

TEST REPORT

Report Number: 100031229MPK-001

Project Number: G100031229

Report Date: December 29, 2010

Testing performed on the

Radio Module

Model: FH915

FCC ID: WJ4FH915

IC ID: 3504A-FH915

to

FCC Part 15 Subpart C (15.247)

RSS-210 Issue 8

For

Javad GNSS, Inc.

Test Performed by:

Intertek Testing Services NA, Inc
1365 Adams Court
Menlo Park, CA 94025

Test Authorized by:

Javad GNSS, Inc.
900 Rock Avenue
San Jose, CA 95131, USA

Prepared by:


Krishna K Vemuri

Date:

December 29, 2010

Reviewed by:


Ollie Moyrong

Date:


December 29, 2010

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Report No. 100031229MPK-001

Equipment Under Test:	Radio Module
Trade Name:	Javad GNSS, Inc.
Model No.:	FH915
Part No.:	05-587301-02
FCC ID:	WJ4FH915
IC ID:	3504A-FH915
Applicant:	Javad GNSS, Inc.
Contact:	Mr. Vladimir Zhukov
Address:	900 Rock Avenue San Jose, CA 95131
Country:	USA
Tel. Number:	(408) 770-1770
Fax:	(408) 770-1799
Email:	v.zhukov@javad.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) RSS-210 Issue 8
Test Site Location:	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	December 15 to December 22, 2010

We attest to the accuracy of this report:



Krishna K Vemuri
Test Engineer



Ollie Moyrong
Engineering Manager

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1.0 Introduction

The Equipment under Test (EUT), model: FH915 is Radio Module with Spread Spectrum Transceiver operating 900 MHz frequency band.

FH915 is an external Radio Module transceiver used for commercial, indoor and outdoor use.

1.1 Summary of Tests

TEST	REFERENCE FCC Part 15 Subpart C (15.247)	REFERENCE RSS-210	RESULTS
RF output power	15.247(b)	A8.4	Complies
20-dB Bandwidth	15.247(a)(1)	A8.1(a)	Complies
Channel Separation	15.247(a)(1)	A8.1(b)	Complies
Number of Hopping Channels	15.247(a)(1)	A8.1(d)	Complies
Average Channel Occupancy Time	15.247(a)(1)	A8.1(d)	Complies
Out-of-band Antenna Conducted Emission	15.247(d)	A8.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	A8.5, 2.2	Complies
RF exposure	15.247(i)	RSS-102	Complies
AC Conducted Emission	15.207	RSS-GEN	Complies
Radiated Emission from Digital Parts and receiver	15.109	ICES-003	Complies
Antenna Requirement	15.203	RSS-Gen	Complies



2.0 General Description

2.1 Product Description

The Equipment under Test (EUT), model: FH915 is Radio Module operating in the 900 MHz frequency band.

Overview of the EUT

Applicant	Javad GNSS, Inc. 900 Rock Avenue San Jose, CA 95131, USA
Manufacturer name & address	Javad GNSS, Inc. 900 Rock Avenue San Jose, CA 95131, USA
Trade Name & Part No.	FH915, p/n 05-587301-02
FCC Identifier	WJ4FH915
IC Identifier	3504A-FH915
Use of Product	Radio Module
Type of Transmission	Spread Spectrum, Frequency Hopping
Rated RF Output	1W
Frequency Range	902.2 – 927.6 MHz
Number of Channel(s)	128
Data Rate	64 kbps
Antenna(s) type & Gain	Model: DEXRN902RTN from Antenex, swivel, 1/2 wave, 2.5 dBi

EUT receive date: December 14, 2010

EUT receive condition: The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.

Test start date: December 15, 2010

Test completion date: December 22, 2010

2.2 Related Submittal(s) Grants

None.



2.3 Test Methodology

Radiated and AC Line conducted emissions measurements were performed according to the procedures in ANSI C63.4. 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

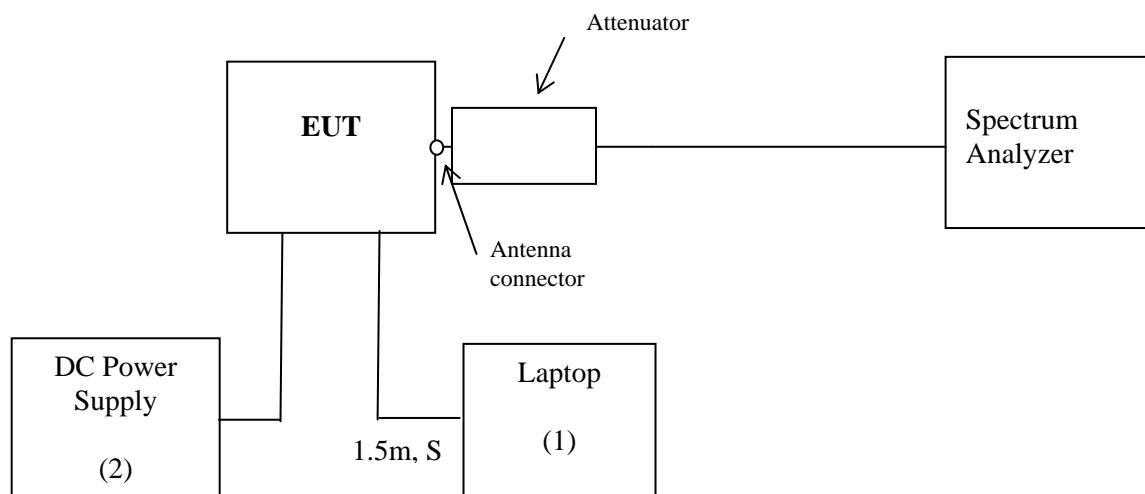
Then radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC.

3.0 System Test Configuration

3.1 Support Equipment

Item #	Description	Model No.	Serial No.
1	Compaq Laptop	Compaq nc6400	6A9B901B2U41BM
2	EXTECH DC Power Supply	EP-3003	D30030012

3.2 Block Diagram of Test Setup



S = Shielded	F = With Ferrite
U = Unshielded	m = 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.

3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was provided by the Applicant.

3.5 Mode of Operation During Test

The EUT was tested in two modes: hopping mode as in normal use and hopping disabled mode in which the EUT was transmitting at the lowest, middle, and highest channels (frequencies).

3.6 Modifications Required for Compliance

No modifications were installed by Intertek Testing Services during compliance testing in order to bring the product into compliance.



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. Power was read directly and cable loss correction was added to the reading to obtain the power at the EUT antenna terminal.

Test Results

Frequency (MHz)	Output in dBm	Output in W	Plot number
902.2	29.80	0.955	1.1
915.6	29.92	0.982	1.2
927.6	29.92	0.982	1.3

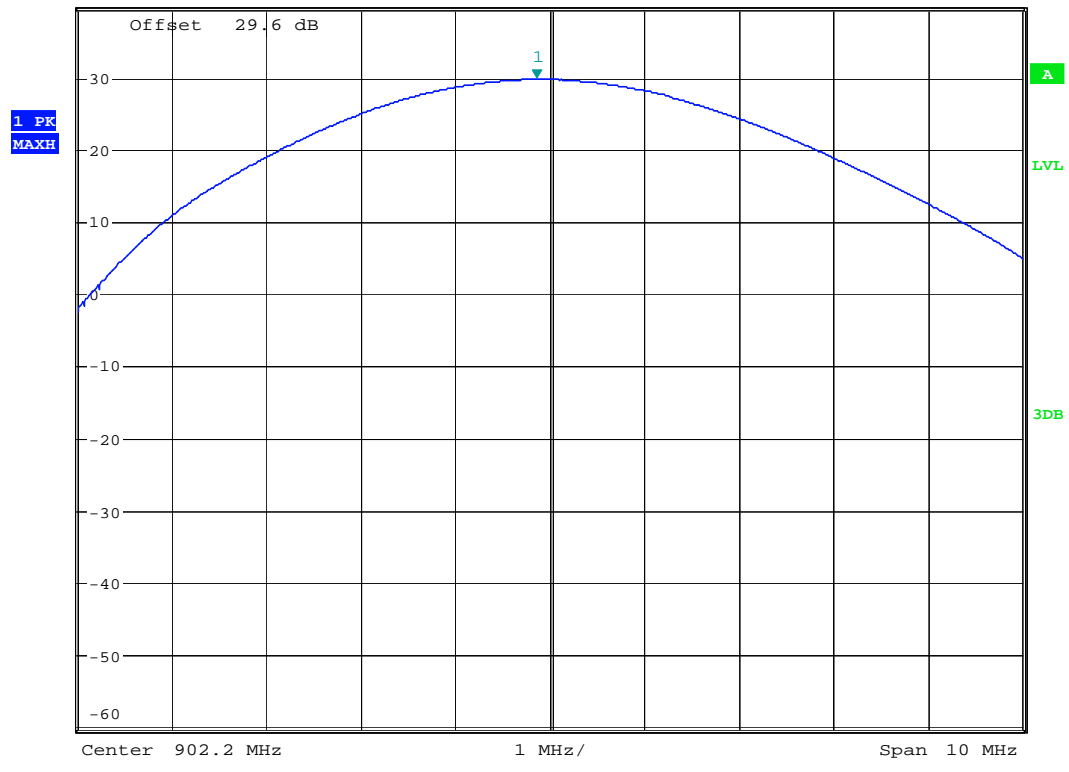
Notes: 1. Hopping function was disabled during the test.
2. The EUT's antenna has less than 6 dBi gain.

Refer to attached plots 1.1-1.3.



Plot 1.1

* RBW 3 MHz Marker 1 [T1]
 * VBW 3 MHz 29.80 dBm
 Ref 39.6 dBm Att 35 dB SWT 125 ms 902.04800000 MHz



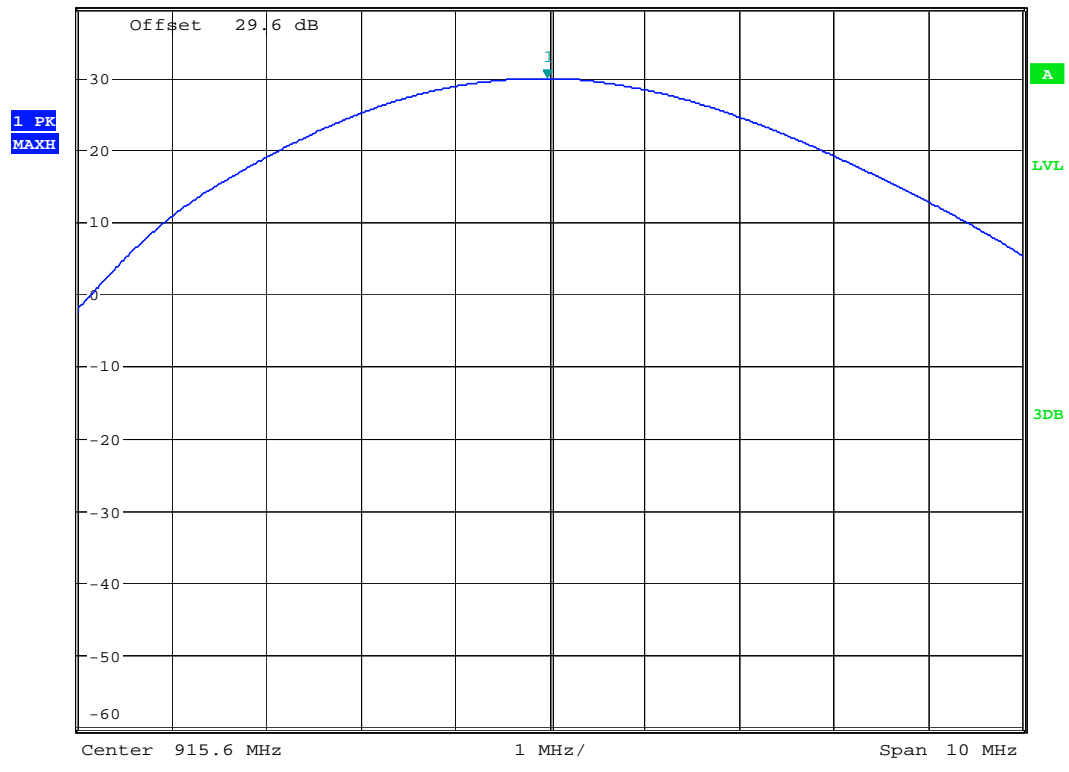
Output Power

Date: 16.DEC.2010 15:12:55



Plot 1.2

* RBW 3 MHz Marker 1 [T1]
 * VBW 3 MHz 29.92 dBm
 Ref 39.6 dBm Att 35 dB SWT 125 ms 915.561000000 MHz



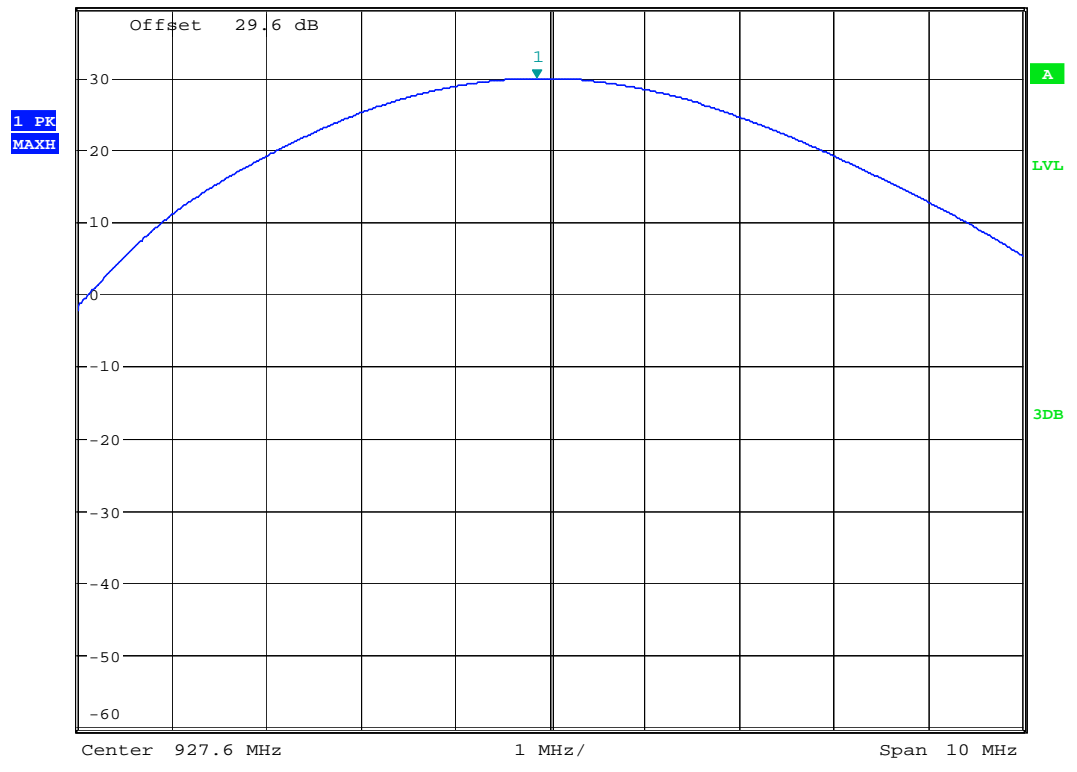
Output Power

Date: 16.DEC.2010 16:49:44



Plot 1.3

* RBW 3 MHz Marker 1 [T1]
 * VBW 3 MHz 29.92 dBm
 Ref 39.6 dBm Att 35 dB SWT 125 ms 927.461000000 MHz



Output Power

Date: 16.DEC.2010 16:50:39

4.2 Hopping Channel 20-dB Bandwidth FCC 15.247(a)(1)(i)

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.

