TEST REPORT

Report Number: 3097358MIN-001H
Project Number: 3097358
May 19, 2006

Evaluation of the
Mini Handheld (Module) Transceiver
FCC ID:
P4U-MNTA1

to
FCC Part 2
FCC Part 15, Subpart C, Section 15.247

For
Kar-Tech Inc.

Test Performed by:
Intertek
7250 Hudson Blvd. Suite 100
Oakdale, MN 55128

Test Authorized by:
Kar-Tech Inc.
111 Enterprise Road
Delafield, WI 53018

Prepared by: _____ Date: May 21, 2006
Norman Shpilsher

Reviewed by: _____ Date: May 21, 2006
Uri Spector

CONTENTS

1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the *Kar-Tech Mini Handheld (Module) Transceiver* for Certification under FCC Part 15, Subpart C.
There are no other simultaneous applications.

1.2 Product Description

The *Mini Handheld (Module) Transceiver* are a radio provides a wireless spread spectrum hopping communication within 902 - 928MHz frequency band under **CFR 47:2005**, Section 15.247. The intended use of the *Transceivers* is to generate a RF signal, deliver the signal to the antenna in order to communicate with the remote radios.
The *Mini Handheld Transceiver* is powered at 3VDC from two internal batteries.

Antenna:

¼-wave whip antenna, non-detachable (soldered) wire about 3.2" in length 1.8dBi gain

Sample Submitted: May 9, 2006
Test Work Started: May 15, 2006
Test Work Completed: May 18, 2006

1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2003 and FCC Public Notice DA 00-705: March 30, 2000. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on December 2005 submitted to FCC. Please reference the site registration number: 90706, dated December 6, 2006.

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

The *Mini Handheld Transceiver* have electrically identical RF portions with the *Mini Machine Mounted Transceiver* (with different board size and component layout and different antennas); both devices use the same frequency band, modulation and intended to communicate each other, therefore all Conducted measurements at antenna terminal were performed on *Mini Machine Mounted Transceiver* as device containing a detachable antenna.
Mini Handheld Transceiver, tested as a stand alone configuration for Radiated Emissions measurements, complies with requirements according to FCC Public Notice DA 00-1407: June 26, 2000 for modular transmitter approval, including own RF shield, power regulator, permanently attached (soldered) antenna.

2.2 EUT Setup

For simplicity of testing, the transmitters were supplied with switches, which allowed run units at single channel at low, middle, and upper frequency in frequency range of 902 to 928MHz in transmitting mode, run units at single channel at low, middle, and upper frequency in frequency range of 902 to 928MHz in receiving mode, and run units in hopping transmitting mode.

2.3 EUT Exercising Software

N/A

2.4 Special Accessories

There are no special accessories necessary for compliance of these products.

2.5 Equipment Modification

No modifications were installed during the testing.

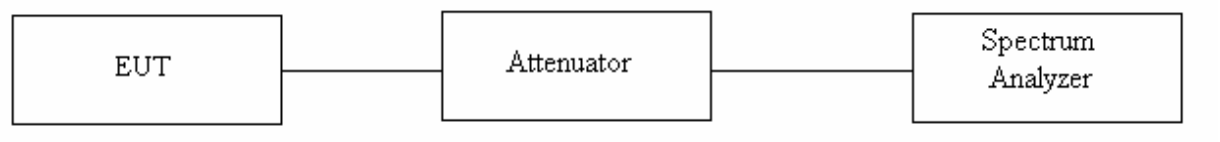
2.6 Support Equipment List and Description

BK Precision 1611A DC Power Supply (to power the *Mini Handheld Transceiver)*

2.7 Test Configuration Block Diagrams

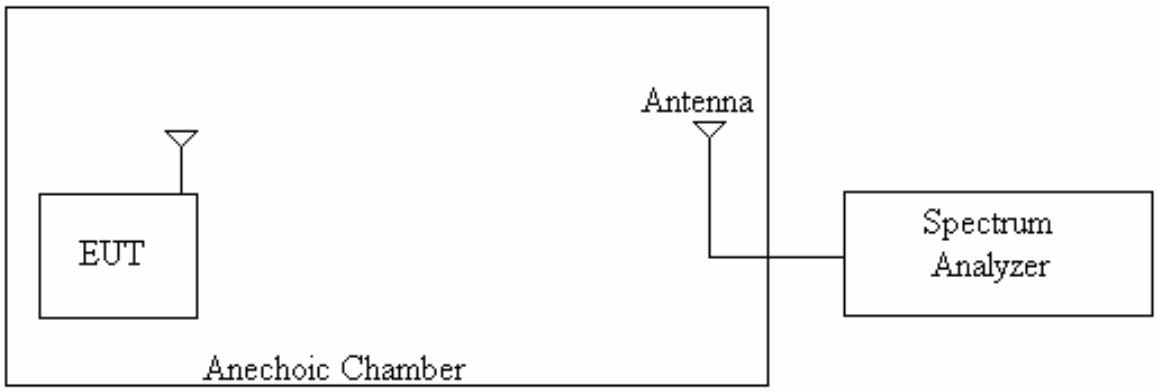
The EUT's were setup as tabletop equipment.
The *Mini Handheld Transceiver* was powered at 3VDC from 2 AA-size fresh batteries.

Measurements at Antenna Terminal



The *Mini Machine Mounted Transceiver* was connected to the Spectrum Analyzer via the RF cable with 0.3dB attenuation at 915MHz.

Field Strength Measurements



3.0 TEST RESULTS

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

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements includes the following:

47 CFR 15.247(b)(2)	Maximum Peak Output Power
47 CFR 15.247(a)(1)	Channel Frequency Separation
47 CFR 15.247(a)(1)(i)	20dB Channel Bandwidth
47 CFR 15.247(a)(1)(i)	Time of Channel Occupancy
47 CFR 15.247(b)(2)	Number of Hopping Channels
47 CFR 15.247(b)(5)	RF Exposure Calculations
47 CFR 15.247(d)	Band Edge Compliance
47 CFR 15.247(d)	Spurious RF Conducted Emissions
47 CFR 15.247(e)	Peak Power Spectral Density
47 CFR 15.247(d) 15.205, 15.209	Radiated Spurious Emissions
47 CFR 15.207	Conducted Emissions
47 CFR 15.109	Receiver Radiated Emissions

3.1 Maximum Peak Output Power, FCC 15.247(b)(3)

Maximum Peak Output Power measurements were made at antenna terminal of the transmitter with disabled hopping function at the low, center, and high frequency channels.

The Peak Power Output for the device was measured at the maximum power transmission level.

Table 3-1-1 and Graphs from 3-1-1 to 3-1-3 below show the Maximum Peak Output Power and antennas compliance.

Maximum Peak Output Power **Date:** 05-15-2006

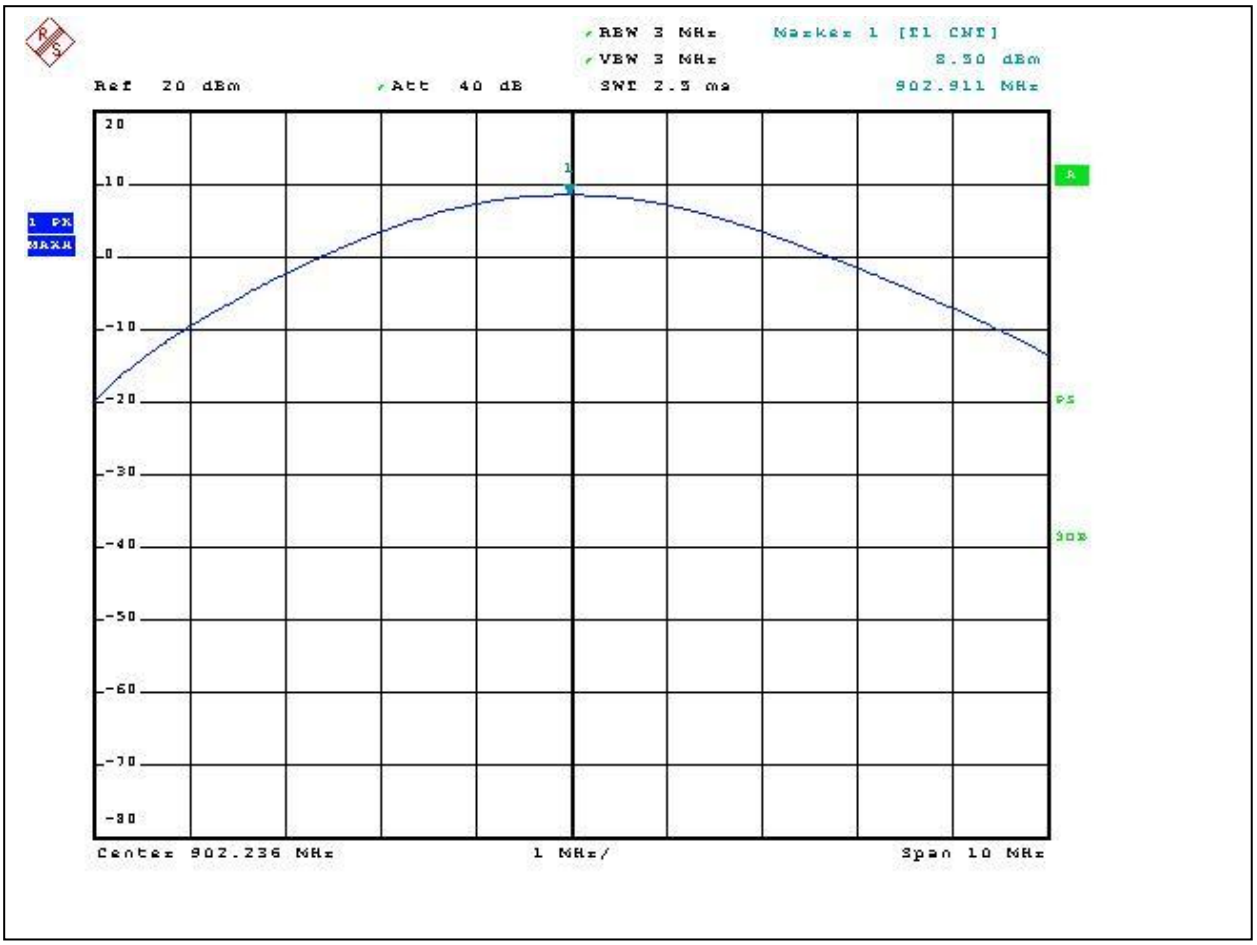
Company: Kar-Tech Inc.
Model: Mini Macine Mounted Transmitter
Test Engineer: Norman Shpilsher
Special Info.: The EUT antenna terminal was connected to the Spectrum Analyzer
Standard: FCC Part 15.247(b)(3)

Table # 3-1-1

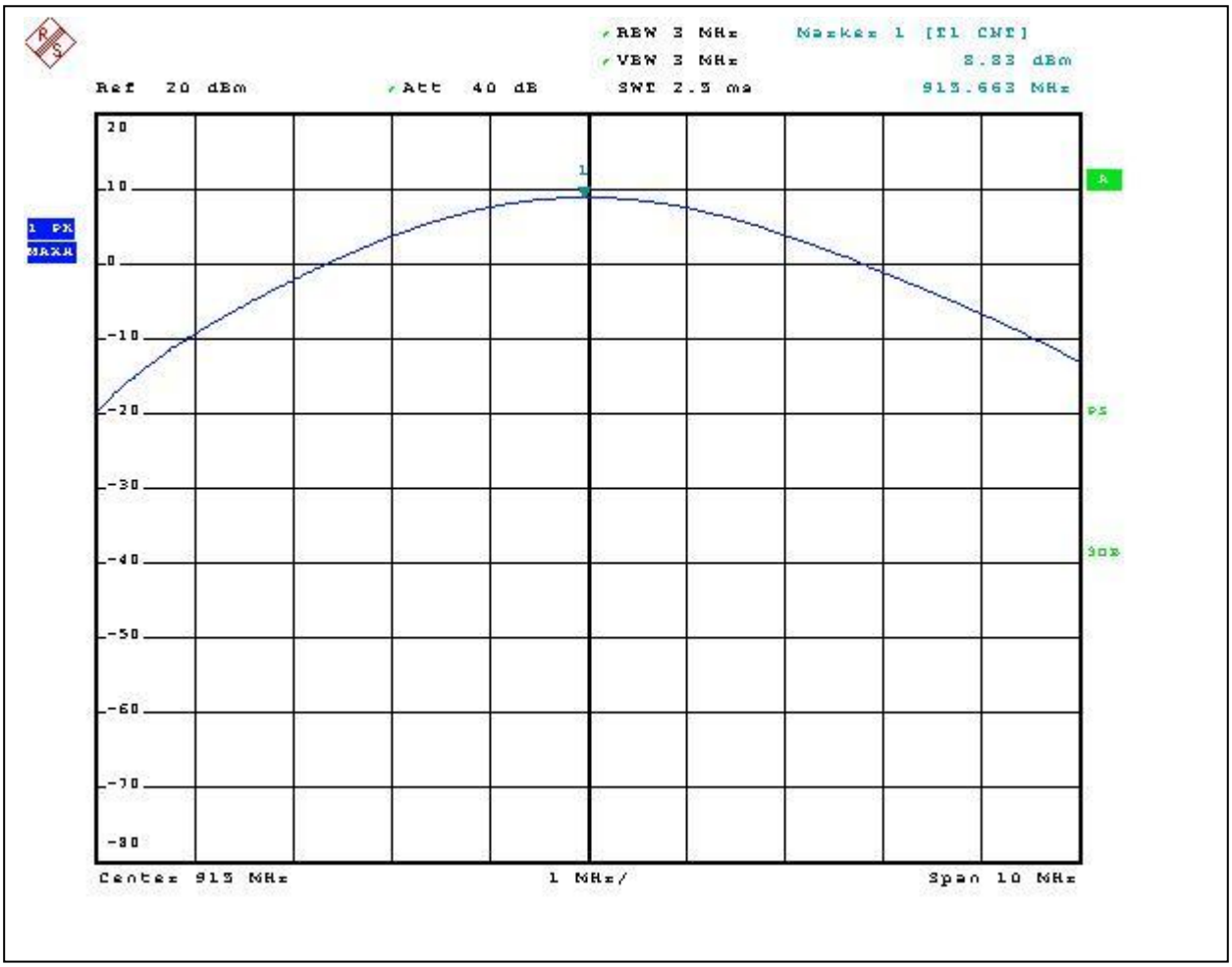
Output Freq. MHz	Measured Power dBm	Cable loss dB	Maximum Peak Output Power dBm	Maximum Peak Output Power mW	Max Allowed Peak Peak Output Power mW
902	8.50	0.30	8.80	7.59	1000.00
915	8.83	0.30	9.13	8.18	1000.00
928	9.06	0.30	9.36	8.63	1000.00

Note: No additional Output Power calculation is necessary as antennas used gain is below 6dBi

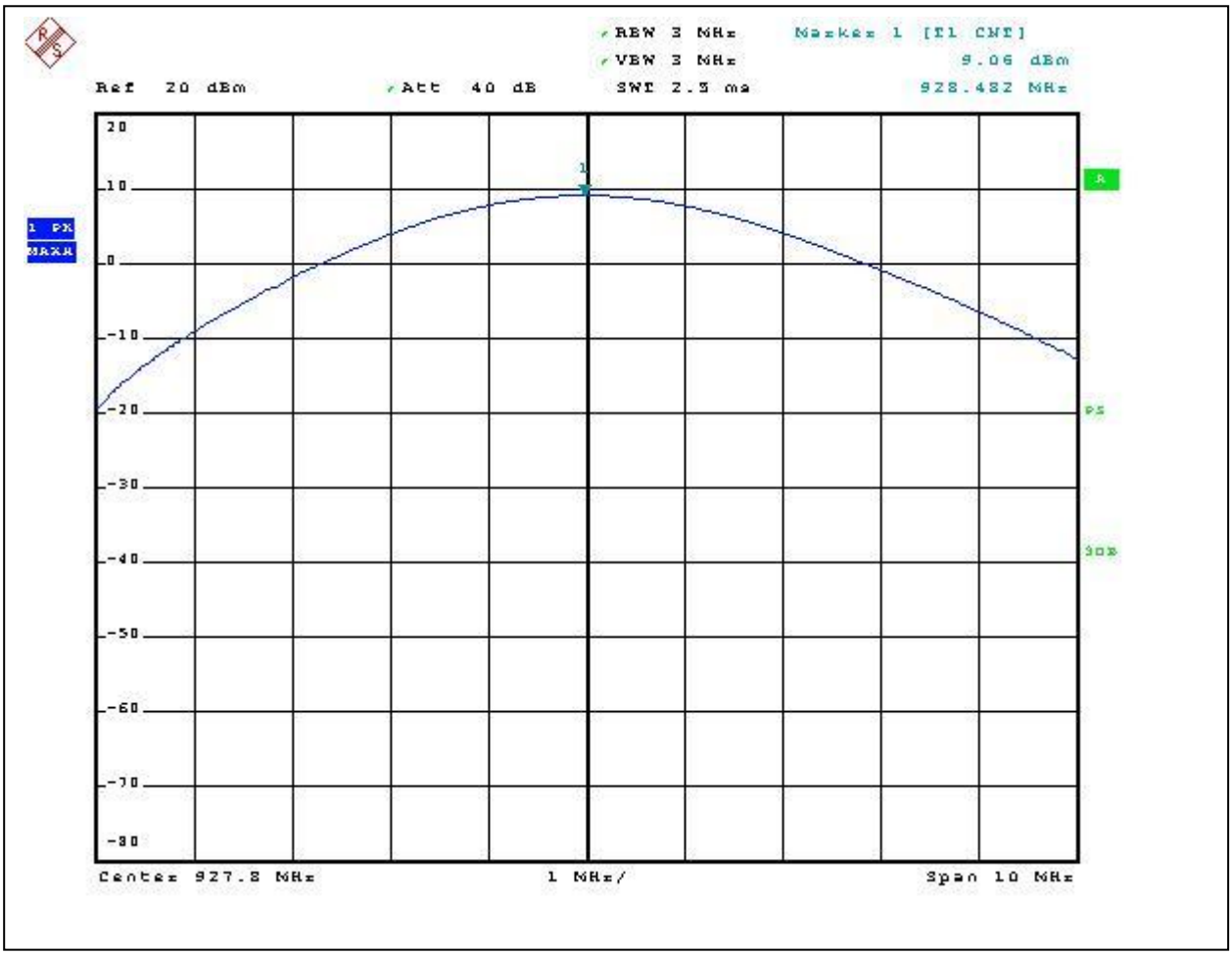
Graph # 3-1-1
Maximum Peak Output Power, 902MHz Channel



Graph # 3-1-2
Maximum Peak Output Power, 915MHz Channel



Graph # 3-1-3
Maximum Peak Output Power, 928MHz Channel

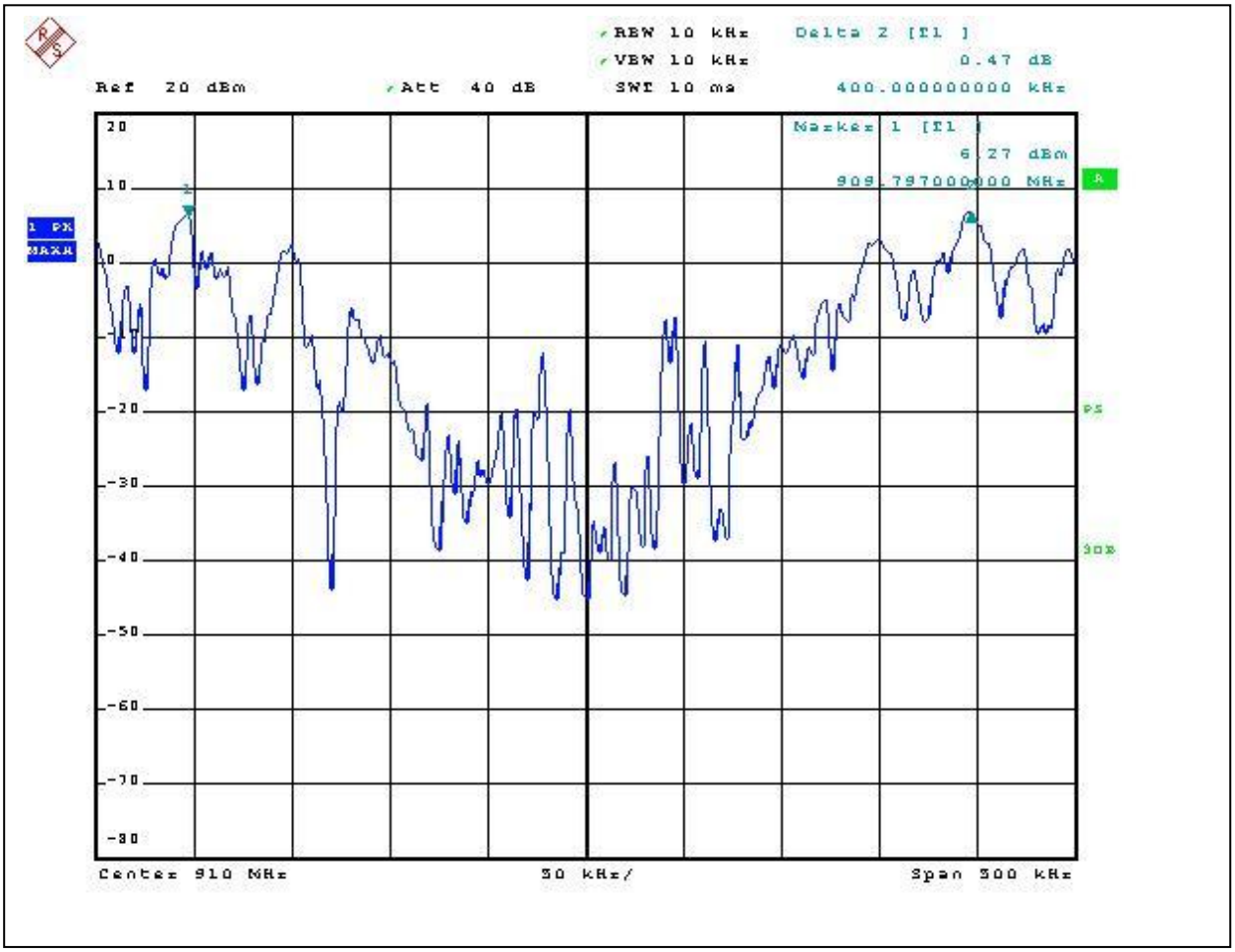


3.2 Channel Frequency Separation, FCC 15.247(a)(1)

The Hopping Channel Carrier Frequency Separation measurements were made at antenna terminal of the transmitter on two adjacent channels with transmitter hopping mode, and measured of 400kHz with minimum allowed value equals the 20dB Bandwidth of the Hopping Channel of 208kHz (see Section 3.3).

