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TransCore

Application
For Certification
RF Module, Model IT2611

FCC ID: FIH2611SS

March 11, 2002
Revision 3

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TABLE OF CONTENTS

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1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the IT2611RF Module for Certification under FCC Part 90, Subpart M. There are no other simultaneous applications.

1.2 Product Description

Purpose of the IT2611 RF Module

The *IT2611 RF Module* is a part of the non-multiratelation Location and Monitoring Service (LMS) System. The *IT2611 RF Module* is mounted with antennas. The intended use of the *IT2611 RF Module* unit is to generate a RF signal upon command from a reader, and deliver the signal to one of the antennas for transmission and receive the reflected modulated tag signal returned through the antenna(s). Then *IT2611 RF Module* demodulates, amplifies, and filters the received tag signal, and forwards the digital data to the reader for processing. The *IT2611 RF Module* powered at 120VAC/60Hz through the external power adapter manufactured by TransCore.

The IT2611 RF Module Transmitter

The *IT2611 RF Module* Transmitter operates in frequency ranges with type of modulation:

Uplink Mode (CW only):
From 902.25 to 903.75MHz (Continuous Wave, N0N Emission Modulation Designator) and
From 910.00 to 921.75MHz (Continuous Wave, N0N Emission Modulation Designator),
adjustable in 0.25MHz step.

Down link Mode (Digital modulation only):
From 912.75 to 918.75MHz (Manchester encode 300kbps Modulated Signal, L1D Emission Modulation Designator), adjustable in 0.25MHz step.

Operating Power Level:

1 Watt maximum (30dBm) and may be attenuated up to 15dB with 1dB step

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The IT2611 RF Module Antennas

Two different antennas could be used to transmit RF signal from the IT2611 RF Module:

AA3152 Universal Toll Antenna (UTA)

Frequency range: 902 to 928MHz
Gain: 13dBi
Impedance: 50Ohms

AA3153 Toll Antenna

Frequency range: 902 to 928MHz
Gain: 10.5dBi
Impedance: 50Ohms

The IT2611 RF Module Receiver

The *IT2611 RF Module* Receiver is a three-channel differential receiver with pre-amplifier. The power at the receiving antenna terminal is not exceed 2.0 nanowatts.

1.3 Test Methodology

Emission measurements were performed according to the procedures in specified by ANSI/TIA/EIA-603-1992. All field strength radiated emissions measurements were performed in the semi-anechoic chamber using a substitution antenna method. 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 January 2000 submitted to your office. Please reference the site registration number: 90706, dated May 19, 2000.

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2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

FCC Part 90.210(k)(4) specifies measurements at LMS Sub-Band edges FCC Part 90.210(k)(6) for a non-multilateration transmitter using 100kHz RBW. However, based on the rules interpretations provided by TransCore in reference to the FCC Letter dated on June 9, 1997 (uploaded with application) measurements of the Out-of-Band emissions with center frequencies within 1MHz from the band edges were taken using 300Hz RBW (See Section 3.4).

2.2 EUT Exercising Software

The *IT2611 RF Module* was tested in the continuous transmission mode.

2.3 Special Accessories

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

2.4 Equipment Modification

No modifications were installed during the testing.

2.5 Support Equipment List and Description

BSI Computer, s/n BSI1023175
Data Interface unit manufactured by TransCore
1611A BK Precision DC Power Supply, s/n 241-00988

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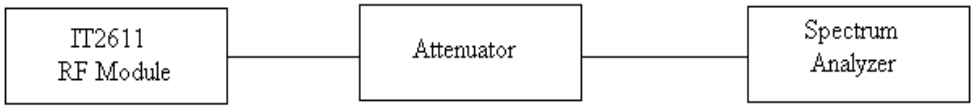
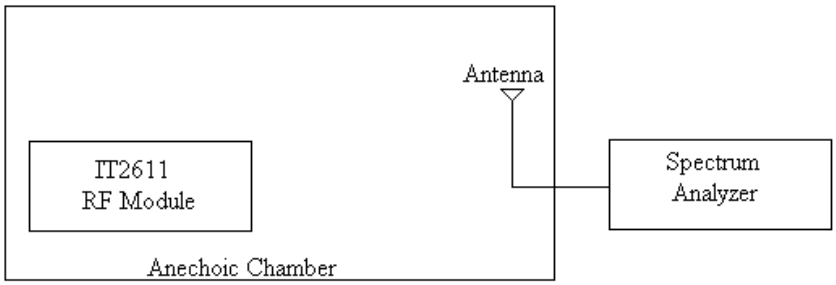
2.6 Test Configuration Block Diagrams

