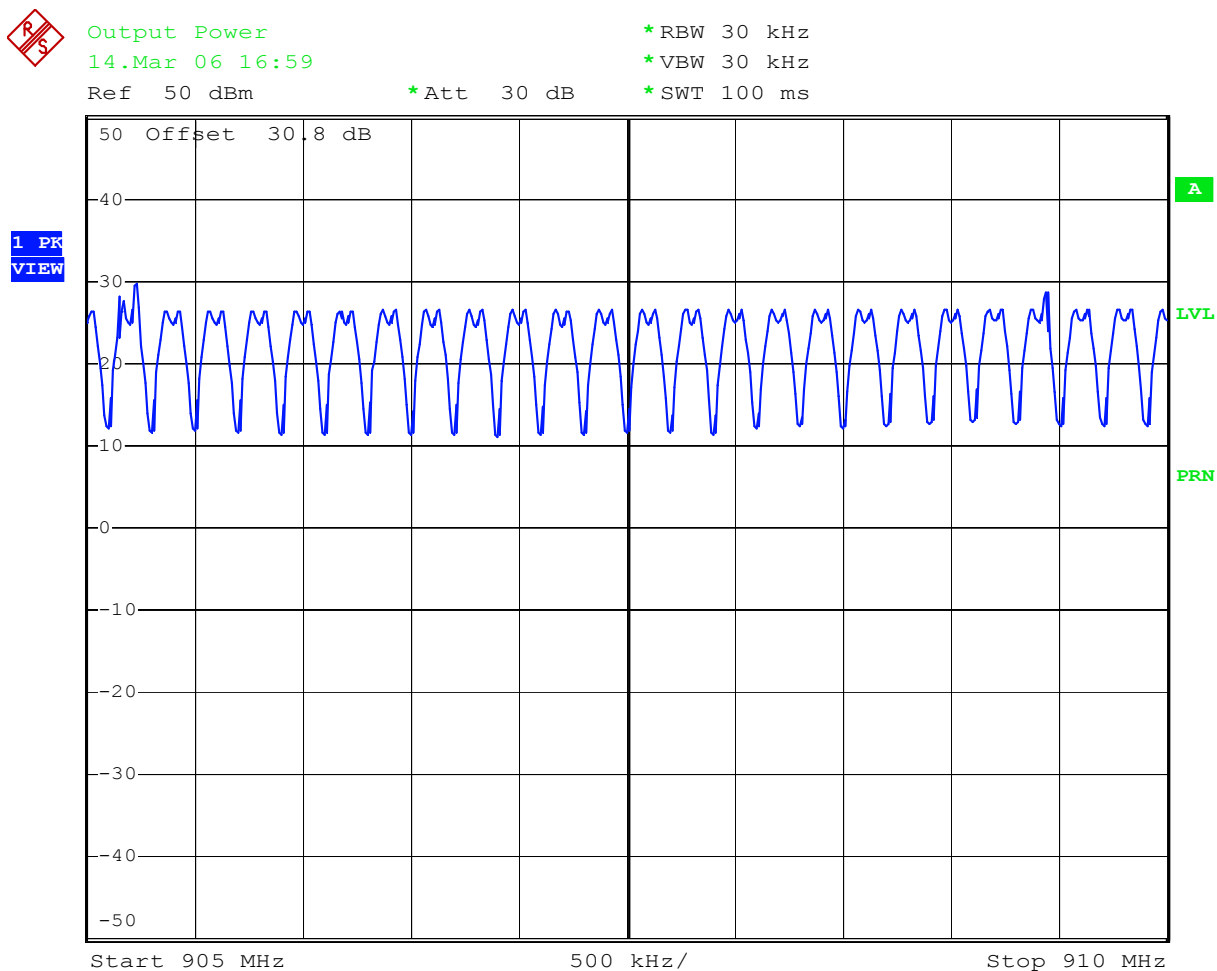
Refer to attached plots 4.1-4.5.

Plot 4.1



Comment: Number of channels, hopping enable, 57600 baud  
Date: 14.MAR.2006 16:57:42

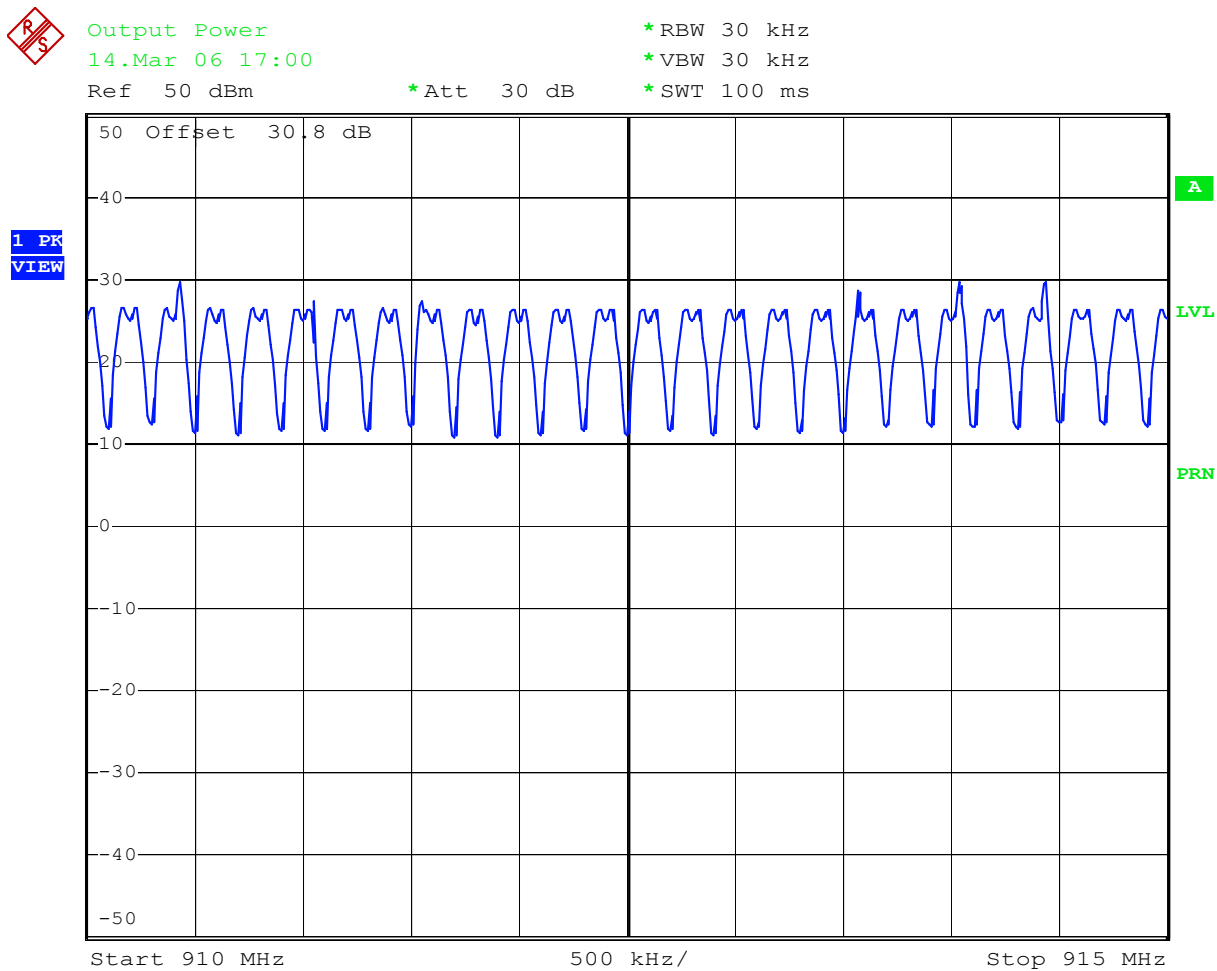
Plot 4.2



Comment: Number of channels, hopping enable, 57600 baud  
Date: 14.MAR.2006 16:59:02

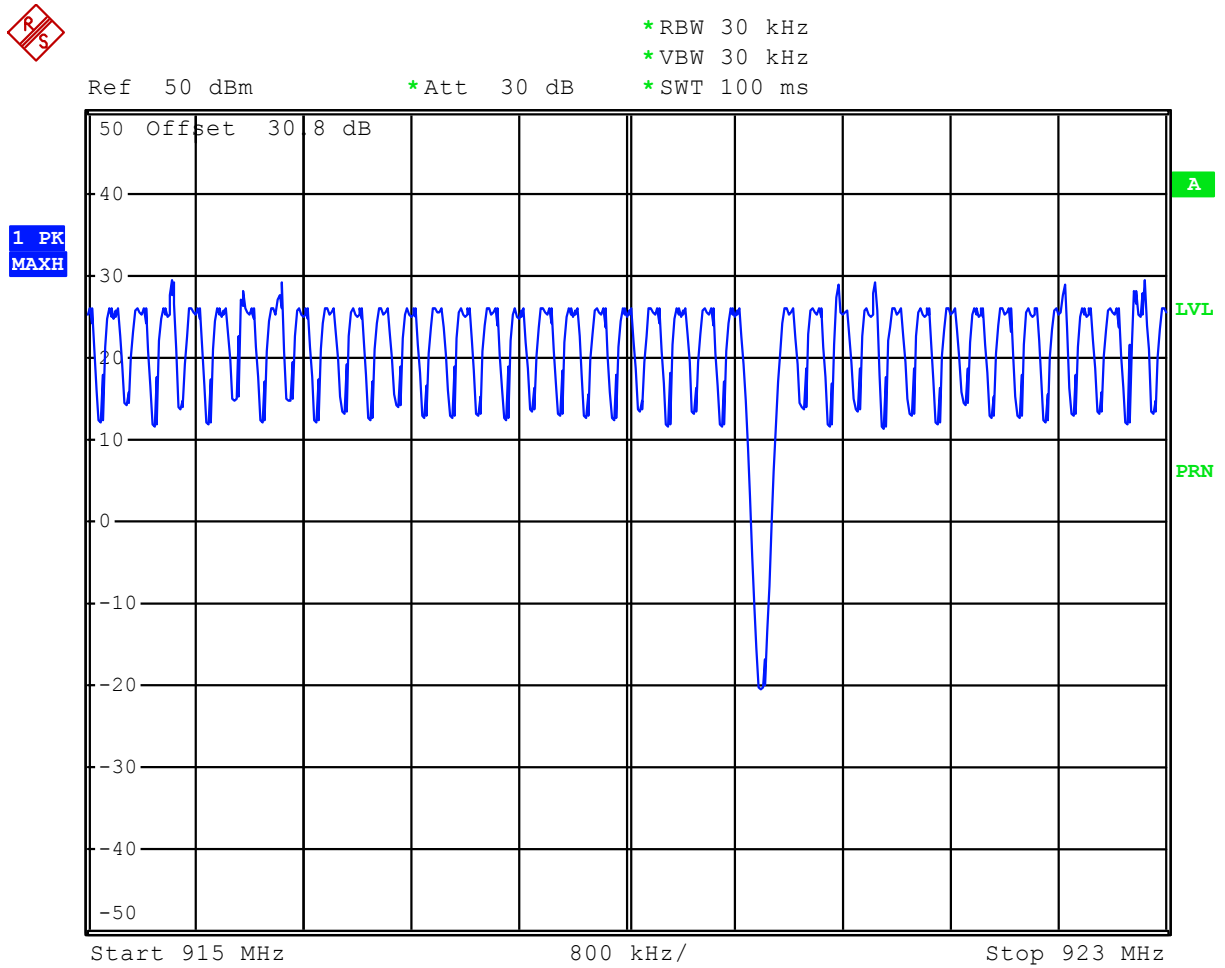


Plot 4.3



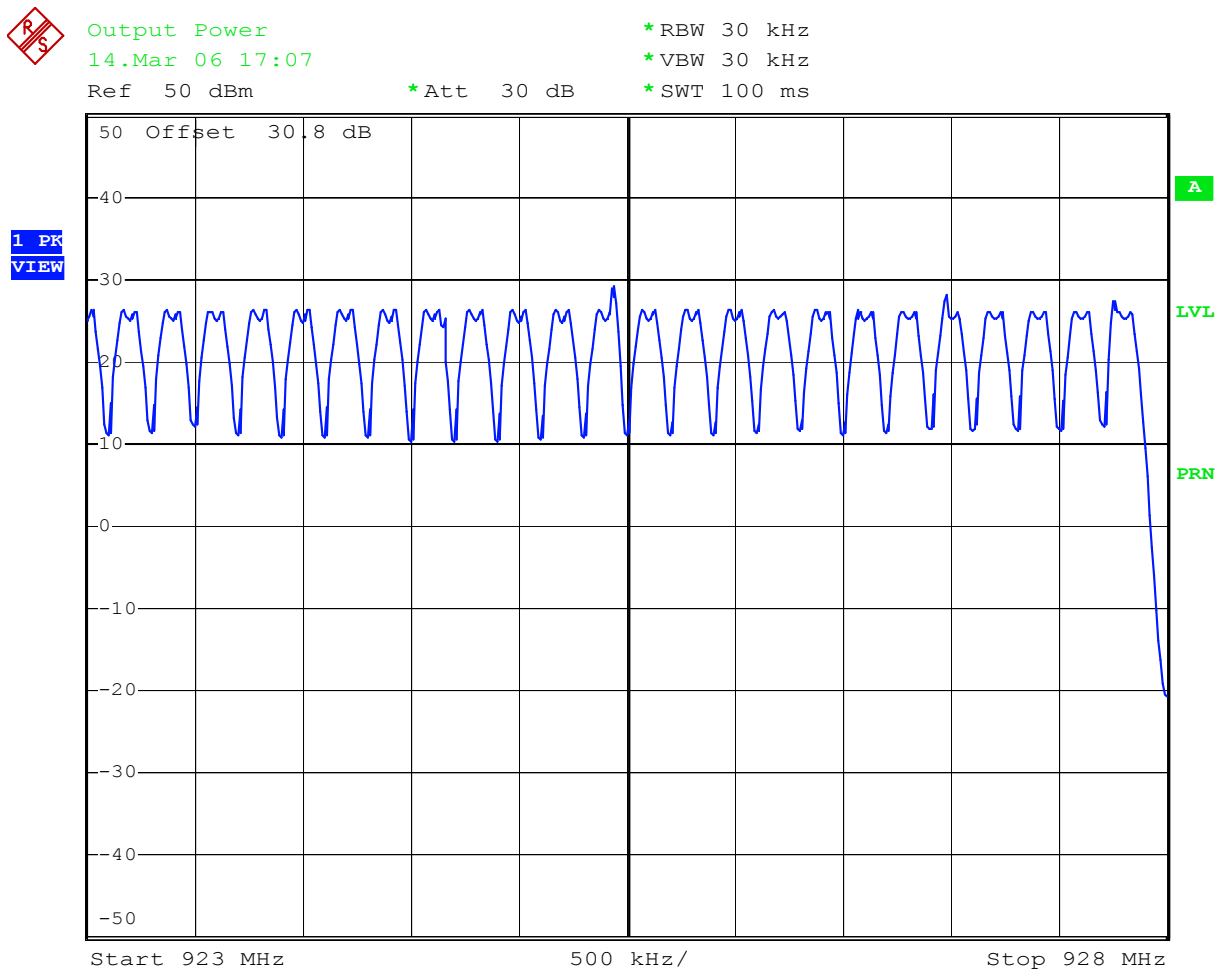
Comment: Number of channels, hopping enable, 57600 baud  
Date: 14.MAR.2006 17:00:06

Plot 4.4



Comment: Number of channels, hopping enable, 57600 baud  
 Date: 14.MAR.2006 17:04:18

Plot 4.5



Comment: Number of channels, hopping enable, 57600 baud  
Date: 14.MAR.2006 17:07:55

#### 4.5 Average Channel Occupancy Time FCC 15.247(a)(1)(ii)(iii)

##### Requirements

For systems operating in the 902 - 928 MHz band and using at least 50 hopping channels with the 20-dB bandwidth of less than 250 kHz, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 20 second period.