In addition, the occupied bandwidth (99%) was measured.

Test Results

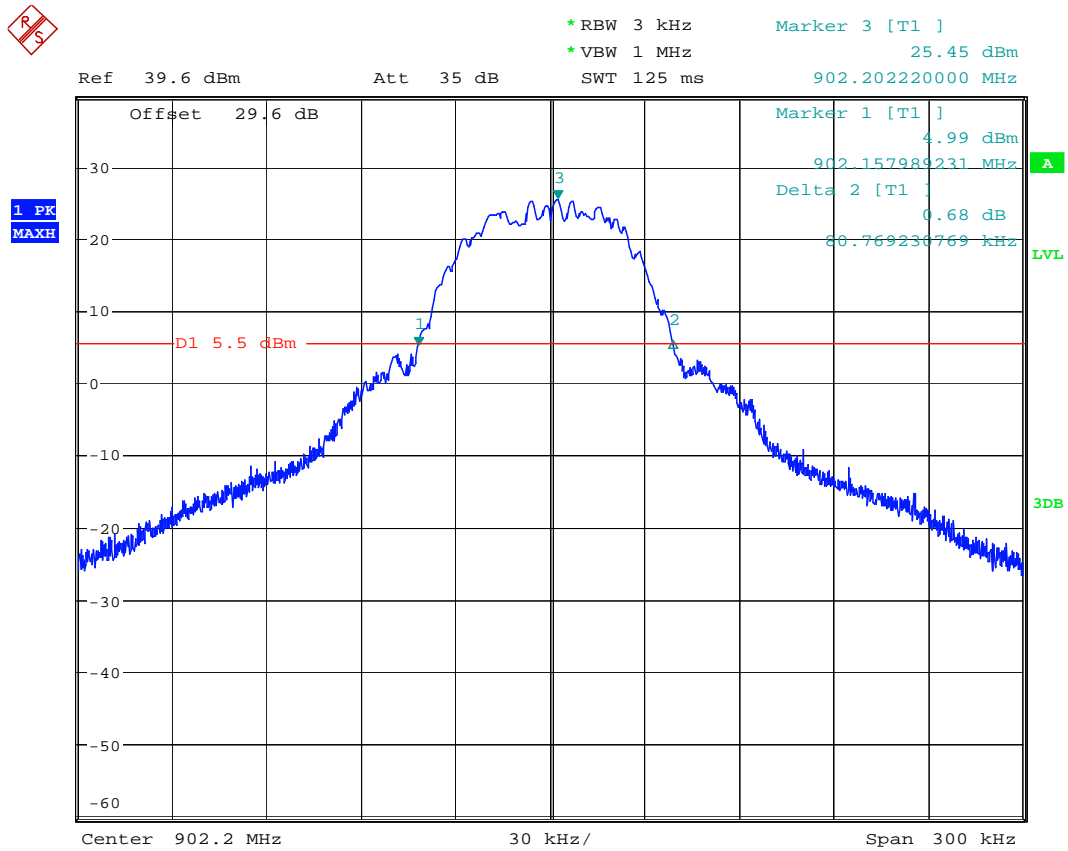
Frequency (MHz)	20-dB channel bandwidth (kHz)	Plot
902.2	80.77	2.1
915.6	80.29	2.2
927.6	80.29	2.3

Frequency (MHz)	Occupied bandwidth (kHz)	Plot
902.2	72.33	2.4
915.6	72.23	2.5
927.6	72.05	2.6

Note: Hopping function was disabled during the test.

Refer to attached plots 2.1-2.6.