Graph from 3-2-1 shows the Hopping Channel Carrier Frequency Separation

Graph # 3-2-1
Hopping Channel Carrier Frequency Separation

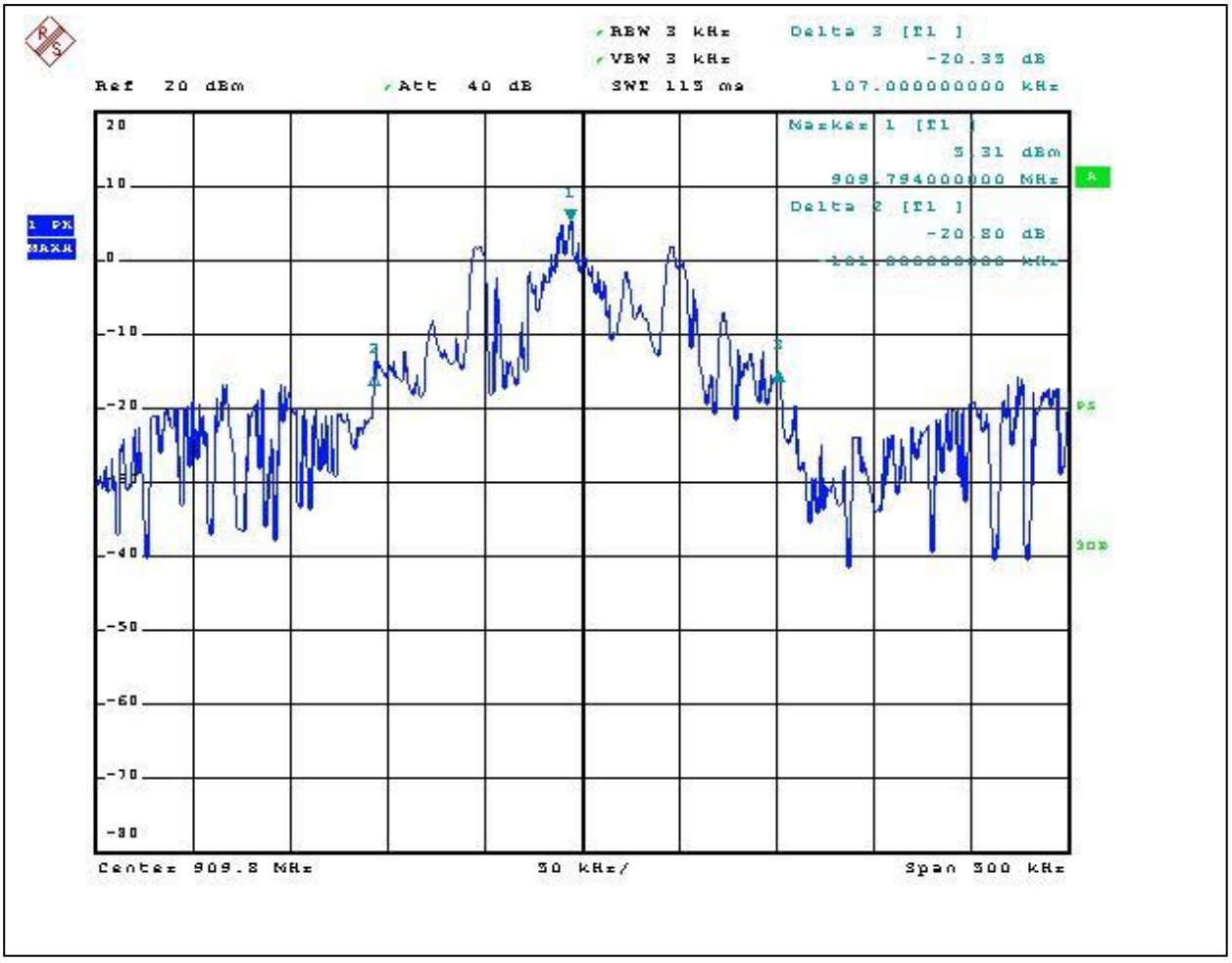


3.3 20dB Bandwidth, FCC 15.247(a)(1)(i)

The 20dB Bandwidth of the Hopping Channel measurements was made at antenna terminal of the transmitter with transmitter hopping mode and measured of 208kHz with maximum allowed bandwidth of 250kHz (with at least 50 hopping channels).

Graph 3-3-1 shows the 20dB Bandwidth of the Hopping Channel

Graph # 3-3-1
20dB Bandwidth of the Hopping Channel



3.4 Time of Channel Occupancy, FCC 15.247(a)(1)(i)

Time of Occupancy measurements were made at antenna terminal of the transmitter with transmitter hopping mode and measured of 145mS with maximum allowed value of 400mS.

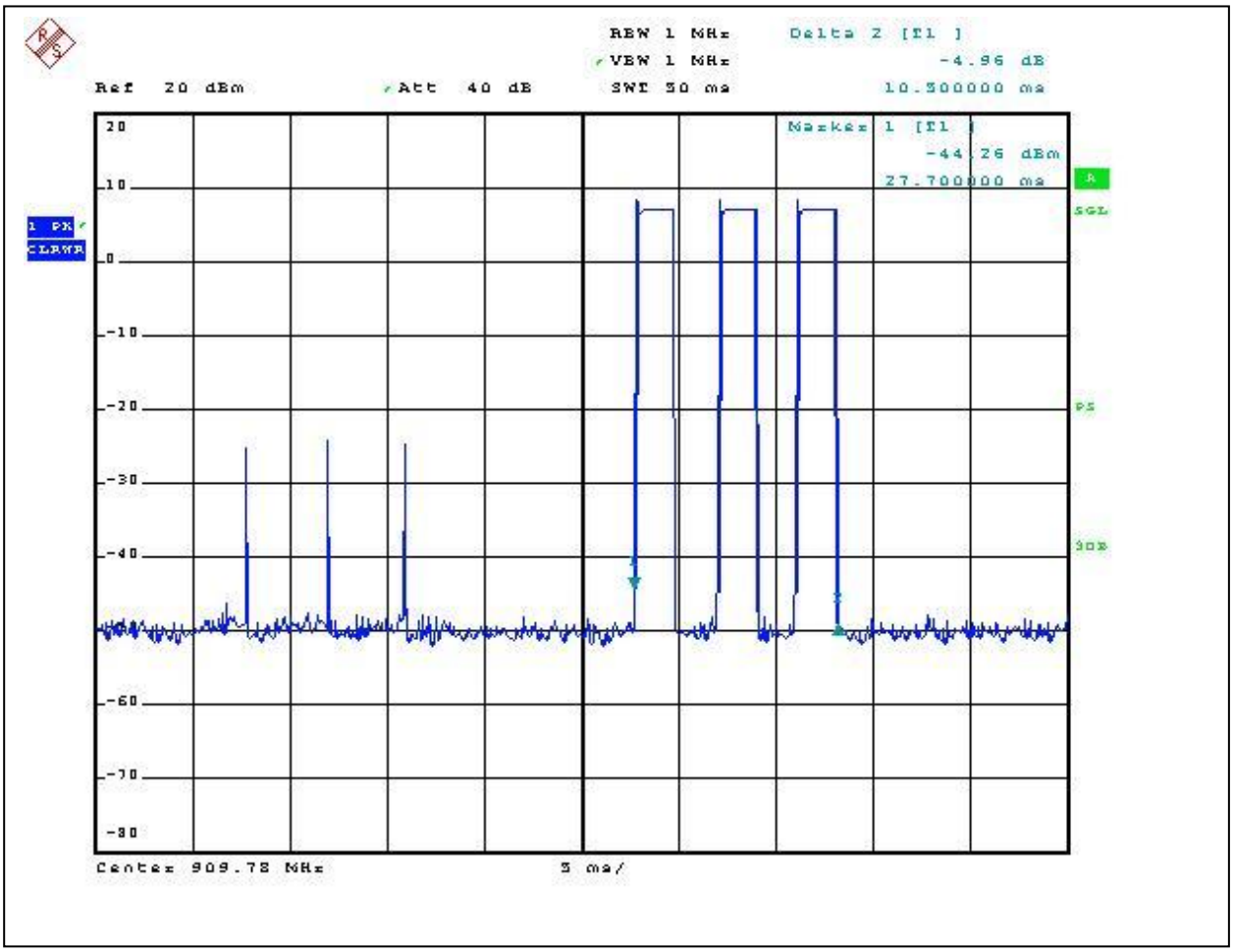
Graph 3-4-1 and 3-4-2 show the Time of Occupancy measurements.

Time of Occupancy Calculation

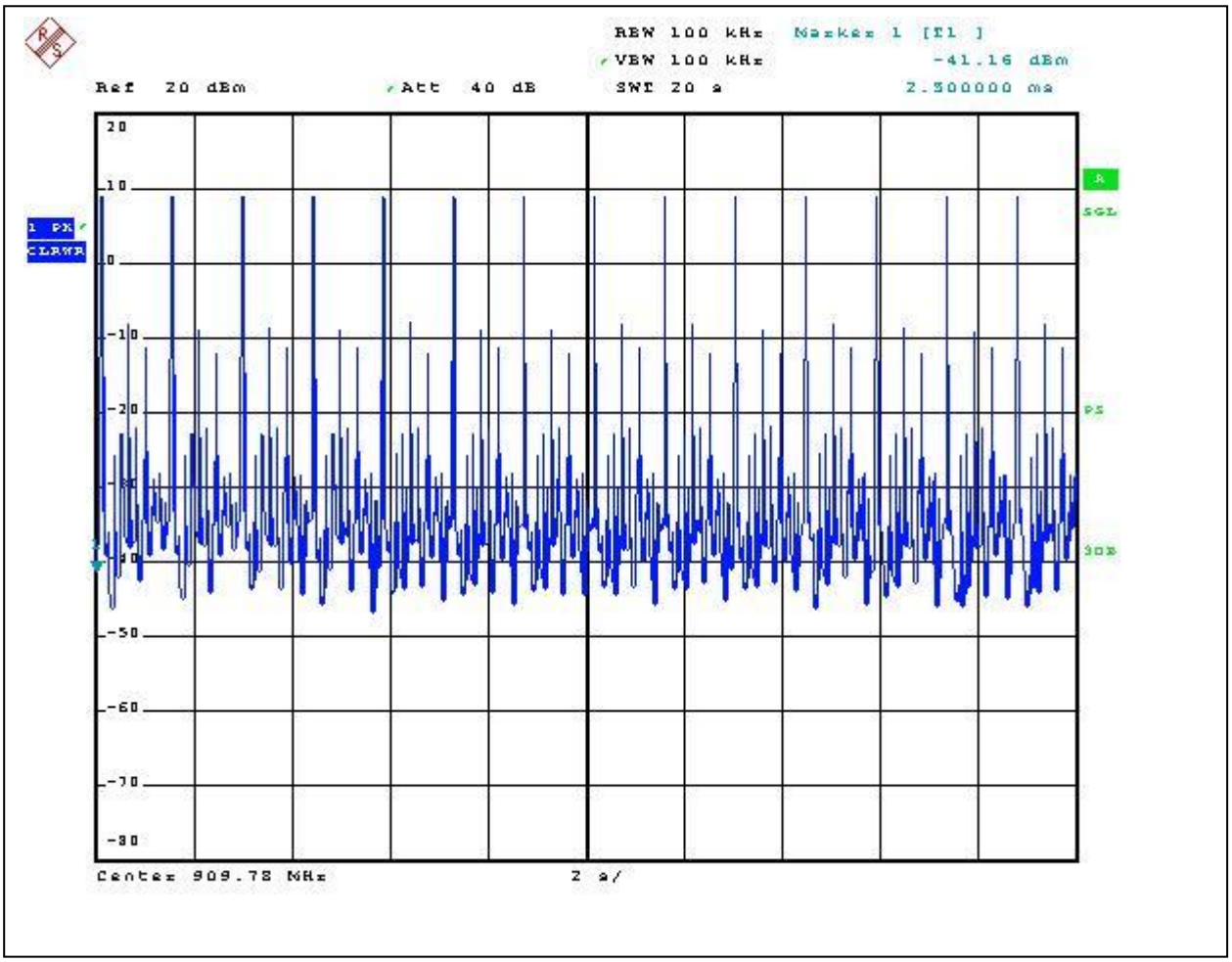
Single transmitting time: t = 10.5ms (Graph 3-4-1)
Maximum number of the transmission within a 20sec period: N = 14 (Graph 3-4-2)

Time of Occupancy = t x N = 10.5ms x 14 = 145ms
The Maximum Average Time of Occupancy = 400ms.

Graph # 3-4-1
Single Transmitting Time



Graph # 3-4-2
Number of Transmissions Over 20 Sec Period

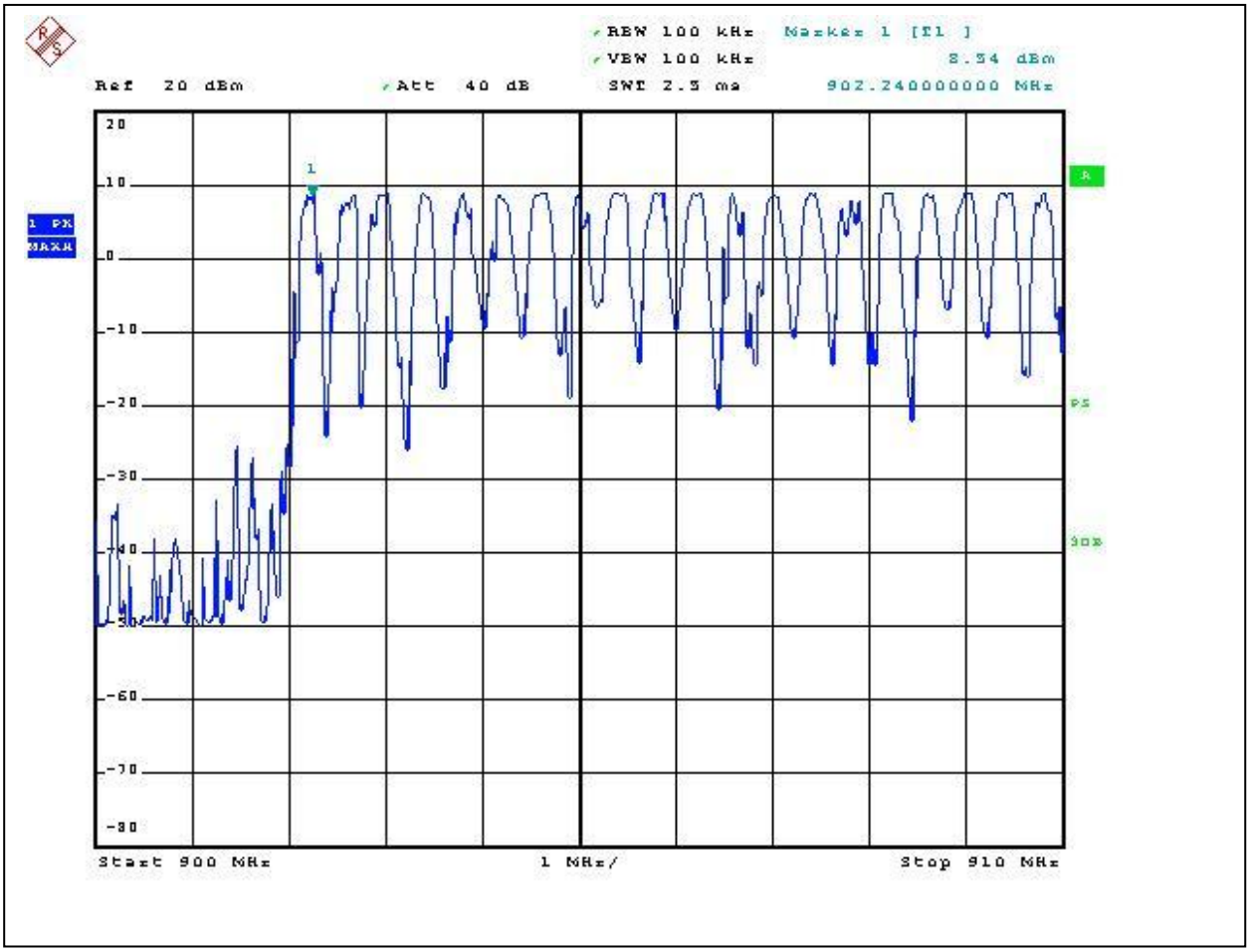


3.5 Number of Hopping Channels, FCC 15.247(b)(2)

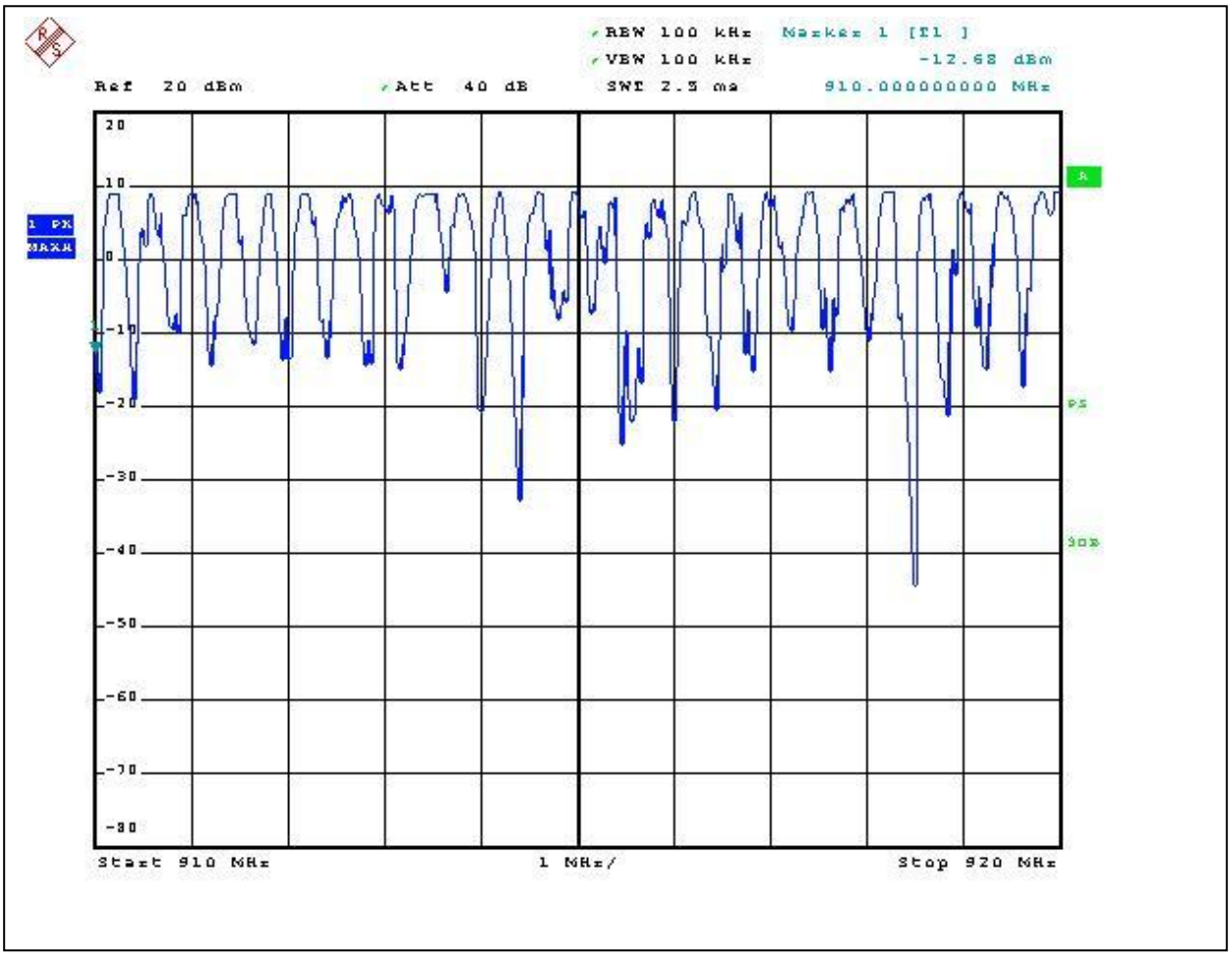
Number of Hopping Channels measurements were made at antenna terminal of the transmitter with transmitter hopping mode, and 65 Hopping Channels was detected on the device.

Graphs 3-5-1 to 3-5-3 show the Number of Hopping Frequencies.