For systems operating in the 902 - 928 MHz band and using at least 25 hopping channels with the 20-dB bandwidth of 250 kHz or greater, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 10 second period.

##### Procedure

The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 1 second, the SPAN was set to ZERO SPANS, and the TRIGGER was set to VIDEO. The time duration of the transmission so captured was measured with the MARKER DELTA function.

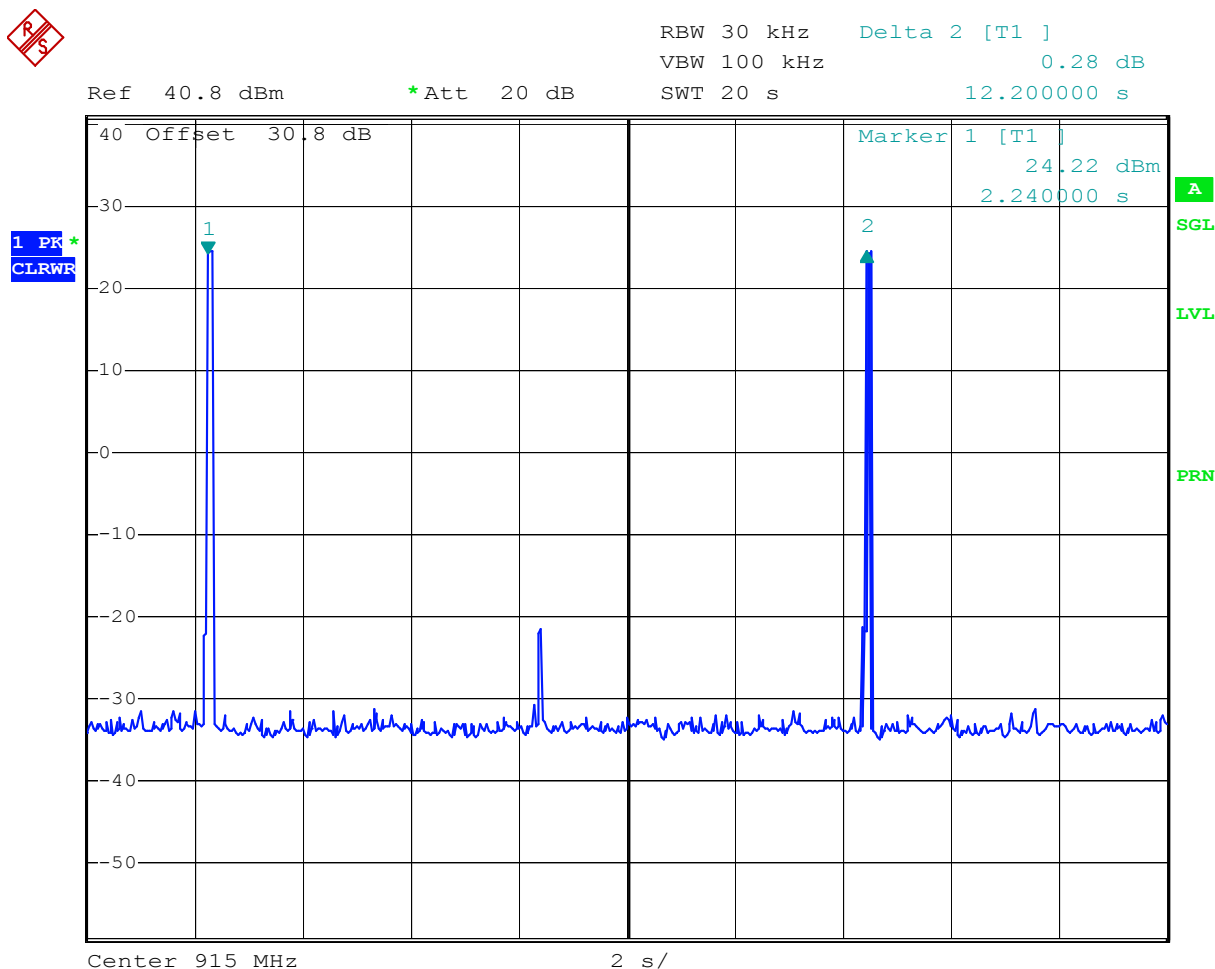
The SWEEP was then set to the time required by the regulation (20 seconds). The analyzer was set to SINGLE SWEEP, the total ON time was added and compared against the limit (0.4 seconds).

##### Test Results

The average time occupancy is:  $85.2 \times 2 = 170.4$  ms.

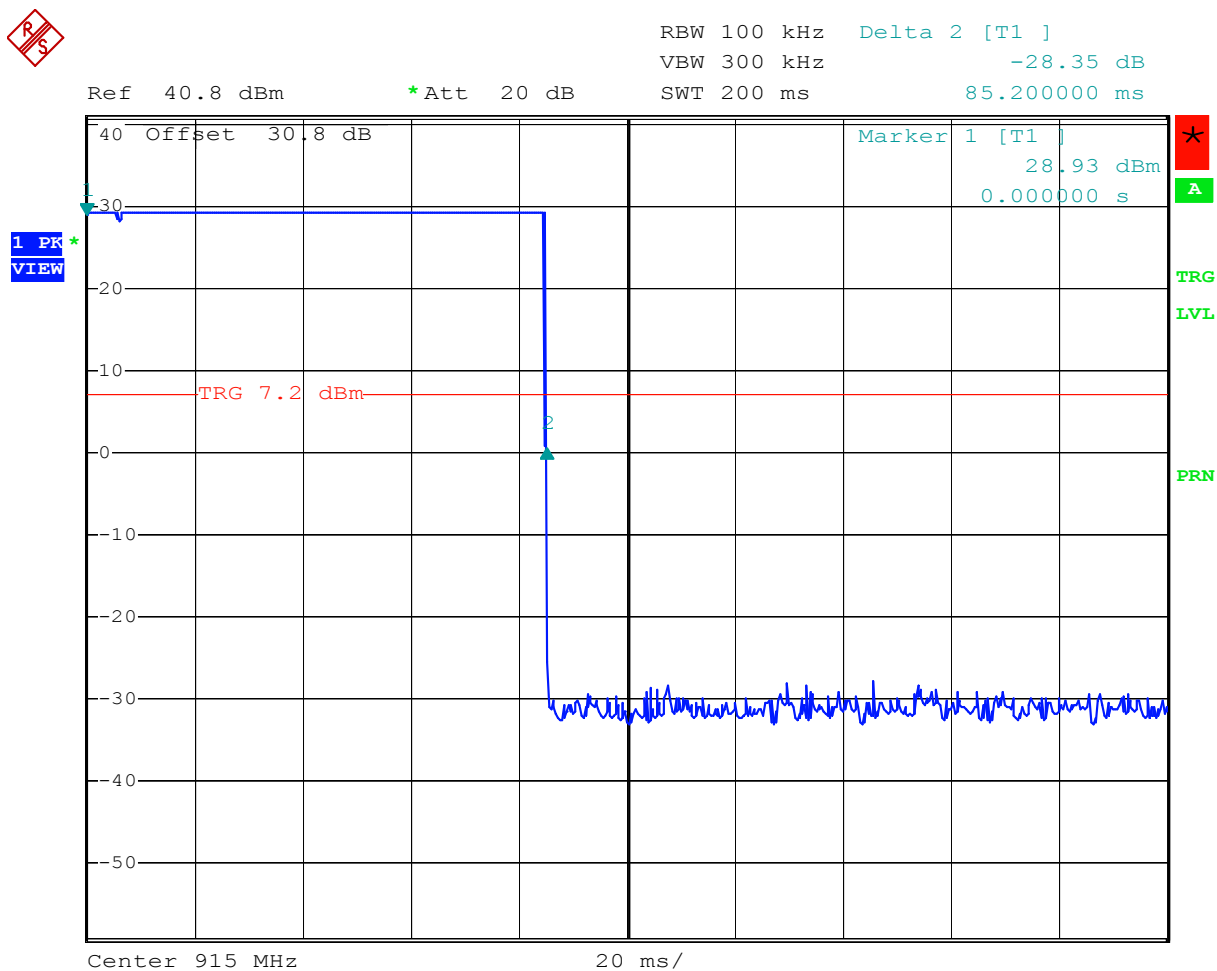
Refer to attached plots 5.1-5.4.

Plot 5.1



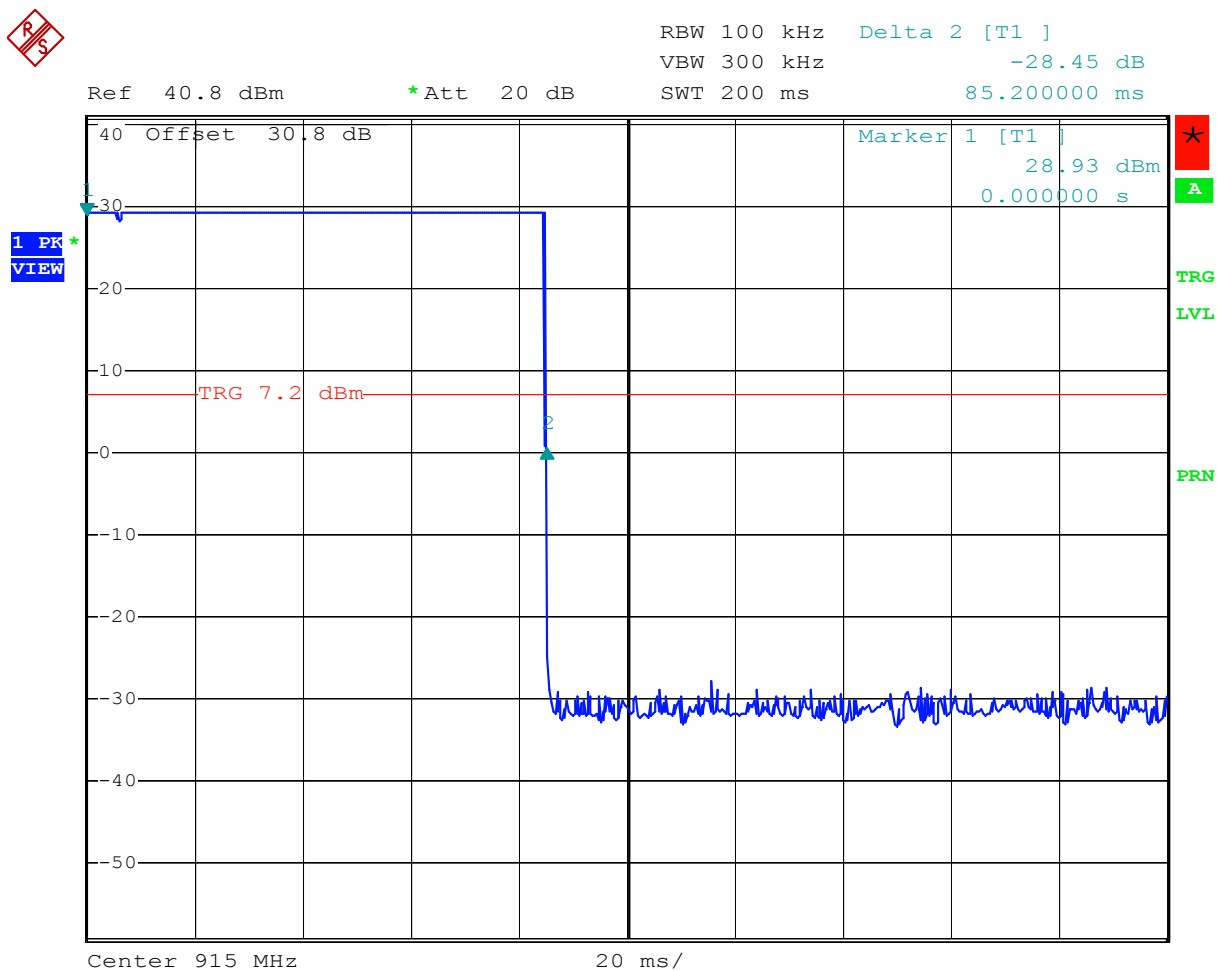
Comment: Time of occupancy, hopping enable, 57600 baud  
Date: 15.MAR.2006 10:07:41