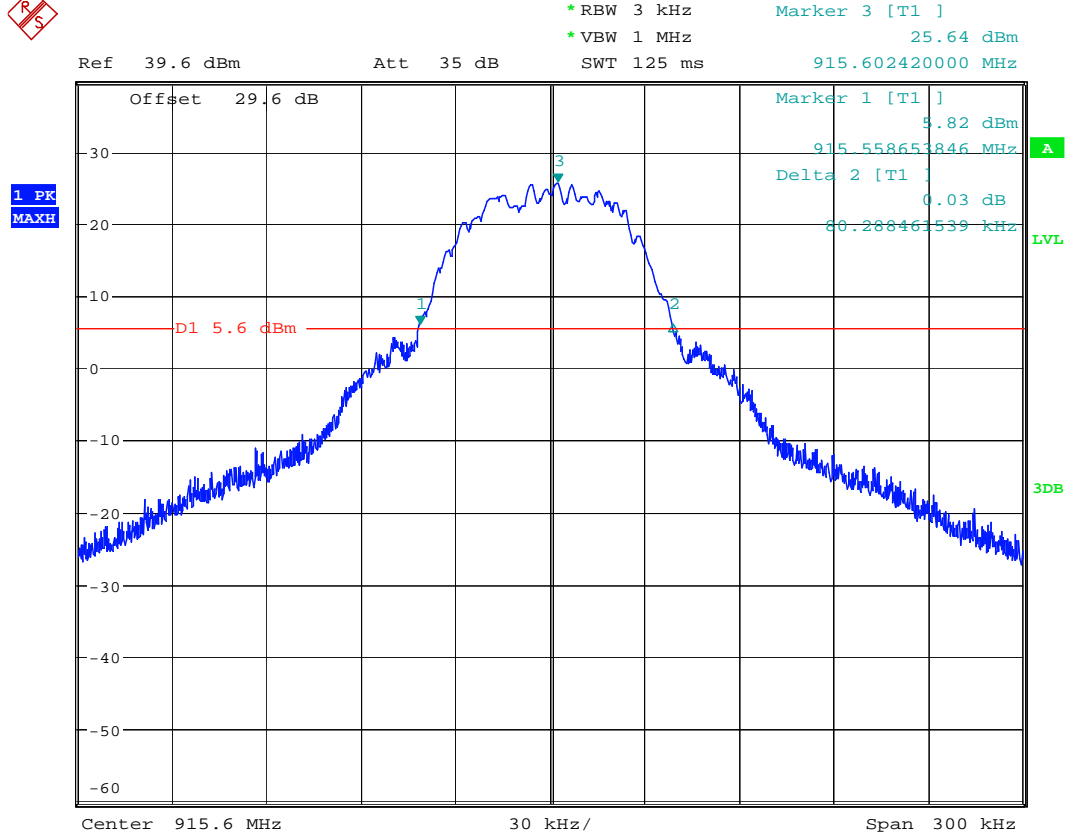
Plot 2.1



20-dB Bandwidth

Date: 16.DEC.2010 16:06:11

Plot 2.2

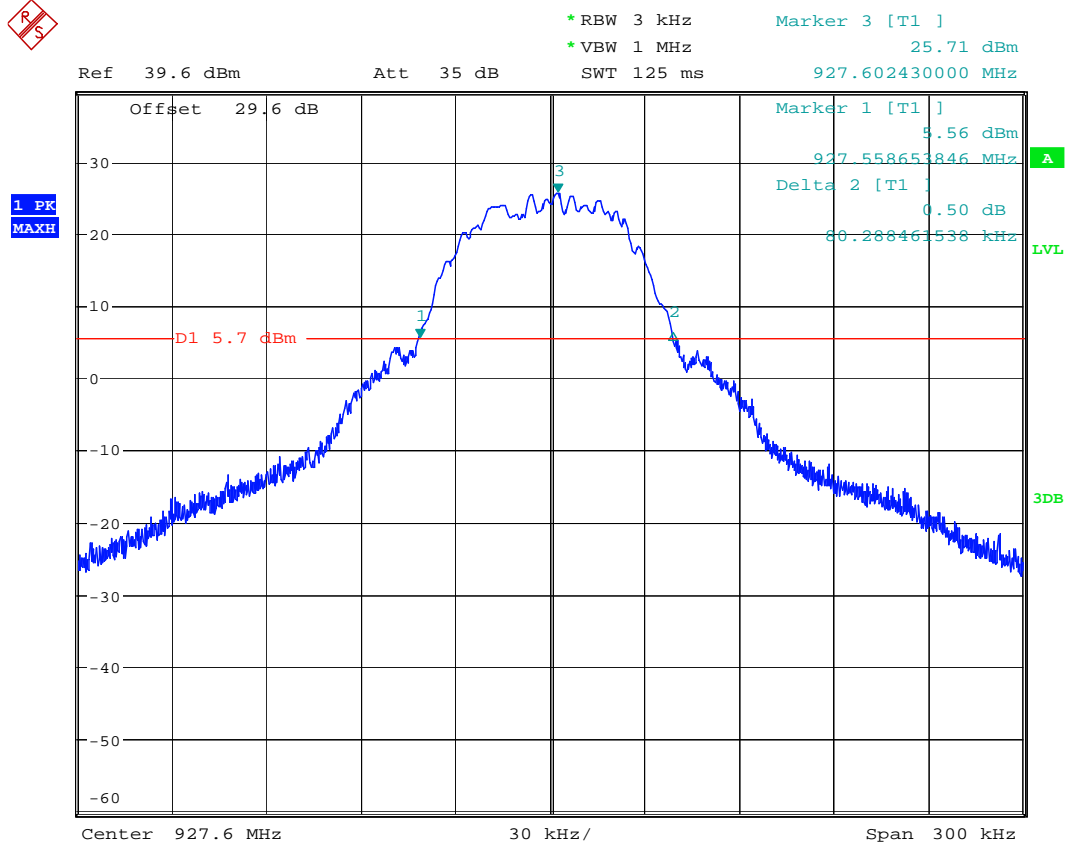


20-dB Bandwidth

Date: 16.DEC.2010 16:10:36



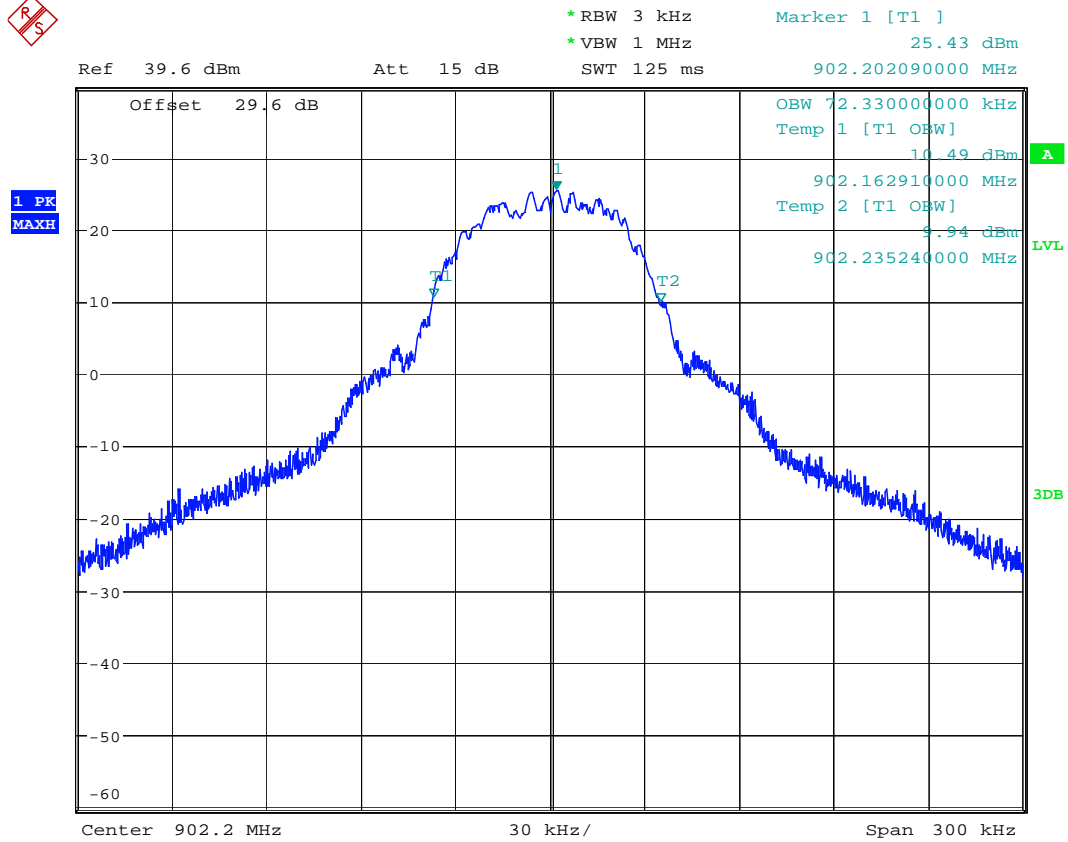
Plot 2.3



20-dB Bandwidth

Date: 16.DEC.2010 16:16:41

Plot 2.4

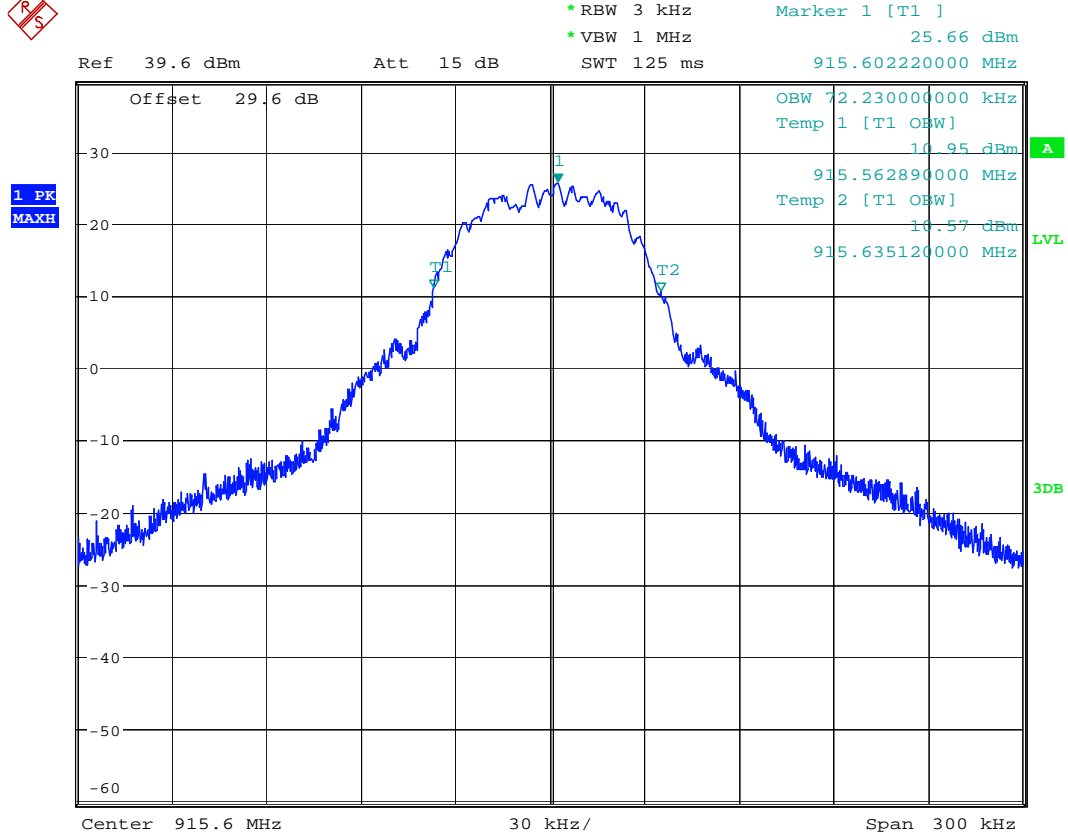


Occupied Bandwidth

Date: 16.DEC.2010 16:25:23



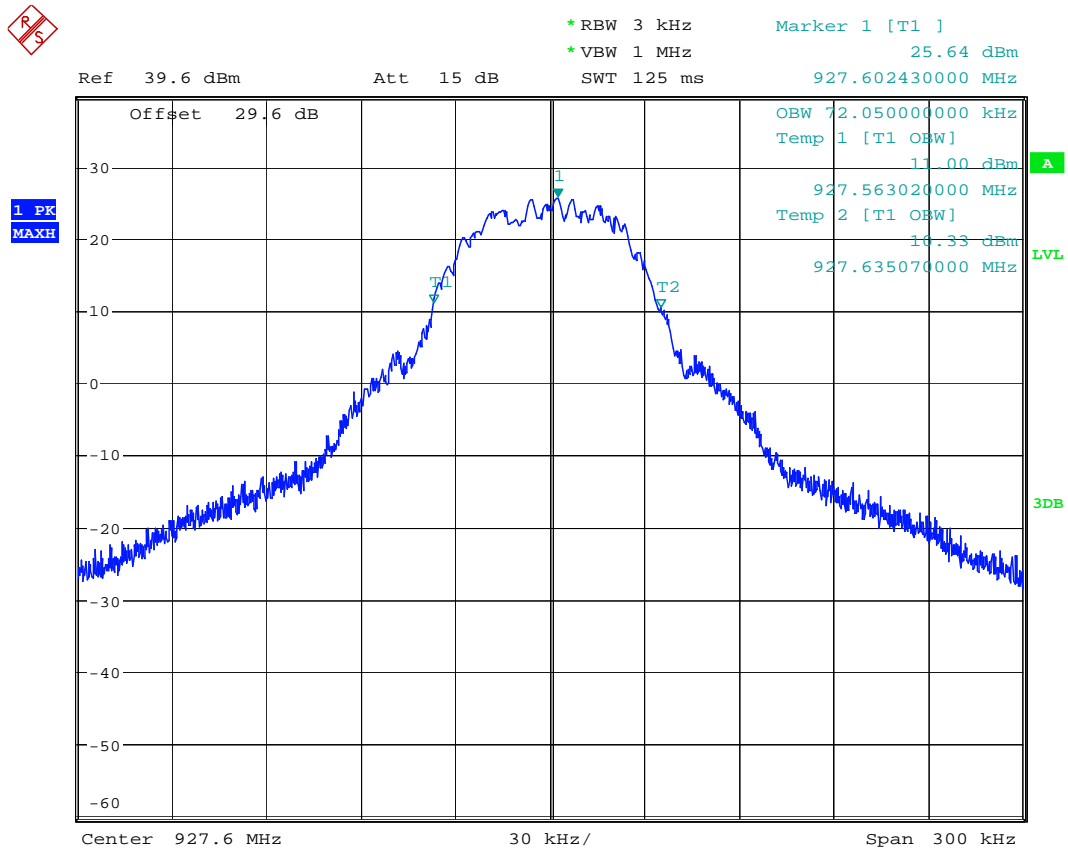
Plot 2.5



Occupied Bandwidth

Date: 16.DEC.2010 16:22:39

Plot 2.6



Occupied Bandwidth

Date: 16.DEC.2010 16:20:14



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.

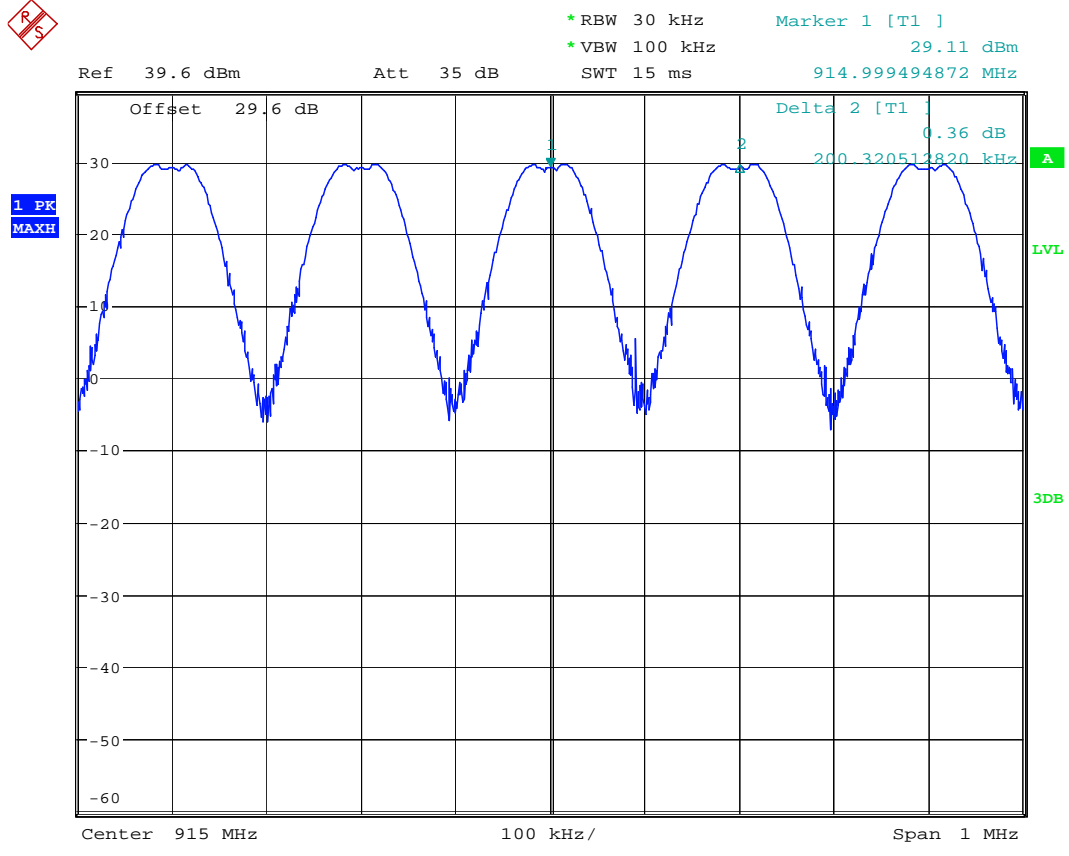
Test Results

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

The channel separation is 200.32 kHz.



Plot 3.1



Carrier frequency separation
Date: 16.DEC.2010 17:08:28



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

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

Test Results

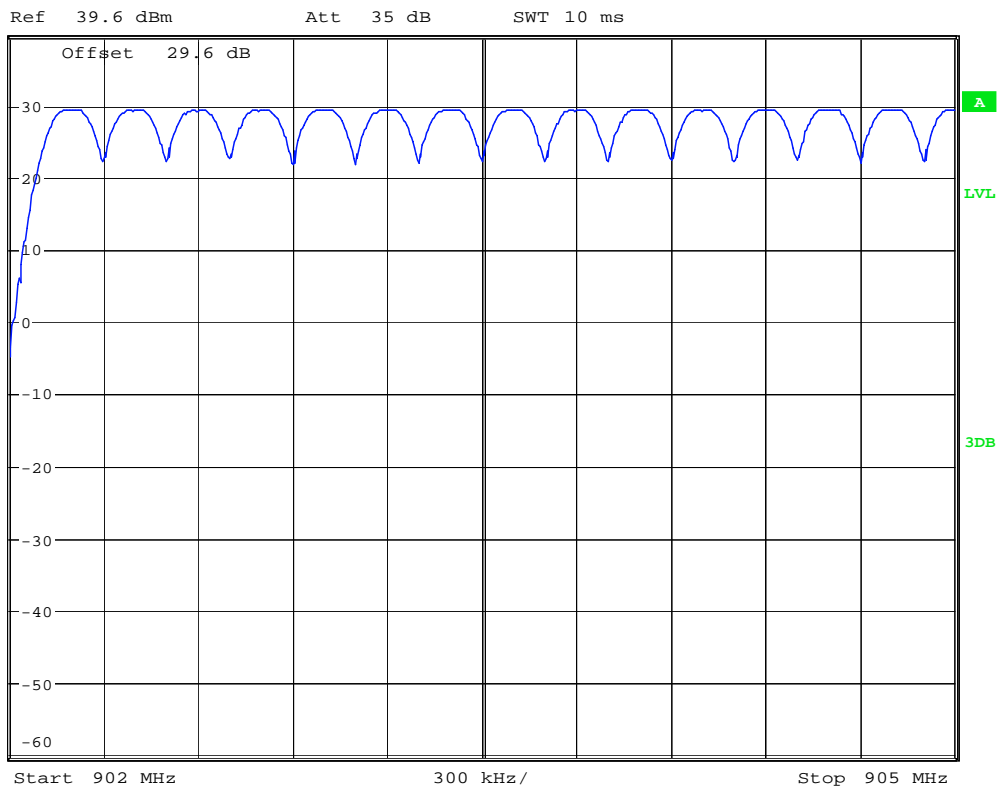
Number of hopping channels with the bandwidth less than 250 kHz	128
---	-----

Refer to attached plots 4.1-4.6.