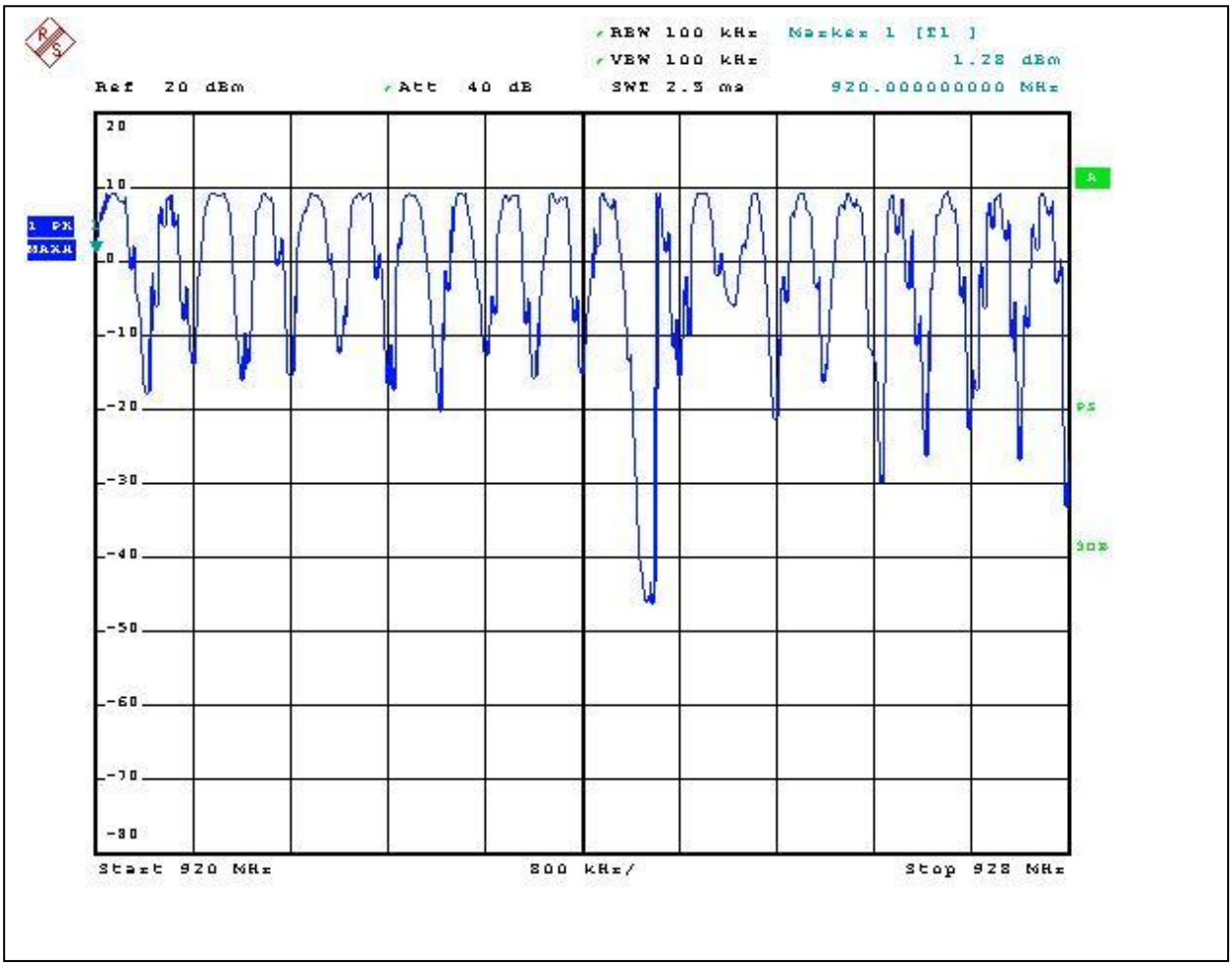
Graph # 3-5-1
Number of Hopping Channels below 910MHz



Graph # 3-5-2
Number of Hopping Channels from 910 to 920MHz



Graph # 3-5-1
Number of Hopping Channels above 920MHz



3.6 RF Exposure Calculation, FCC 15.247(b)(5)

The RF Exposure calculations are based on manufacturer specification that minimum distance from the antenna to operator (user) is 20cm.
The RF Exposure can be calculated according to equation from OET Bulletin 65, Edition 97-01:

$S = PG/4*pi*R^2$,

Where: S is Limits for Maximum Permissive Exposure (MPE) (mW/cm^2),
P is Maximum Peak Power to Antenna (mW),
G is Antenna Gain (numerical gain),
R is Distance to the antenna radiation center (cm), must be below 20cm (FCC 2.1093)

$S = (F/1500) mW/cm^2$ according to FCC 1.1310, where F (in MHz) from 300 to 1500MHz
$S = 902/1500 = 0.6\ mW/cm^2$
P = 9.36dBm = 8.63mW,
G1 = 0.71dBi = 1.18 (numerical gain) – for Machine Mounted transmitter,
G2 = 1.8dBi = 1.51 (numerical gain) – for Handheld transmitter

R1 is calculated and = 1.2cm, within 20 cm – for Machine Mounted transmitter.

R2 is calculated and = 1.3cm, within 20 cm – for Handheld transmitter.

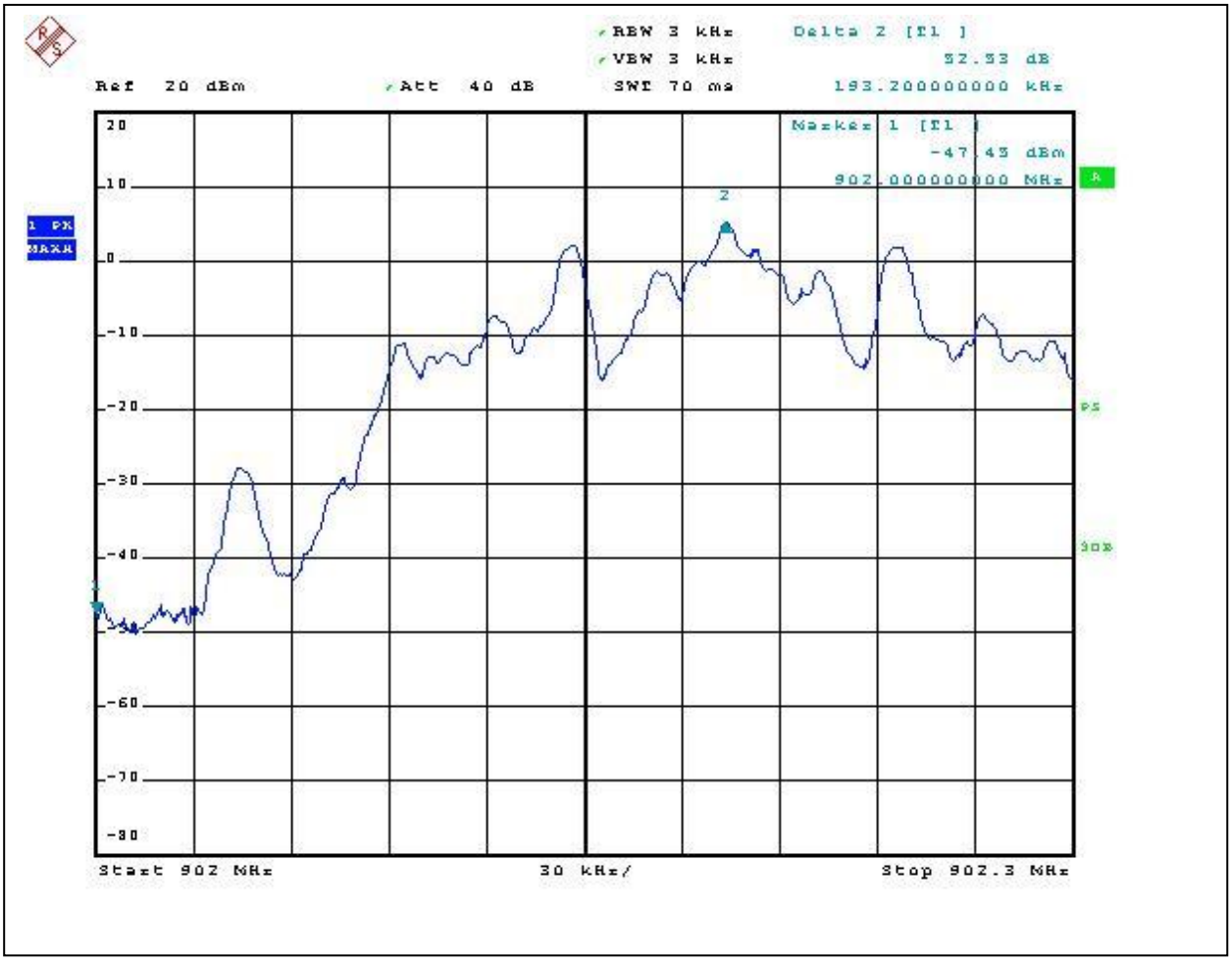
3.7 Band Edge Compliance, FCC 15.247(d)

Band Edge Compliance measurements were made at antenna terminal of the transmitter with disabled hopping function at the low and high frequency channels for band edge frequencies of 902 and 928MHz, the measurements were repeated also with transmitter enable hopping function.

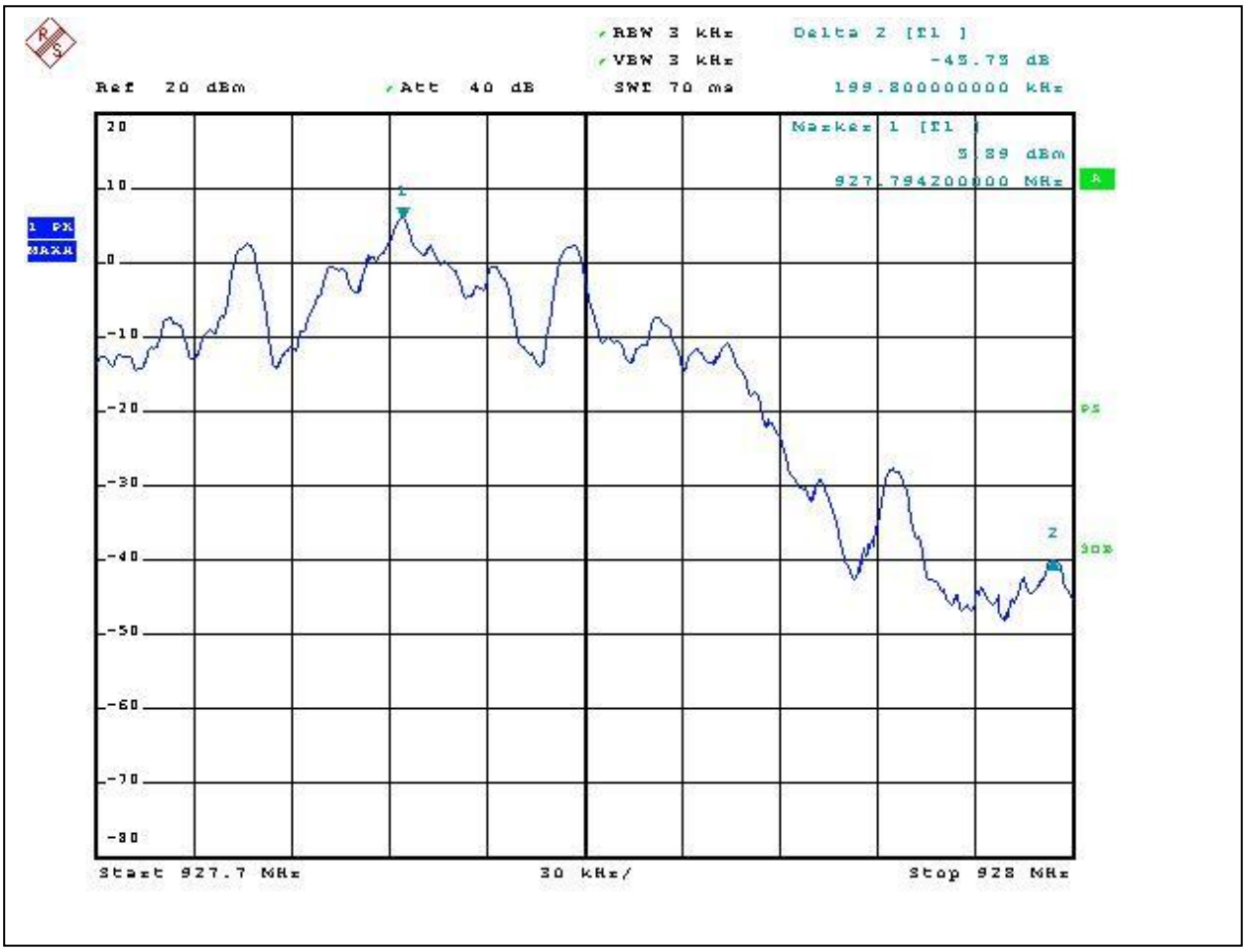
The minimum measured band edge emissions attenuation was measured of 24.09dB with minimum allowed attenuation of 20dB.

Graphs 3-7-1 and 3-7-2 show the band edge emissions attenuation with disabled hopping function. Graphs 3-7-3 and 3-7-4 show the band edge emissions attenuation with enabled hopping function.

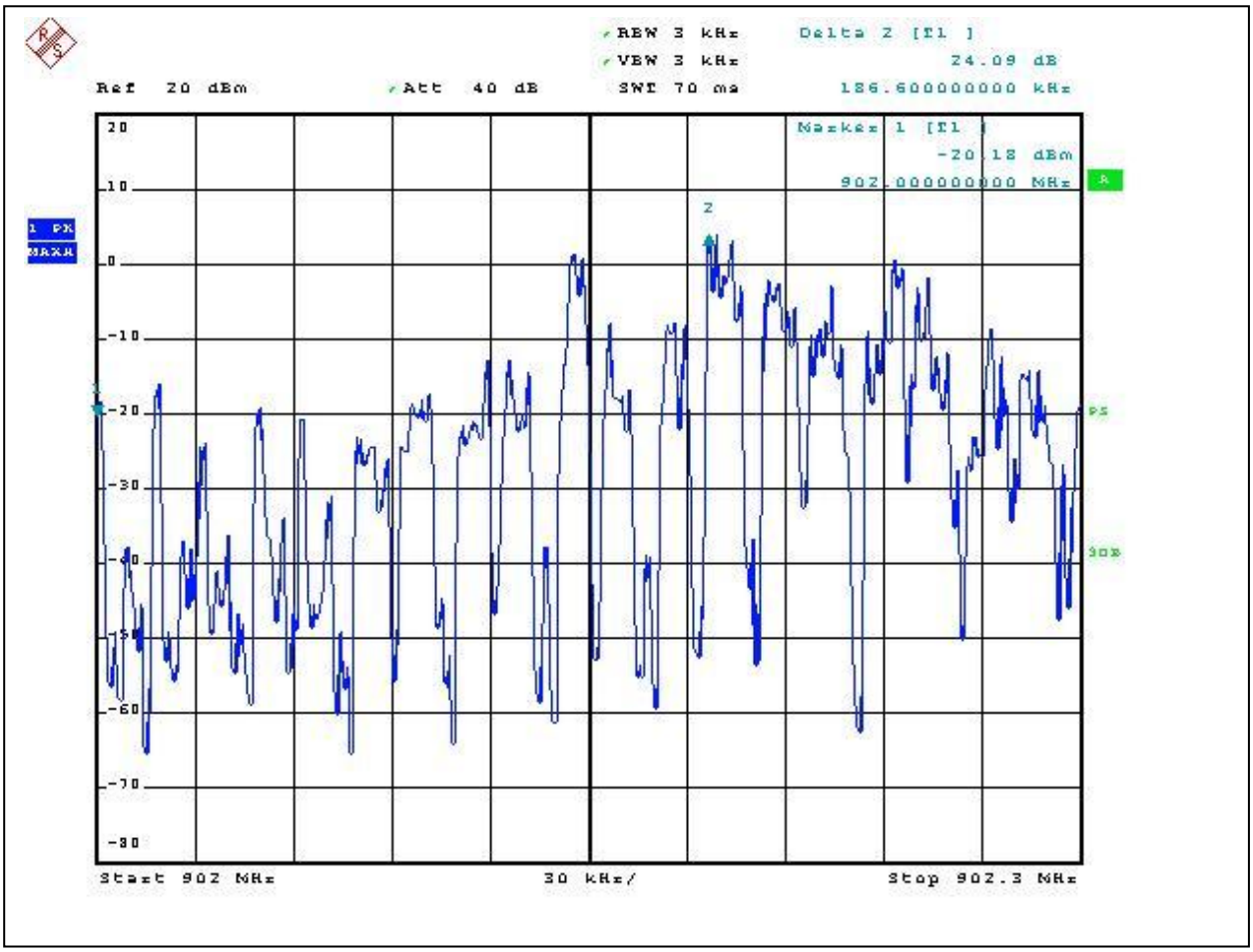
Graph # 3-7-1
Band Edge Emissions at 902MHz, Hopping Function Disabled



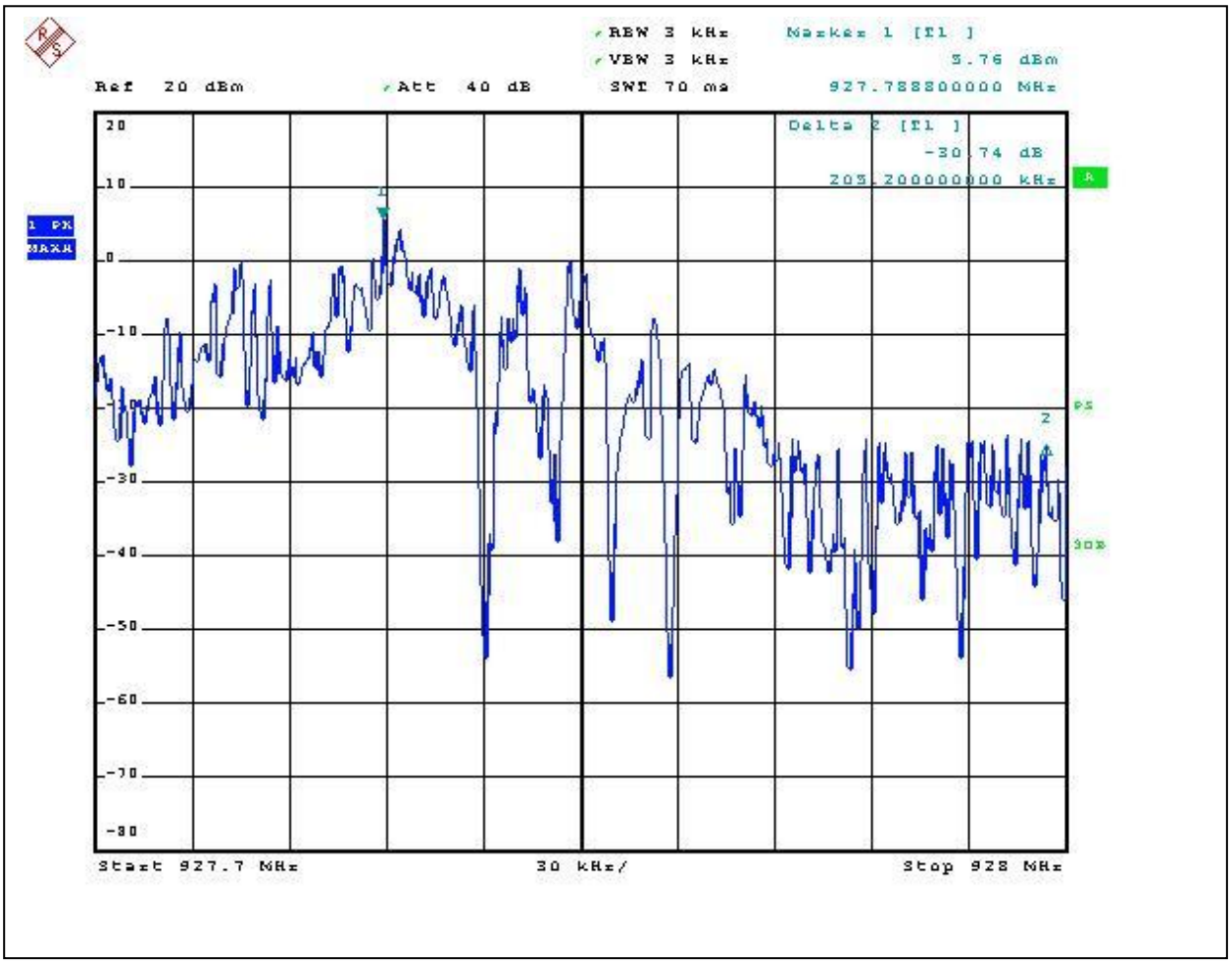
Graph # 3-7-2
Band Edge Emissions at 928MHz, Hopping Function Disabled



Graph # 3-7-3
Band Edge Emissions at 902MHz, Hopping Function Enabled



Graph # 3-7-4
Band Edge Emissions at 928MHz, Hopping Function Enabled



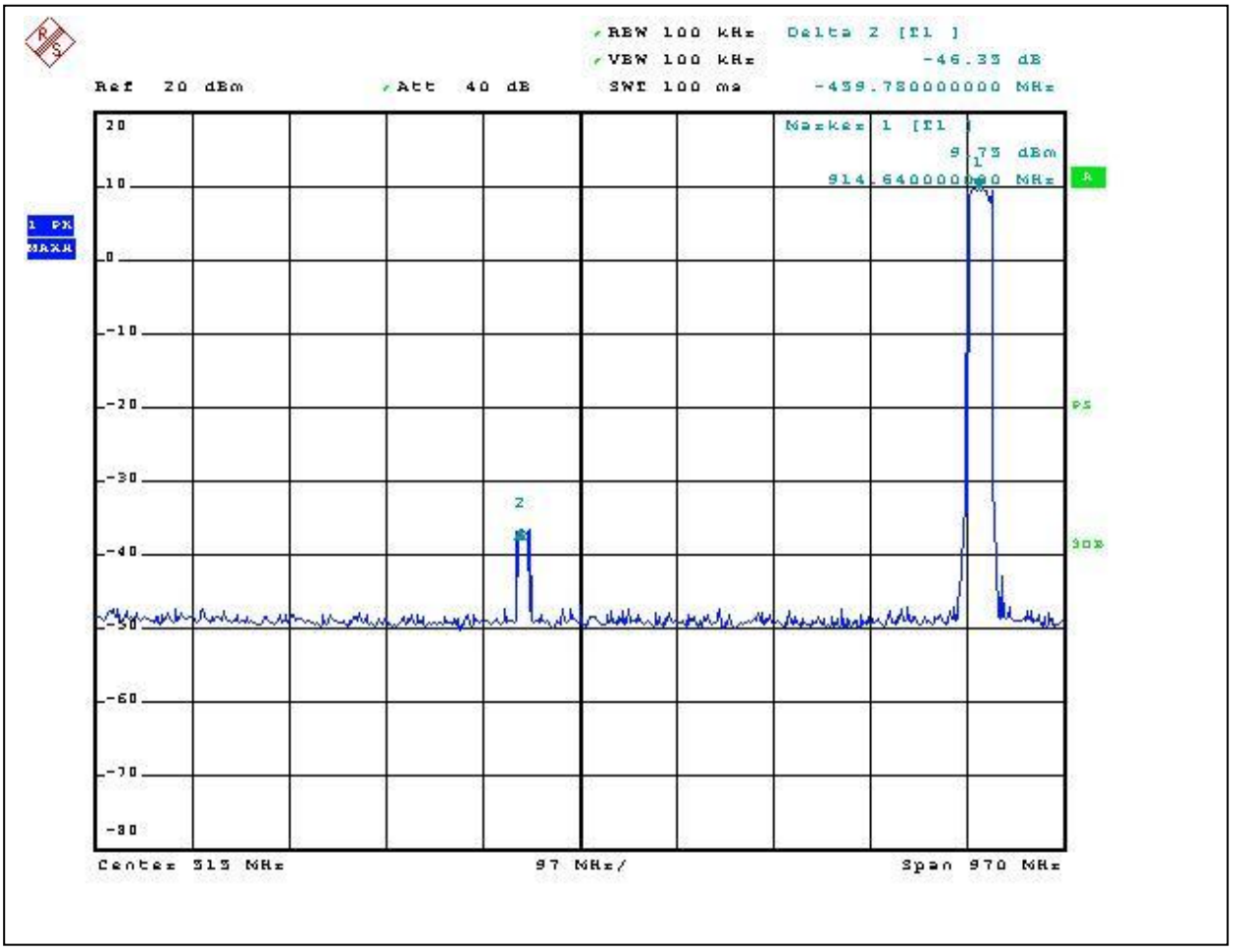
3.8 Spurious RF Conducted Emissions, FCC 15.247(d)

Spurious RF Antenna Conducted Emissions measurements were made at antenna terminal of the transmitter with transmitter hopping mode in frequency range from 30MHz to 10GHz (up to 10th harmonic).