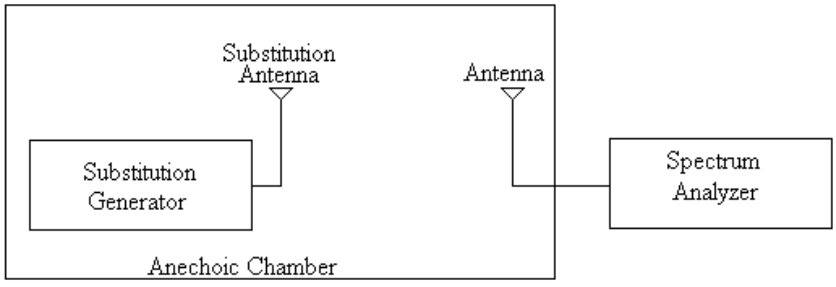
The EUT was powered at 120VAC/60Hz through external power supply unit. The EUT was set up as tabletop equipment.

Measurements at Antenna Terminal



Field Strength Measurements





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3.0 TEST RESULTS

Data is included of 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 90 (Subpart I and M), Part 15 (Subpart B). Specific test requirements include the following:

47 CFR 90.205(j), 2.1046	RF Power Output
47 CFR 90.209(b)(5), 2.1049	Occupied Bandwidth
47 CFR 90.210(k)(3)(ii), 2.1051	Spurious Emissions at Antenna Terminal
47 CFR 90.210(k)(3)(ii), 2.1051	Out of Band Spurious Emissions at Antenna Terminals
47 CFR 90.210(k)(3)(ii), 2.1053	Field Strength of Spurious Radiation
47 CFR 90.213(a), 2.1055	Frequency Stability

The EUT does not re-modulate or re-key the signal. Based on the lack of re-keying/re-modulation circuitry, the following test was not performed:

47 CFR 90.211, 2.1047 RF	Modulation Characteristics

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3.1 RF Power Output, FCC 90.205(j), 2.1046

RF Output measurements were made in the start, center, and end frequency of each frequency range with appropriate type of modulation for these frequency ranges. The follow frequency ranges are used in the EUT:

Uplink Mode:
From 902.25 to 903.75MHz (Continuous Wave Emission Designator)
From 910.00 to 921.75MHz (Continuous Wave Emission Designator),

Downlink Mode
From 912.75 to 918.75MHz (Modulated Signal Emission Designator, digital modulation, 300kbps, Manchester code).

So, RF Output measurements were made for frequencies:
902.25MHz, CW
903.00MHz, CW
903.75MHz, CW
910.00MHz, CW
915.75MHz, CW
921.50MHz, CW
912.75MHz, Modulated
915.75MHz, Modulated
918.75MHz, Modulated

Test Procedure

The RF Power Output for the device was measured at the maximum power transmission condition. The transmitter antenna port was connected to the Spectrum analyzer via the attenuator.

Total Power was calculated from Measured Power adding 6.2dB factor of the external-of-analyzer attenuator.

Maximum Output Power at Antenna Terminal calculation
According to the FCC 90.205(j), the maximum ERP output power is 30 Watts (44.77dBm).
Maximum output power at antenna terminal = Max ERP Power – Antenna Gain = 44.77dBm – 13dBi
Maximum output power at antenna terminal = 31.77dBm
According to the client specification, the maximum output power at antenna terminal is 1 Watt, or 30dBm. As a worse case, 30dBm output power at antenna terminal is chosen as a reference level of the Maximum Output Power at antenna terminal.

Table and graphs below show the RF Power Output at antenna terminal.
Note: Emission level shown in the Graphs does not include 6.2dB attenuation factor of the attenuator.