Plot 5.2



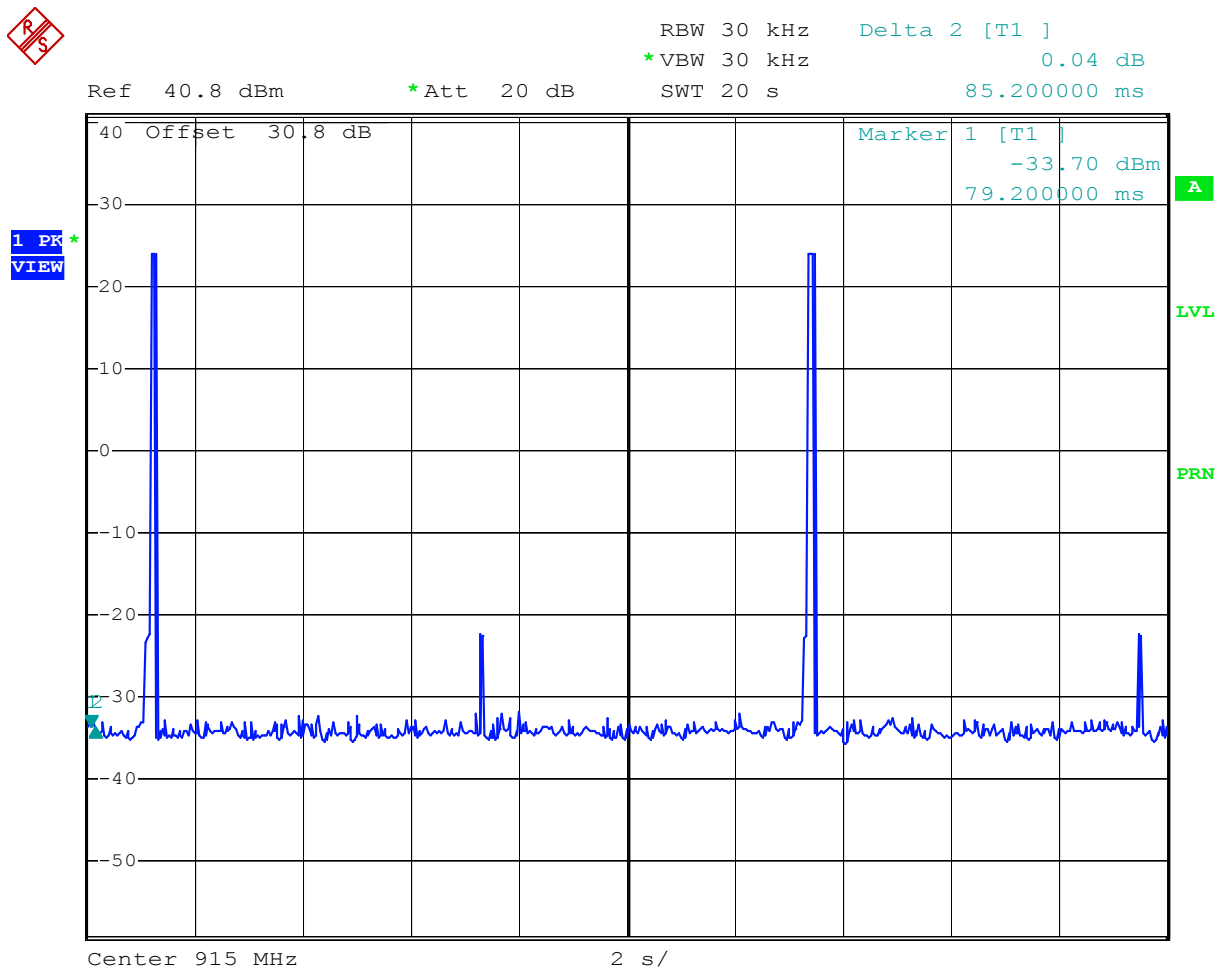
Comment: Time of occupancy, hopping enable, 57600 baud  
 Date: 15.MAR.2006 10:33:46

Plot 5.3



Comment: Time of occupancy, hopping enable, 9600 baud  
 Date: 15.MAR.2006 10:35:08

Plot 5.4



Comment: Time of occupancy, hopping enable, 9600 baud  
 Date: 15.MAR.2006 10:38:43



#### 4.6 Out-of-Band Conducted Emissions FCC 15.247(c)

##### Requirements

In any 100 kHz bandwidth outside the EUT pass-band, the RF power shall be at least 20 dB below that of the maximum in-band 100 kHz emission.

##### Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 10 MHz to 10 GHz. For this test hopping function was disabled during the test.

In addition, the emission attenuation on the band-edge frequencies was measured with hopping function disabled and enabled.

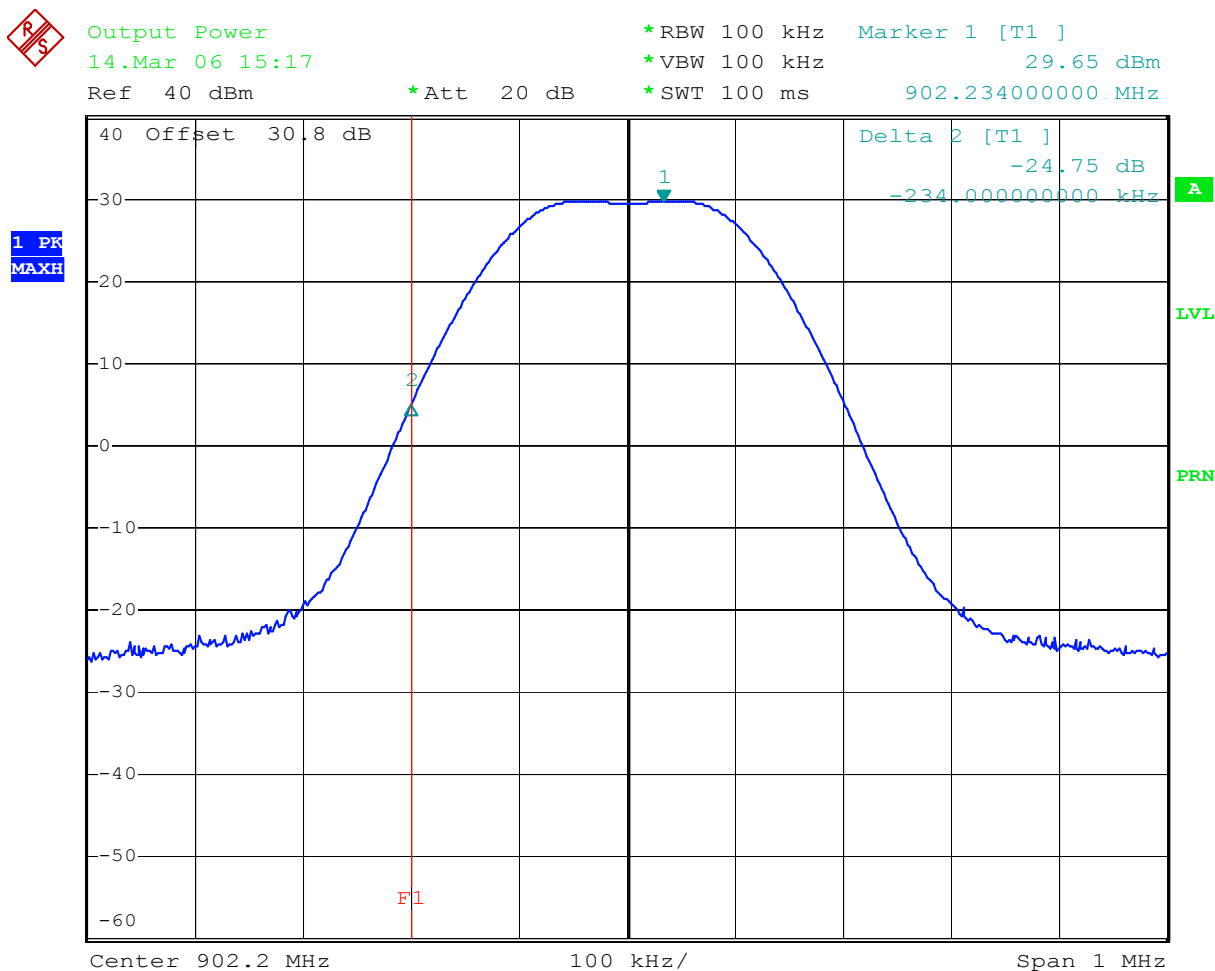
##### Test Result

Refer to the following plots for the test result:

<b>Out-of-Band conducted emissions</b>	
Plots 6.1, 6.2	Band-edge Emissions, low Channel, hopping disabled
Plots 6.3, 6.4	Band-edge Emissions, high Channel, hopping disabled
Plots 6.5, 6.6	Band-edge Emissions, low Channel, hopping enabled
Plots 6.7, 6.8	Band-edge Emissions, high Channel, hopping enabled
Plot 6.9	Band-edge Emissions, low Channel, hopping enabled, low power
Plot 6.10	Band-edge Emissions, high Channel, hopping enabled, low power
Plots 6.11, 6.12	Out-of-band Emissions, low Channel, 30-902 MHz, 928-10000 MHz
Plots 6.13, 6.14	Out-of-band Emissions, middle Channel, 30-902 MHz, 928-10000 MHz
Plots 6.15, 6.16	Out-of-band Emissions, high Channel, 30-902 MHz, 928-10000 MHz

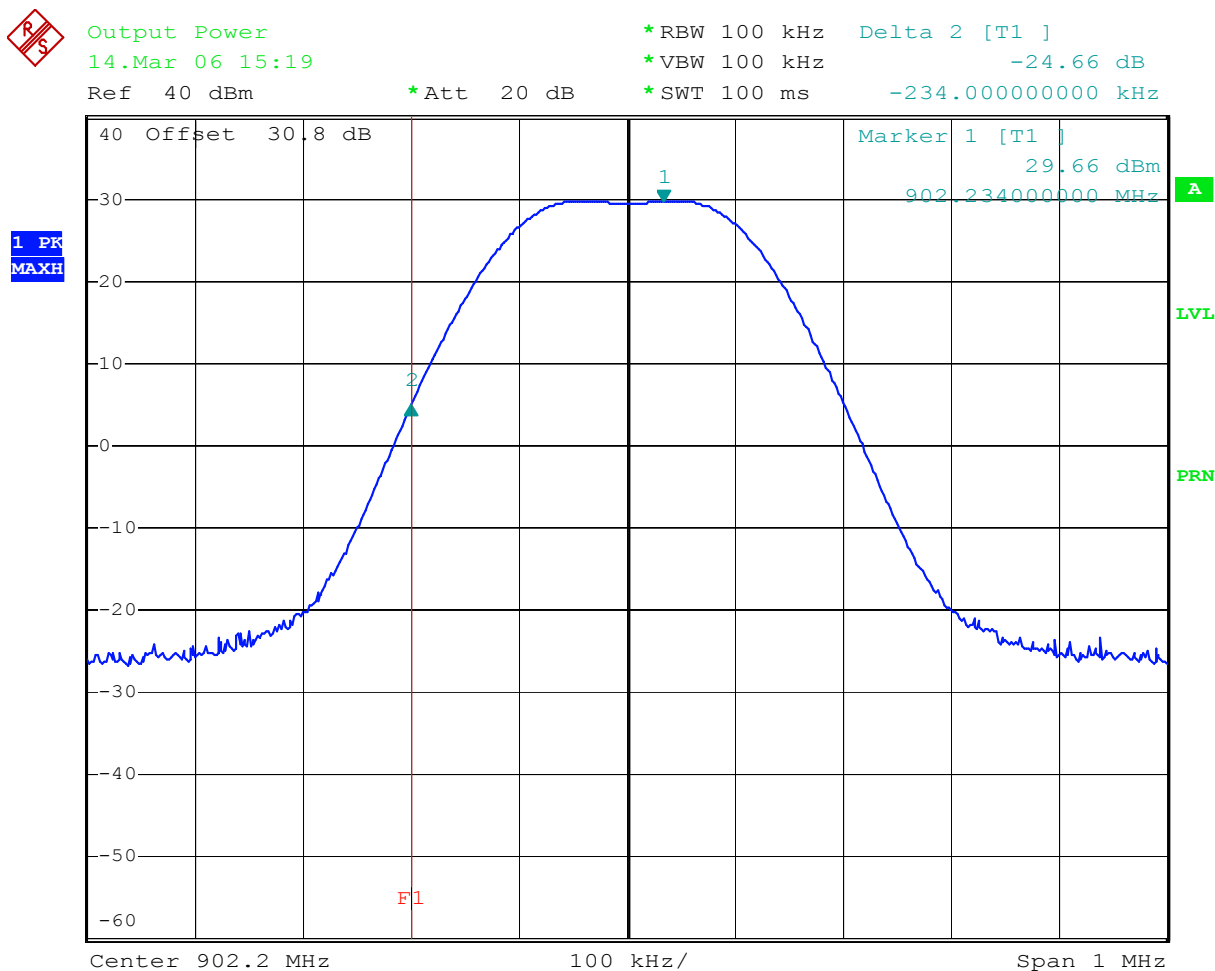
The attenuation is more than 20 dB.