Plot 4.1

* RBW 100 kHz
* VBW 100 kHz



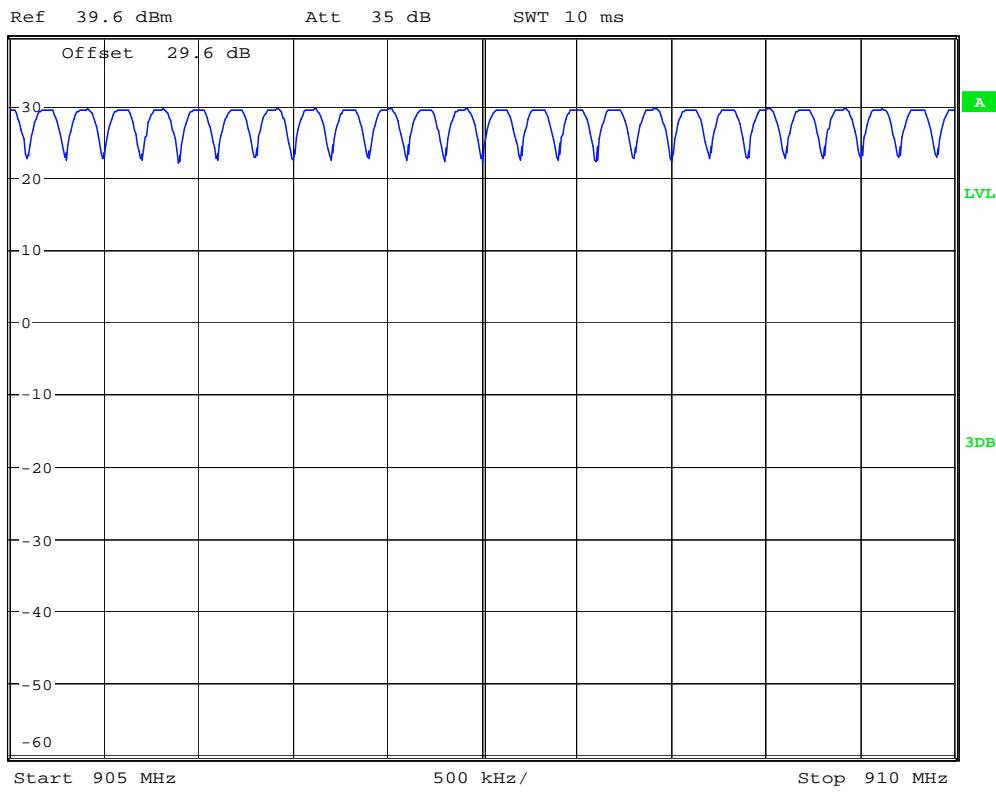
Number of hopping channels

Date: 16.DEC.2010 17:43:52



Plot 4.2

* RBW 100 kHz
* VBW 100 kHz



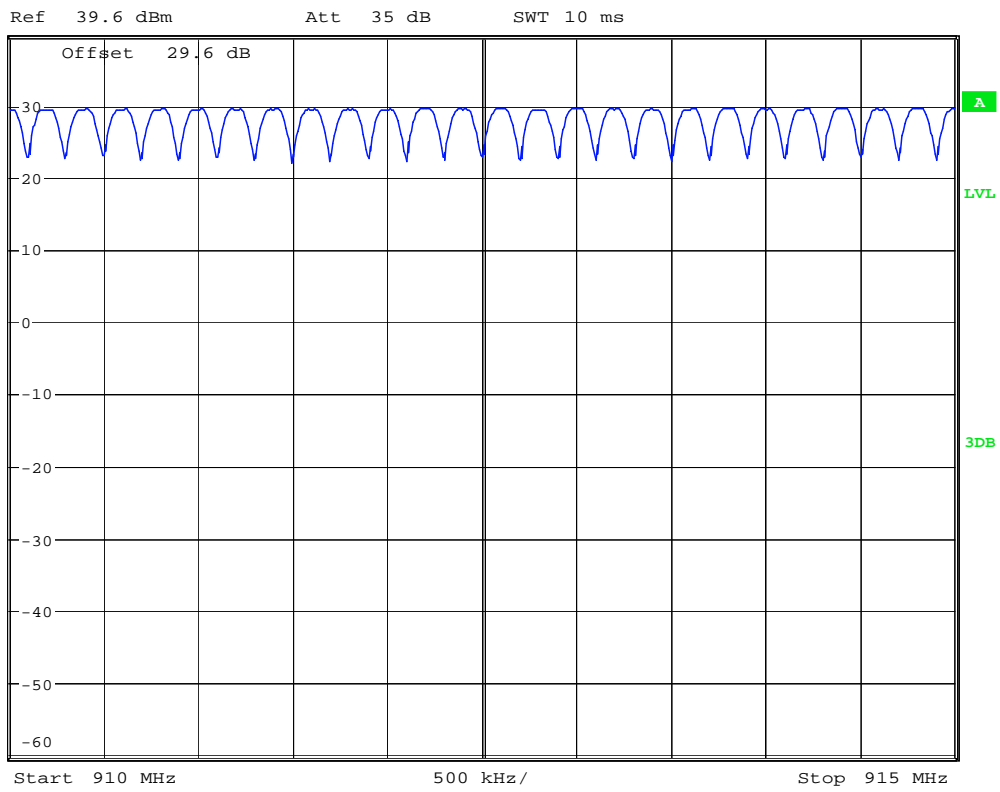
Number of hopping channels

Date: 16.DEC.2010 17:47:48



Plot 4.3

* RBW 100 kHz
* VBW 100 kHz



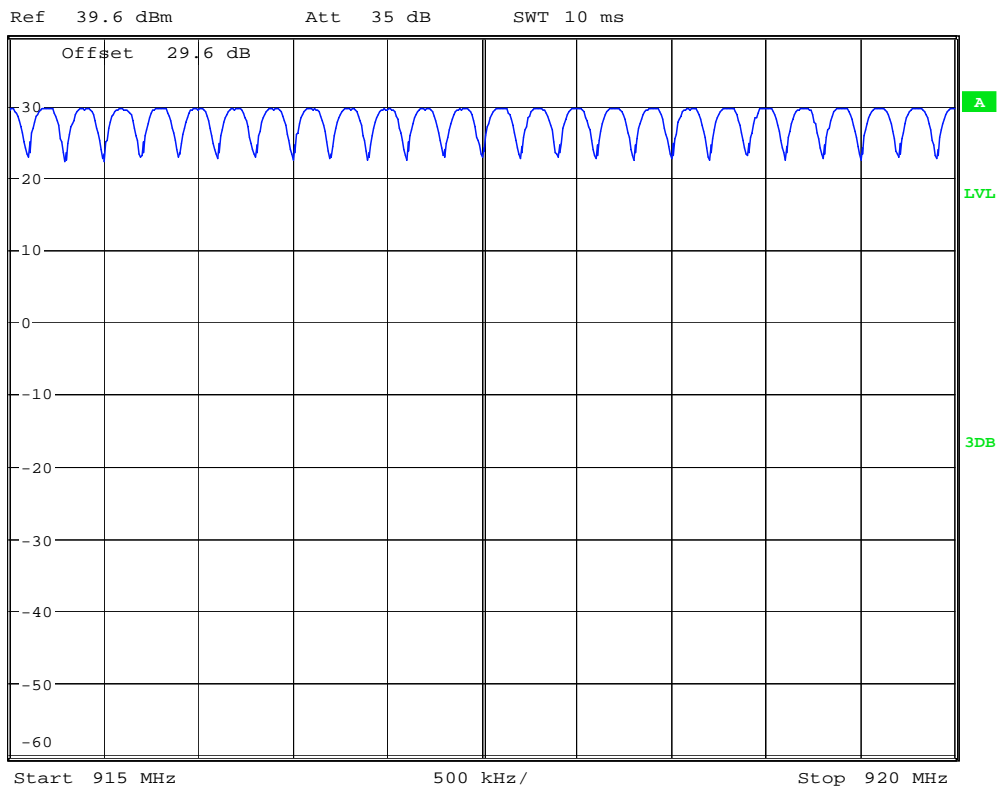
Number of hopping channels

Date: 16.DEC.2010 17:51:24

Plot 4.4



* RBW 100 kHz
* VBW 100 kHz



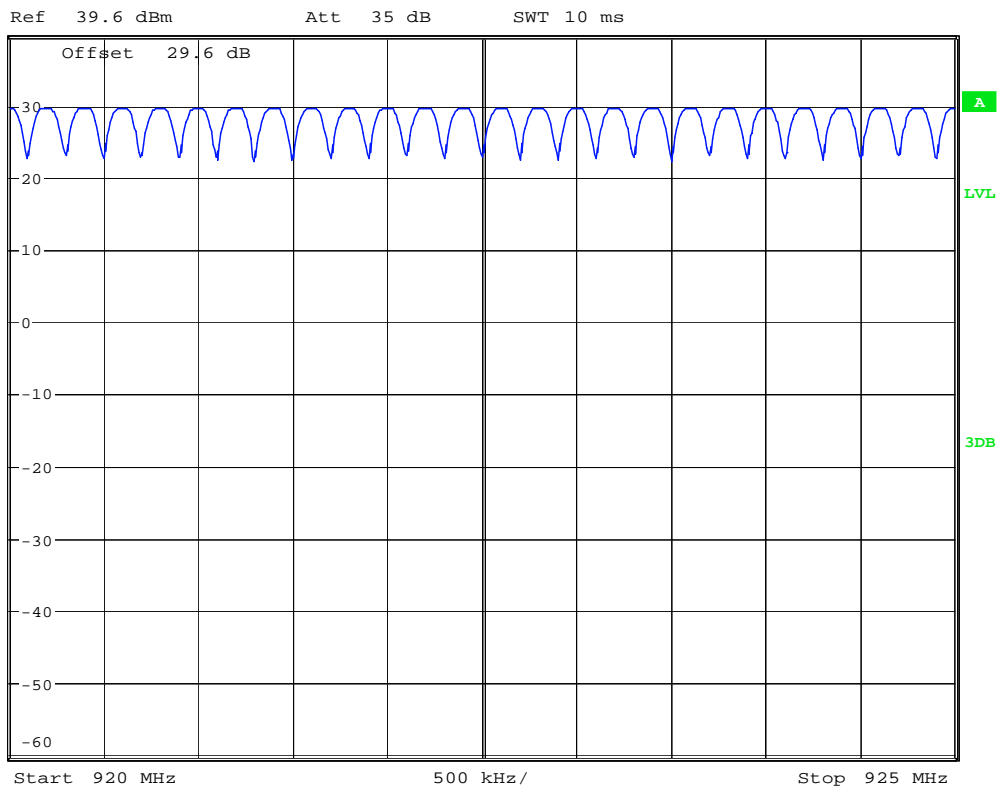
Number of hopping channels

Date: 16.DEC.2010 17:54:53



Plot 4.5

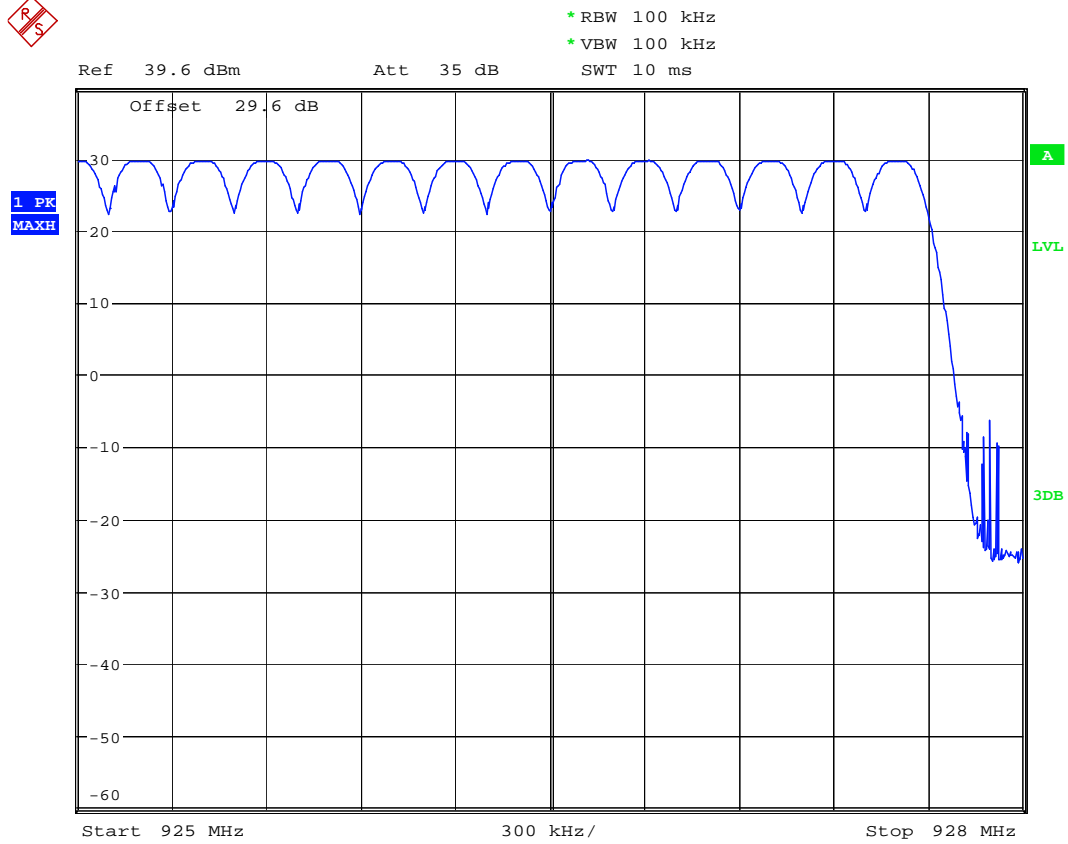
* RBW 100 kHz
* VBW 100 kHz



Number of hopping channels

Date: 16.DEC.2010 17:57:53

Plot 4.5



Number of hopping channels

Date: 16.DEC.2010 18:07:49



4.5 Average Channel Occupancy Time FCC 15.247(a)(1)(i)

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.

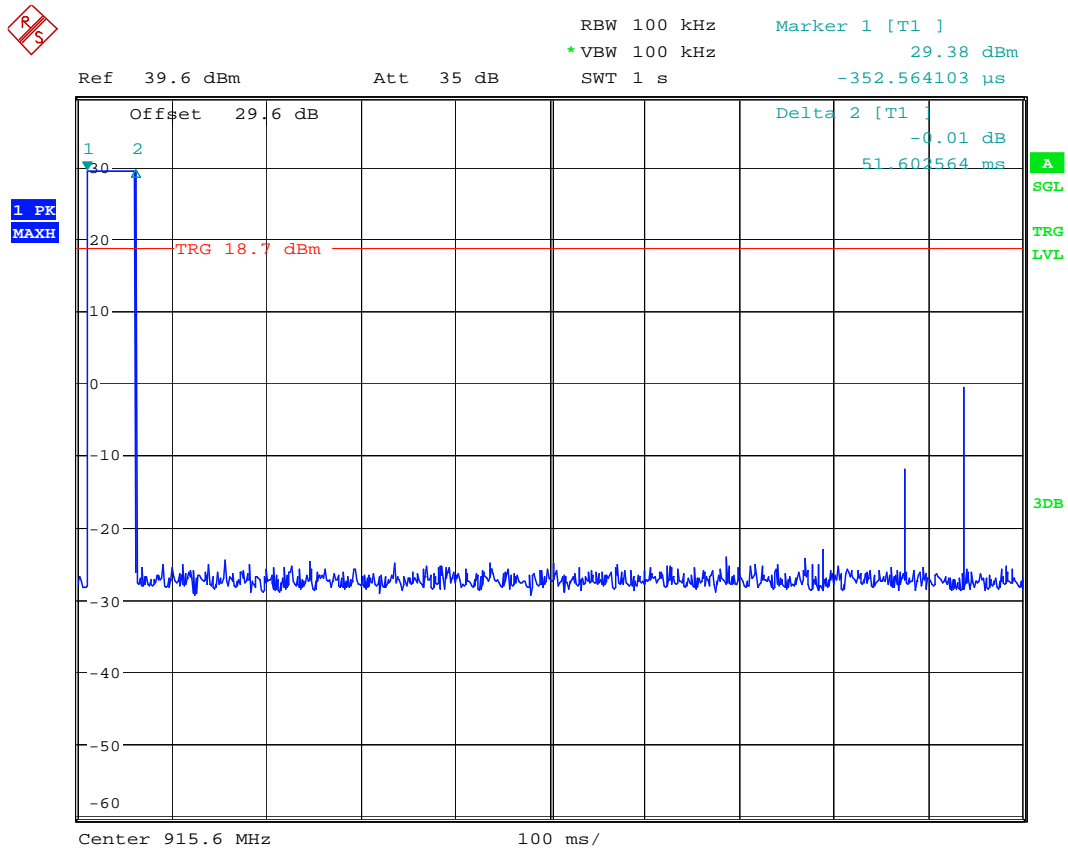
The SWEEP was then set to the time required by the regulation (20 seconds). The analyzer was set to SINGLE SWEEP, the total ON time was added and compared against the limit (0.4 seconds).

Test Results

The average time occupancy is: $51.6 \times 3 = 154.8$ ms

Refer to attached plots 5.1-5.2.

Plot 5.1



Dwell Time

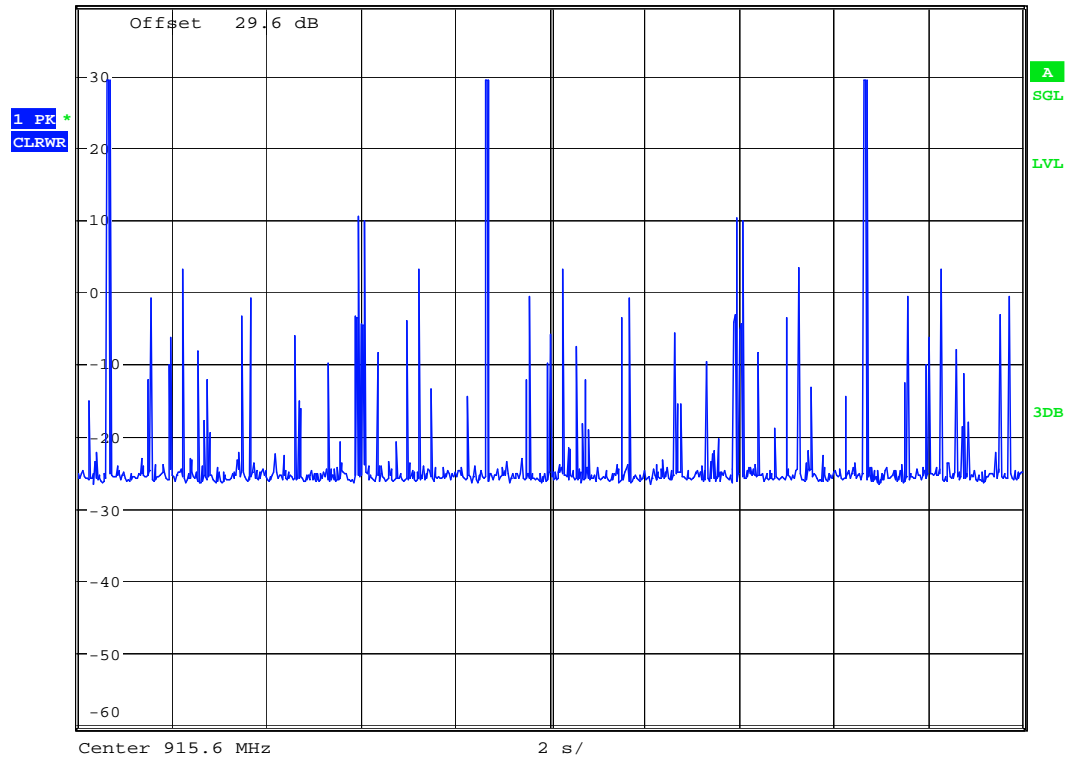
Date: 20.DEC.2010 11:38:31

Plot 5.2



RBW 100 kHz
* VBW 100 kHz

Ref 39.6 dBm Att 35 dB SWT 20 s



Dwell Time

Date: 20.DEC.2010 11:22:40



4.6 Out-of-Band Conducted Emissions FCC 15.247(d)

Requirements

In any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

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.