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RF Power Output **Date:** 01-03-2002
Company: TransCore
Model: IT2611
Test Engineer: Norman Shpilsher
Special Config. Info: The EUT antenna terminal was connected to the Spectrum Analyzer through the attenuator 6.2dB (including cable loss).
Standard: FCC Part 90.205(j) and Part 2.1046

Table # 3-1-1

Output Freq. MHz	Measured Power dBmV	Total Power dBmV	Total Power dBm	Maximum Power dBm	Margin dB	Comments
902.25 (CW)	129.8	136.0	29.0	30.0	-1.0	
903.00 (CW)	129.4	135.6	28.6	30.0	-1.4	
903.75 (CW)	129.7	135.9	28.9	30.0	-1.2	
910.00 (CW)	129.7	135.9	28.9	30.0	-1.1	
915.75 (CW)	130.2	136.4	29.4	30.0	-0.6	
921.50 (CW)	130.3	136.5	29.5	30.0	-0.5	
912.75 (Mod)	129.6	135.8	28.8	30.0	-1.2	
915.75 (Mod)	129.5	135.7	28.7	30.0	-1.3	
918.75 (Mod)	129.7	135.9	28.9	30.0	-1.1	

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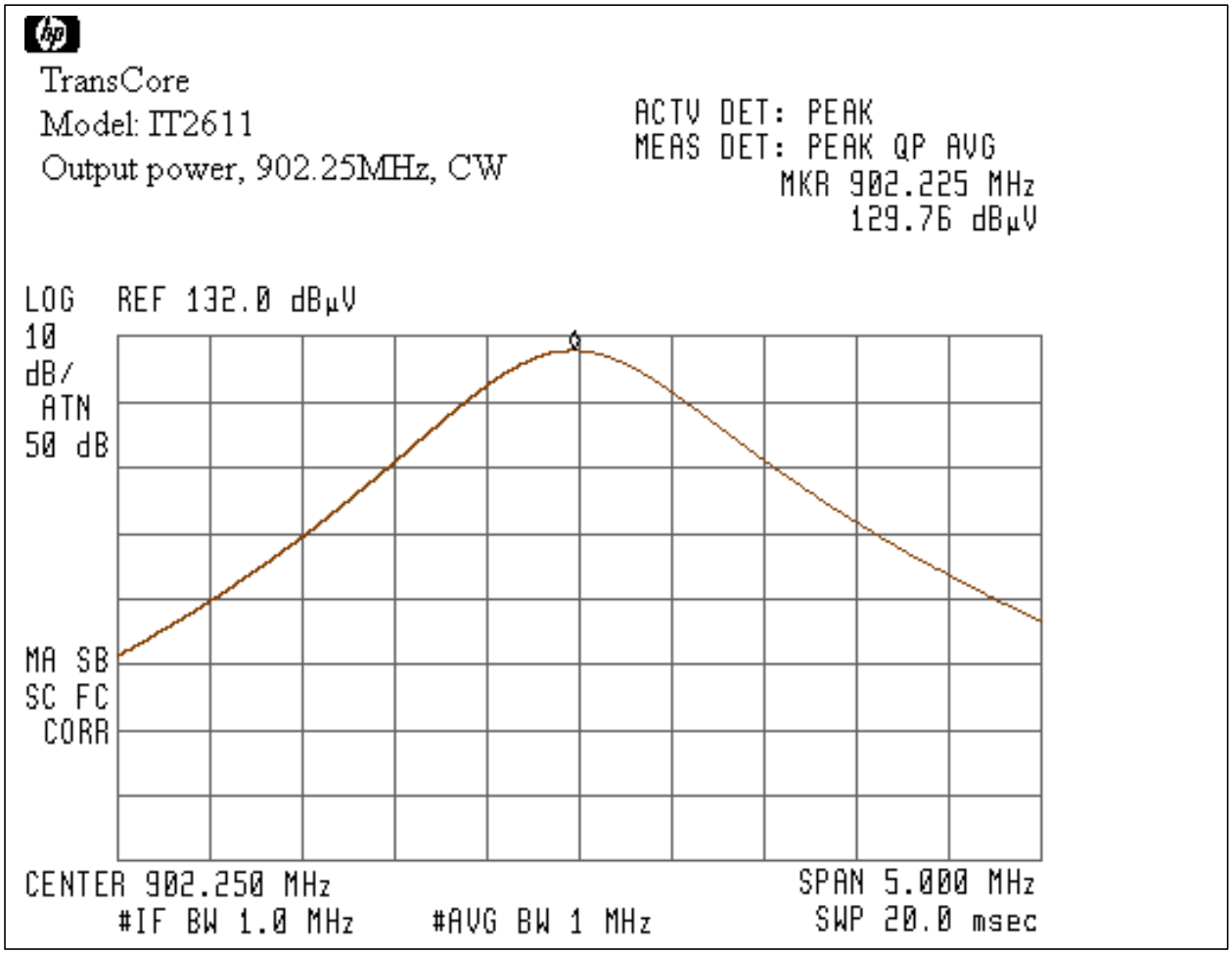
Graph # 3-1-1