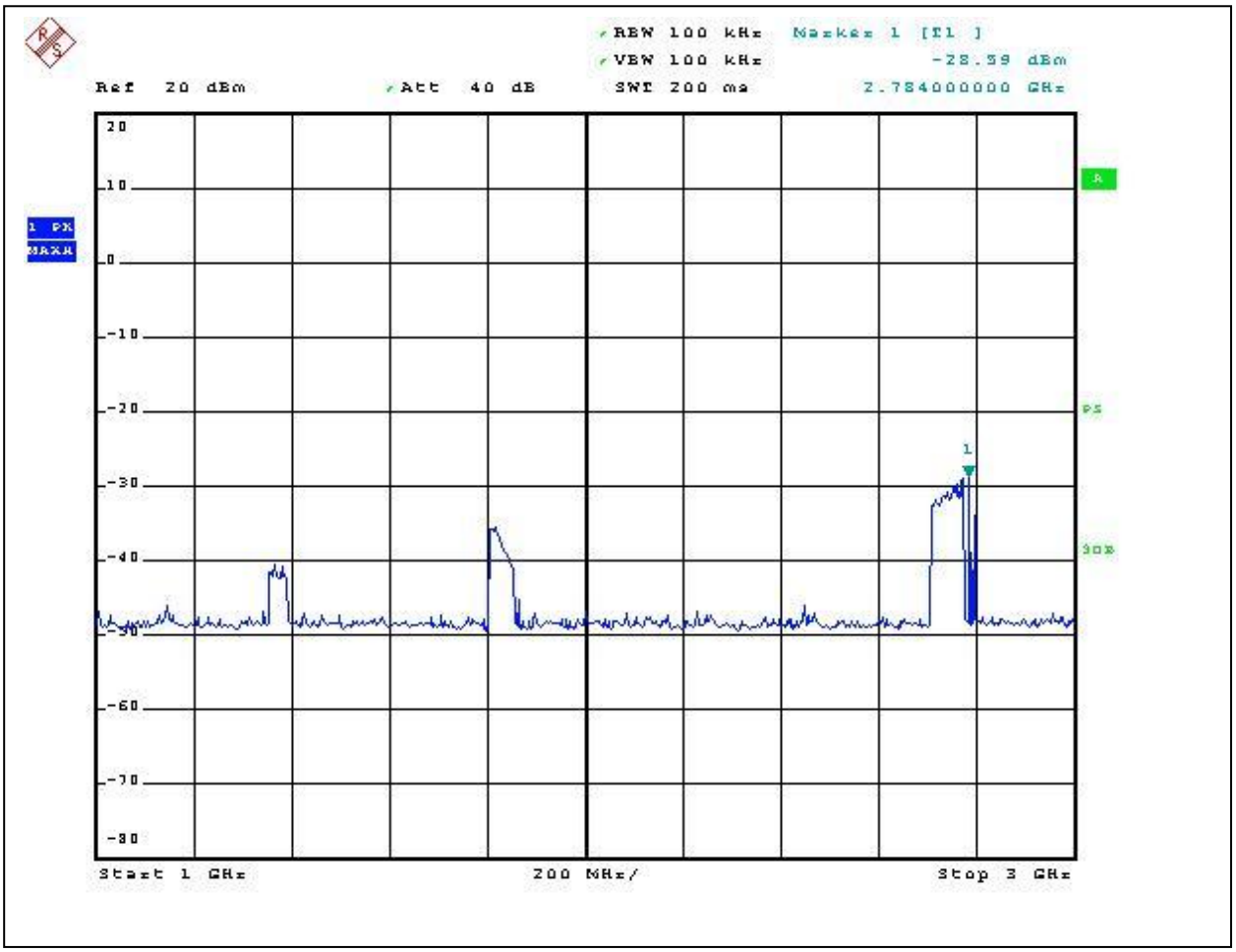
No Spurious Emissions above assigned limits (20dB below of the level in operating band) were observed.

Graphs from 3-4-1 to 3-4-3 show the Spurious RF Antenna Conducted Emissions.

Graph # 3-8-1
Spurious Emissions at Antenna Terminal from 30MHz to 1GHz

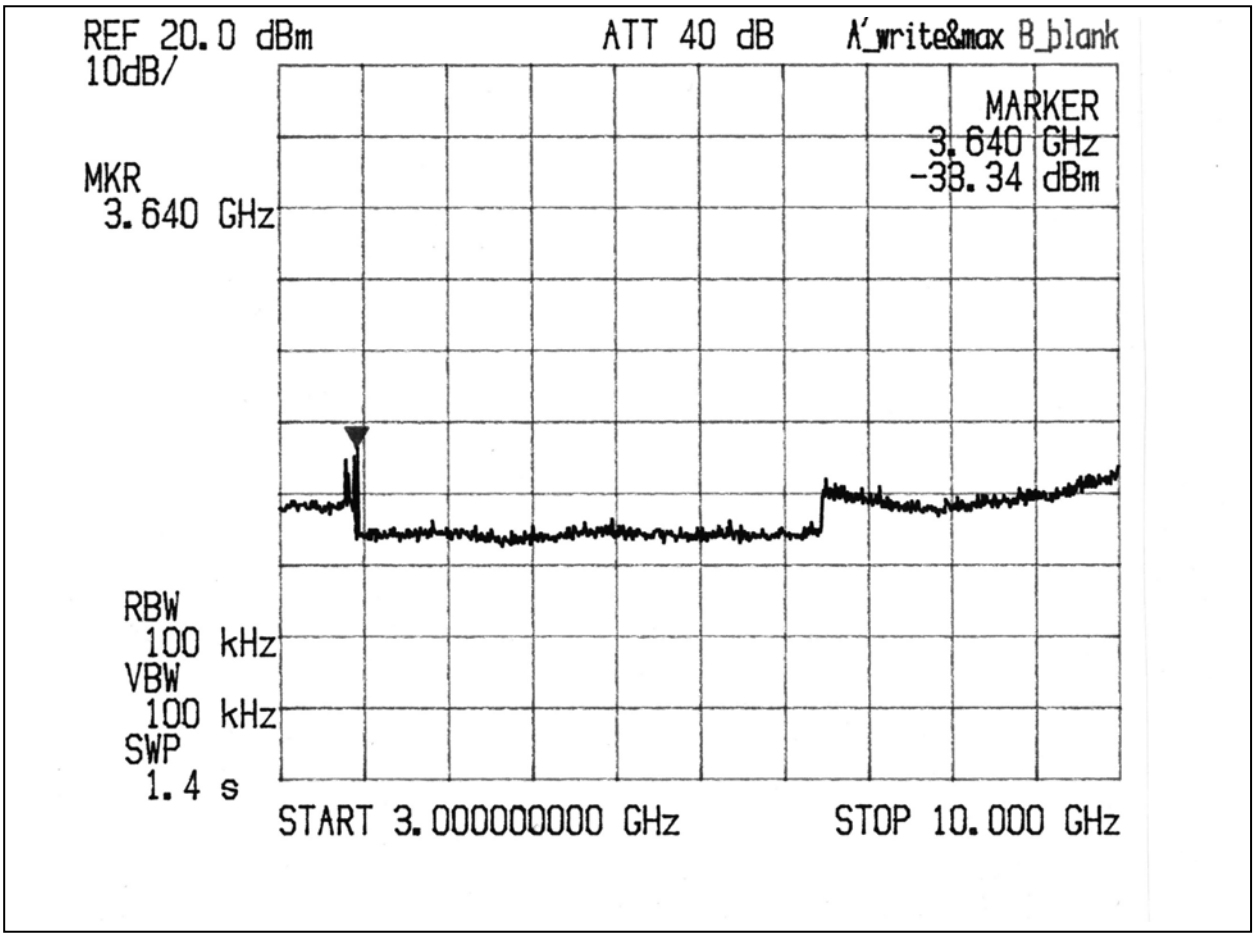


Graph # 3-8-1
Spurious Emissions at Antenna Terminal from 1 to 3GHz



Graph # 3-8-1

Spurious Emissions at Antenna Terminal from 3 to 10GHz



3.9 Spurious Radiated Emissions, FCC 15.247(d), 15.205, 15.209

Field Strength of Spurious Radiated Emissions measurements were measured in the restricted bands in the frequency range from 30MHz up to 10GHz (10th harmonic) at the low, center, and high frequency channels (902, 915, and 928MHz).

Spurious Radiated Emissions Limits

Frequency of Emissions (MHz)	Limits at 3 m (dBμV/m)		
	Quasi-peak	Average	Peak
30 to 88	40		
88 to 216	44		
216 to 960	46		
960 to 1000	54		
Above 1000		54	74

NOTE: In the emission tables above, the tighter limit applies at the band edges.

The Spurious Radiated Emissions measurements were measured at the maximum power transmission condition and with 120kHz resolution bandwidth and 300kHz video bandwidth for measurements below 1GHz, and with 1MHz resolution bandwidth and video bandwidth for measurements above 1GHz.

Bicono-Log antenna was used for measurements in frequency range from 30MHz to 2GHz, and Horn antenna with pre-amplifier and high pass filter was used for measurements in frequency range above 2GHz.

The maximum spurious radiated emissions were measured of 8.5dB below limits at 972.85MHz for.

Table 3-9-1 shows the Peak Field Strength of Spurious Emissions.
Table 3-9-2 shows the Field Strength Average Value
Note: Average of spurious emissions above 1GHz was calculated from emissions peak level and adjusting by a “duty cycle correction factor” (see Section 3.9.1).

Graphs 3-9-1 to 3-9-9 show the Field Strength Harmonics Emissions from 30MHz to 6.5GHz.
No emissions above ambient was found above 5th harmonics.

Spurious Peak Radiated Emissions **Date:** 05/15-17/2006

Company: Kar-Tech Inc.
Model: Mini Handheld Transmitter
Test Engineer: Norman Shpilsher
Special Info: Limits increased by 20dB for emissions above 1GHz
Standard: FCC Parts 15.247, 15.209, 15.205
Test Site: 3m Anechoic Chamber, 3m measurement distance

Table # 3-9-1

Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Amp.Gain dB	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
		902MHz operating Frequency					
1.012 GHz	V	29.4	25.9		55.2	74.0	-18.8
1.1213 GHz	V	26.4	26.8		53.2	74.0	-20.8
1.128 GHz	V	27.0	26.8		53.8	74.0	-20.2
1.0113 GHz	H	27.1	25.9		53.0	74.0	-21.1
1.1213 GHz	H	20.3	26.8		47.1	74.0	-26.9
1.1273 GHz	H	20.0	26.8		46.8	74.0	-27.2
2.7116 GHz	V	61.0	32.0	37.9	55.1	74.0	-18.9
3.6116 GHz	V	57.2	34.9	37.6	54.5	74.0	-19.5
4.5144 GHz	V	52.8	36.6	37.5	51.8	74.0	-22.2
2.7087 GHz	H	57.6	32.0	37.9	51.7	74.0	-22.3
3.6116 GHz	H	59.3	34.9	37.6	56.6	74.0	-17.4
4.5144 GHz	H	40.9	36.6	37.5	39.9	74.0	-34.1
		915MHz operating Frequency					
972.41 MHz	V	19.8	25.6		45.5	54.0	-8.5
1.026 GHz	V	27.6	26.0		53.6	74.0	-20.4
1.1367 GHz	V	25.0	26.9		51.9	74.0	-22.1
1.1433 GHz	V	25.5	27.0		52.5	74.0	-21.6
972.41 MHz	H	18.7	25.6		44.3	54.0	-9.7
1.026 GHz	H	24.6	26.0		50.7	74.0	-23.4
1.1433 GHz	H	20.3	27.0		47.3	74.0	-26.7
2.7481 GHz	V	60.6	32.1	37.9	54.8	74.0	-19.2
3.6622 GHz	V	54.3	35.1	37.6	51.8	74.0	-22.2
4.5791 GHz	V	50.0	36.7	37.5	49.1	74.0	-24.9
2.7481 GHz	H	59.0	32.1	37.9	53.2	74.0	-20.8
3.6622 GHz	H	58.1	35.1	37.6	55.6	74.0	-18.5
4.5791 GHz	H	40.3	36.7	37.5	39.4	74.0	-34.6
		928MHz operating Frequency					
1.0407 GHz	V	27.8	26.1		53.9	74.0	-20.1
1.1527 GHz	V	23.1	27.1		50.2	74.0	-23.8
1.16 GHz	V	23.4	27.1		50.5	74.0	-23.5
1.0407 GHz	H	21.9	26.1		48.1	74.0	-25.9
2.7875 GHz	V	59.5	32.3	37.9	53.9	74.0	-20.1
3.7156 GHz	V	54.5	35.3	37.6	52.1	74.0	-21.9
4.6409 GHz	V	49.0	36.8	37.6	48.2	74.0	-25.8
2.7875 GHz	H	58.3	32.3	37.9	52.7	74.0	-21.3
3.7156 GHz	H	57.2	35.3	37.6	54.8	74.0	-19.2
4.6409 GHz	H	40.9	36.8	37.6	40.1	74.0	-33.9

Spurious Radiated Emissions Above 1GHz, Average Value **Date:** 05/15-17/2006

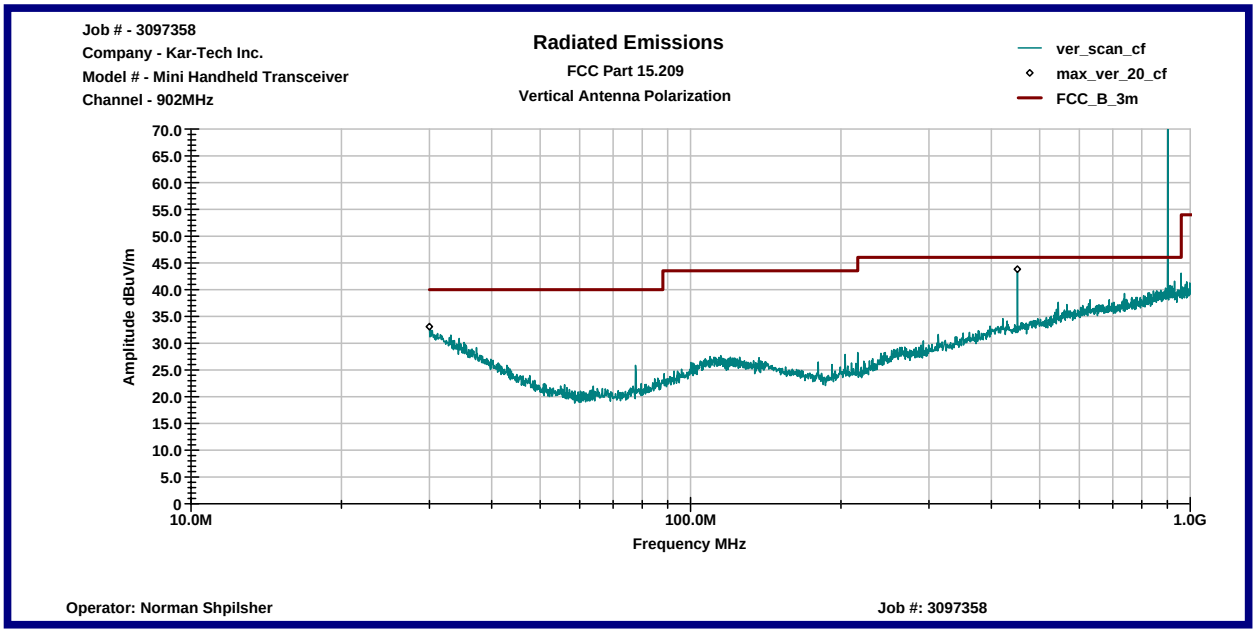
Company: Kar-Tech Inc.
Model: Mini Handheld Transmitter
Test Engineer: Norman Shpilsher
Special Info: For emissions above FCC 15.209 Duty Cycle Correction Factor of 19.5dB subtracted
Standard: FCC Parts 15.247, 15.209, 15.205
Test Site: 3m Anechoic Chamber, 3m measurement distance

Table # 3-9-2

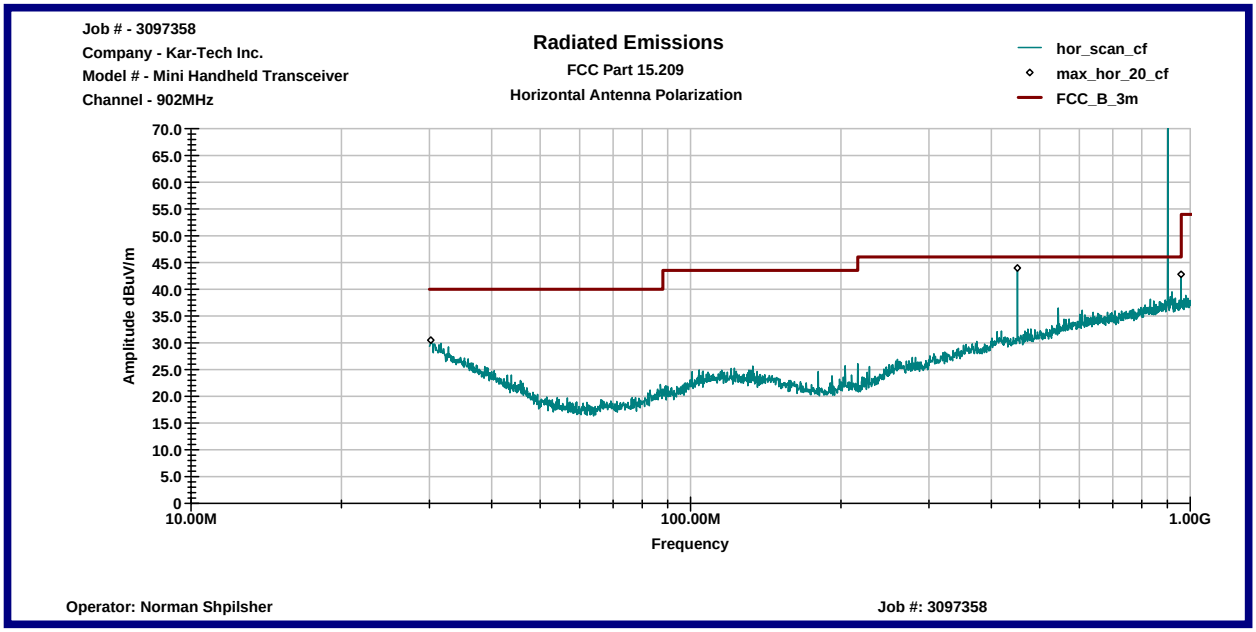
Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Amp.Gain dB	Duty Cycle C.F. (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
			902MHz operating Frequency					
1.012 GHz	V	29.4	25.9		19.5	35.7	54.0	-18.3
1.1213 GHz	V	26.4	26.8			53.2	54.0	-0.8
1.128 GHz	V	27.0	26.8			53.8	54.0	-0.2
1.0113 GHz	H	27.1	25.9			53.0	54.0	-1.1
1.1213 GHz	H	20.3	26.8			47.1	54.0	-6.9
1.1273 GHz	H	20.0	26.8			46.8	54.0	-7.2
2.7116 GHz	V	61.0	32.0	37.9	19.5	35.6	54.0	-18.4
3.6116 GHz	V	57.2	34.9	37.6	19.5	35.0	54.0	-19.0
4.5144 GHz	V	52.8	36.6	37.5		51.8	54.0	-2.2
2.7087 GHz	H	57.6	32.0	37.9		51.7	54.0	-2.3
3.6116 GHz	H	59.3	34.9	37.6	19.5	37.1	54.0	-16.9
4.5144 GHz	H	40.9	36.6	37.5		39.9	54.0	-14.1
			915MHz operating Frequency					
1.026 GHz	V	27.6	26.0			53.6	54.0	-0.4
1.1367 GHz	V	25.0	26.9			51.9	54.0	-2.1
1.1433 GHz	V	25.5	27.0			52.5	54.0	-1.6
1.026 GHz	H	24.6	26.0			50.6	54.0	-3.4
1.1433 GHz	H	20.3	27.0			47.3	54.0	-6.7
2.7481 GHz	V	60.6	32.1	37.9	19.5	35.3	54.0	-18.7
3.6622 GHz	V	54.3	35.1	37.6		51.8	54.0	-2.2
4.5791 GHz	V	50.0	36.7	37.5		49.1	54.0	-4.9
2.7481 GHz	H	59.0	32.1	37.9		53.2	54.0	-0.8
3.6622 GHz	H	58.1	35.1	37.6	19.5	36.1	54.0	-18.0
4.5791 GHz	H	40.3	36.7	37.5		39.4	54.0	-14.6
			928MHz operating Frequency					
1.0407 GHz	V	27.8	26.1			53.9	54.0	-0.1
1.1527 GHz	V	23.1	27.1			50.2	54.0	-3.8
1.16 GHz	V	23.4	27.1			50.5	54.0	-3.5
1.0407 GHz	H	21.9	26.1			48.1	54.0	-5.9
2.7875 GHz	V	59.5	32.3	37.9		53.9	54.0	-0.1
3.7156 GHz	V	54.5	35.3	37.6		52.1	54.0	-1.9
4.6409 GHz	V	49.0	36.8	37.6		48.2	54.0	-5.8
2.7875 GHz	H	58.3	32.3	37.9		52.7	54.0	-1.3
3.7156 GHz	H	57.2	35.3	37.6	19.5	35.3	54.0	-18.7
4.6409 GHz	H	40.9	36.8	37.6		40.1	54.0	-13.9