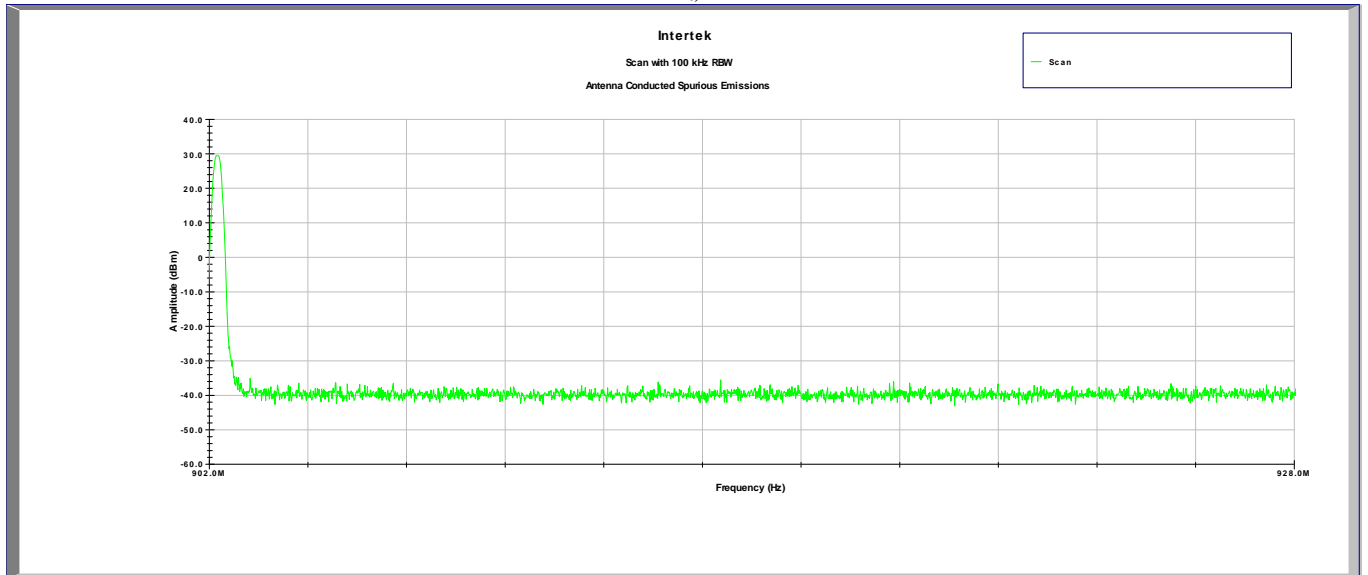
Test Result

Refer to the following plots for the test result:

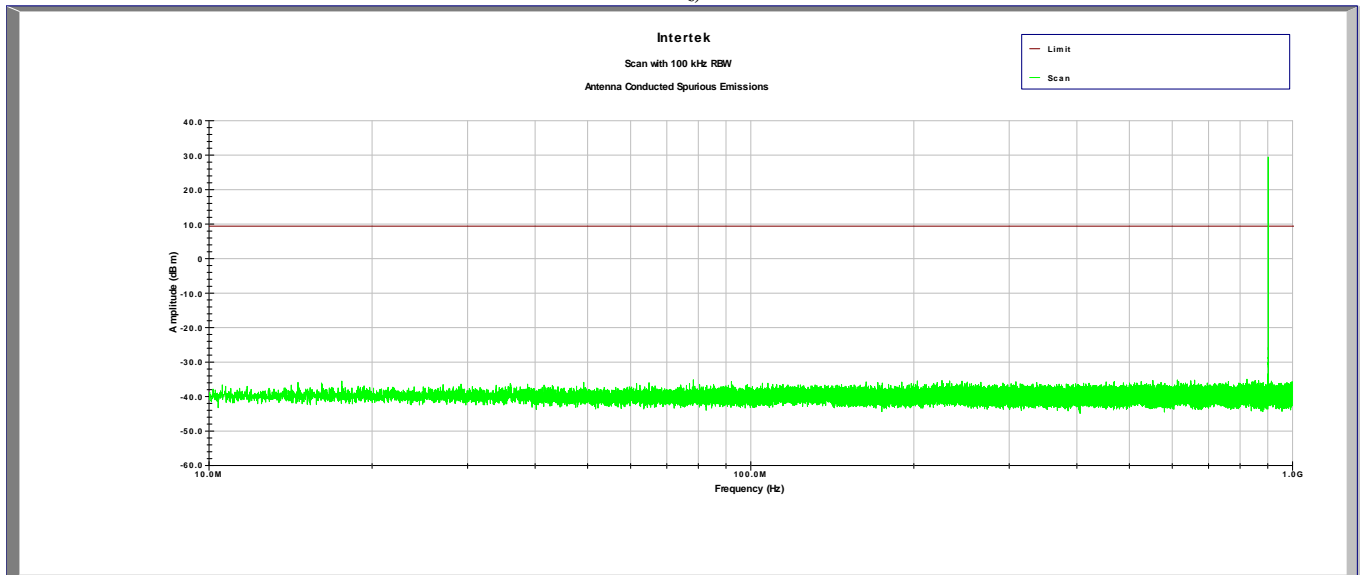
Frequency (MHz)	Channel	Modulation	Description	Plot
902.2	1	FHSS	In-band Emissions	4.1
	1	FHSS	Scan 30 MHz – 25 GHz	4.2, 4.3
	1	FHSS	Emissions on the low band-edge frequency, Hopping mode	4.10, 4.11
915.6	68	FHSS	In-band Emissions	4.4
	68	FHSS	Scan 30 MHz – 25 GHz	4.5, 4.6
927.6	128	FHSS	In-band Emissions	4.7
	128	FHSS	Scan 30 MHz – 25 GHz	4.8, 4.9
	128	FHSS	Emissions on the high band-edge frequency, Hopping mode	4.12, 4.13

The attenuation is more than 20 dB.