TransCore
Model: IT2611
Output power, 902.25MHz, CW
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 902.225 MHz
129.76 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
MA SB
SC FC
CORR
CENTER 902.250 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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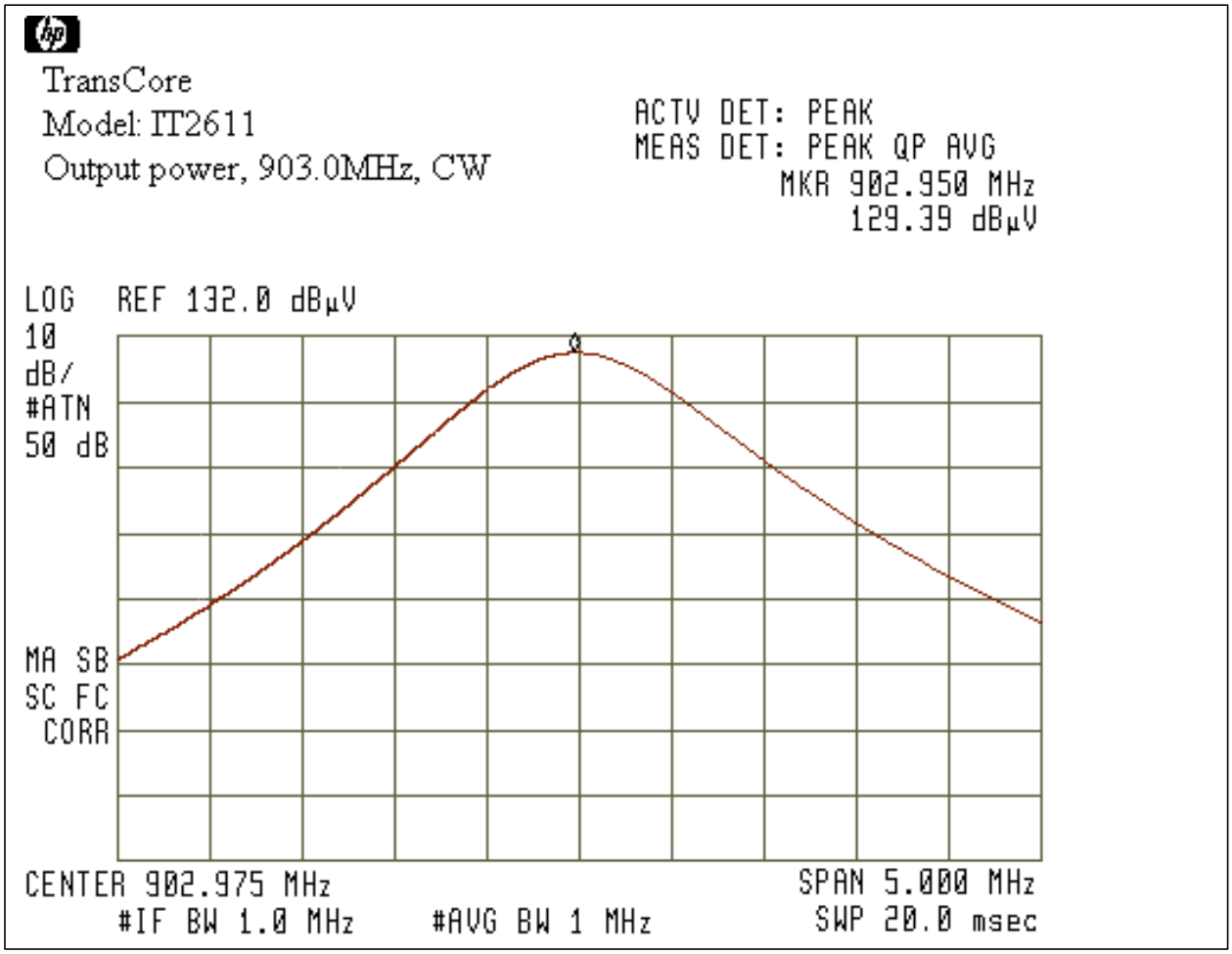
Graph # 3-1-2