Plot 6.1



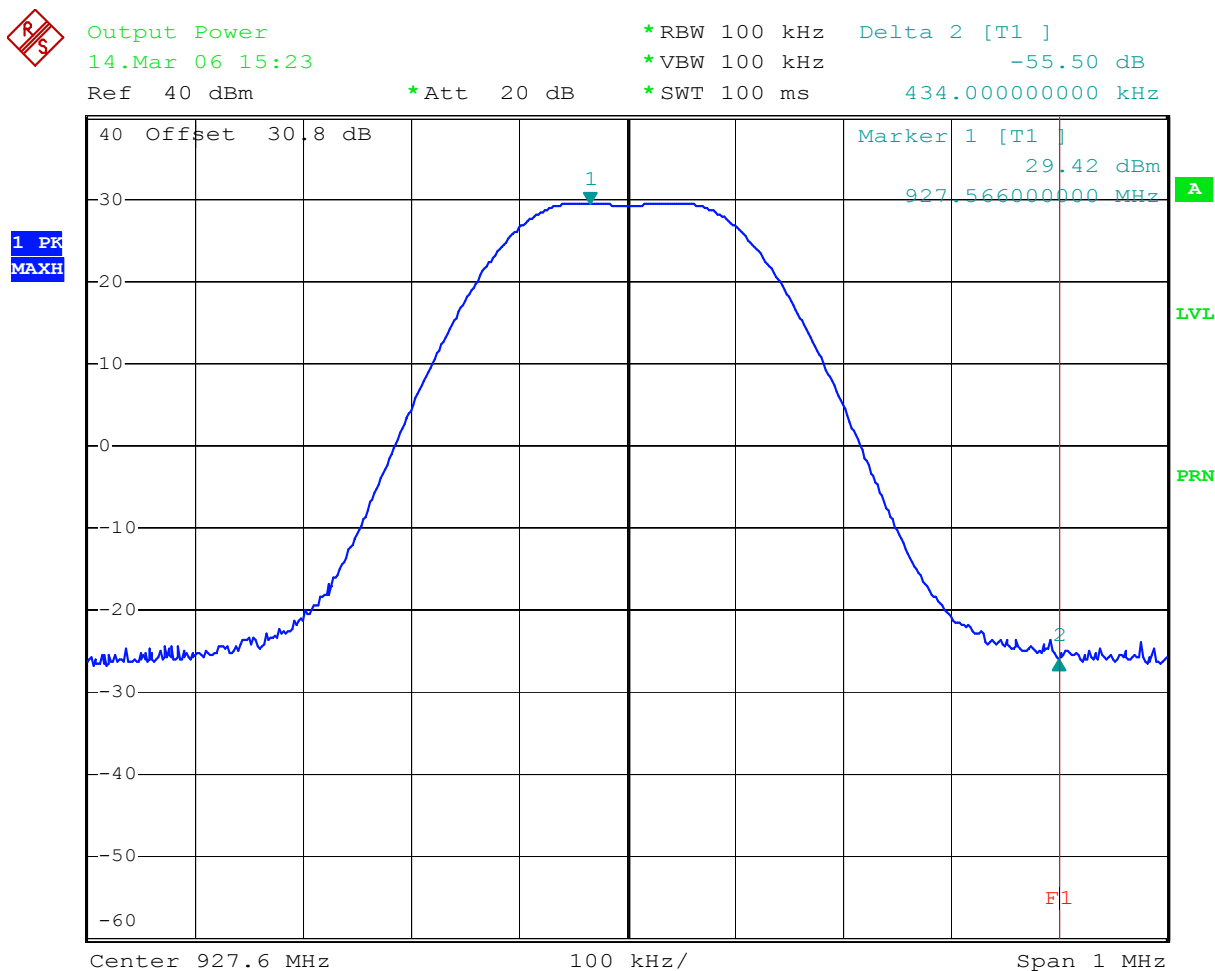
Comment: Out-of-band emissions, hopping disable, 57600 baud  
Date: 14.MAR.2006 15:17:22

Plot 6.2



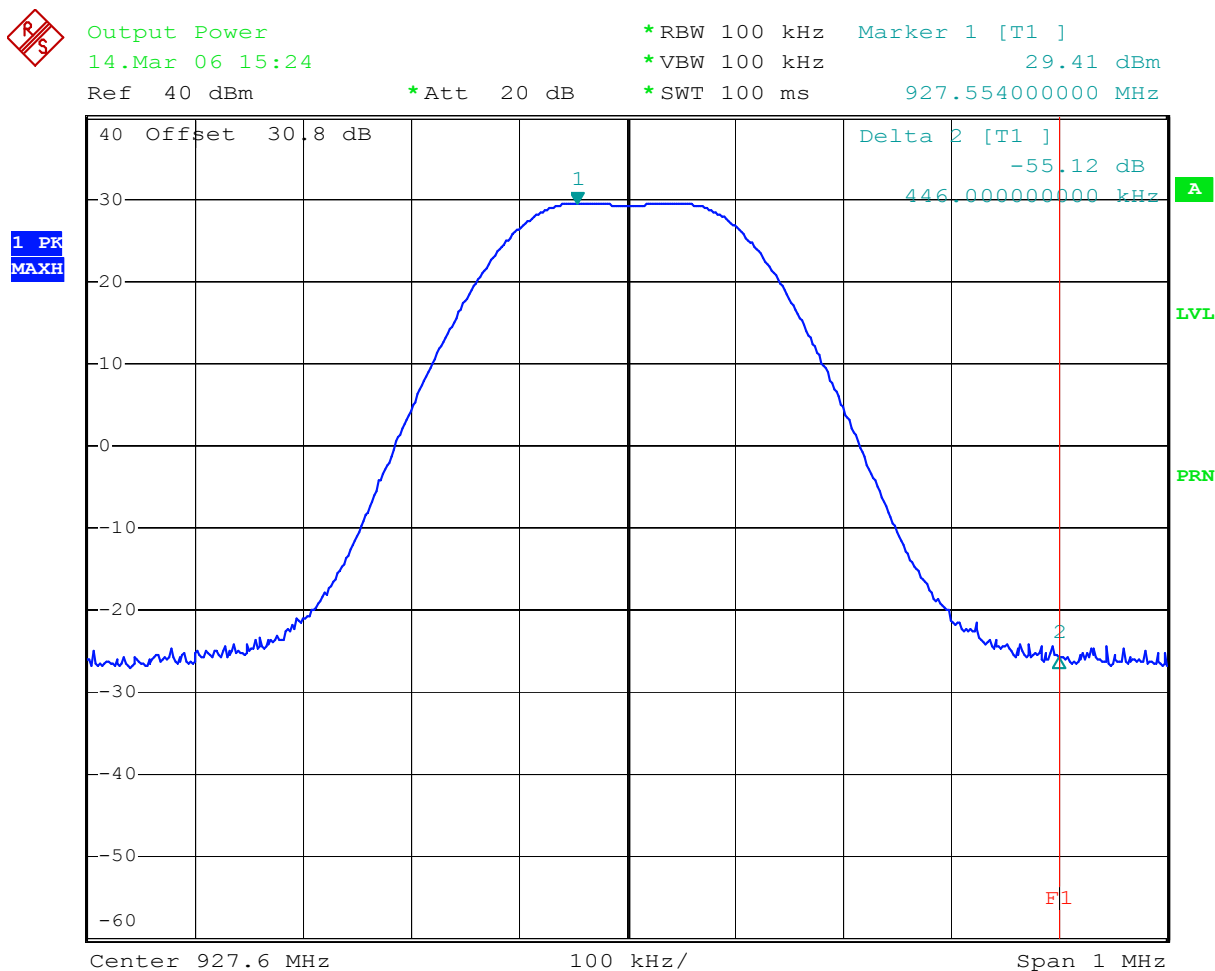
Comment: Out-of-band emissions, hopping disable, 9600 baud  
Date: 14.MAR.2006 15:19:37

Plot 6.3



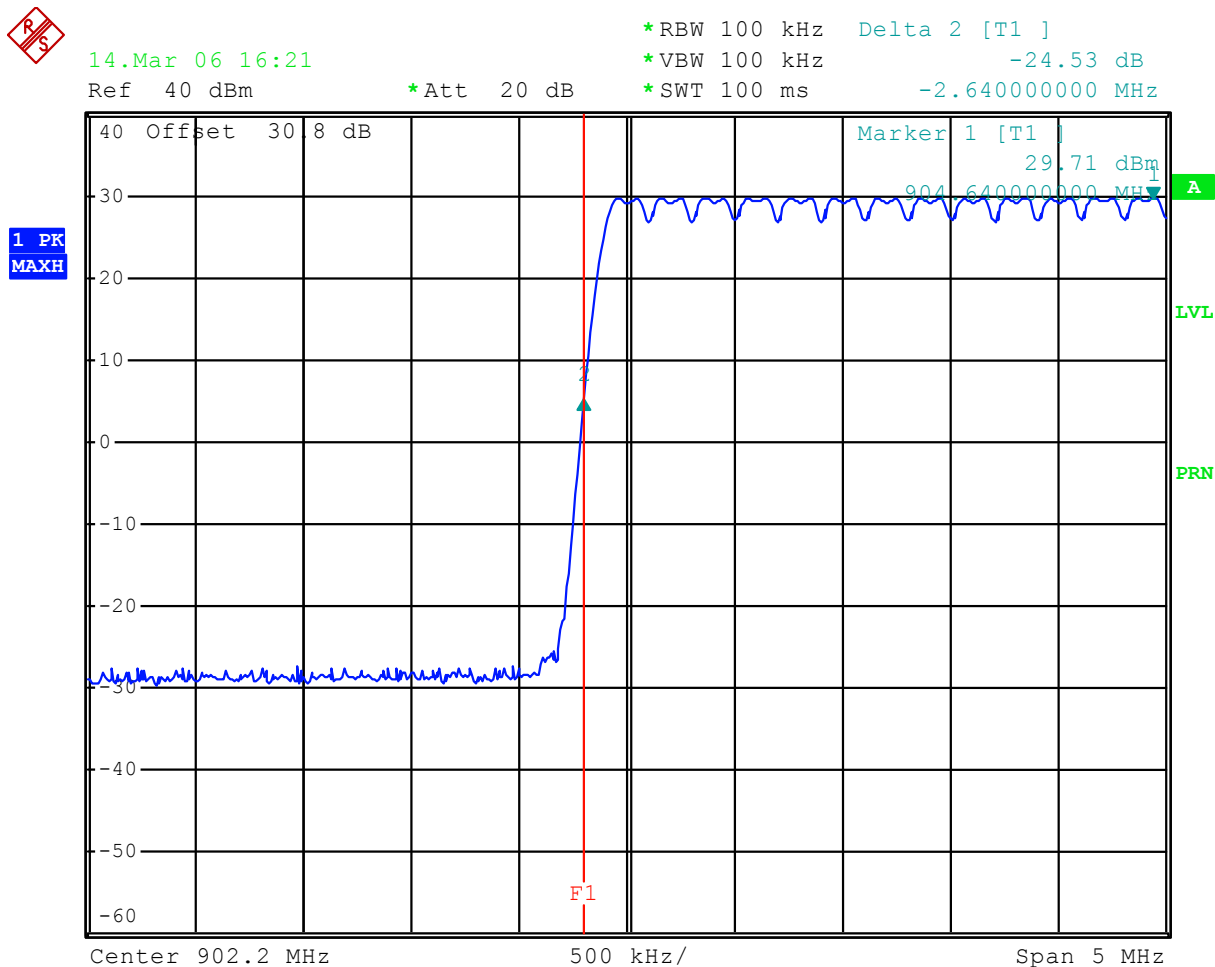
Comment: Out-of-band emissions, hopping disable, 57600 baud  
Date: 14.MAR.2006 15:23:19

Plot 6.4



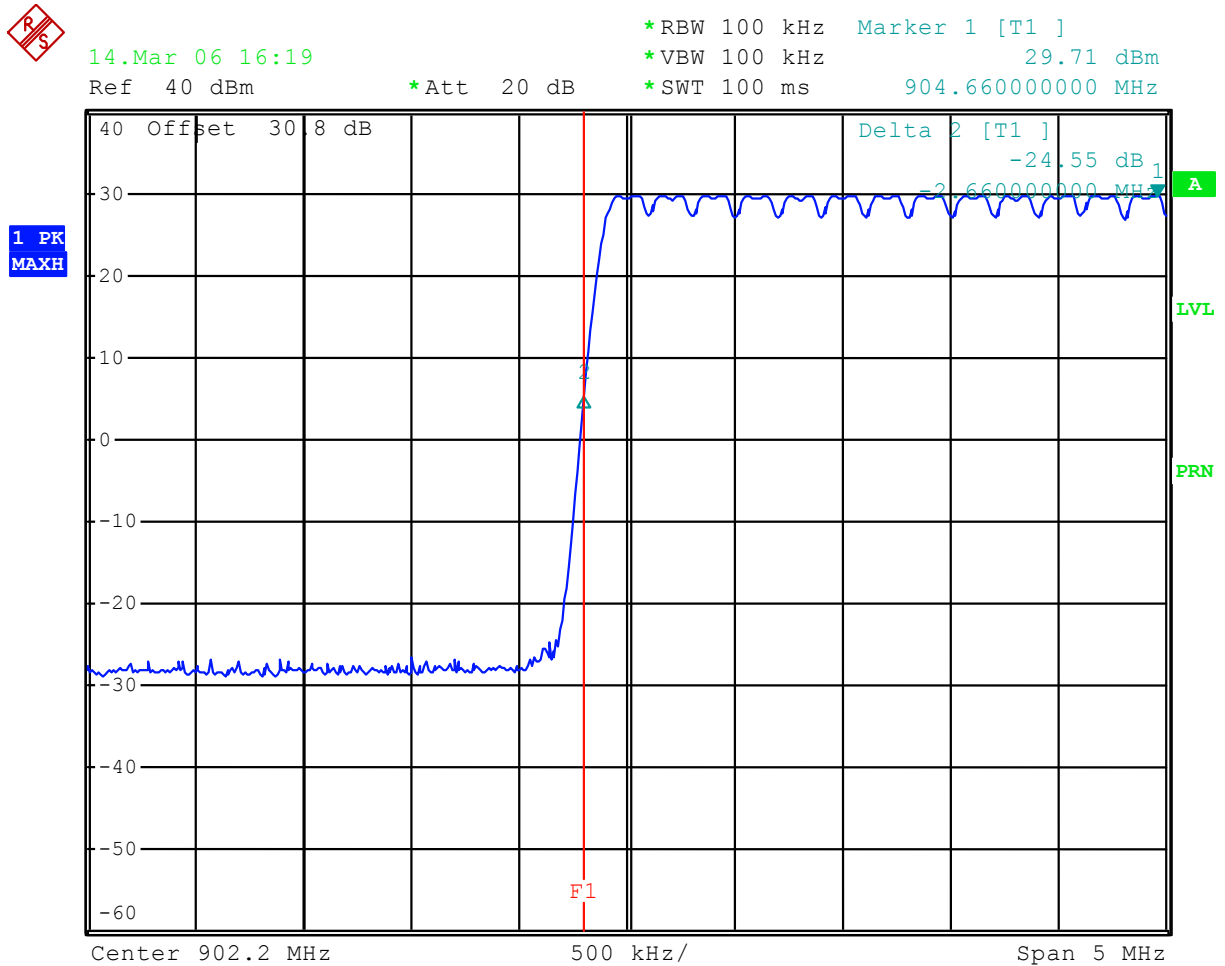
Comment: Out-of-band emissions, hopping disable, 9600 baud  
Date: 14.MAR.2006 15:24:43