Graph # 3-9-1
Radiated Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

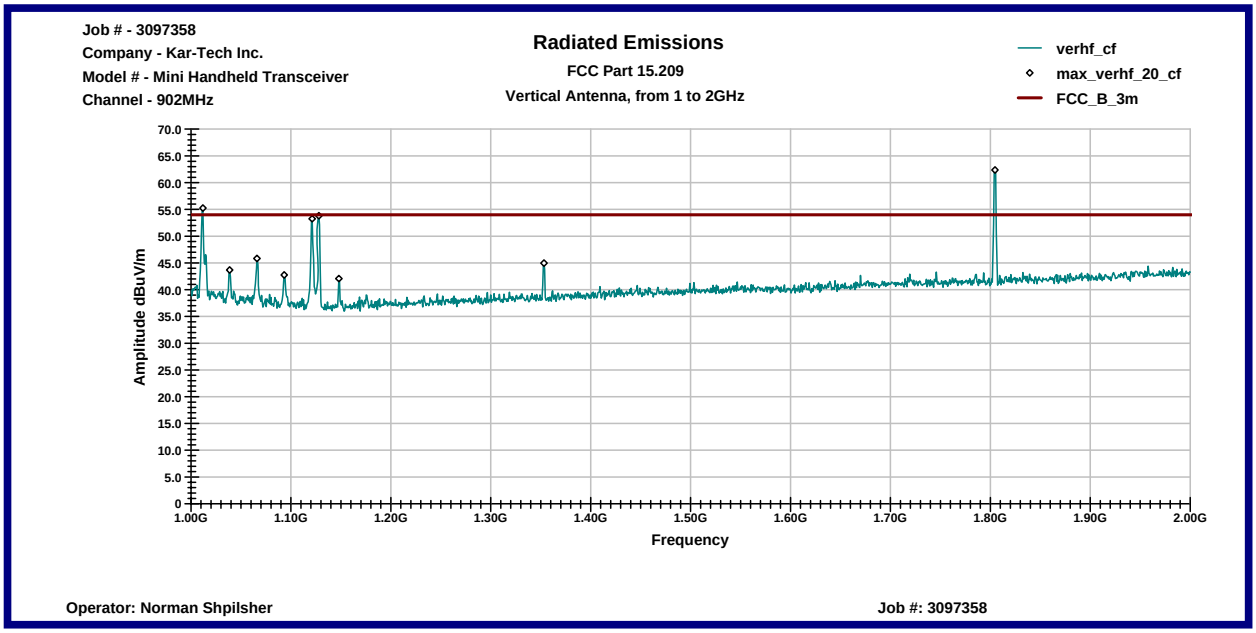


Horizontal Antenna Polarization

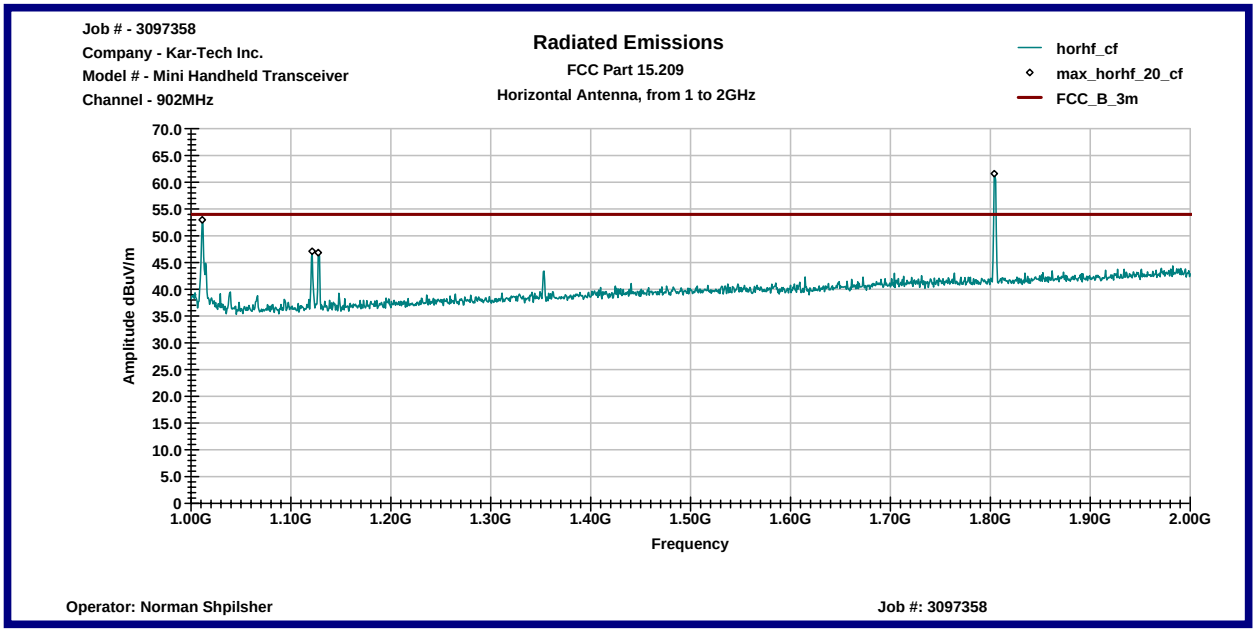


Graph # 3-9-2
Radiated Emissions from 1 to 2GHz

Vertical Antenna Polarization

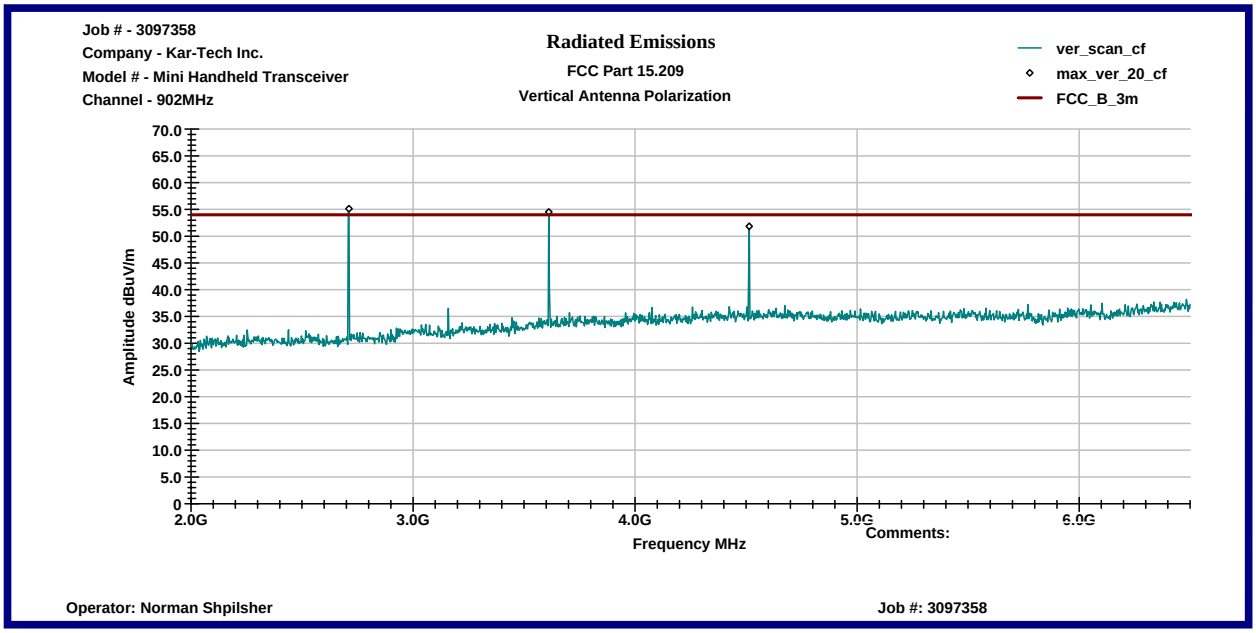


Horizontal Antenna Polarization

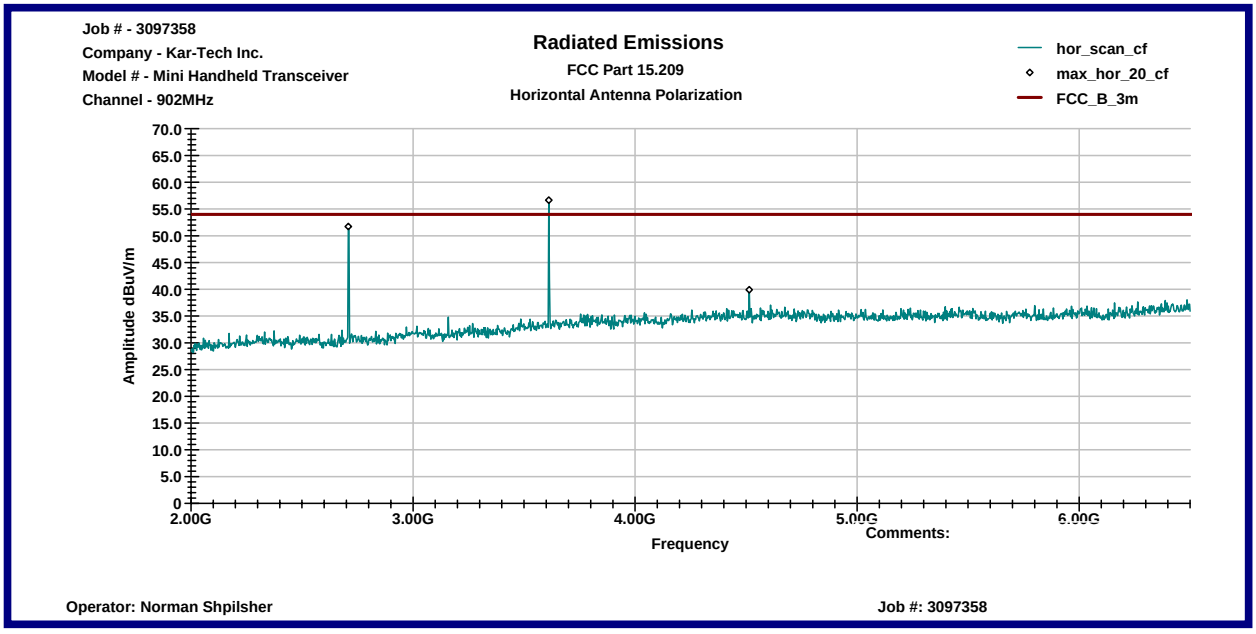


Graph # 3-9-3
Radiated Emissions from 2 to 6.5GHz

Vertical Antenna Polarization

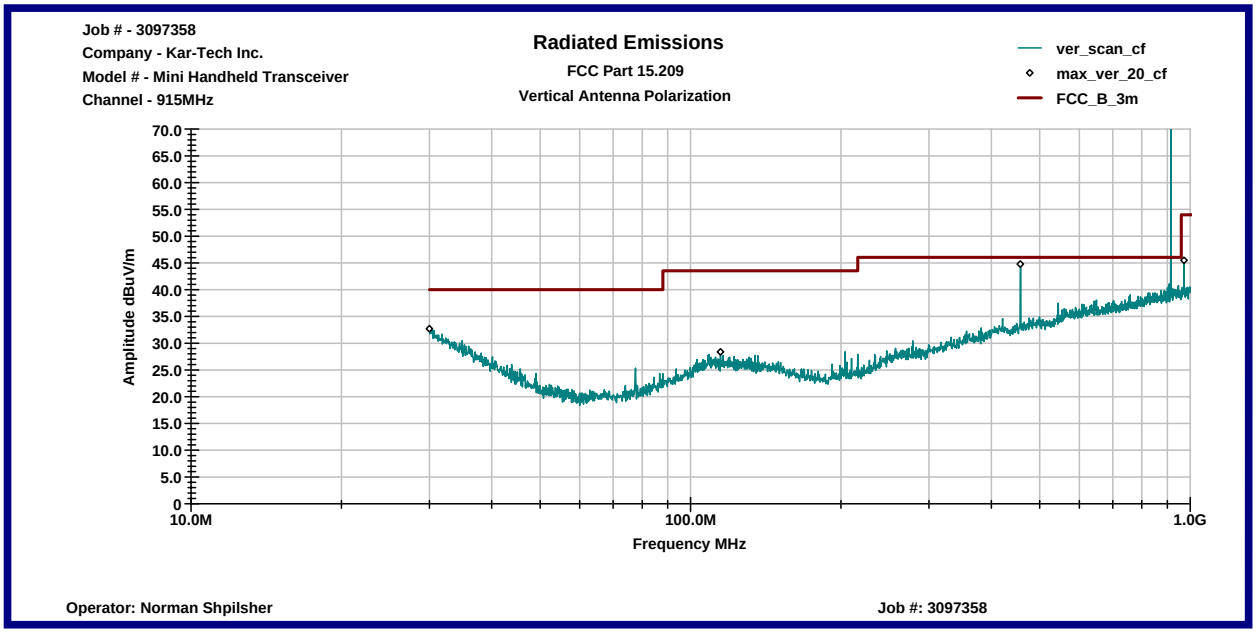


Horizontal Antenna Polarization

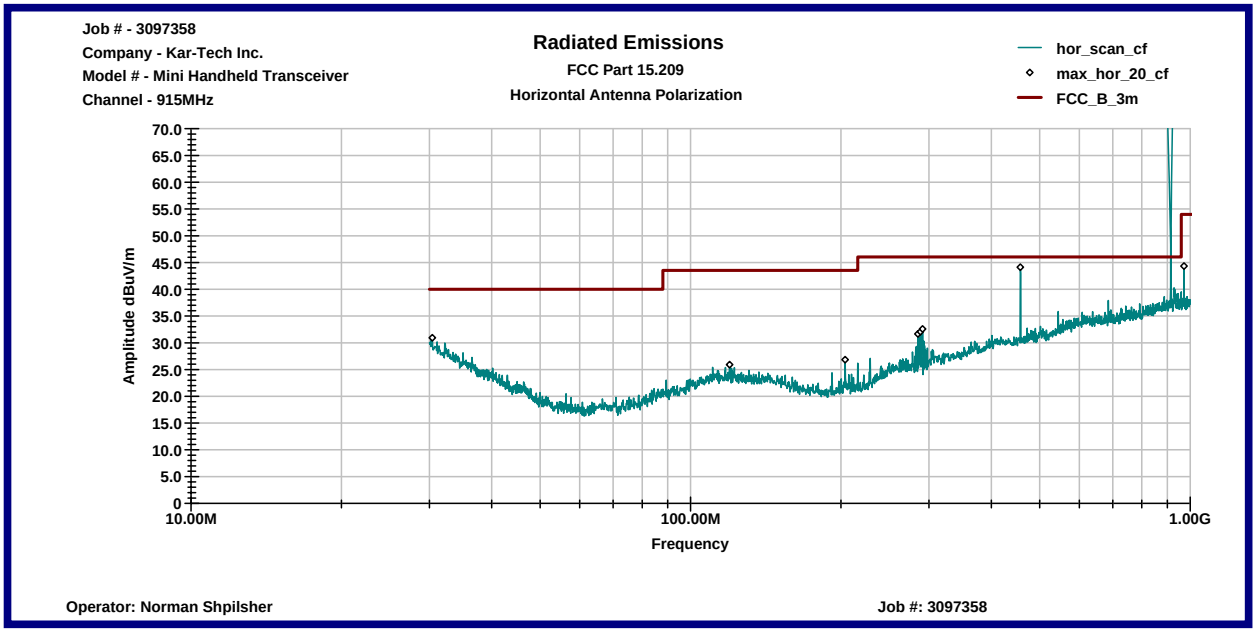


Graph # 3-9-4
Radiated Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

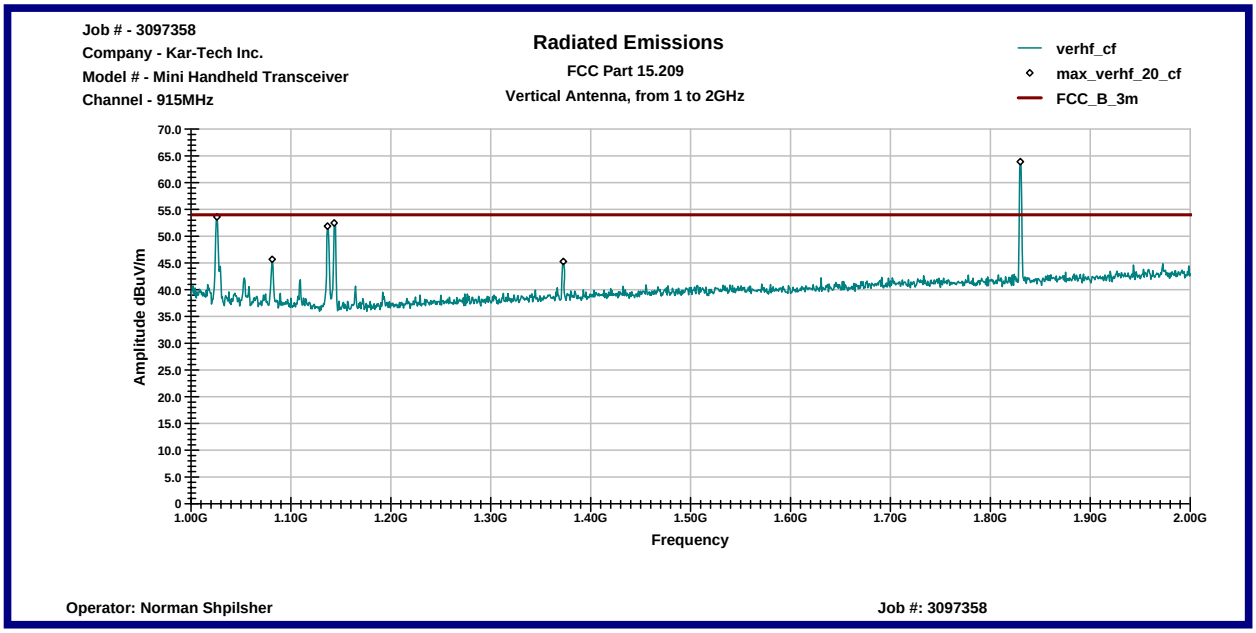


Horizontal Antenna Polarization

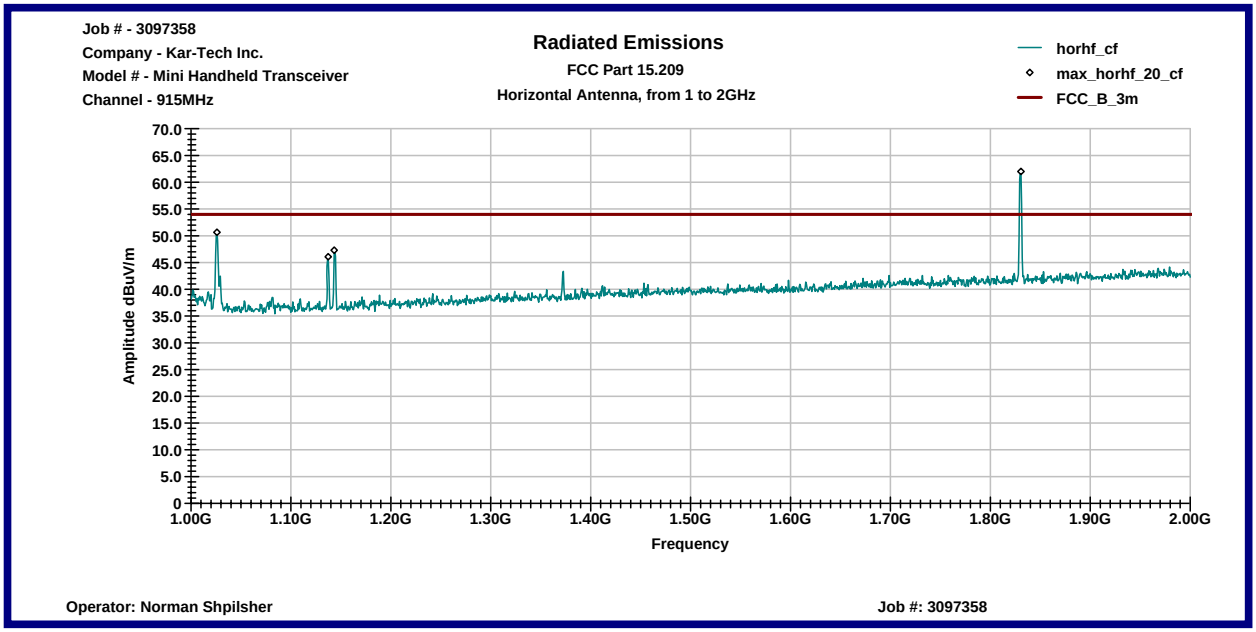


Graph # 3-9-5
Radiated Emissions from 1 to 2GHz

Vertical Antenna Polarization

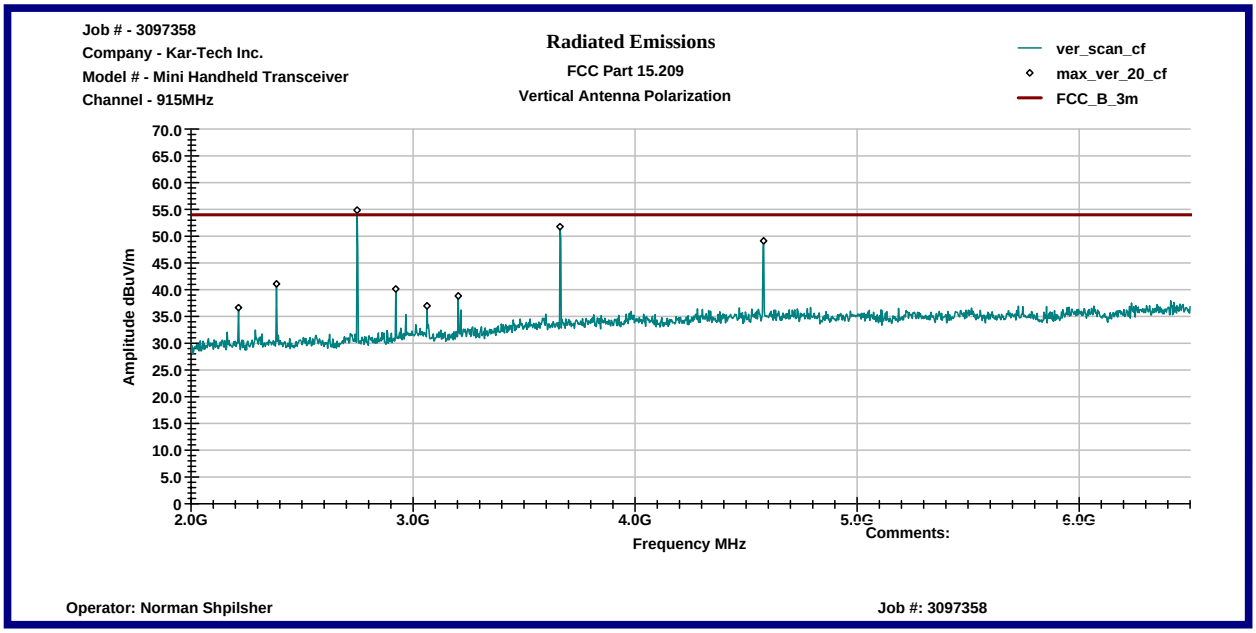


Horizontal Antenna Polarization

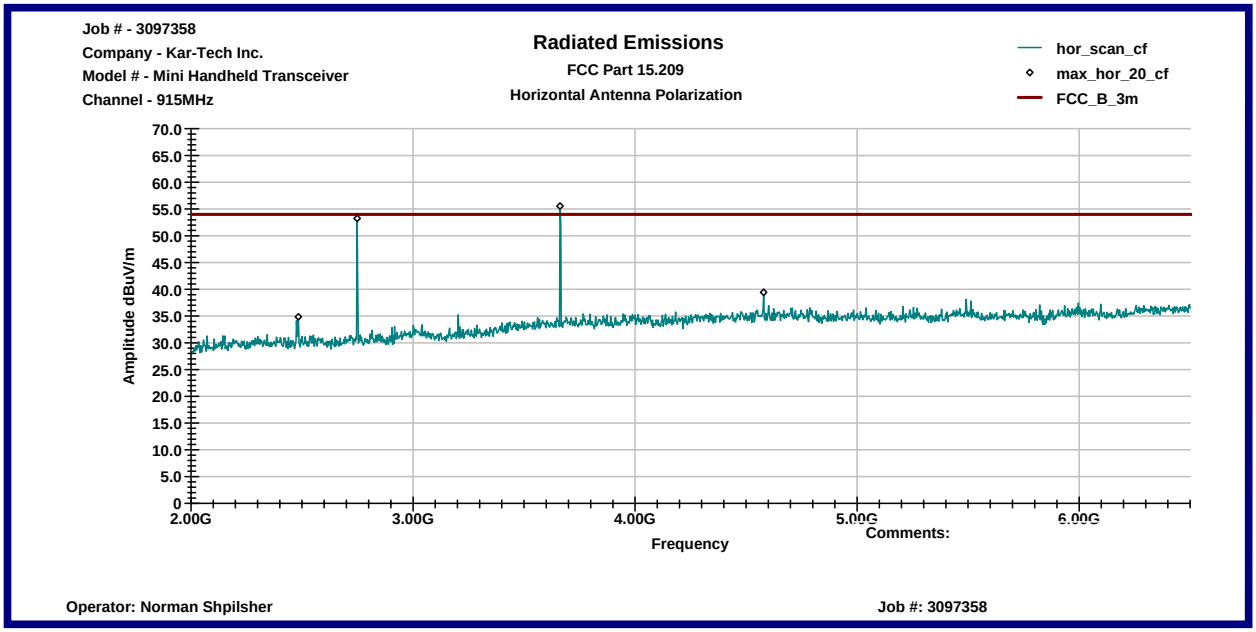