TransCore
Model: IT2611
Output power, 903.0MHz, CW
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 902.950 MHz
129.39 dBµV
LOG REF 132.0 dBµV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
CENTER 902.975 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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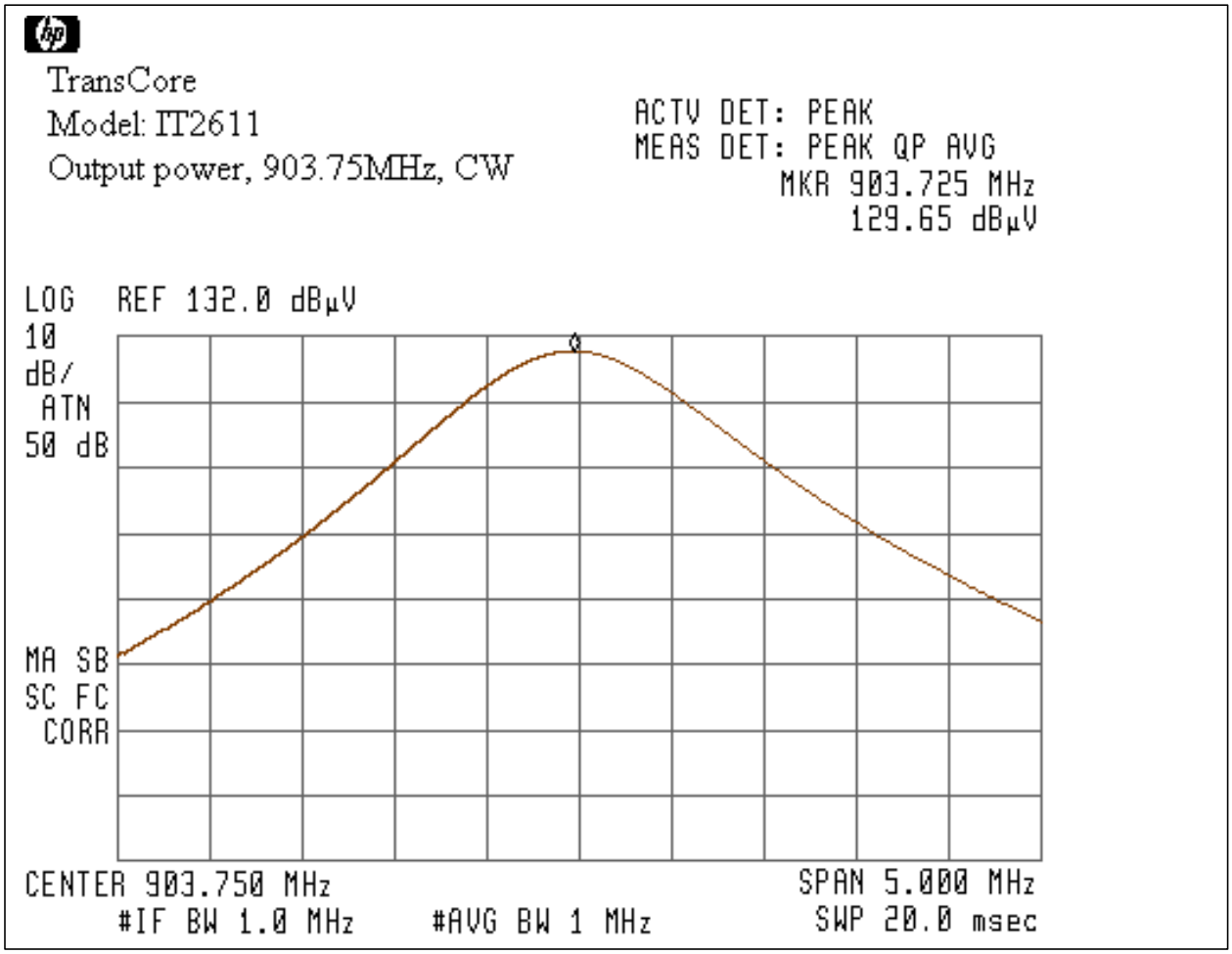
Graph # 3-1-3