Plot 6.5



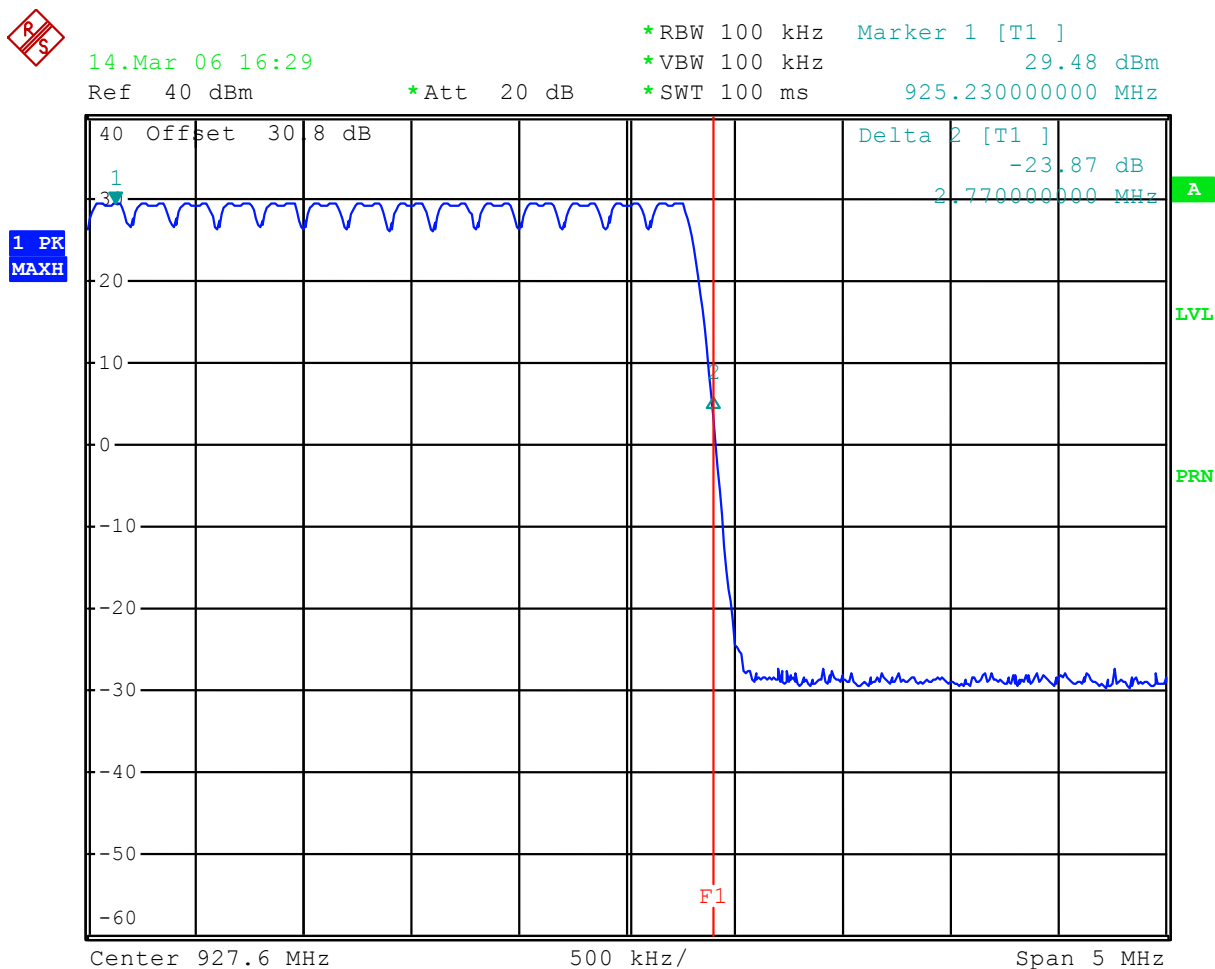
Comment: Out-of-band emissions, hopping enable, 5700 baud  
 Date: 14.MAR.2006 16:21:58

Plot 6.6



Comment: Out-of-band emissions, hopping enable, 9600 baud  
 Date: 14.MAR.2006 16:19:57

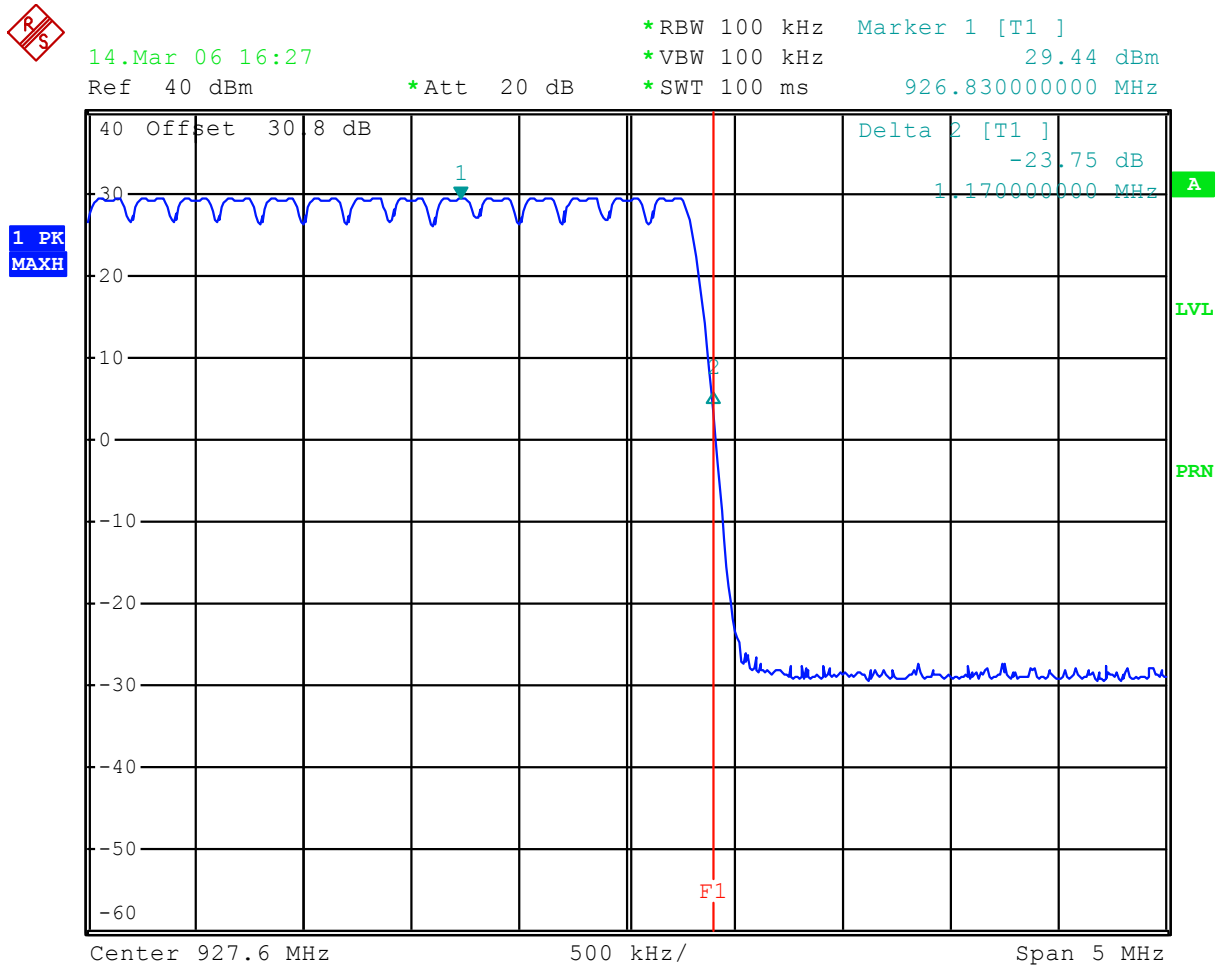
Plot 6.7



Comment: Out-of-band emissions, hopping enable, 57600 baud  
 Date: 14.MAR.2006 16:29:07

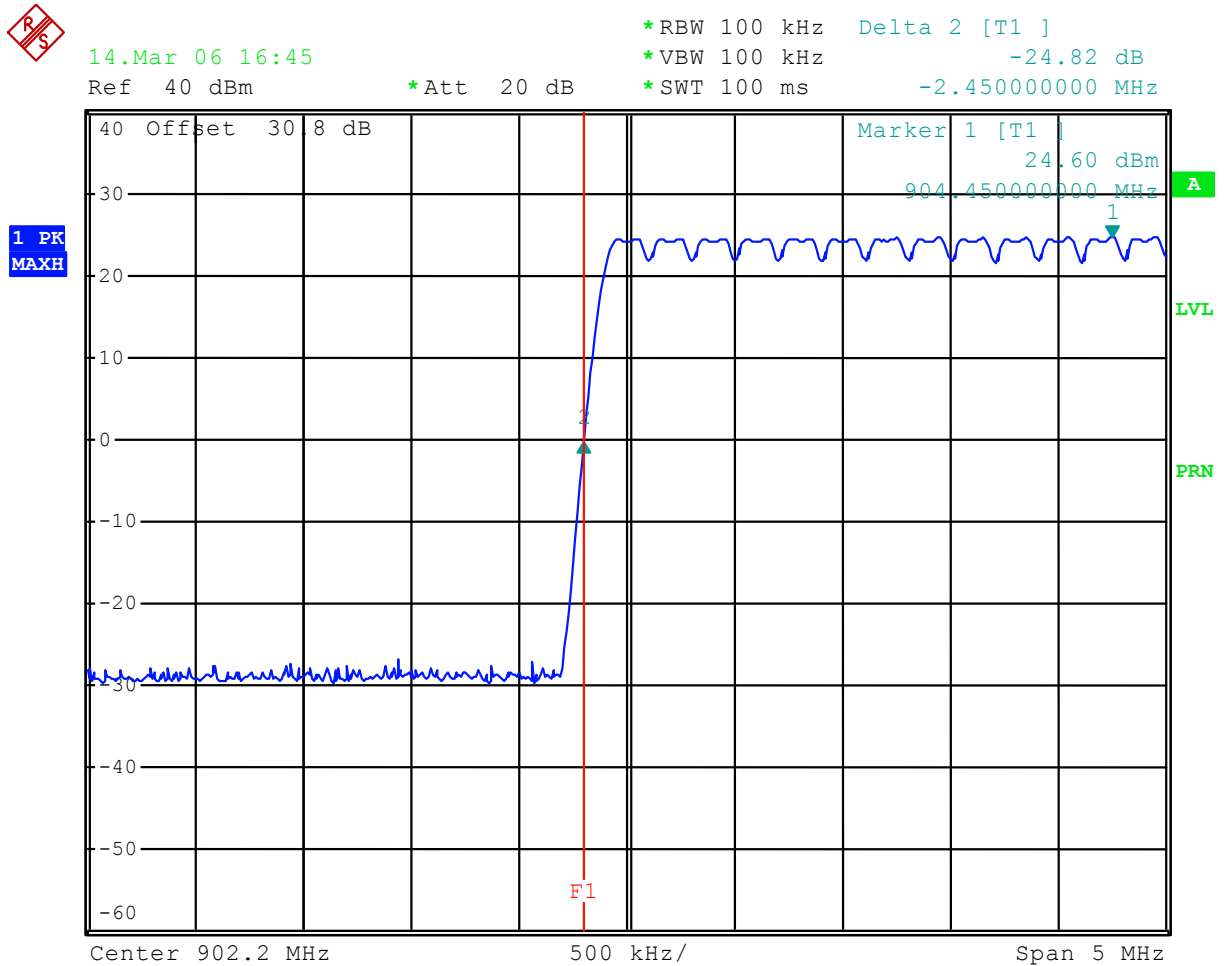


Plot 6.8



Comment: Out-of-band emissions, hopping enable, 9600 baud  
 Date: 14.MAR.2006 16:27:22