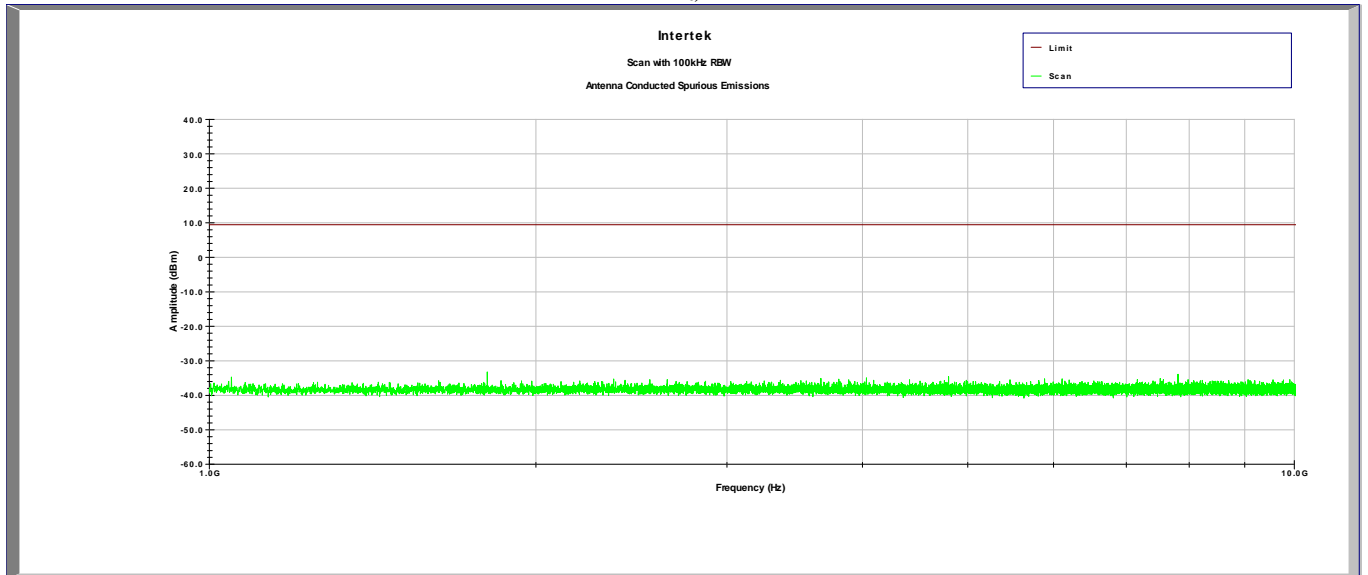
Plot 6.1
Tx @ 902.2MHz, Ch1



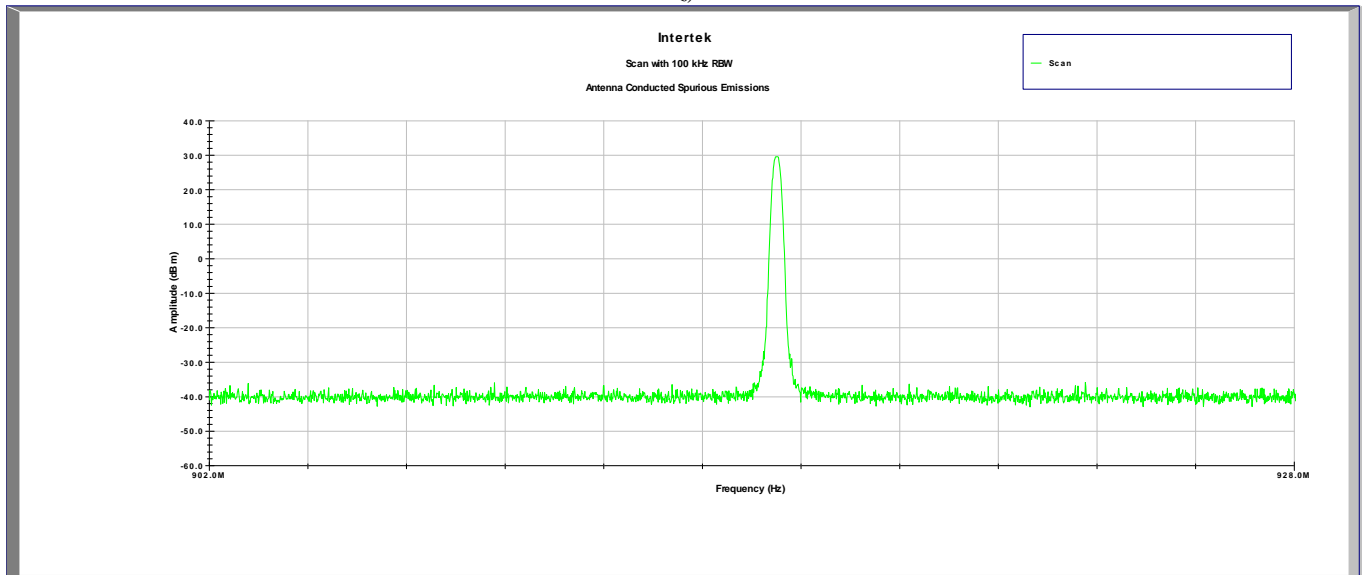
Plot 6.2
Tx @ 902.2MHz, Ch1



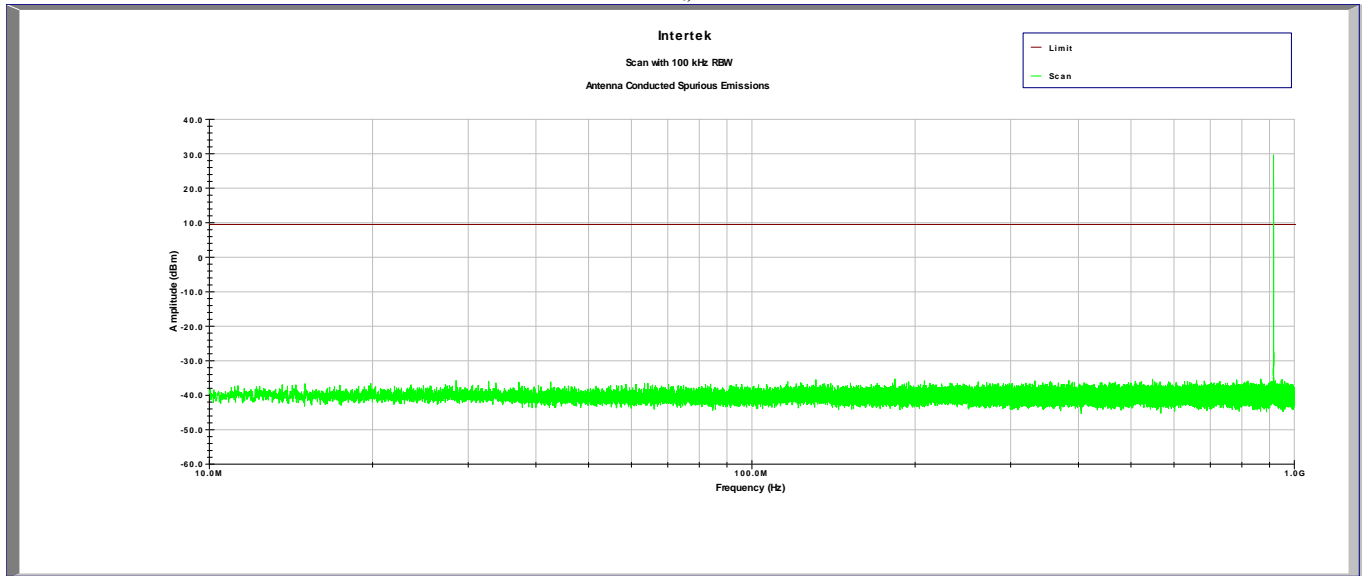
Plot 6.3
Tx @ 902.2MHz, Ch1



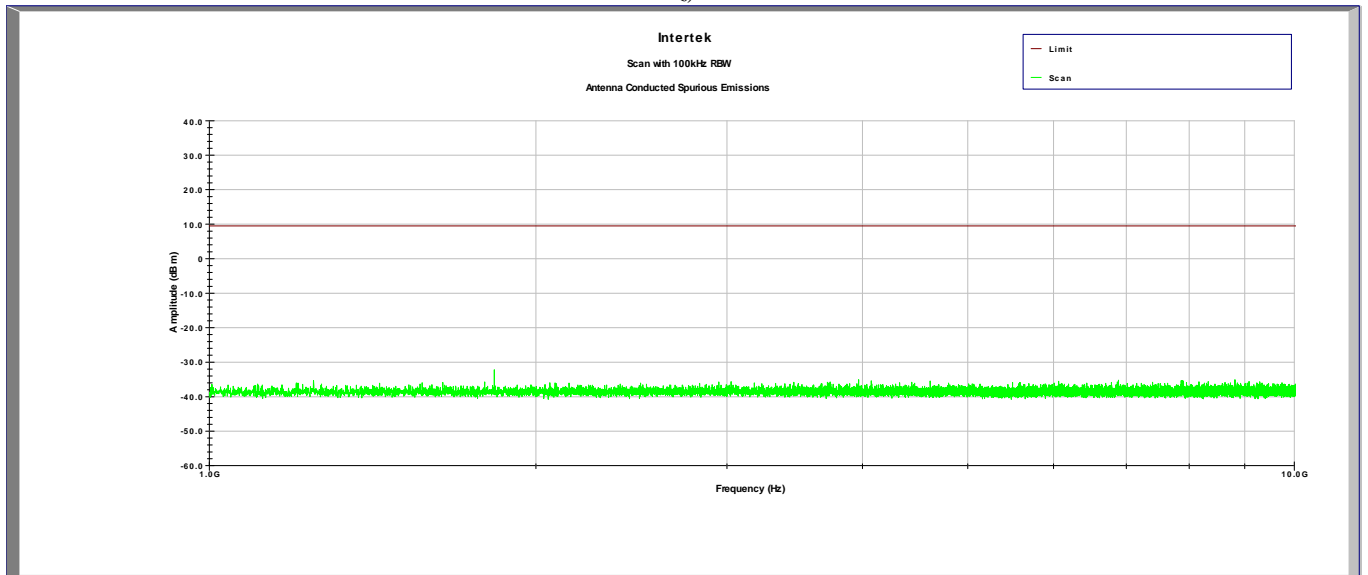
Plot 6.4
Tx @ 915.6MHz, Ch68



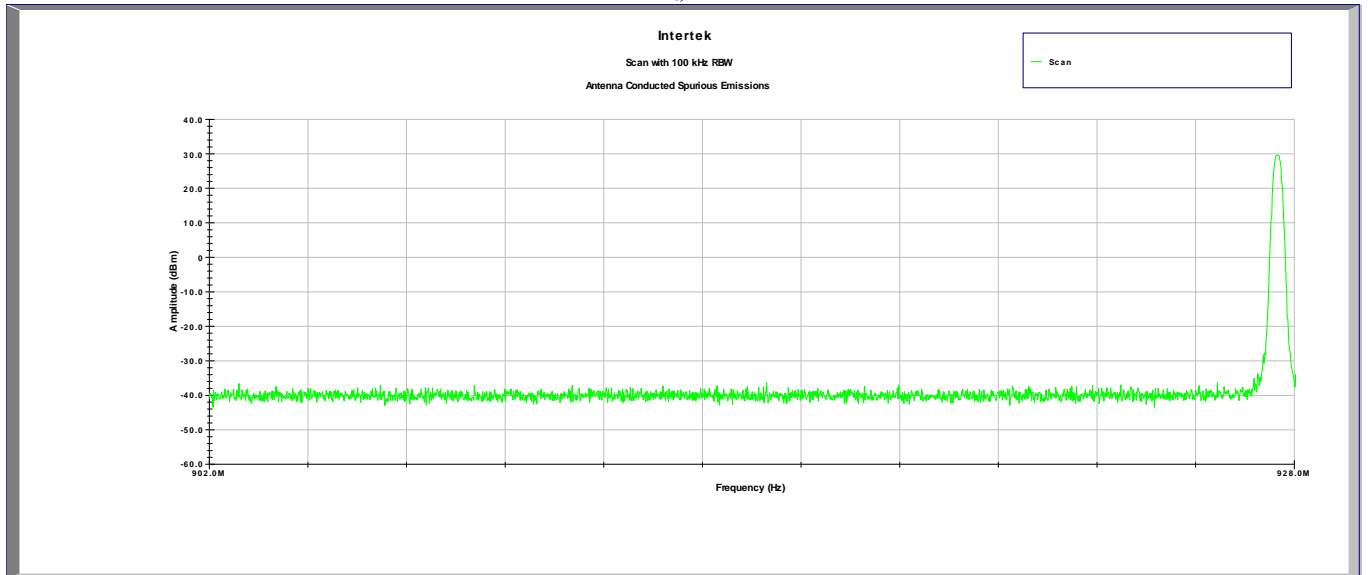
Plot 6.5
Tx @ 915.6MHz, Ch68



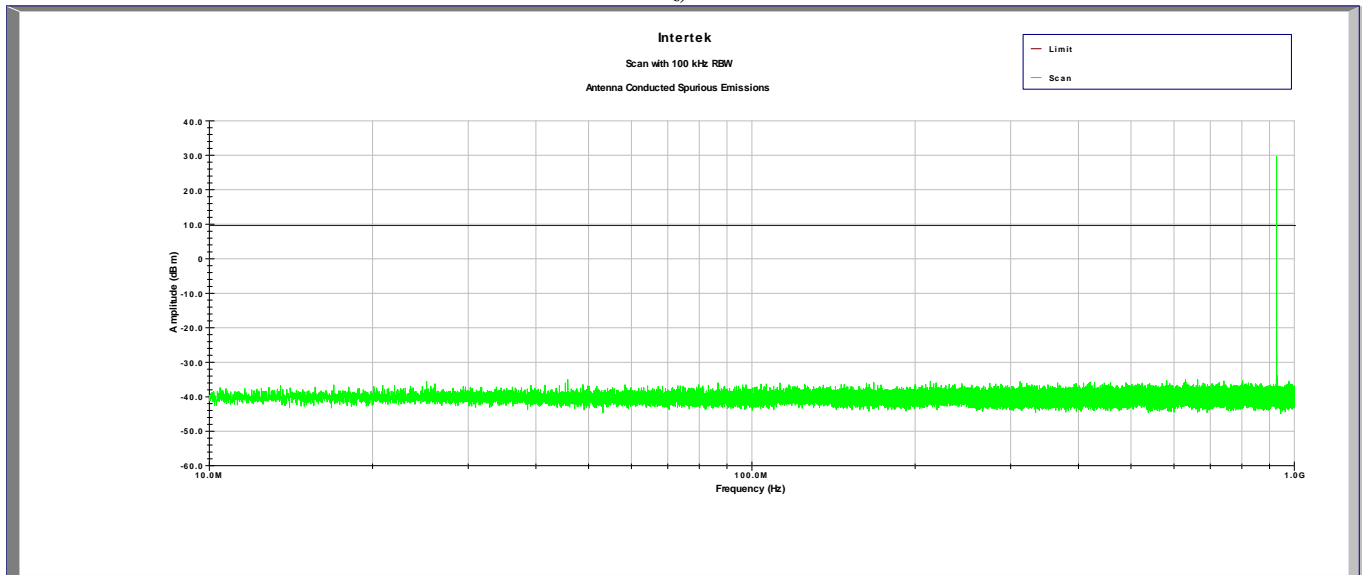
Plot 6.6
Tx @ 915.6MHz, Ch68



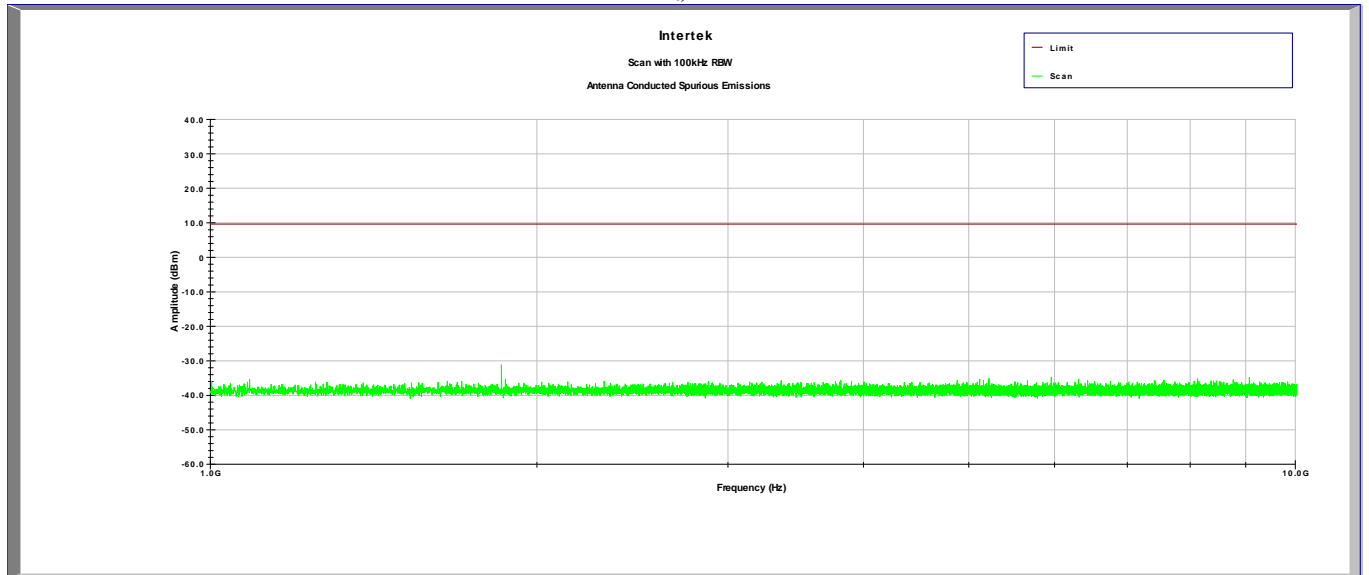
Plot 6.7
Tx @ 927.6MHz, Ch128



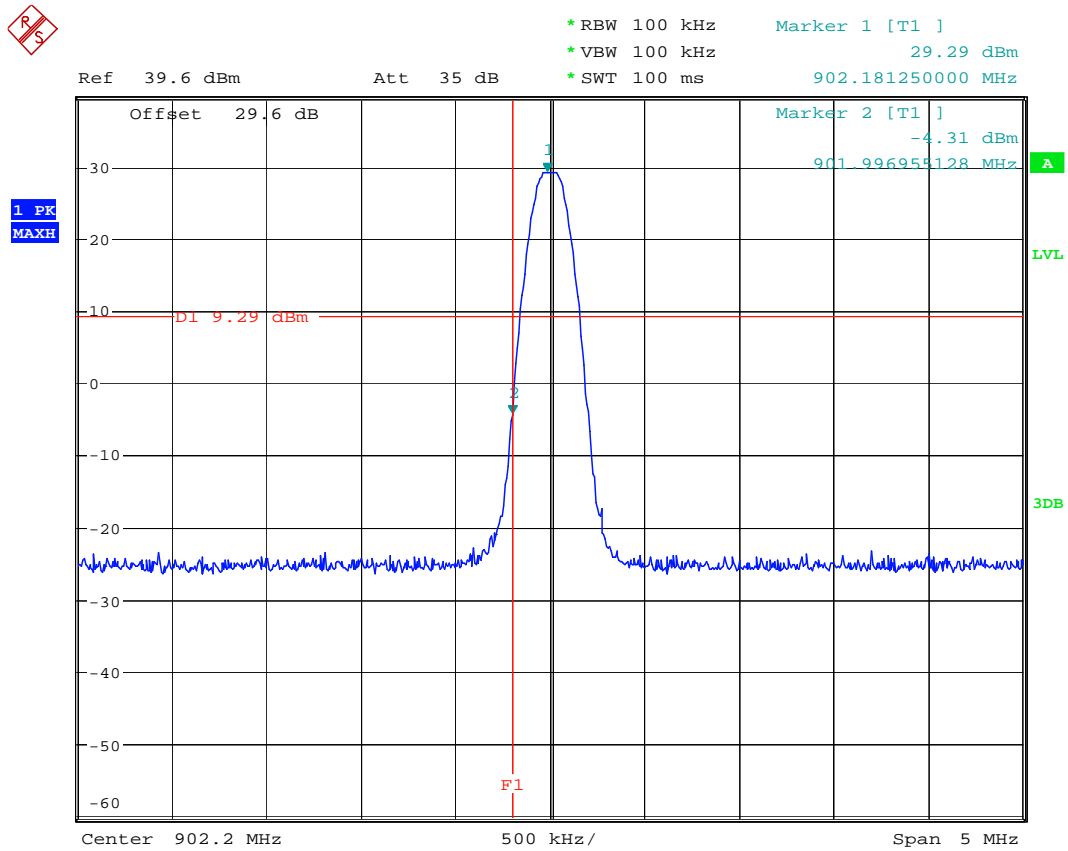
Plot 6.8
Tx @ 927.6MHz, Ch128



Plot 6.9
Tx @ 927.6MHz, Ch128



Plot 6.10

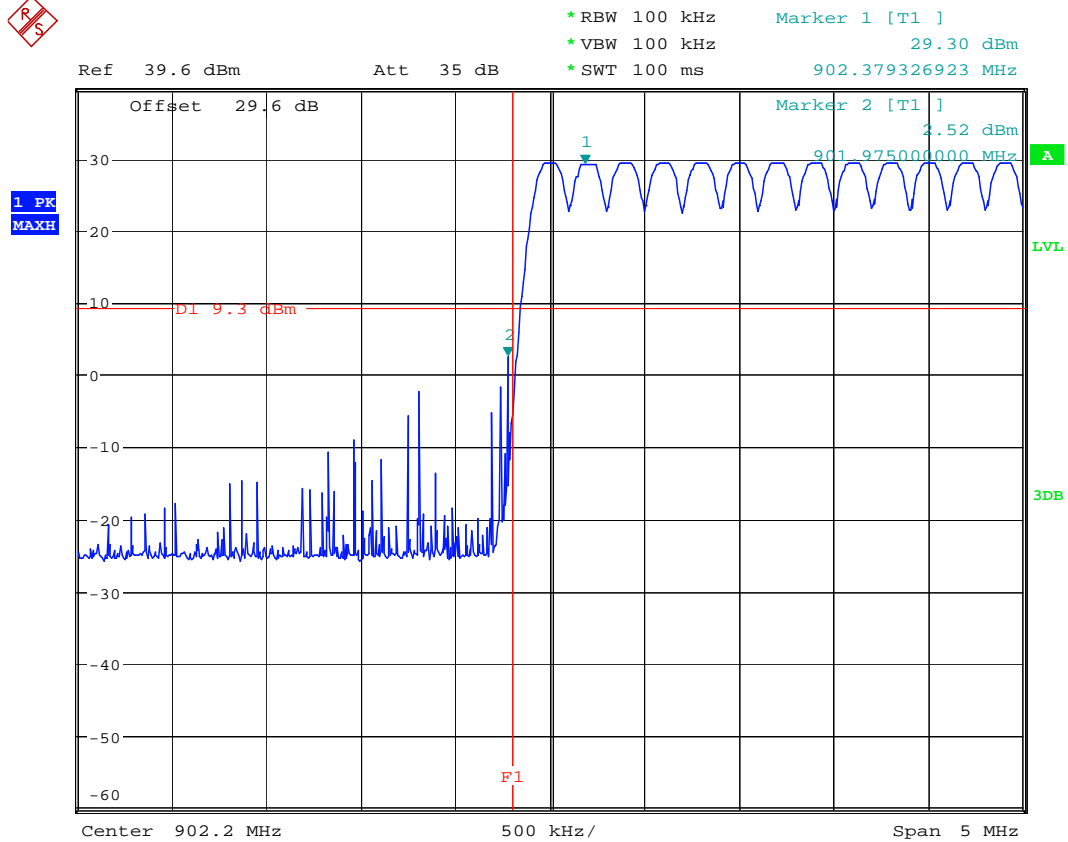


Out-of-band emissions, 902.2MHz

Date: 17.DEC.2010 14:32:49



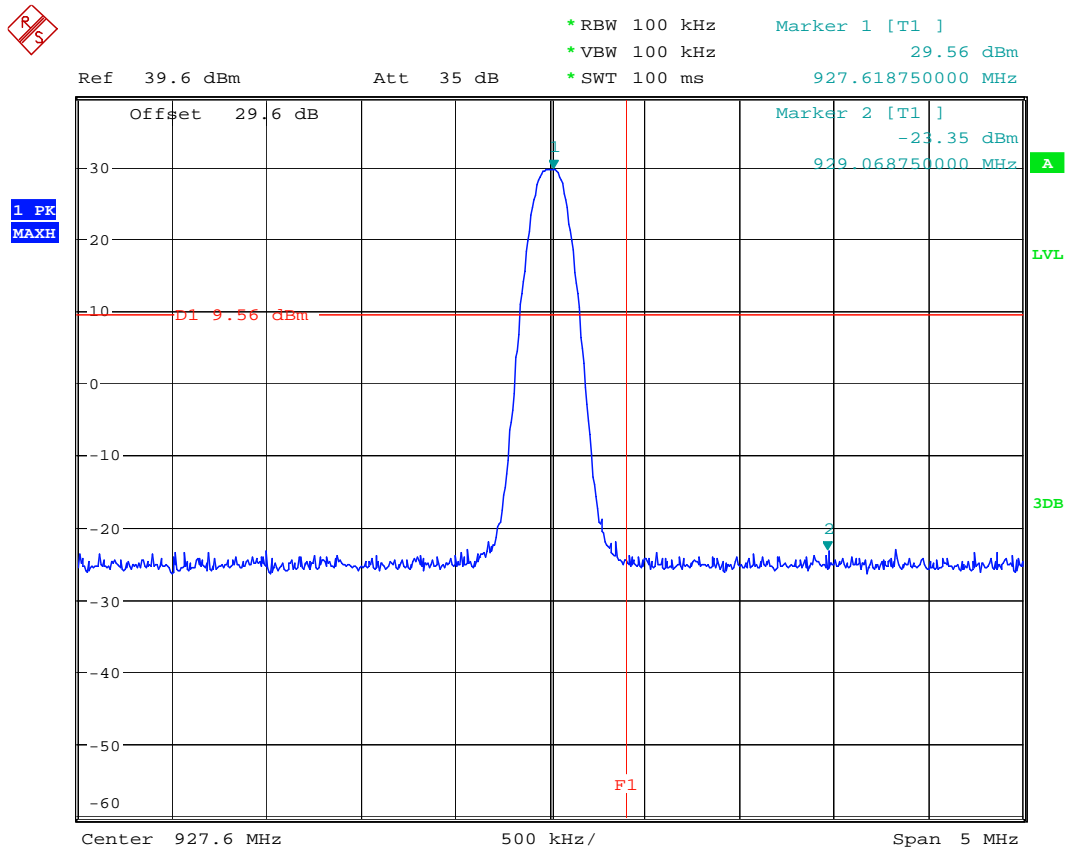
Plot 6.11



Out-of-band emissions, 902.2MHz

Date: 17.DEC.2010 14:35:51

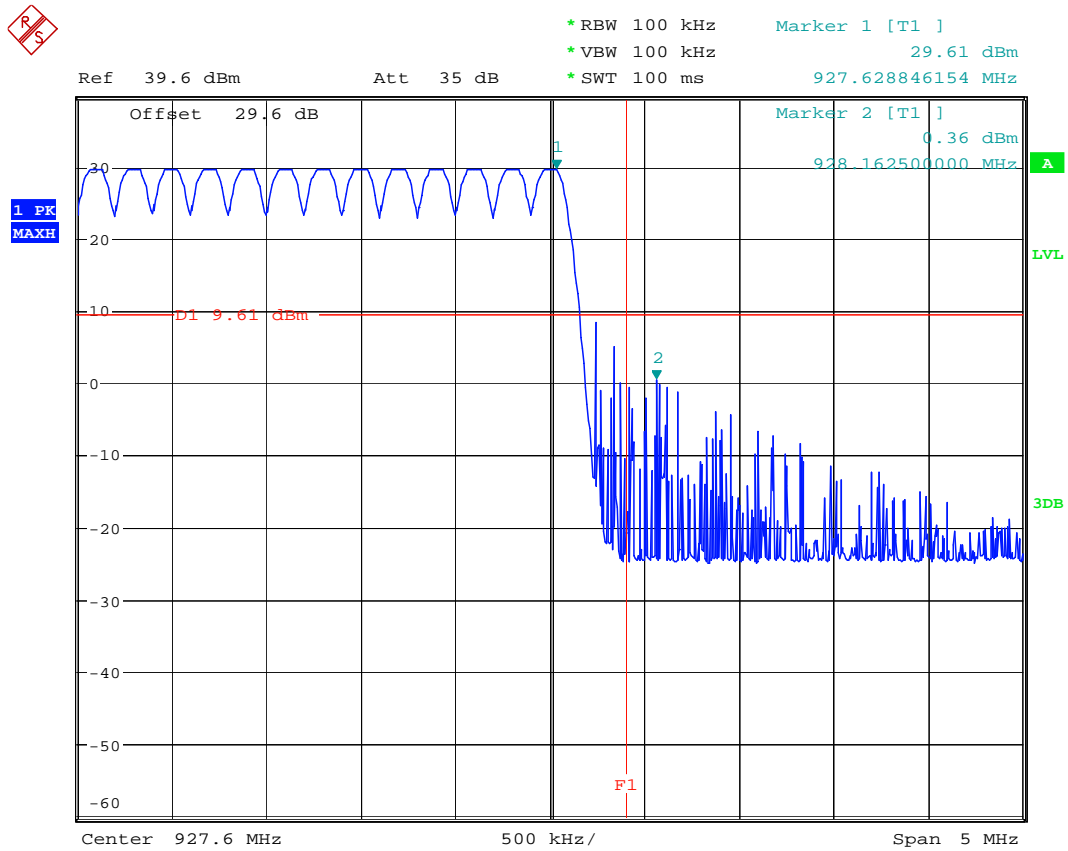
Plot 6.12



Out-of-band emissions, 927.6MHz

Date: 17.DEC.2010 14:38:41

Plot 6.13



Out-of-band emissions, 927.6MHz

Date: 17.DEC.2010 14:45:33



4.7 Transmitter Radiated Emissions FCC Rule 15.247(d), 15.209, 15.205

Requirement

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

Procedure

Radiated emission measurements were performed from 30 MHz to 25,000 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 plastic turntable that is 80 cm in height. 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 for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).



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:

$FS = RA + AF + CF - AG$; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

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

RA = Receiver Amplitude (including preamplifier) in $\text{dB}(\mu\text{V})$; AF = Antenna Factor in $\text{dB}(1/\text{m})$

CF = Cable Attenuation Factor in dB ; AG = Amplifier Gain in dB

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

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

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

$CF = 1.6 \text{ dB}$

$AG = 29.0 \text{ dB}$

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

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



Test Results

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

The EUT passed the test by 3.4dB.

Radiated emissions above 1 GHz

Test Result	
FCC Part 15 Subpart C (15.247) Radiated Emission in Restricted Bands	
Temperature: 21C	Javad GNSS, Inc.
Humidity: 48%	Model: FH915
Test distance = 3 m	
Test date: December 15, 2010	

Frequency MHz	Detector	SA reading dB(uV)	Correction Factor dB	Ant. Factor dB(1/m)	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx at 902.2 MHz							
2706.6	Peak	51.8	-30.6	28.7	49.9	74.0	-24.1
3608.8	Peak	49.1	-31.4	30.8	48.5	74.0	-25.5
4511	Peak	49.2	-29.9	32.0	51.3	74.0	-22.7
5413.2	Peak	44.1	-29.5	33.6	48.2	74.0	-25.8
7217.6	Peak	37.6	-26.7	37.2	48.1	74.0	-25.9
8119.8	Peak	37.6	-27.0	37.2	47.8	74.0	-26.2
9022	Peak	37.7	-26.3	37.7	49.1	74.0	-24.9
10826.4	Peak	37.1	-25.0	38.5	50.6	74.0	-23.4
11728.6	Peak	35.9	-25.9	38.7	48.7	74.0	-25.3
12630.8	Peak	37.2	-26.0	38.9	50.1	74.0	-23.9
2706.6	Aver	50.4	-30.6	28.7	48.5	54.0	-5.5
3608.8	Aver	46.0	-31.4	30.8	45.4	54.0	-8.6
4511	Aver	47.0	-29.9	32.0	49.1	54.0	-4.9
5413.2	Aver	38.6	-29.5	33.6	42.7	54.0	-11.3
7217.6	Aver	24.8	-26.7	37.2	35.3	54.0	-18.7
8119.8	Aver	24.8	-27.0	37.2	35.0	54.0	-19.0
9022	Aver	25.2	-26.3	37.7	36.6	54.0	-17.4
10826.4	Aver	26.1	-25.0	38.5	39.6	54.0	-14.4
11728.6	Aver	22.7	-25.9	38.7	35.5	54.0	-18.5
12630.8	Aver	23.6	-26.0	38.9	36.5	54.0	-17.5

- a) RBW = 1 MHz, VBW = 1 MHz - for peak measurements
RBW = 1MHz, VBW = 100 Hz - for average measurements
- b) Correction Factor: Pre-amplifier gain + Cable loss + HP-Filter loss
- c) All other emissions are 20 dB below the limit.

Radiated emissions above 1 GHz

Test Result	
FCC Part 15 Subpart C (15.247) Radiated Emission in Restricted Bands	
Temperature: 21C	Javad GNSS, Inc.
Humidity: 48%	Model: FH915