TransCore
Model: IT2611
Output power, 903.75MHz, CW
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 903.725 MHz
129.65 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
MA SB
SC FC
CORR
CENTER 903.750 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 5.000 MHz
SWP 20.0 msec

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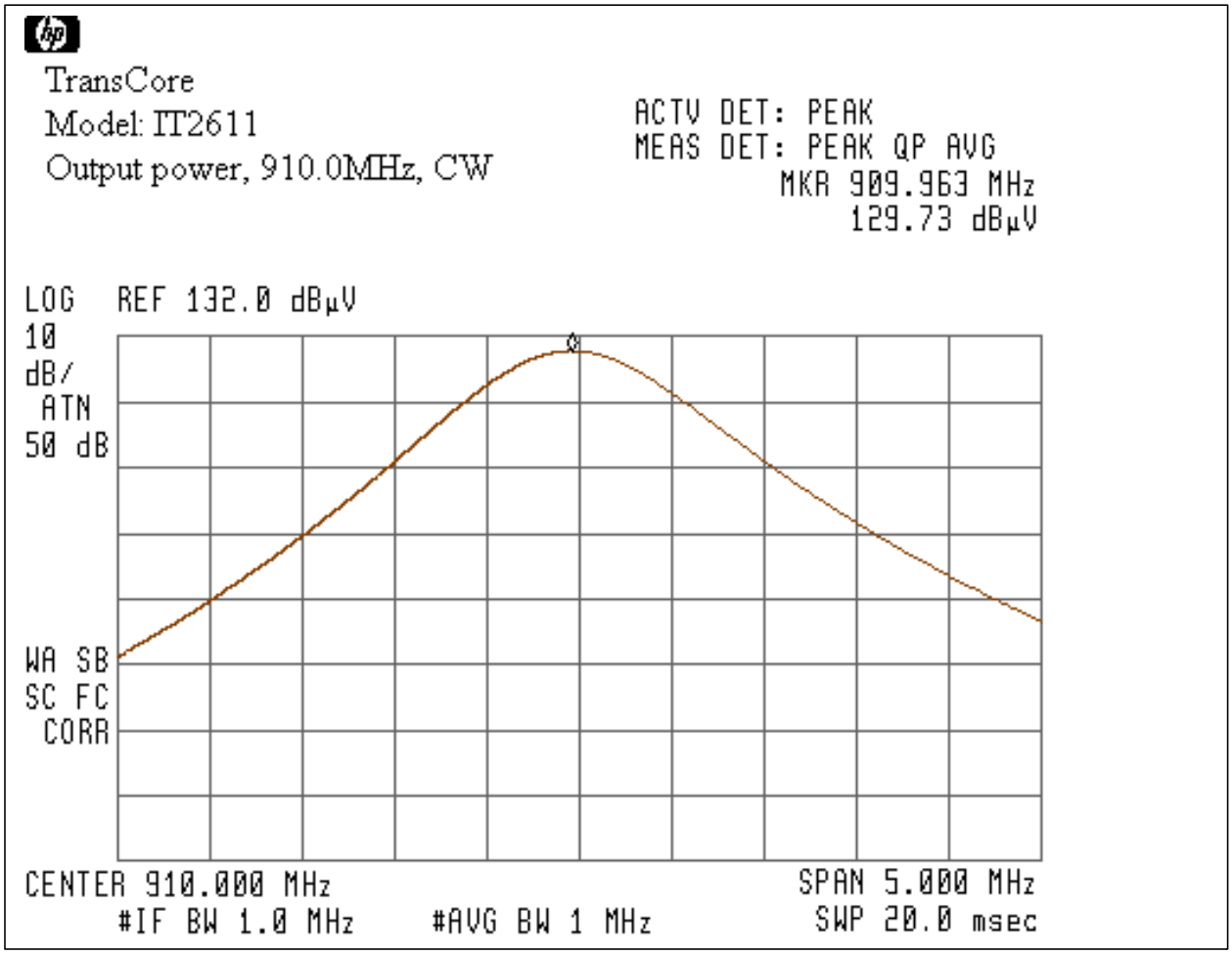
Graph # 3-1-4