Plot 6.9

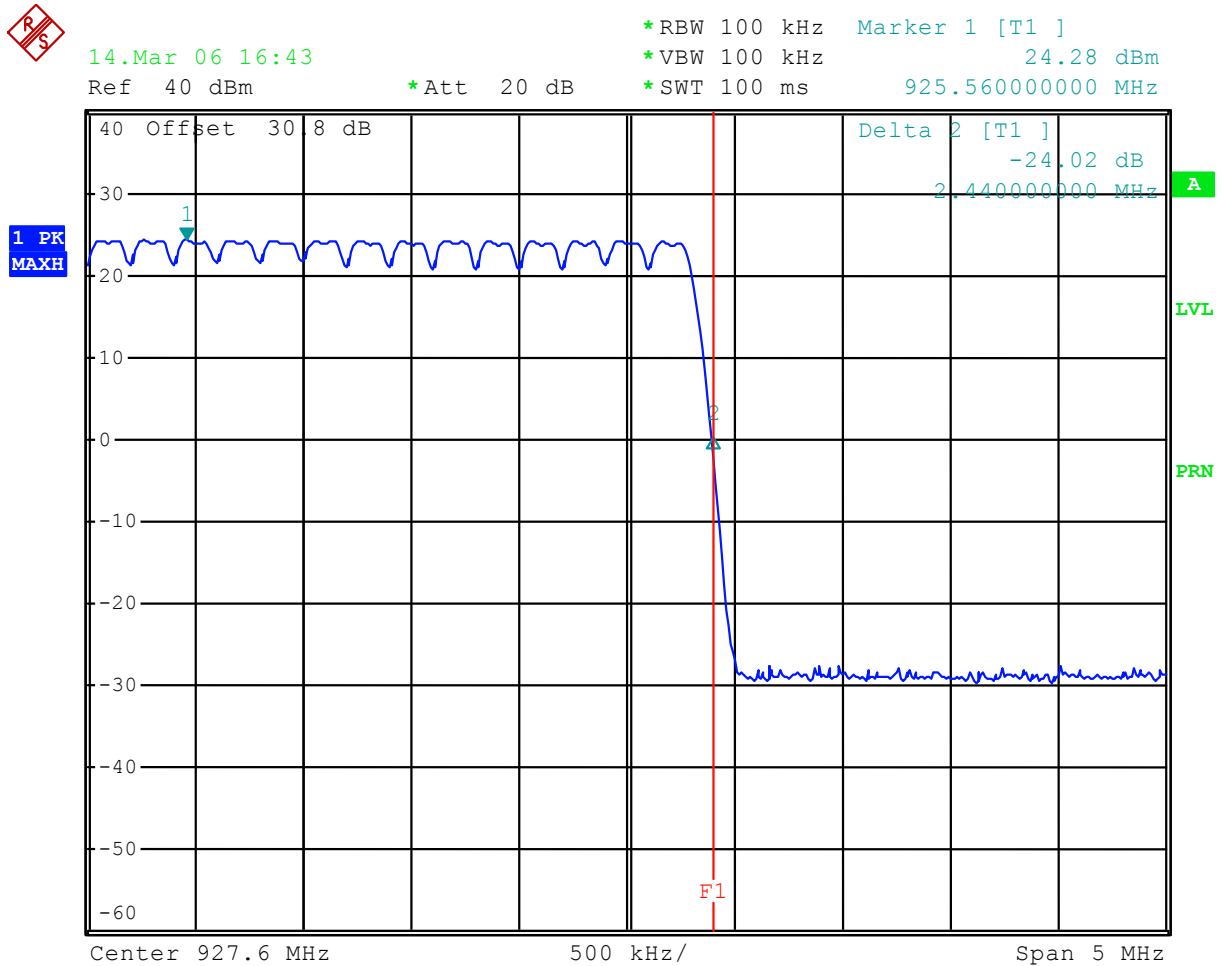


Comment: Out-of-band emissions, hopping enable, 57600 baud, low power

Comment:

Date: 14.MAR.2006 16:45:17

Plot 6.10

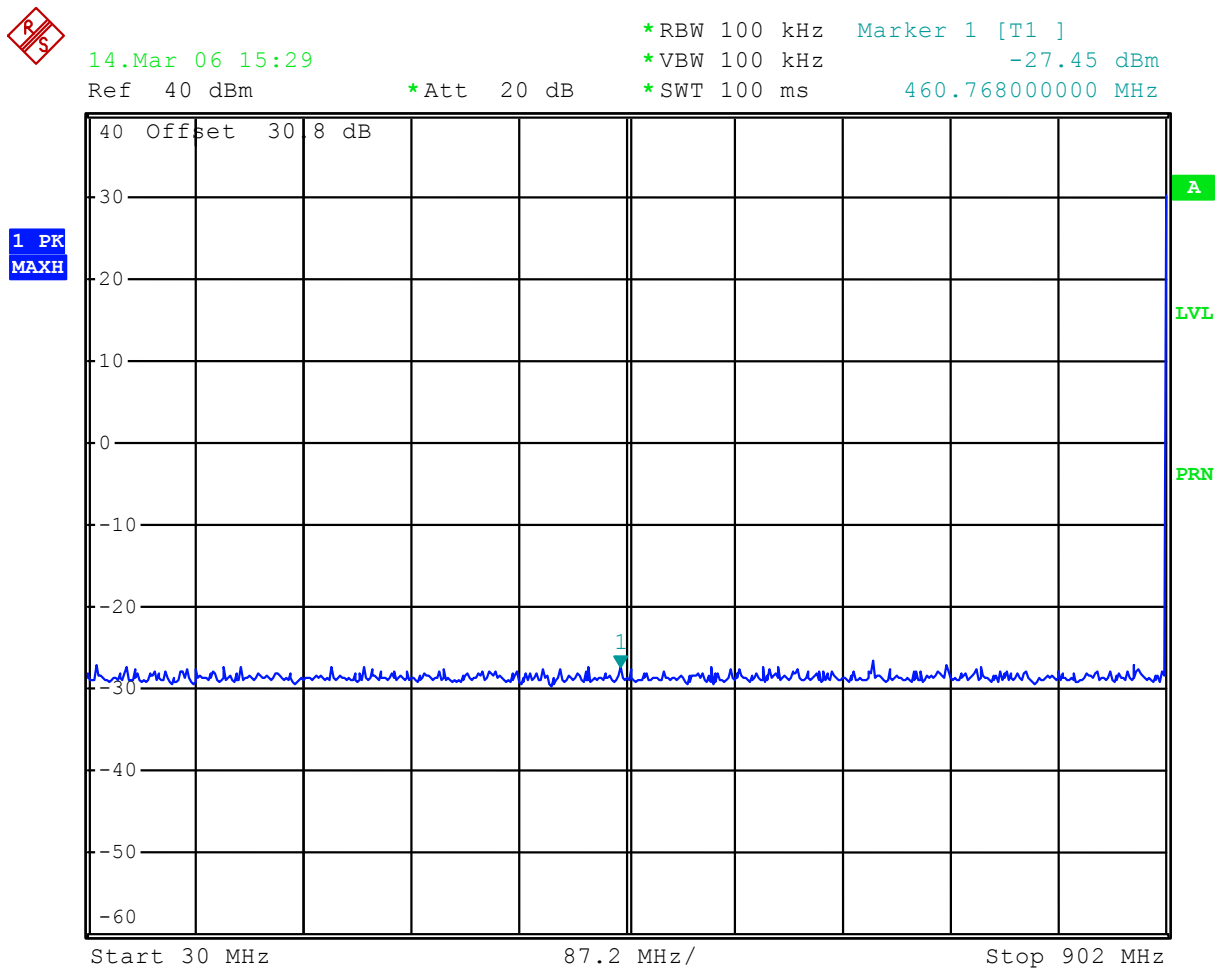


Comment: Out-of-band emissions, hopping enable, 57600 baud, low power

Comment:

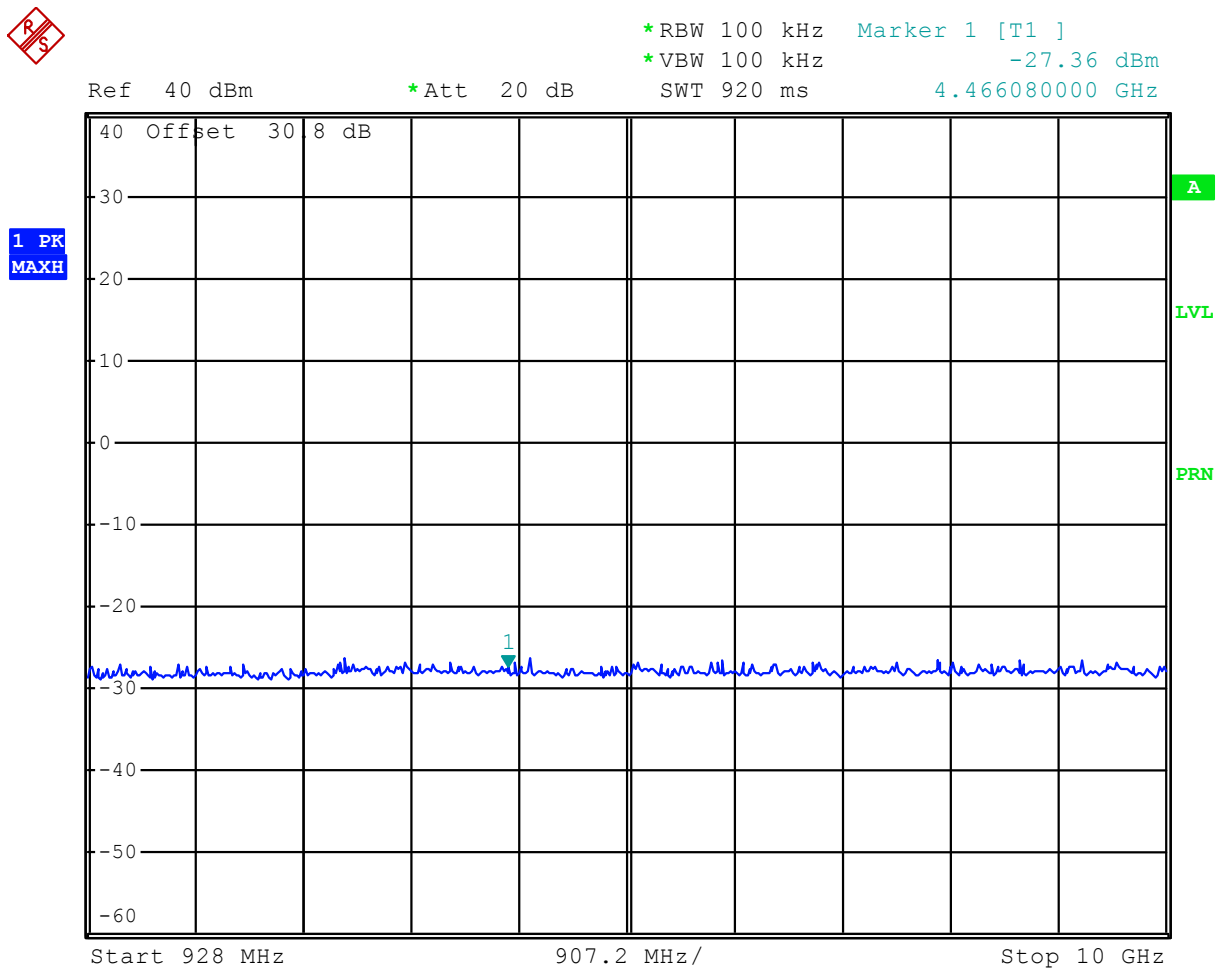
Date: 14.MAR.2006 16:43:37

Plot 6.11



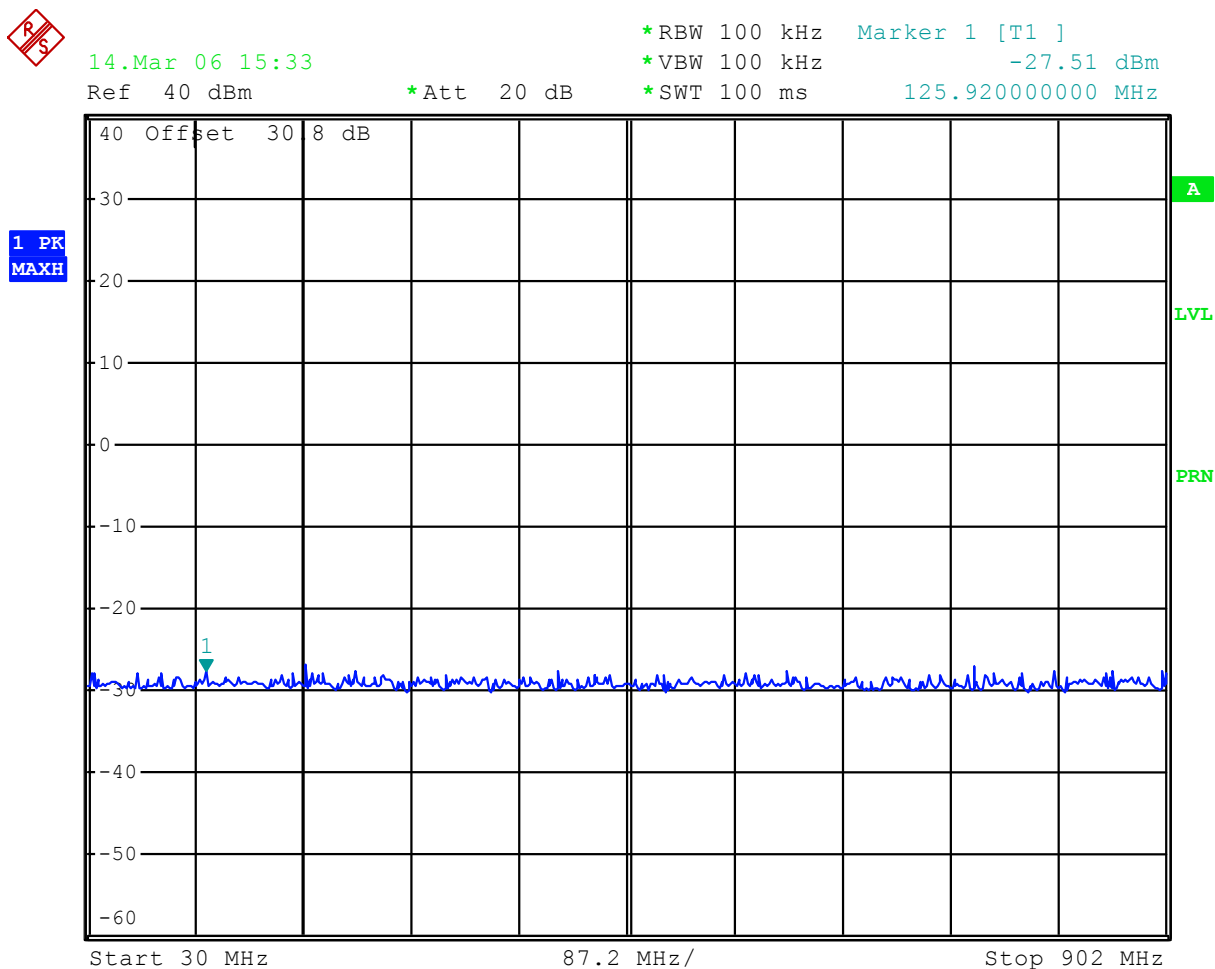
Comment: Out-of-band emissions, 902.2 MHz, 57600 baud  
 Date: 14.MAR.2006 15:29:54