Graph # 3-9-6
Radiated Emissions from 2 to 6.5GHz

Vertical Antenna Polarization

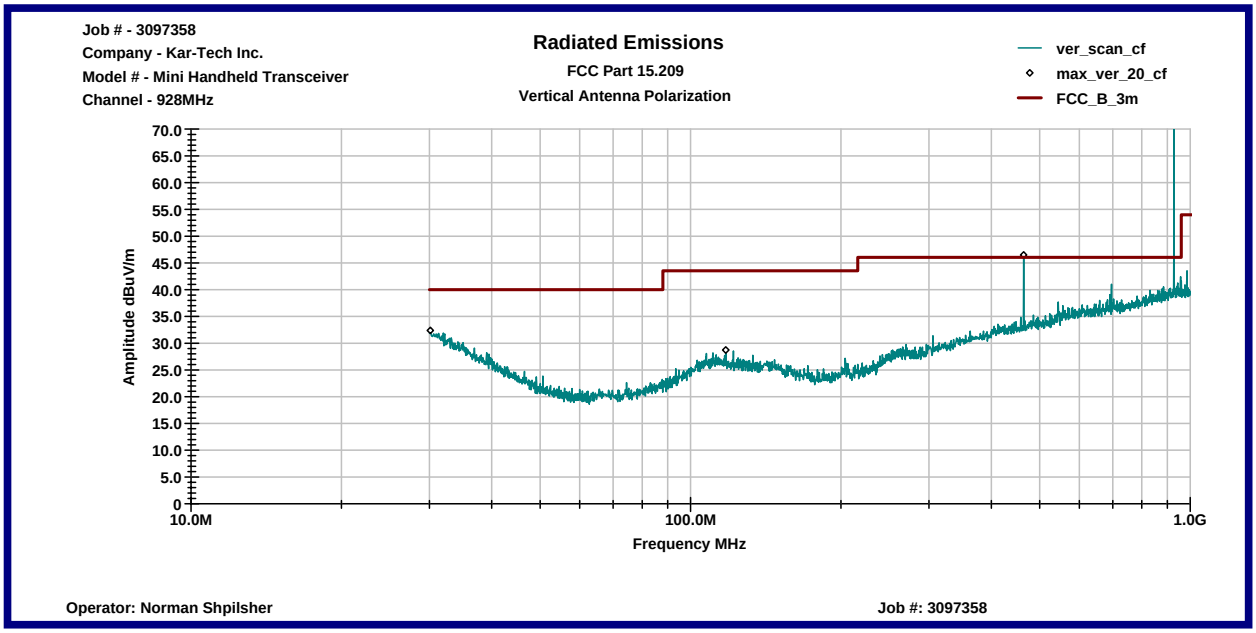


Horizontal Antenna Polarization

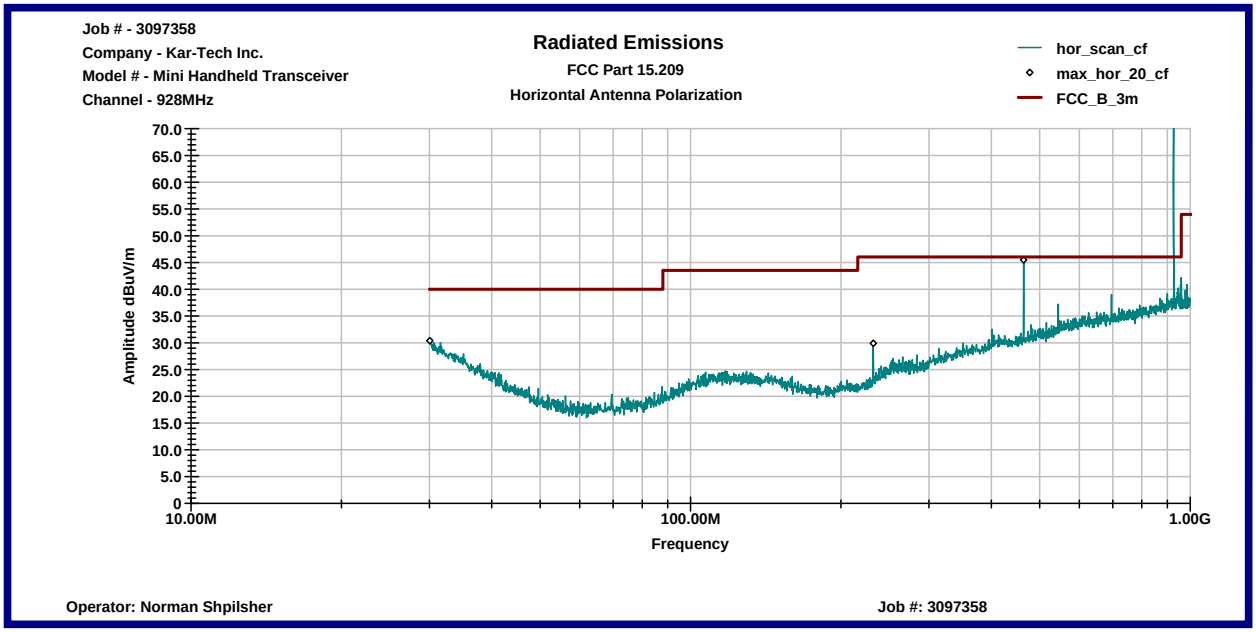


Graph # 3-9-7
Radiated Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

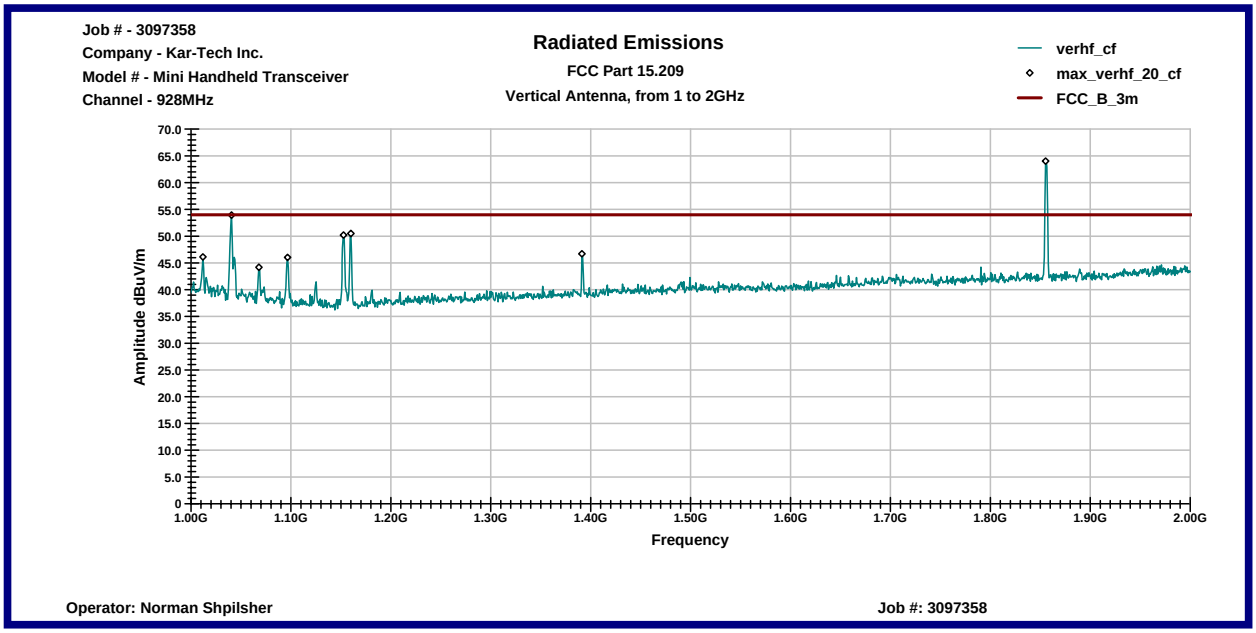


Horizontal Antenna Polarization

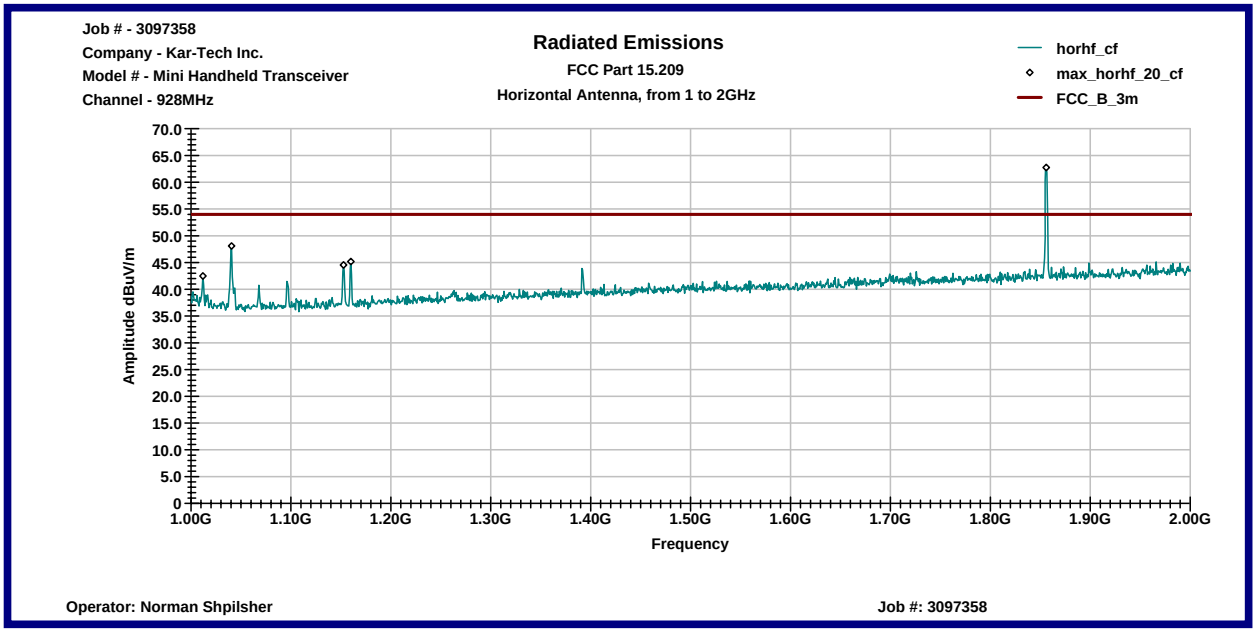


Graph # 3-9-8
Radiated Emissions from 1 to 2GHz

Vertical Antenna Polarization

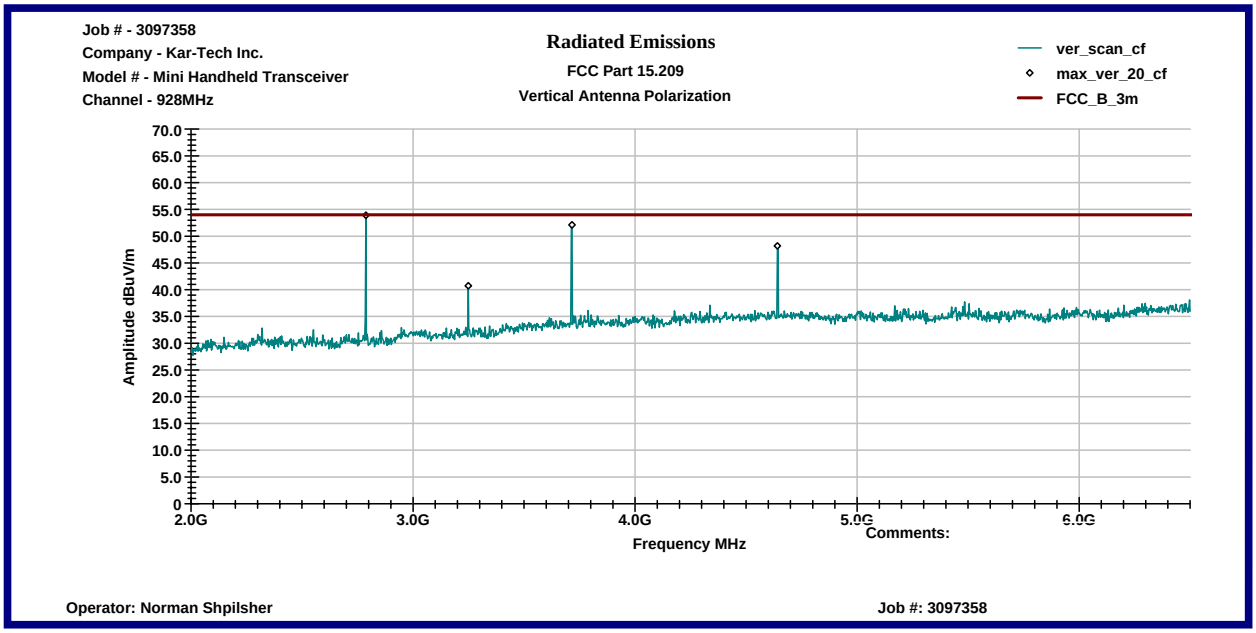


Horizontal Antenna Polarization

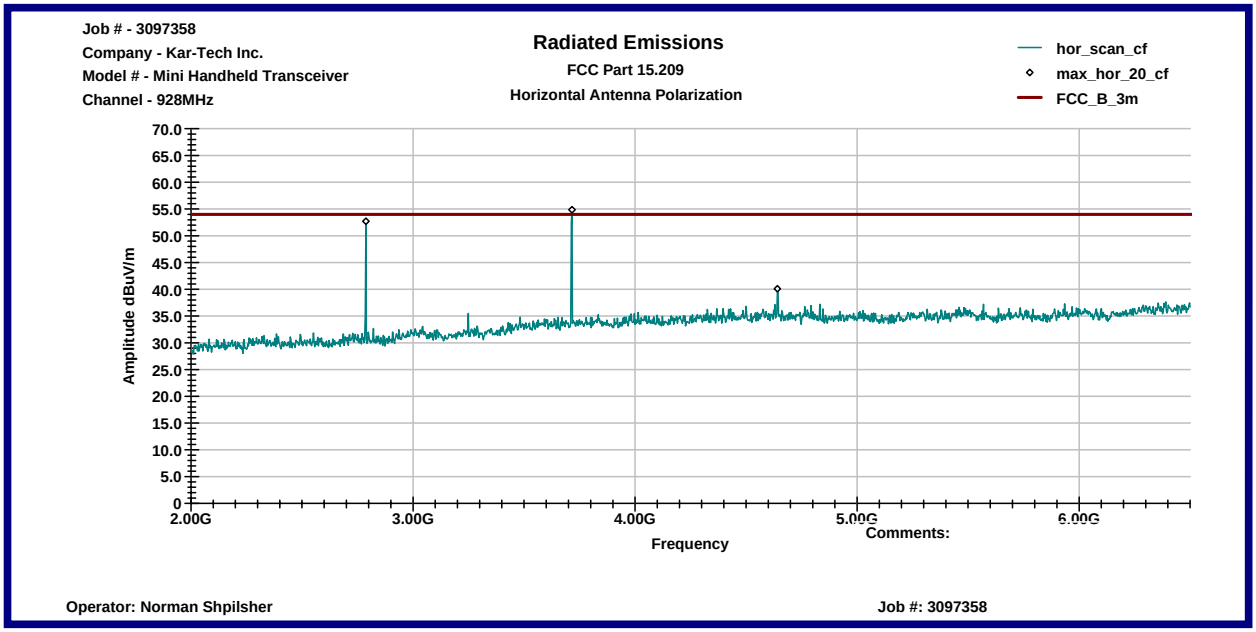


Graph # 3-9-9
Radiated Emissions from 2 to 6.5GHz

Vertical Antenna Polarization



Horizontal Antenna Polarization



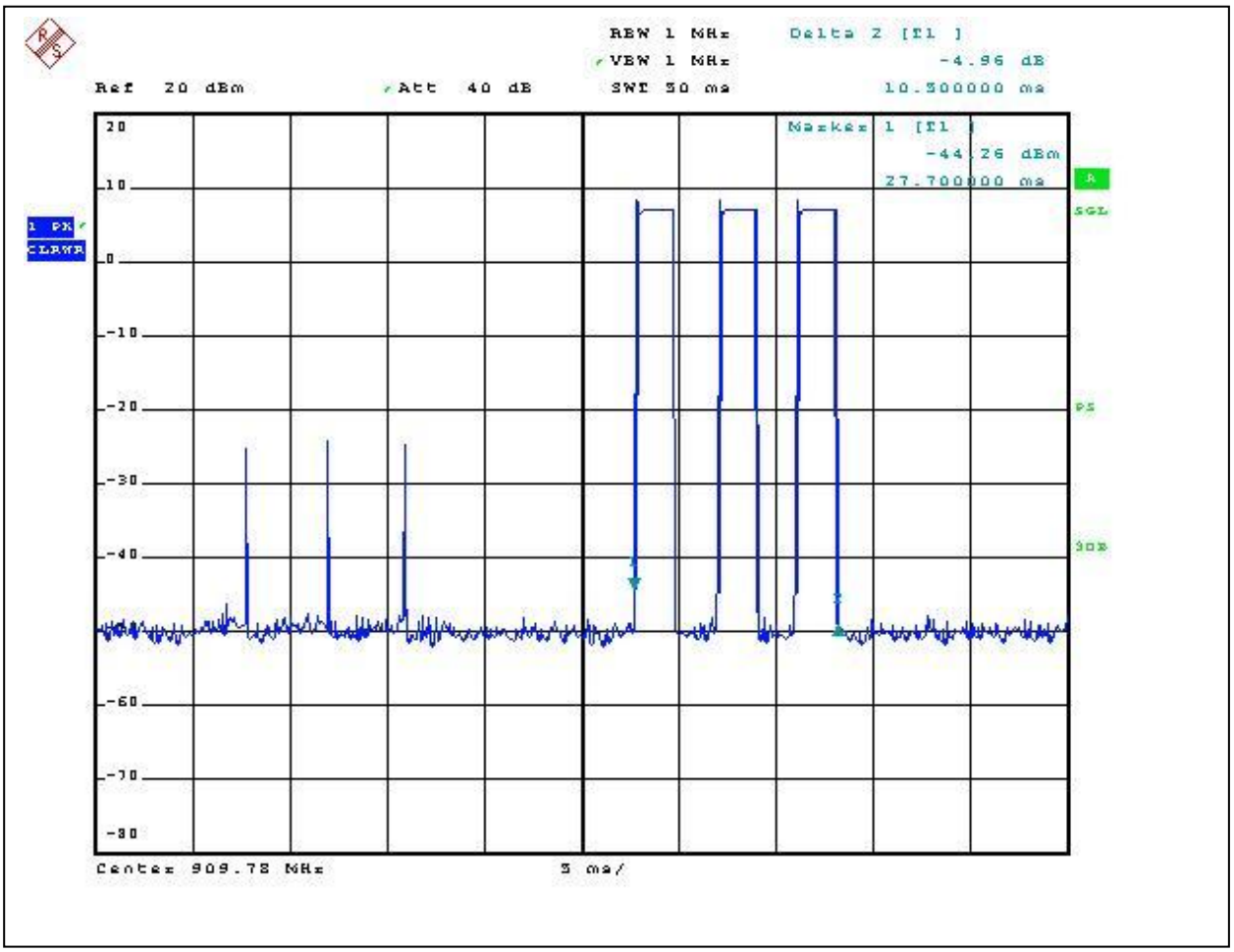
3.9.1 Duty Cycle Correction Factor Calculation, FCC 15.35

Duty Cycle Correction Factor (DCCF) was calculated as a ratio of one complete pulse train over 0.1s (for pulse train less than 0.1s).