TransCore
Model: IT2611
Output power, 910.0MHz, CW
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 909.963 MHz
129.73 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
WA SB
SC FC
CORR
CENTER 910.000 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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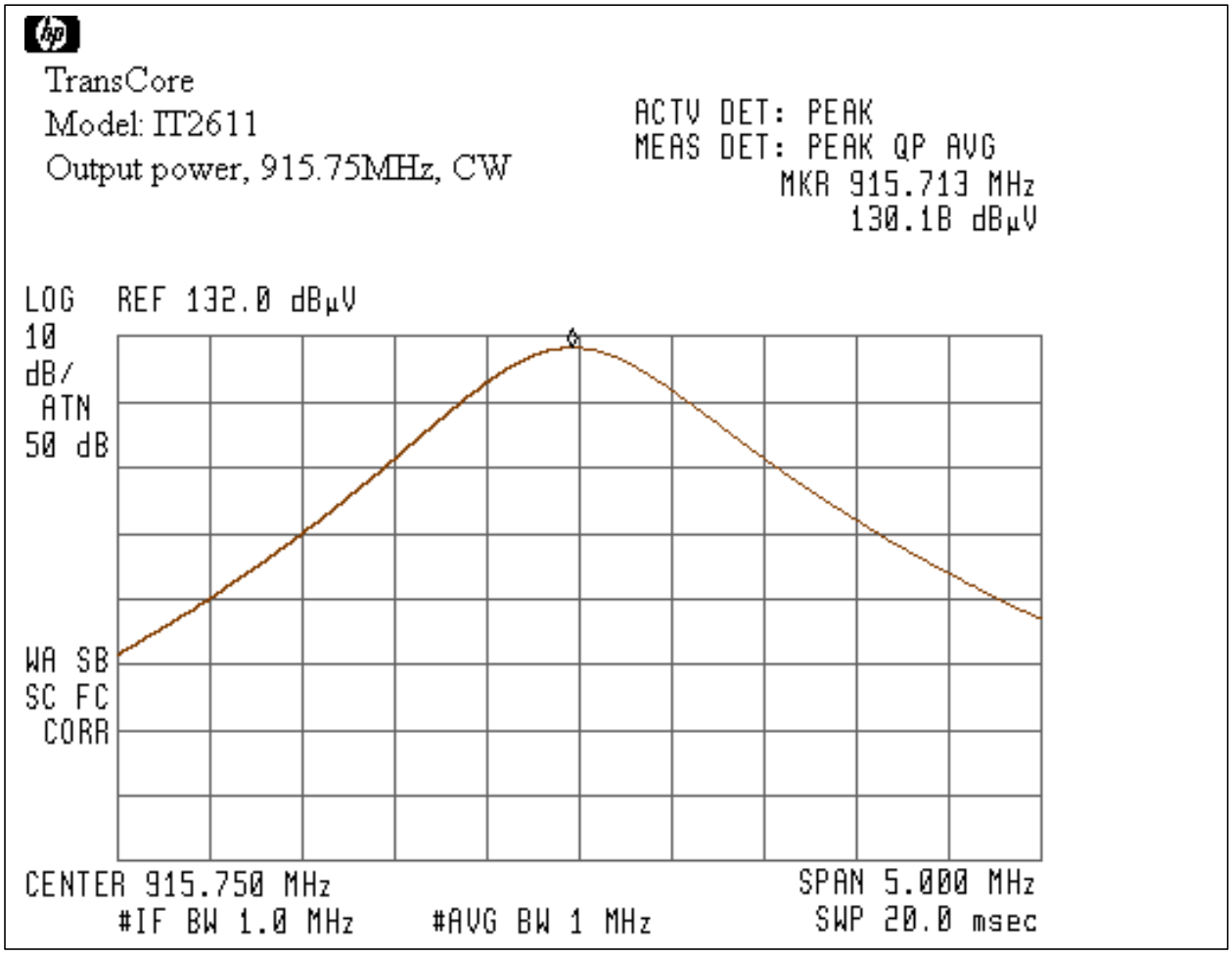
Graph # 3-1-5