Test distance = 3 m	
Test date: December 15, 2010	

Frequency MHz	Detector	SA reading dB(uV)	Correction Factor dB	Ant. Factor dB(1/m)	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx at 915.6 MHz							
2746.8	Peak	51.2	-30.9	28.7	49.0	74.0	-25.0
3662.4	Peak	46.6	-31.4	31.0	46.2	74.0	-27.8
4578	Peak	47.7	-29.7	32.2	50.2	74.0	-23.8
5493.6	Peak	43.1	-29.0	33.8	47.9	74.0	-26.1
7324.8	Peak	39.1	-26.8	37.5	49.8	74.0	-24.2
8240.4	Peak	38.3	-26.7	37.3	48.9	74.0	-25.1
9156	Peak	37.2	-26.1	37.7	48.8	74.0	-25.2
10987.2	Peak	37.4	-25.0	38.4	50.8	74.0	-23.2
11902.8	Peak	36.8	-25.6	38.7	49.9	74.0	-24.1
2746.8	Aver	49.0	-30.9	28.7	46.8	54.0	-7.2
3662.4	Aver	41.6	-31.4	31.0	41.2	54.0	-12.8
4578	Aver	44.2	-29.7	32.2	46.7	54.0	-7.3
5493.6	Aver	37.0	-29.0	33.8	41.8	54.0	-12.2
7324.8	Aver	28.7	-26.8	37.5	39.4	54.0	-14.6
8240.4	Aver	24.4	-26.7	37.3	35.0	54.0	-19.0
9156	Aver	25.2	-26.1	37.7	36.8	54.0	-17.2
10987.2	Aver	26.5	-25.0	38.4	39.9	54.0	-14.1
11902.8	Aver	22.7	-25.6	38.7	35.8	54.0	-18.2

- d) RBW = 1 MHz, VBW = 1 MHz - for peak measurements
RBW = 1MHz, VBW = 100 Hz - for average measurements
- e) Correction Factor: Pre-amplifier gain + Cable loss + HP-Filter loss
- f) All other emissions are 20 dB below the limit.

Radiated emissions above 1 GHz

Test Result	
FCC Part 15 Subpart C (15.247) Radiated Emission in Restricted Bands	
Temperature: 21C	Javad GNSS, Inc.
Humidity: 48%	Model: FH915
Test distance = 3 m	
Test date: December 15, 2010	

Frequency MHz	Detector	SA reading dB(uV)	Correction Factor dB	Ant. Factor dB(1/m)	Field Strength dB(uV/m)	Limit dB(uV/m)	Margin dB
Tx at 927.6 MHz							
2782.8	Peak	48.7	-30.3	28.7	47.1	74.0	-26.9
3710.4	Peak	43.3	-30.0	31.1	44.4	74.0	-29.6
4638	Peak	47.5	-29.1	32.4	50.8	74.0	-23.2
5565.6	Peak	43.1	-28.8	34	48.3	74.0	-25.7
7420.8	Peak	38.1	-26.9	37.6	48.8	74.0	-25.2
8348.4	Peak	36.6	-26.4	37.4	47.6	74.0	-26.4
11131.2	Peak	35.9	-25.2	38.4	49.1	74.0	-24.9
12058.8	Peak	37.2	-26.2	38.6	49.6	74.0	-24.4
2782.8	Aver	45.8	-30.3	28.7	44.2	54.0	-9.8
3710.4	Aver	35.7	-30.0	31.1	36.8	54.0	-17.2
4638	Aver	43.1	-29.1	32.4	46.4	54.0	-7.6
5565.6	Aver	36.9	-28.8	34	42.1	54.0	-11.9
7420.8	Aver	26.9	-26.9	37.6	37.6	54.0	-16.4
8348.4	Aver	23.4	-26.4	37.4	34.4	54.0	-19.6
11131.2	Aver	22.5	-25.2	38.4	35.7	54.0	-18.3
12058.8	Aver	23.1	-26.2	38.6	35.5	54.0	-18.5

- g) RBW = 1 MHz, VBW = 1 MHz - for peak measurements
RBW = 1MHz, VBW = 100 Hz - for average measurements
- h) Correction Factor: Pre-amplifier gain + Cable loss + HP-Filter loss
- i) All other emissions are 20 dB below the limit.

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

Operator: KK
December 21, 2010
Test distance = 10 m

Model Number: FH915
Company: Javad GNSS, Inc.

Frequency (MHz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	CF dB	AG dB	DCF dB	AF dB(1/m)
47.4	28.8	40.0	-11.2	35.4	0.8	31.9	10.5	14.1
90.175	26.8	43.5	-16.7	38.9	1.1	32.1	10.5	8.4
179.35	33.3	43.5	-10.2	43.9	1.6	31.9	10.5	9.3
181.525	33.0	43.5	-10.5	43.5	1.6	31.9	10.5	9.4
196.025	32.5	43.5	-11.0	42.4	1.6	31.9	10.5	9.9
211.975	29.0	43.5	-14.5	37.5	1.7	31.9	10.5	11.1
214.15	28.5	43.5	-15.0	37.0	1.7	31.9	10.5	11.2
247.5	29.3	46.0	-16.7	36.9	1.9	31.9	10.5	12.0
378.0	30.9	46.0	-15.1	34.7	2.3	31.8	10.5	15.2
408.45	31.7	46.0	-14.3	34.7	2.4	31.9	10.5	16.0
410.625	32.9	46.0	-13.1	36.0	2.4	31.9	10.5	15.9
473.7	33.0	46.0	-13.0	34.3	2.6	31.9	10.5	17.5
506.325	37.0	46.0	-9.0	38.7	2.7	31.9	10.5	17.2
538.95	40.1	46.0	-5.9	40.2	2.8	32.0	10.5	18.6
571.575	39.8	46.0	-6.2	40.6	2.8	32.0	10.5	17.9
604.2	41.2	46.0	-4.8	40.7	2.9	32.0	10.5	19.2
637.55	34.9	46.0	-11.1	34.4	3.0	32.1	10.5	19.1
802.125	37.6	46.0	-8.4	34.0	3.4	32.0	10.5	21.6
898.55	41.7	46.0	-4.3	36.2	3.6	31.6	10.5	23.0
995.45	39.7	54.0	-14.3	33.2	3.8	30.9	10.5	23.2

Test Mode: Normal (Tx/Rx mode)

Temperature: 21.6 C

Humidity : 40.3 %

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

Operator: KK

Model Number: FH915

December 21, 2010

Company: Javad GNSS, Inc.