Plot 6.12



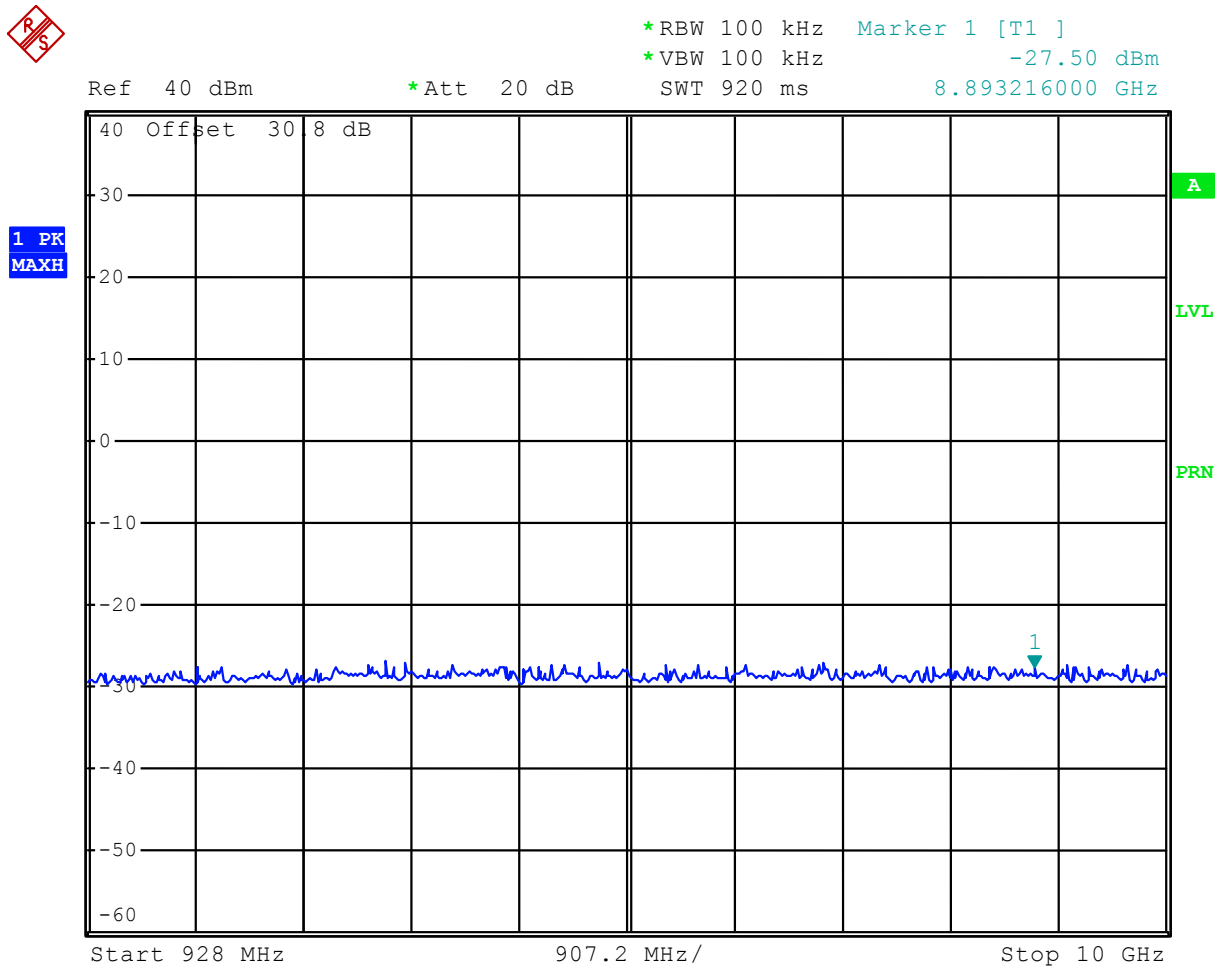
Comment: Out-of-band emissions, 902.2 MHz, 57600 baud  
 Date: 14.MAR.2006 12:26:03

Plot 6.13



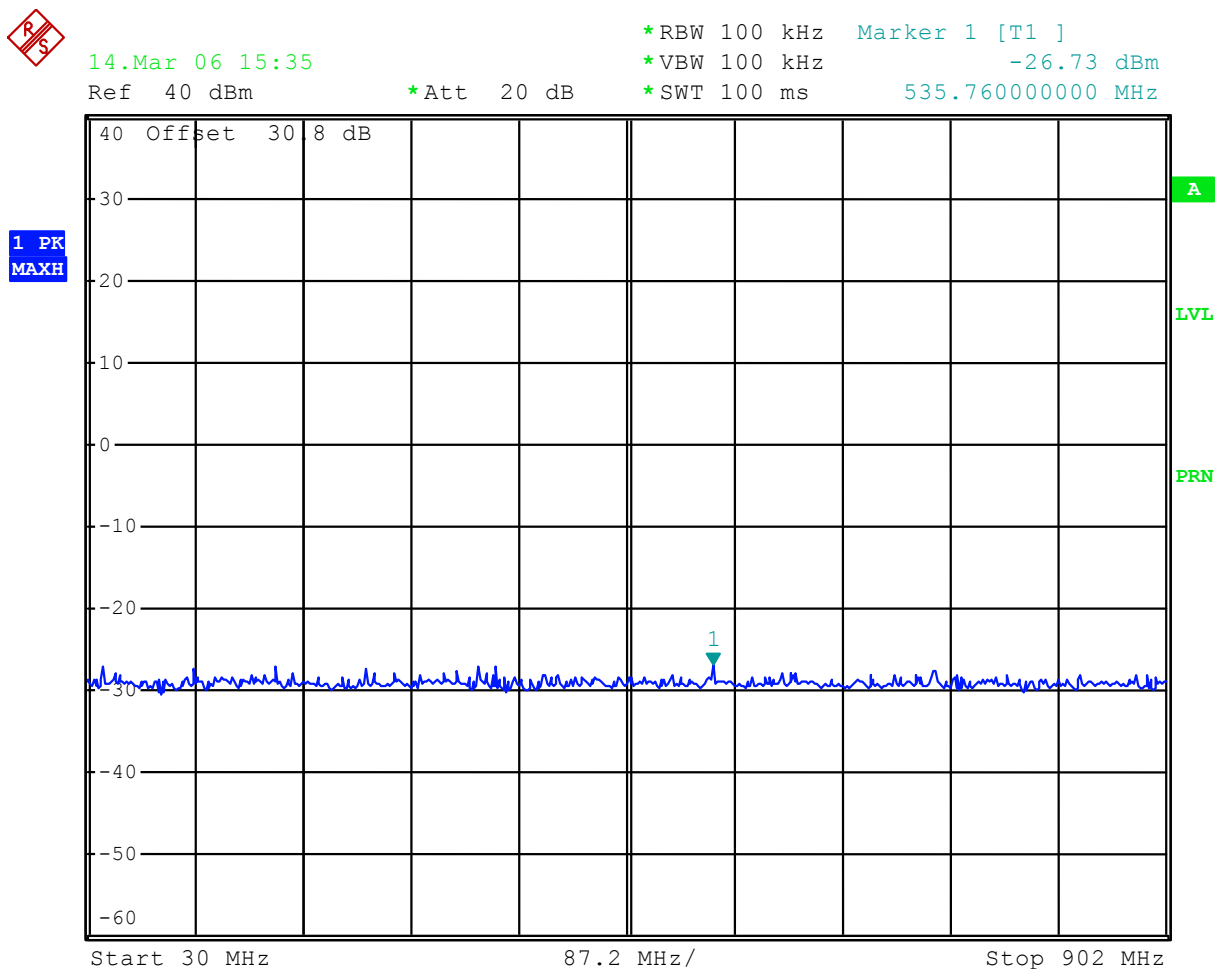
Comment: Out-of-band emissions, 915.0 MHz, 57600 baud  
 Date: 14.MAR.2006 15:33:12

Plot 6.14



Comment: Out-of-band emissions, 915.0 MHz, 57600 baud  
 Date: 14.MAR.2006 12:27:32

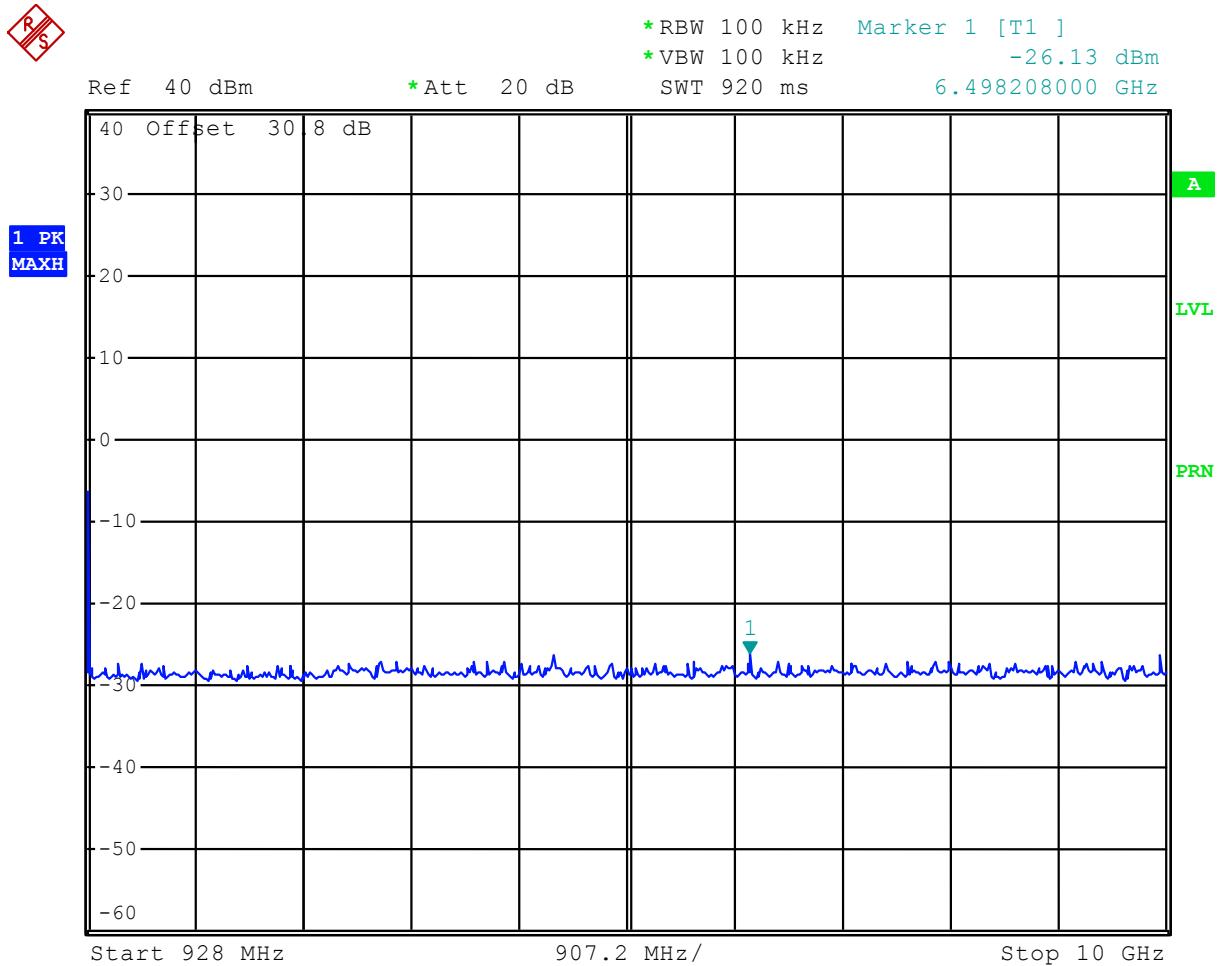
Plot 6.15



Comment: Out-of-band emissions, 927.6 MHz, 57600 baud  
 Date: 14.MAR.2006 15:35:58



Plot 6.16



Comment: Out-of-band emissions, 927.6 MHz, 57600 baud  
 Date: 14.MAR.2006 12:29:43

#### 4.7 Out-of-Band Radiated Emissions (except emissions in restricted bands) FCC 15.247(c)

For out-of-band radiated emissions (except for frequencies in restricted bands) that are close to or that exceed the 20 dB attenuation requirement described in the specification, radiated measurements were performed at a 3 m separation distance to determine whether these emissions complied with the general radiated emission requirement.

Test was not performed, as the EUT passed out-of-band antenna conducted emission test.

#### 4.8 Transmitter Radiated Emissions in Restricted Bands FCC 15.247 (c), 15.205

##### Procedure

Radiated emission measurements were performed from 30 MHz to 10,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz - for frequencies above 1000 MHz.

The EUT is placed on a non-conductive table. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

##### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where FS = Field Strength in dB( $\mu$ V/m)

RA = Receiver Amplitude (including preamplifier) in dB( $\mu$ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB( $\mu$ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB( $\mu$ V/m). This value in dB( $\mu$ V/m) was converted to its corresponding level in  $\mu$ V/m.

$$RA = 52.0 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(1/\text{m})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 \text{ dB}(\mu\text{V}/\text{m})$$

$$\text{Level in } \mu\text{V}/\text{m} = \text{Common Antilogarithm } [(32 \text{ dB}\mu\text{V}/\text{m})/20] = 39.8 \mu\text{V}/\text{m}$$

### Result

The data on the following page list the significant emission frequencies, the limit and the margin of compliance.

The EUT passed by 0.3 dB.