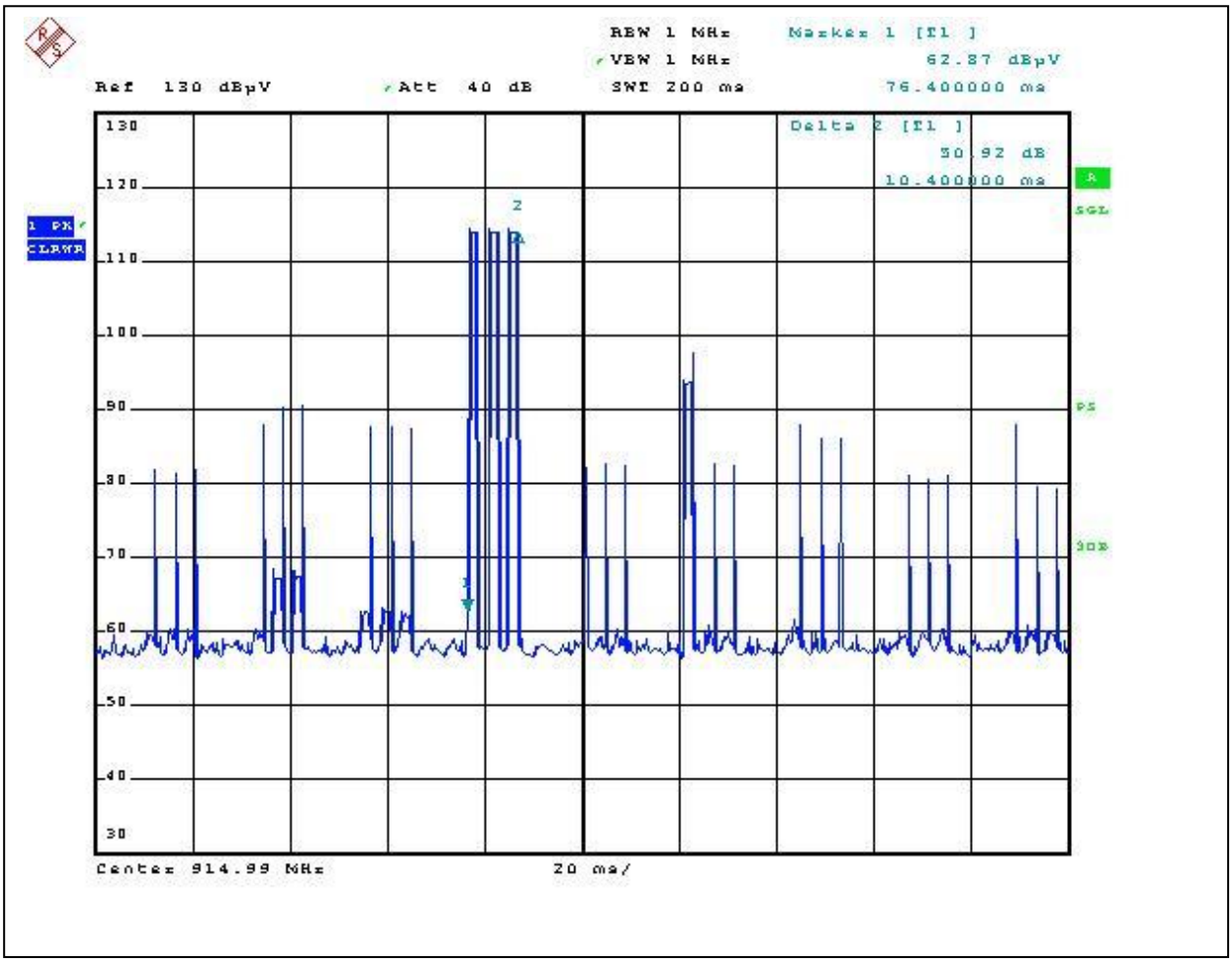
Duty Cycle Correction Factor = 20Log(Pulse_Train/100ms) = 20Log(10.5/100) = 19.5dB

Graphs 3-9-19 and 3-9-20 show transmitter operation for Duty Cycle Correction Factor calculation.

Graph # 3-9-19
Single Transmitting Time



Graph # 3-9-20
A Channel Operation Over 200mS Period



3.10 Receiver Radiated Emissions, FCC 15.109

Field Strength of Radiated Emissions measurements were measured for the device operating in receiving mode in the frequency range from 30MHz up to 5GHz (5^{th} harmonic) at the low, center, and high frequency channels (902, 915, and 928MHz).

Measurements were taken with 120kHz resolution bandwidth and 300kHz video bandwidth for measurements below 1GHz, and with 1MHz resolution bandwidth and video bandwidth for measurements above 1GHz.

The maximum Receiver radiated emissions were measured of 6.8dB below limits at 544.51MHz.

Table 3-10-1 and graphs 3-10-1 to 3-10-6 show Radiated Emissions in receiver mode for Mini Handheld device.

Receiver Radiated Emissions from 30MHz to 5GHz **Date:** 05/16-18/2006

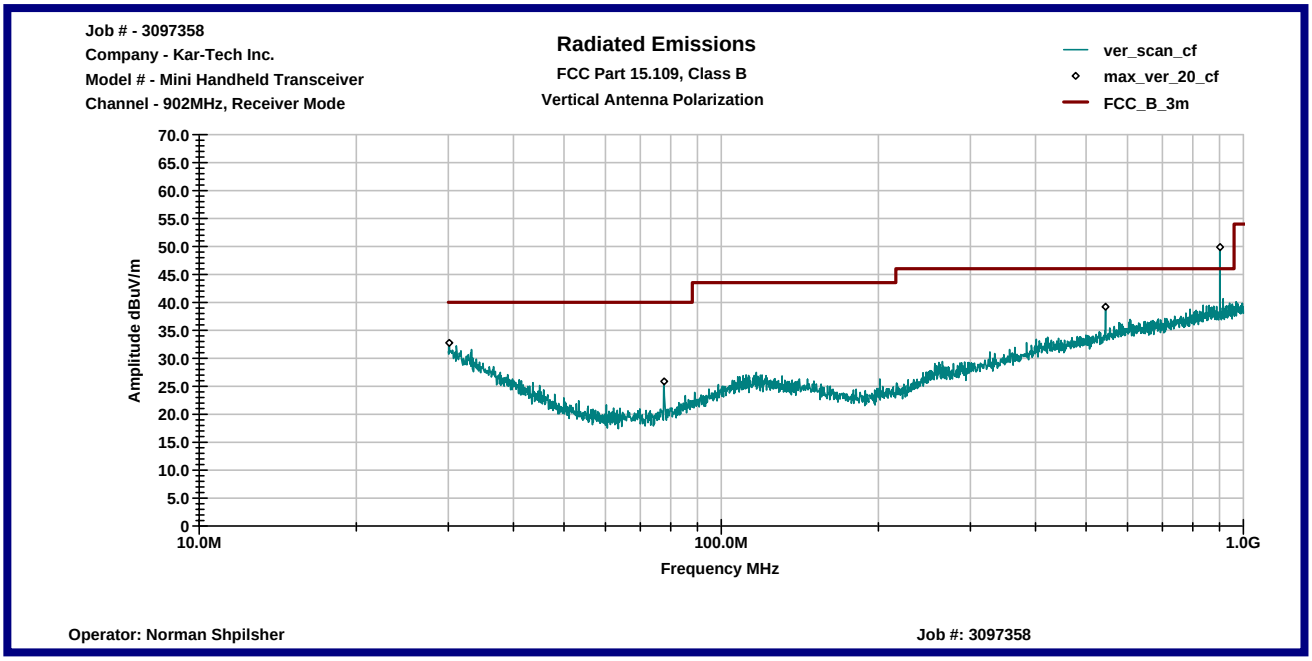
Company: Kar-Tech Inc.
Model: Mini Handheld device
Test Engineer: Norman Shpilsher
Special Info:
Standard: FCC Part 15.109, Class B
Test Site: 3m Anechoic Chamber, 3m measurement distance

Table # 3-10-1

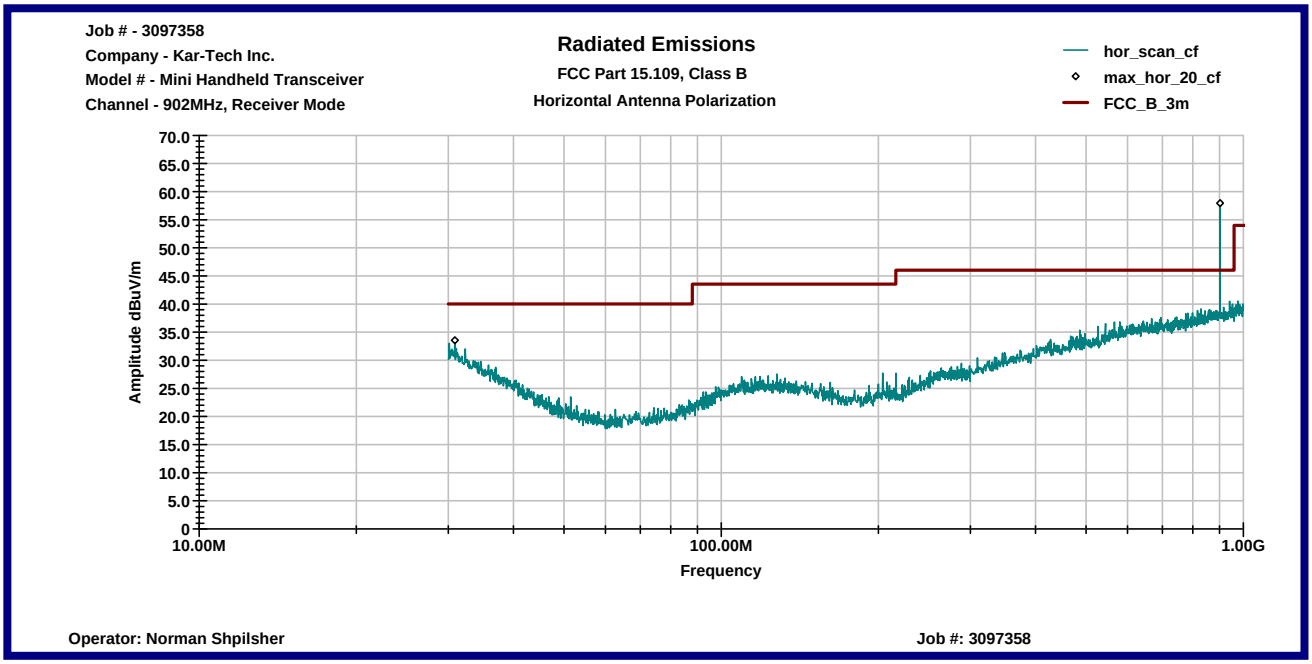
Frequency	Ant. Polarity	Reading dBμV	Ant.Factor dB1/m	Amp.Gain dB	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
			902MHz operating Frequency				
77.765 MHz	V	18.0	7.8		25.9	40.0	-14.2
544.51 MHz	V	18.1	21.1		39.2	46.0	-6.8
1.81 GHz	V	45.9	29.2	38.9	36.2	54.0	-17.8
3.615 GHz	V	44.1	34.9	37.6	41.4	54.0	-12.6
1.81 GHz	H	46.8	29.2	38.9	37.1	54.0	-16.9
3.615 GHz	H	45.8	34.9	37.6	43.1	54.0	-10.8
			915MHz operating Frequency				
77.765 MHz	V	18.2	7.8		26.0	40.0	-14.0
1.835 GHz	V	45.0	29.3	38.9	35.4	54.0	-18.5
3.665 GHz	V	42.5	35.1	37.6	40.0	54.0	-14.0
1.835 GHz	H	45.2	29.3	38.9	35.6	54.0	-18.4
3.665 GHz	H	41.5	35.1	37.6	39.0	54.0	-15.0
			928MHz operating Frequency				
77.616 MHz	V	18.4	7.8		26.2	40.0	-13.8
1.86 GHz	V	44.5	29.4	38.8	35.1	54.0	-18.9
3.715 GHz	V	41.9	35.3	37.6	39.5	54.0	-14.5
1.86 GHz	H	44.5	29.4	38.8	35.1	54.0	-18.9
3.715 GHz	H	41.0	35.3	37.6	38.6	54.0	-15.3