Test distance = 10 m

Frequency (MHz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	CF dB	AG dB	DCF dB	AF dB(1/m)
179.35	32.8	43.5	-10.7	43.4	1.6	31.9	10.5	9.2
196.0	31.7	43.5	-11.8	41.7	1.6	31.9	10.5	9.8
375.825	34.2	46.0	-11.8	38.2	2.3	31.8	10.5	15.1
378.0	35.7	46.0	-10.3	39.7	2.3	31.8	10.5	15.0
393.95	32.9	46.0	-13.1	37.0	2.3	31.8	10.5	14.9
408.45	34.9	46.0	-11.1	38.4	2.4	31.9	10.5	15.5
410.625	36.4	46.0	-9.6	39.7	2.4	31.9	10.5	15.7
443.25	33.2	46.0	-12.8	36.4	2.5	31.9	10.5	15.7
459.2	34.6	46.0	-11.4	37.3	2.5	31.9	10.5	16.2
473.7	37.6	46.0	-8.4	39.3	2.6	31.9	10.5	17.1
475.875	37.1	46.0	-8.9	38.8	2.6	31.9	10.5	17.2
506.325	38.1	46.0	-7.9	40.0	2.7	31.9	10.5	16.9
509.225	36.2	46.0	-9.8	38.0	2.7	31.9	10.5	17.0
524.45	37.3	46.0	-8.7	38.5	2.7	32.0	10.5	17.5
538.95	42.6	46.0	-3.4	43.6	2.8	32.0	10.5	17.7
555.625	36.4	46.0	-9.6	37.1	2.8	32.0	10.5	18.0
572.3	42.0	46.0	-4.0	42.1	2.8	32.0	10.5	18.5
604.925	42.1	46.0	-3.9	42.7	2.9	32.0	10.5	18.0
637.55	37.9	46.0	-8.1	36.7	3.0	32.1	10.5	19.8
786.175	36.3	46.0	-9.7	34.3	3.4	32.0	10.5	20.1
801.4	40.3	46.0	-5.7	38.1	3.4	32.0	10.5	20.3
898.55	38.5	46.0	-7.5	34.6	3.6	31.6	10.5	21.4

Test Mode: Normal (Tx/Rx mode)

Temperature: 21.6 C

Humidity : 40.3 %



4.8 Radiated Emissions from Digital Parts and Receiver FCC Ref: 15.109

Test Limit

*Limits for Electromagnetic Radiated Emissions, FCC Section 15.109(b) and ICES 003 **

Frequency (MHz)	Class A at 10m dB(μ V/m)	Class B at 3m dB(μ V/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

Test Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

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

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

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

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 (2003).

Example Field Strength Calculation

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

$$FS = RA + AF + CF - PA - DCF$$

Where

FS = Field Strength in dB ($\mu\text{V/m}$)

RA = Receiver Amplitude (including preamplifier) in dB (μV)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB (1/m)

AG = Amplifier Gain in dB

DCF=Distance Correction Factor in dB

(Formula: $DCF = 20\log_{10}(\text{measurement distance/specification distance})$)

Assume a receiver reading of 52.0 dB (μV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB and DCF of 10.5 dB (DCF in this example: $20\log_{10}(10/3)$) is subtracted, giving field strength of 21.5 dB ($\mu\text{V/m}$).

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

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

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

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

$$DCF=10.5 \text{ dB}$$

$$FS = RF + AF + CF - AG - DCF$$

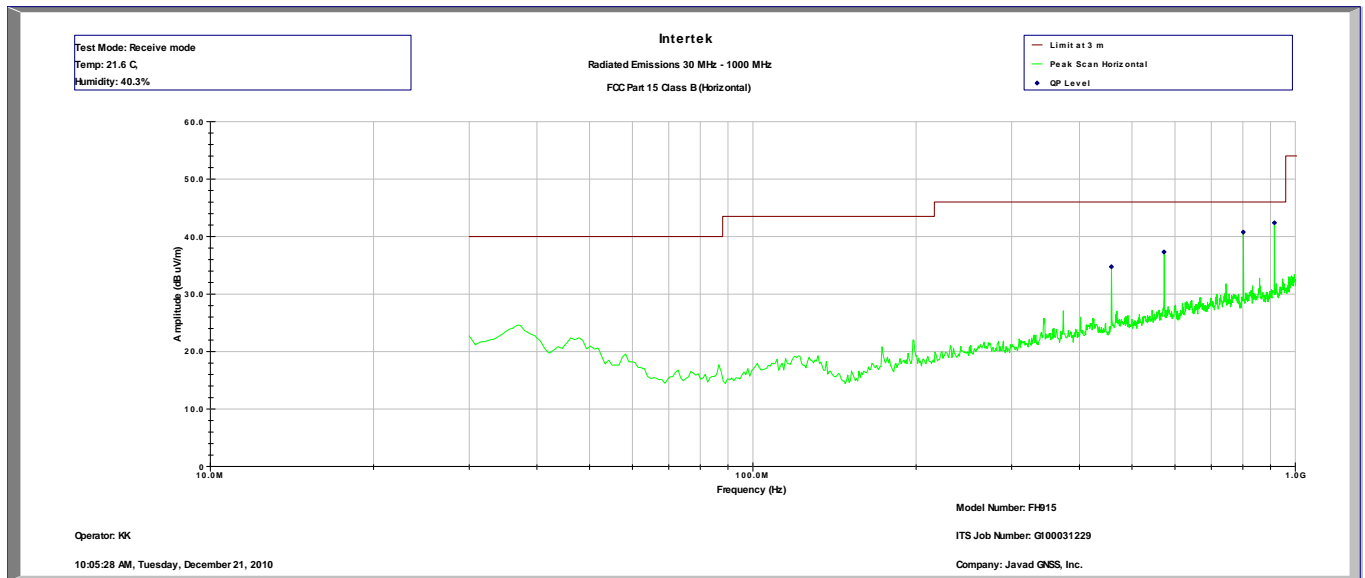
$$FS = 52.0 + 7.4 + 1.6 - 29.0 - 10.5$$

$$FS = 21.5 \text{ dB } (\mu\text{V/m})$$

Test Results

Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater below 1000 MHz and 1 MHz - above 1000 MHz.

The EUT passed by 3.6 dB for Class B.

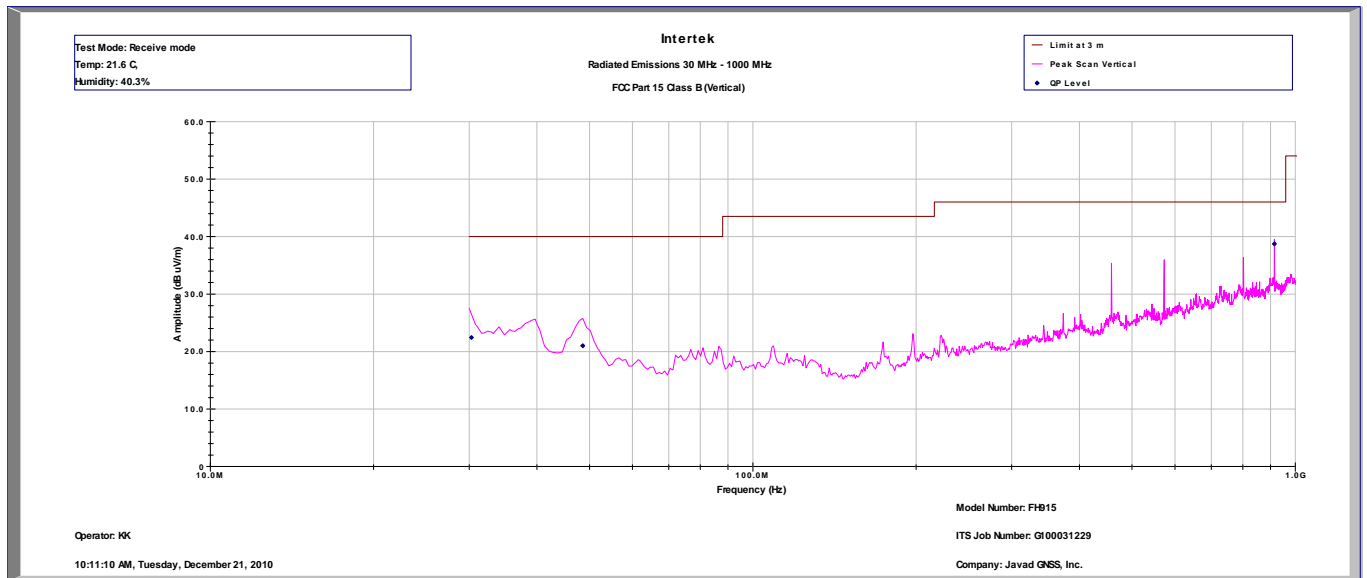


Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class B (QP-Horizontal)
Operator: KK
December 21, 2010
Model Number: FH915
Company: Javad GNSS, Inc.

Frequency (MHz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	CF dB	AG dB	DCF dB	AF dB(1/m)
458.2	34.7	46.0	-11.3	37.5	2.5	31.9	10.5	16.1
572.73	37.3	46.0	-8.7	37.4	2.8	32.0	10.5	18.6
801.83	40.8	46.0	-5.2	38.5	3.4	32.0	10.5	20.3
915.618	42.4	46.0	-3.6	37.8	3.6	31.5	10.5	21.9

Test Mode: Receive mode
Temperature: 21.6 C
Test distance = 10 m

Humidity : 40.3 %



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

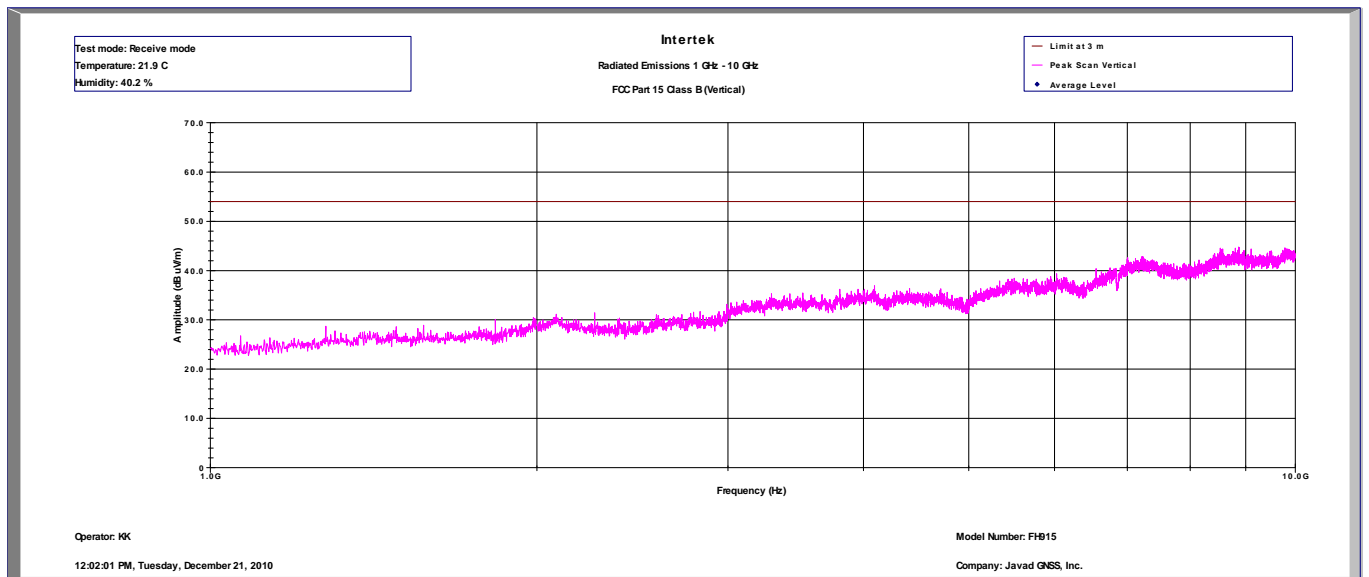
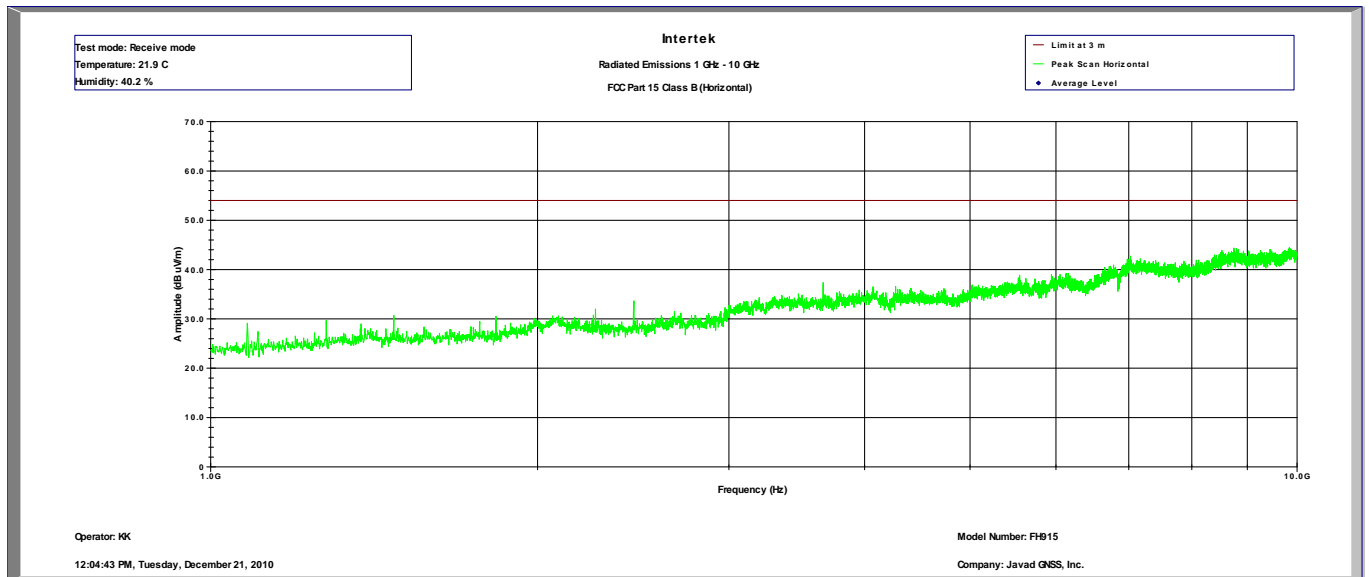
Operator: KK
December 21, 2010

Model Number: FH915
Company: Javad GNSS, Inc.

Frequency (MHz)	Peak FS dB(uV/m)	Limit@3m dB(uV/m)	Margin dB	RA dB(uV)	CF dB	AG dB	DCF dB	AF dB(1/m)
30.3	22.4	40.0	-17.6	26.1	0.6	31.8	10.5	17.0
48.6	21.0	40.0	-19.0	27.9	0.8	31.9	10.5	13.7
915.618	38.7	46.0	-7.3	33.0	3.6	31.5	10.5	23.1

Test Mode: Receive mode
Temperature: 21.6 C
Test distance = 10 m

Humidity : 40.3 %





4.9 AC Line Conducted Emission
FCC 15.207

Not Applicable. The EUT does not contain an AC power port. In normal use, EUT is DC powered.

5.0 RF Exposure Evaluation

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

The maximum conducted power is 0.982 W; antenna is fix-mounted, 2.5dBi gain. Therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The maximum Peak EIRP calculated is 32.42dBm or 1.745W. The Power Density can be calculated using the formula

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

Where: S is Power Density in W/m^2
D is the distance from the antenna.

At 0.2 m, $S = 3.50 \text{ W/m}^2$, which is below the MPE Limit of 10 W/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	12/08/11
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	12/08/11
Spectrum Analyzer	Rohde&Schwarz	FSP40	036612004	12	11/04/11
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	03/18/11
BI-Log Antenna	ARA	LPB-2513/A	1154	12	06/29/11
Horn Antenna	EMCO	3115	00126795	12	10/28/11
Pre-Amplifier	Sonoma	310N	293620	12	11/02/11
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	08/05/11
Power Meter	Hewlett Packard	EPM-442A	US37480416	12	06/03/11
Signal Generator	Hewlett Packard	SMR40	100445	12	08/27/11
LISN	FCC	FCC-LISN-50-50-M-H	2011	12	09/07/11



7.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / G100031229	KK	December 29, 2010	Original document