**Radiated Emissions in the Restricted Bands (FCC 15.205)**  
**Limit per FCC 15.209**

Date: 05/06/2006

Test distance: 3 meters

Model: GR-3

Company: Topcon Positioning Systems

TX Frequency: 902.2 MHz

Frequency	SA reading	Detector	Antenna Factor	AG+CF	Duty cycle correction	Field strength	Limit	Margin
MHz	dBuV		dB(1/m)	dB	dB	dB(uV/m)	dB(uV/m)	dB
2706.6	52.5	Average	29.2	-28.4	-1.4	51.9	54.0	-2.1
3608.8	48.0	Average	31.5	-26.9	-1.4	51.2	54.0	-2.8
4511.0	44.2	Average	32.3	-22.8	-1.4	52.3	54.0	-1.7
5413.2	29.3	Average	34.0	-14.8	-1.4	47.1	54.0	-6.9
8119.8	27.6 *	Average	36.8	-22.4	-	42.0	54.0	-12.0
9022.0	23.9 *	Average	37.4	-10.7	-	50.6	54.0	-3.4

Tx Frequency: 915.0 MHz

Frequency	SA reading	Detector	Antenna Factor	AG+CF	Duty cycle correction	Field strength	Limit	Margin
MHz	dBuV		dB(1/m)	dB	dB	dB(uV/m)	dB(uV/m)	dB
2745.0	54.9	Average	29.2	-29.1	-1.4	53.6	54.0	-0.4
3660.0	39.7	Average	31.5	-26.2	-1.4	43.6	54.0	-10.4
4575.0	44.9	Average	32.3	-22.1	-1.4	53.7	54.0	-0.3
7320.0	32.6	Average	35.4	-22.5	-1.4	44.1	54.0	-9.9
8235.0	28.4 *	Average	36.8	-21.0	-	44.2	54.0	-9.8
9150.0	25.1 *	Average	37.4	-11.7	-	50.8	54.0	-3.2

Tx Frequency: 927.6 MHz

Frequency	SA reading	Detector	Antenna Factor	AG+CF	Duty cycle correction	Field strength	Limit	Margin
MHz	dBuV		dB(1/m)	dB	dB	dB(uV/m)	dB(uV/m)	dB
2782.8	49.7	Average	29.2	-27.4	-1.4	50.1	54.0	-3.9
3710.4	36.0	Average	31.5	-23.1	-1.4	43.0	54.0	-11.0
4638.0	43.9	Average	32.3	-22.8	-1.4	52.0	54.0	-2.0
7420.8	35.2	Average	35.4	-22.4	-1.4	46.8	54.0	-7.2
8348.4	29.4 *	Average	36.8	-20.8	-	45.4	54.0	-8.6

Duty Cycle correction =  $20\log(85.2 \text{ ms}/100 \text{ ms}) = -1.4 \text{ dB}$ , where 85.2 ms is pulse duration (see plot 5.3).

Note: Average value was measured with RBW = 1 MHz, VBW = 100 Hz

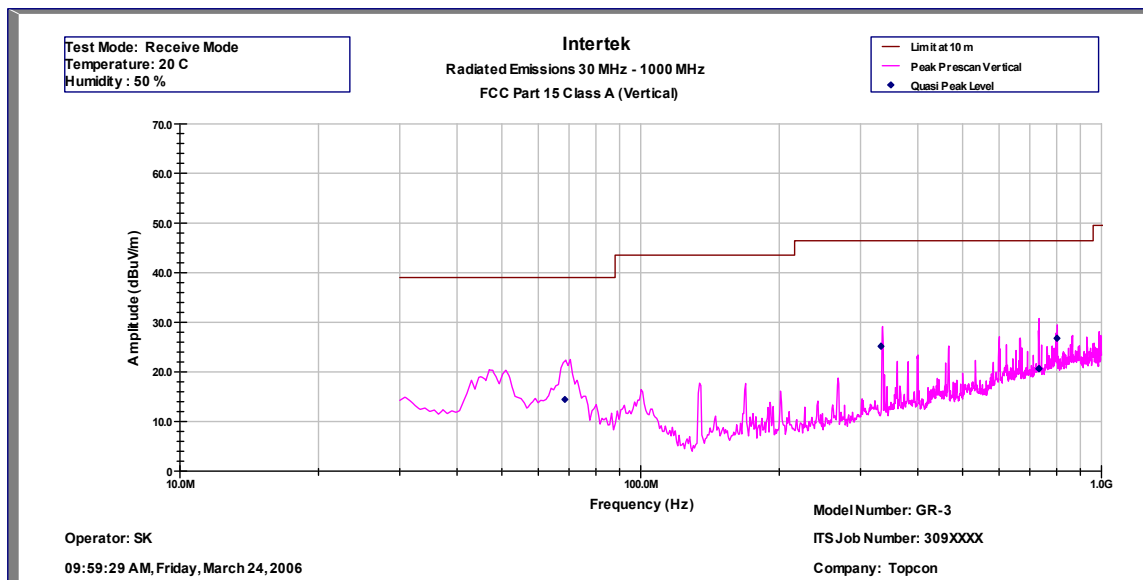
The peak value of the Field Strength is no more than 10 dB higher than the average, therefore, the compliance to the peak Field Strength limit of 74 dB(uV/m) is ensured.

#### 4.9 Radiated Emissions from Digital Parts and Receiver FCC Ref: 15.109

Radiated emission measurements were performed from 30 MHz to 2000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz for frequencies below 1 GHz, and 1 MHz for frequencies above 1 GHz. See also section 4.8.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

The EUT passed by 19.6 dB for Class A, and by 10 dB for Class B.



Intertek Testing Services  
Radiated Emissions 30 MHz - 1000 MHz  
FCC Part 15 Class A (QP-Vertical)

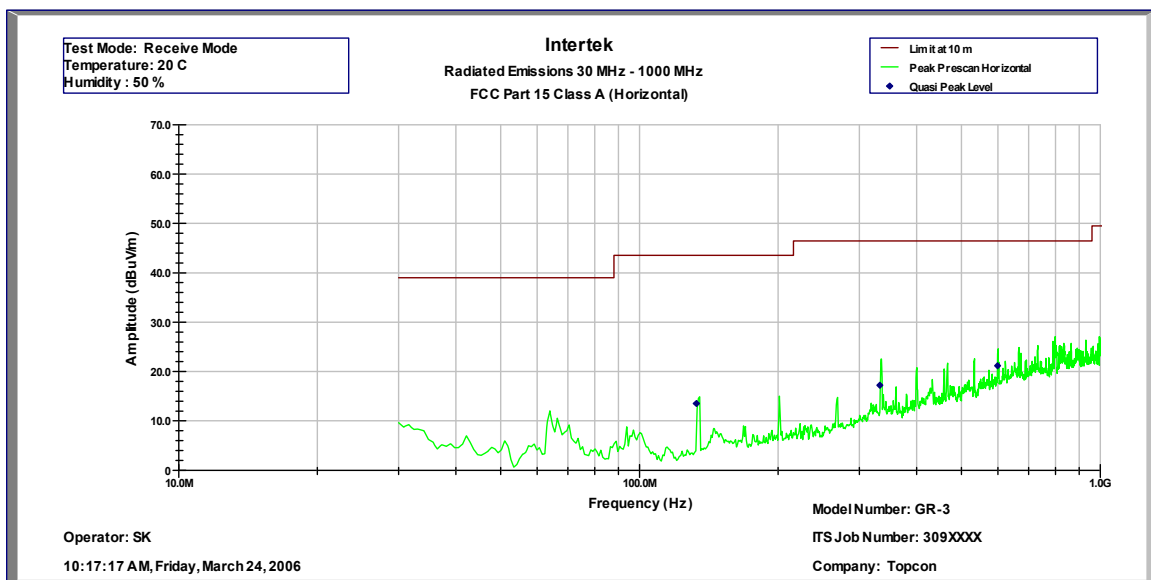
Operator: SK

Model Number: GR-3  
ITS Job Number: 309XXXX  
Company: Topcon

09:59:29 AM, Friday, March 24, 2006

Frequency MHz	Quasi Pk FS dB(uV/m)	Limit@10m dB(uV/m)	Margin dB	RA dB	CF dB	AG dB	AF dB(1/m)
68.53	14.4	39.0	-24.6	36.4	4.1	32.9	6.8
332.51	25.2	46.4	-21.2	37.7	5.7	32.8	14.6
732.36	20.6	46.4	-25.8	24.1	7.1	32.7	22.2
801.82	26.8	46.4	-19.6	29.3	7.3	32.7	22.8

Test Mode: Receive Mode  
Temperature: 20 C  
Humidity : 50 %



Intertek Testing Services  
Radiated Emissions 30 MHz - 1000 MHz  
FCC Part 15 Class A (QP-Horizontal)

Operator: SK

Model Number: GR-3  
ITS Job Number: 309XXXX  
Company: Topcon

10:17:17 AM, Friday, March 24, 2006

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	CF	AG	AF
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
132.95	13.5	43.5	-30.0	34.2	4.6	32.9	7.6
332.51	17.2	46.4	-29.2	29.2	5.7	32.8	15.1
599.28	21.1	46.4	-25.3	27.2	6.8	32.7	19.8

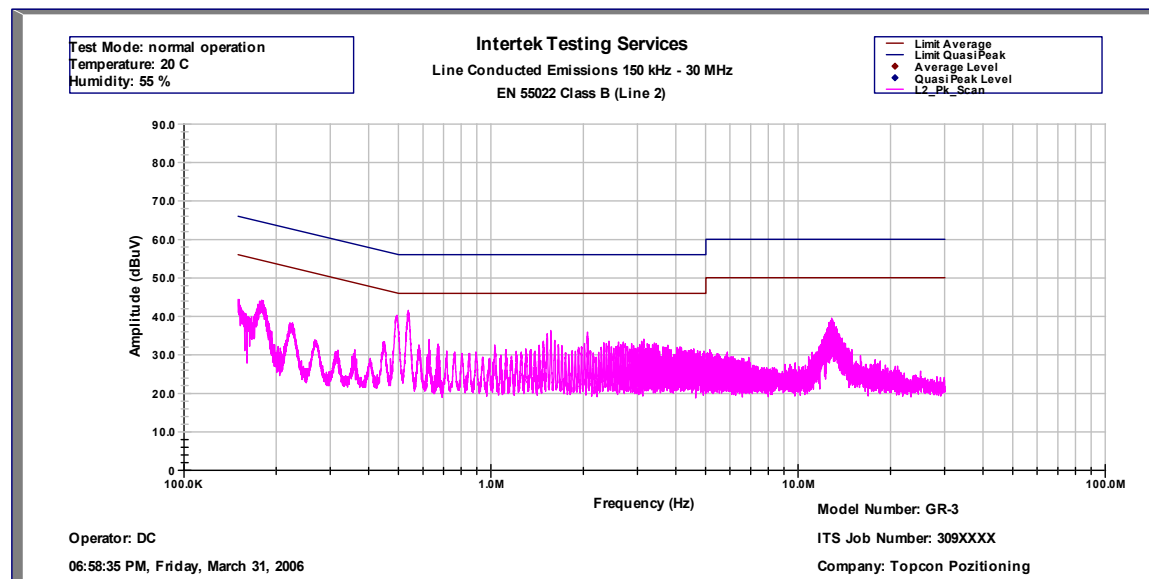
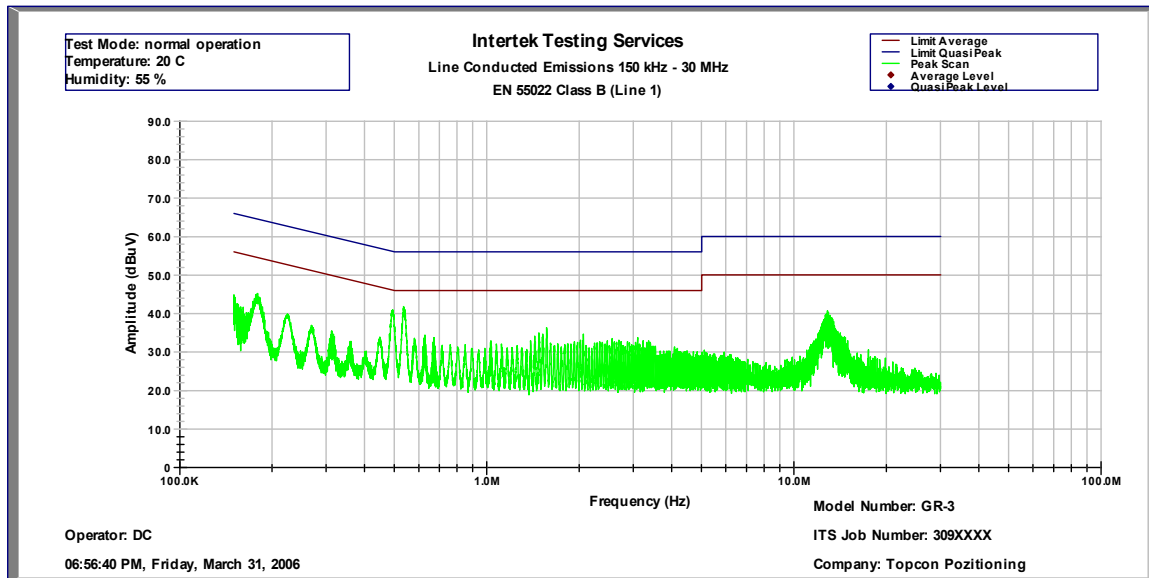
Test Mode: Receive Mode  
Temperature: 20 C  
Humidity : 50 %



4.10 AC Line Conducted Emission  
FCC 15.207:

AC line conducted emission test was performed according the ANSI C63.4 (2003) standard. The EUT was connected to AC Line through the LISN.

For the test result, see attached plots.  
The EUT passed by 5.0 dB.



## 5.0 RF Exposure evaluation

The EUT is a device used in mobile application, at least 20 cm from any body part of the user or near by persons.

The maximum conducted power is 0.8 W; antenna is fix-mounted, 2.5 dBi gain. Therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The maximum Peak EIRP calculated is 31.5 dBm or 1.4 W. The Power Density can be calculated using the formula

$$S = \text{EIRP} / 4\pi D^2$$

Where: S is Power Density in  $\text{W}/\text{m}^2$   
D is the distance from the antenna.

At 0.2 m,  $S = 2.8 \text{ W}/\text{m}^2$ , which is below the MPE Limit of  $10 \text{ W}/\text{m}^2$

## 6.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	9/12/06
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	9/12/06
Spectrum Analyzer	R & S	FSP40	036612004	12	10/3/06
BI-Log Antenna	EMCO	3143	9509-1160	12	11/29/06
Horn Antenna	EMCO	3115	9107-3712	12	5/10/07
LISN	FCC	FCC-LISN-50/250-60-2-02	01004	12	4/21/06
Pre-Amplifier	Sonoma Inst.	310	185634	12	7/05/06
Pre-Amplifier	Hewlett Packard	8449B	3008A01168	12	1/17/07

**7.0 Document History**

<b>Revision/ Job Number</b>	<b>Writer Initials</b>	<b>Date</b>	<b>Change</b>
1.0 / 3093766 and 3099689	DC	June 9, 2006	Original document