Graph # 3-10-1
Radiated Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

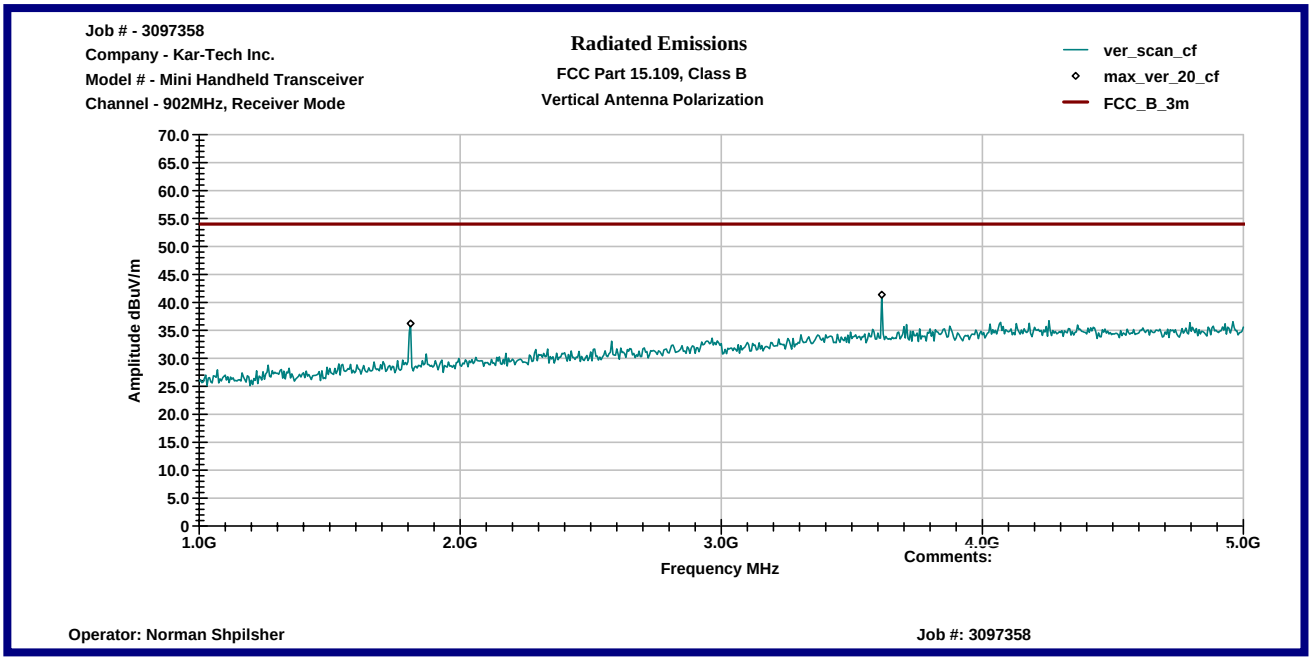


Horizontal Antenna Polarization

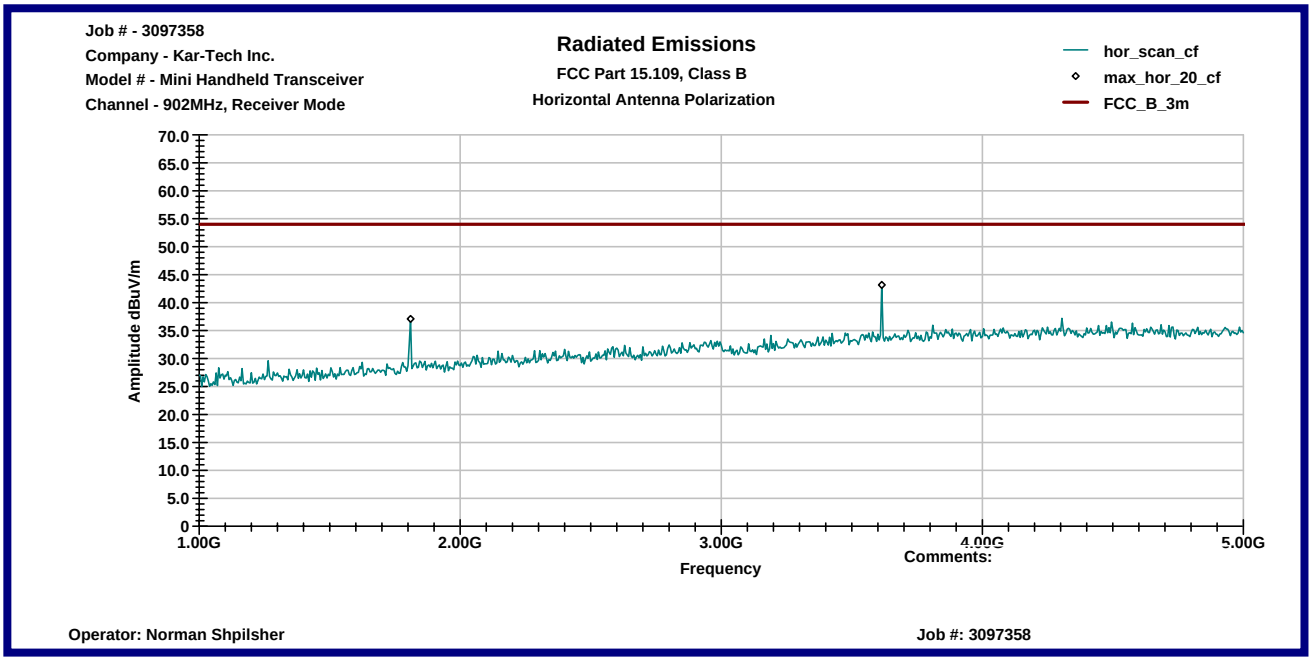


Graph # 3-10-2
Radiated Emissions from 1 to 5GHz

Vertical Antenna Polarization

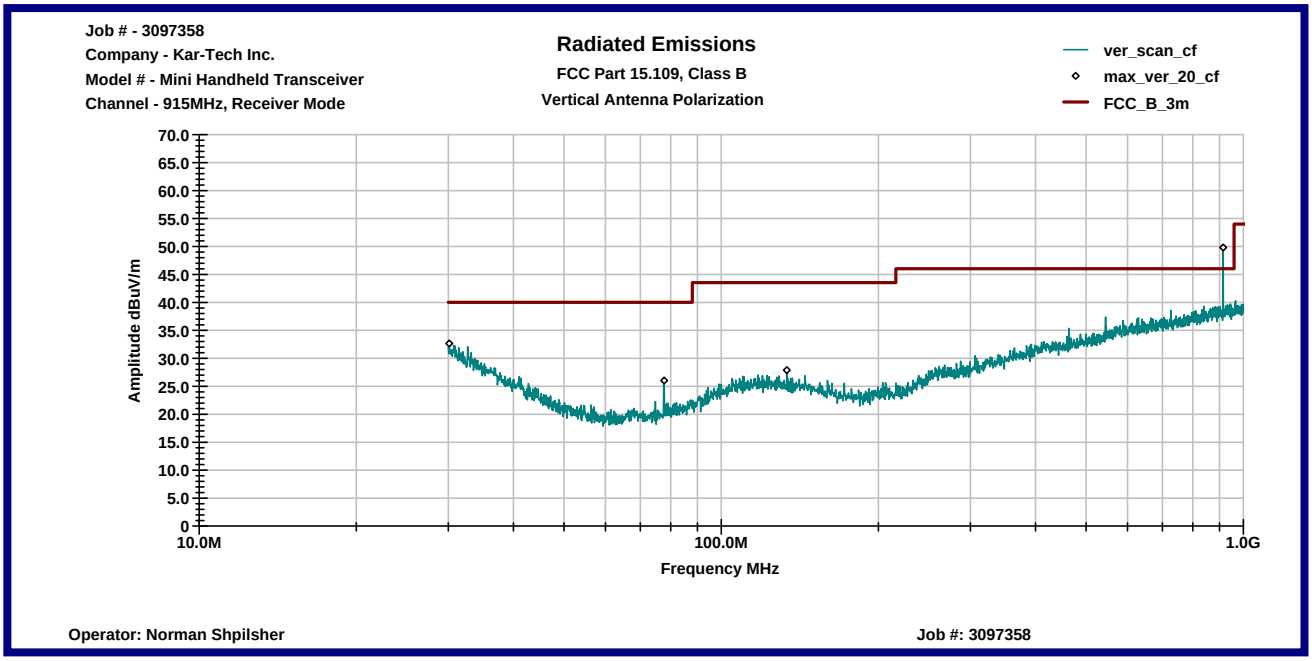


Horizontal Antenna Polarization

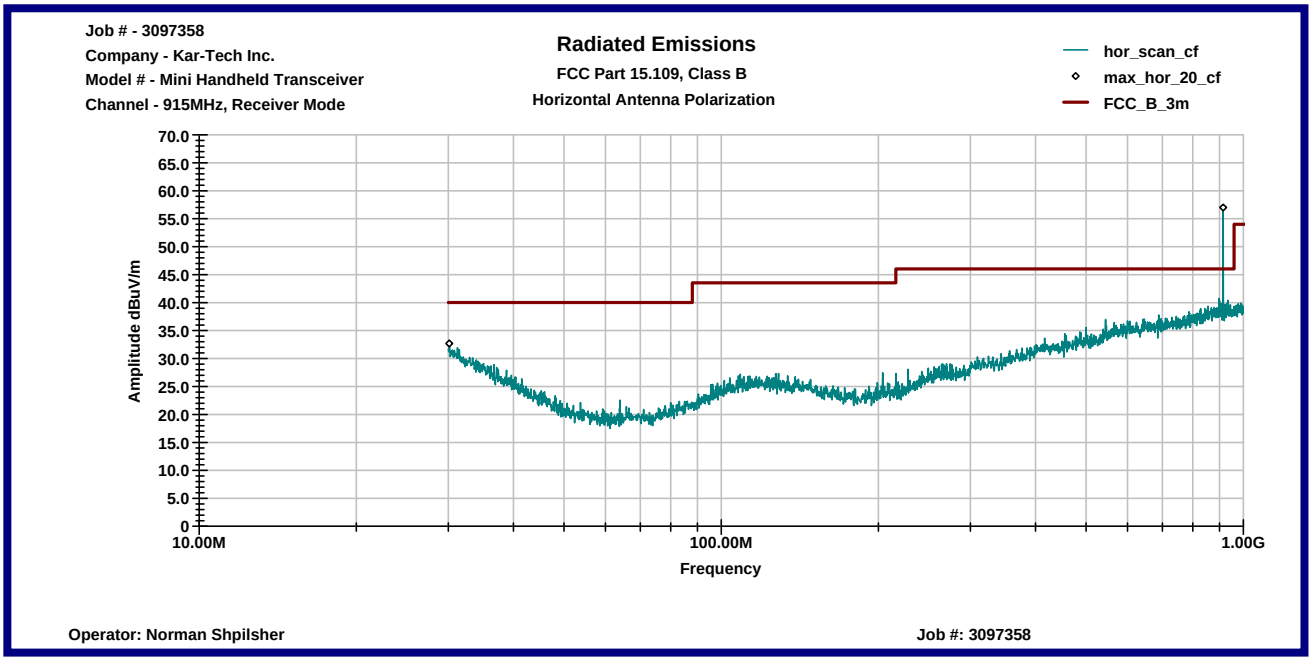


Graph # 3-10-3
Radiated Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

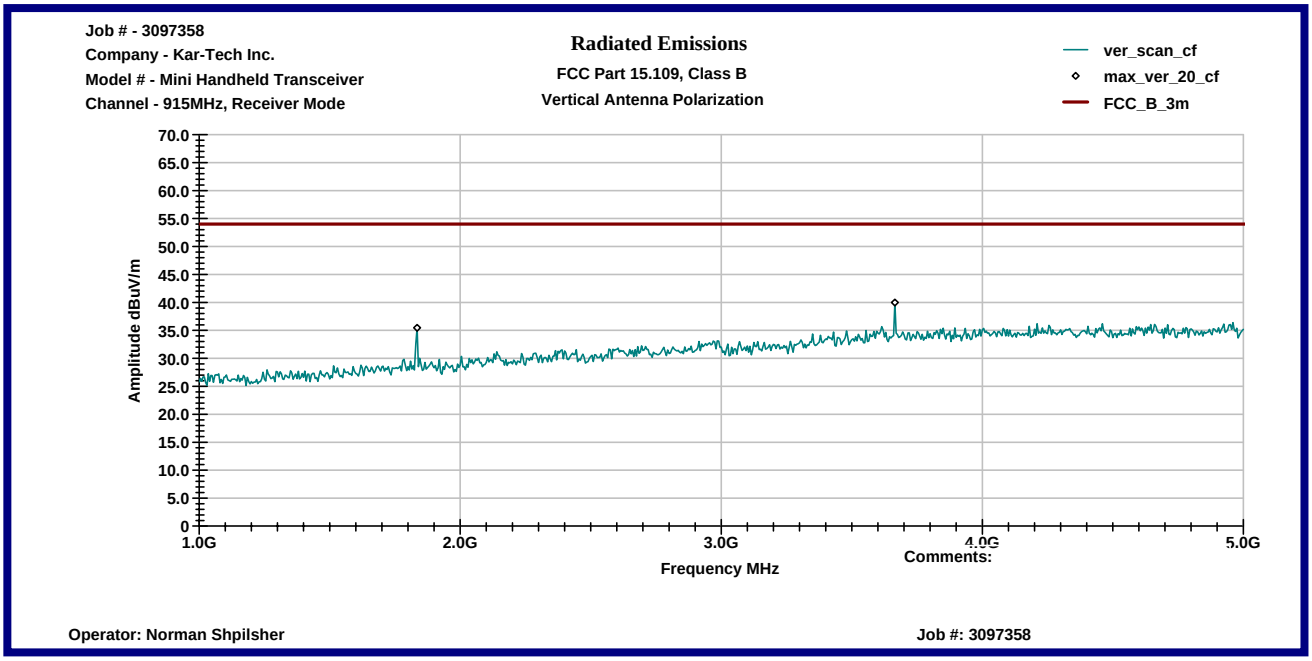


Horizontal Antenna Polarization

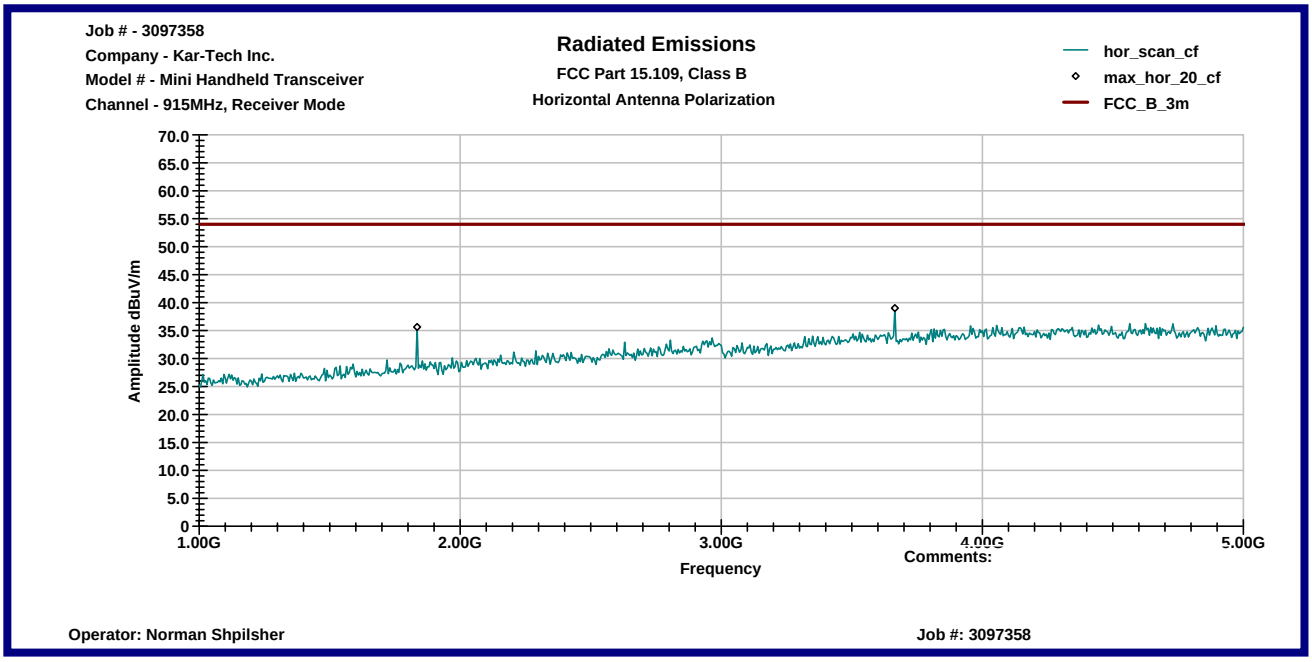


Graph # 3-10-4
Radiated Emissions from 1 to 5GHz

Vertical Antenna Polarization

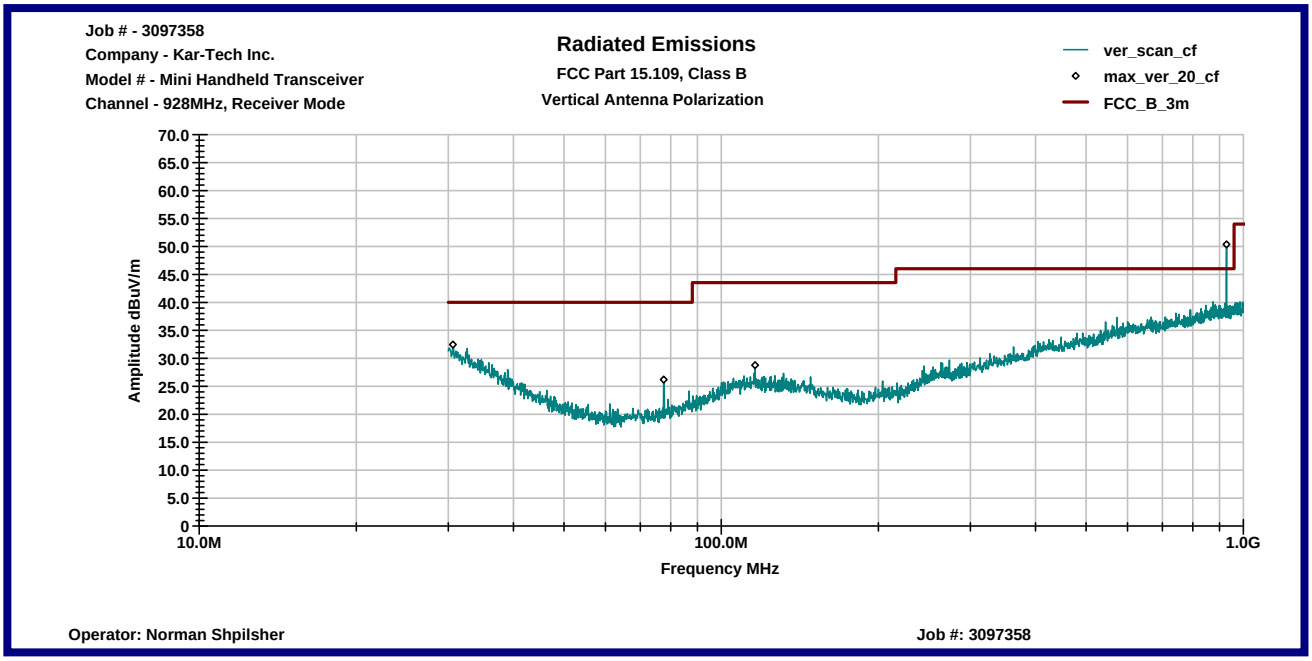


Horizontal Antenna Polarization

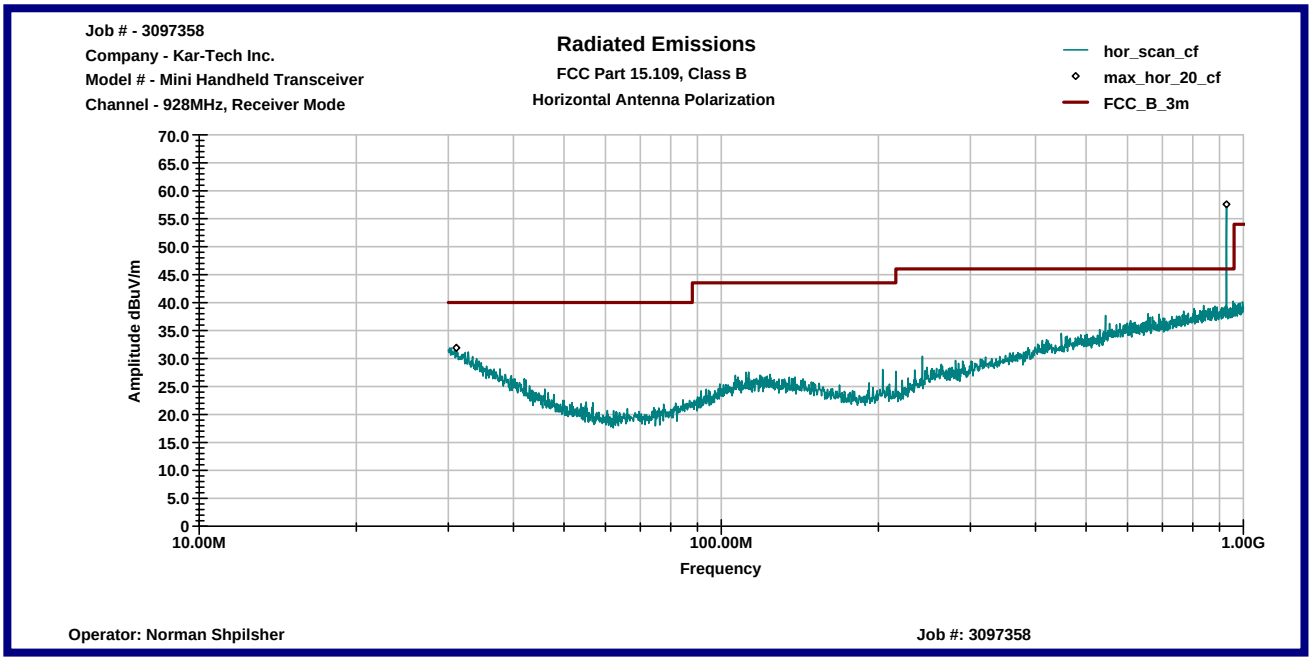


Graph # 3-10-5
Radiated Emissions from 30MHz to 1GHz

Vertical Antenna Polarization

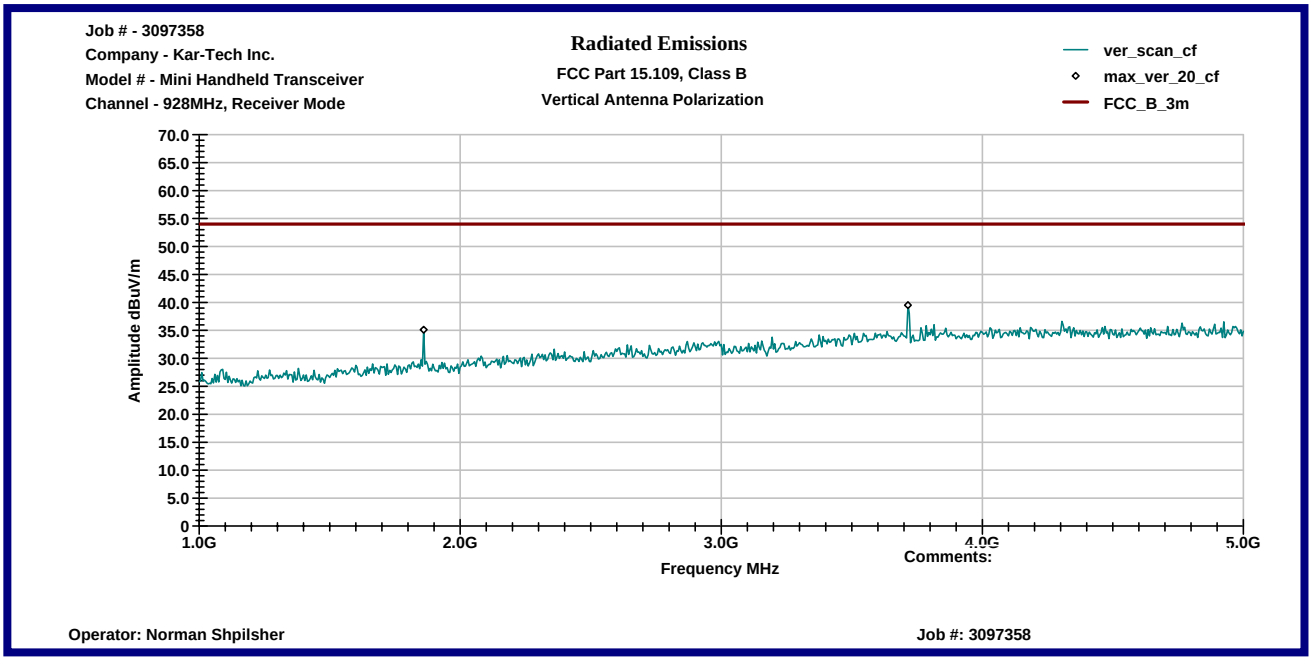


Horizontal Antenna Polarization

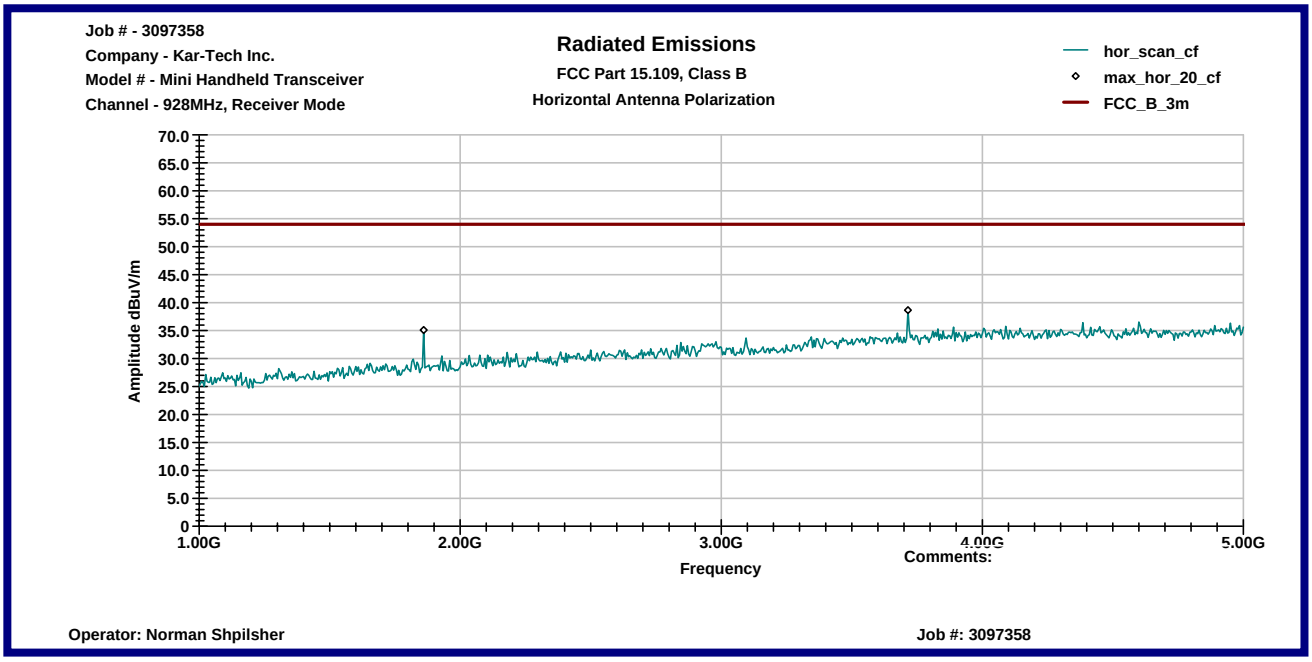


Graph # 3-10-6
Radiated Emissions from 1 to 5GHz

Vertical Antenna Polarization



Horizontal Antenna Polarization



3.11 Test Procedure

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz.
The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes (for hand-held devices), by 360 degrees rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the Field Strength Calculation is shown in Section 3.12.

Antenna Terminal Conducted Emissions Measurements

The Antenna Terminal Conducted Emissions Measurements were obtained with the transmitter antenna terminal directly connected to the spectrum analyzer input.
The emissions level is calculated from the measured power level adding cable loss (attenuation) between the EUT Antenna Terminal and the Analyzer input.

Power Line Conducted Emissions

For conducted emissions testing, the equipment is moved to an insulating platform over the ground plane, and the EUT is powered from a LISN. Both sides of the AC line are measured and the results are compared to the applicable limits. Measurements are taken using CISPR quasi-peak and average detectors when the peak readings approach or exceed the average limit. Only quasi-peak readings are taken when the emissions from the EUT meet the average limit as measured with the quasi-peak detector.

3.12 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 emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μV/m).

RA = 48.1 dB(μV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(μV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Norman Shpilsher
EMC Staff Engineer
Intertek ETL SEMKO

Signature

Date: May 21, 2006

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers and Test Software

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
HP85462A Receiver RF Section	3549A00306	01/06	01/07	X
HP85460A RF Filter Section	3448A00276	01/06	01/07	X
HP85462A Receiver RF Section	3549A00306	04/06	04/07	
HP85460A RF Filter Section	3448A00276	04/06	04/07	
Rohde & Schwarz FSP 40 Spectrum Analyzer	100024	08/05	08/06	
Rohde & Schwarz ESCI Spectrum Analyzer	100358	04/06	04/07	X
Advantest R3271A Spectrum Analyzer	55050084	08/05	08/06	X
Agilent E7402A Spectrum Analyzer	MY44212200	09/05	09/06	
TILE! Instrument Control System	Ver. 3.4 K.8	N/A	N/A	X

Antennas/ Pre-Amplifiers/Filters

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	12/05	12/06	X
Schaffner-Chase Bicono-Log Antenna	2630	08/05	08/06	
EMCO Horn Antenna 3115	9507-4513	01/06	01/07	X
MITEQ AMF-5D Pre-Amplifier	1122951	02/06	02/07	X
Reactel 7HS-1G-S12 SN02-1 Filter	0223	01/06	01/07	X


Intertek
ETL SEMKO