TransCore
Model: IT2611
Output power, 915.75MHz, CW
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 915.713 MHz
130.18 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
WA SB
SC FC
CORR
CENTER 915.750 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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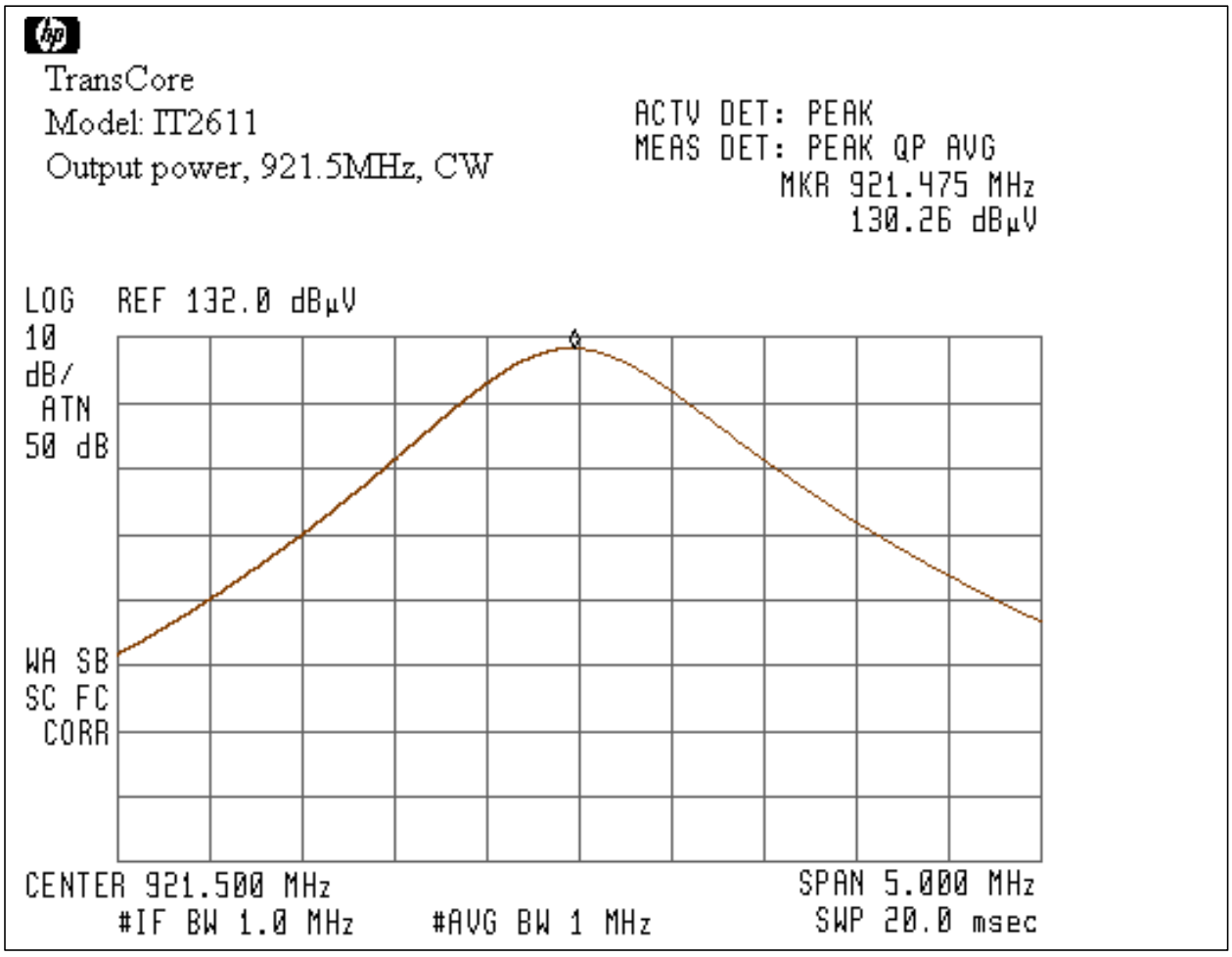
Graph # 3-1-6


TransCore
Model: IT2611
Output power, 921.5MHz, CW
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 921.475 MHz
130.26 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
WA SB
SC FC
CORR
CENTER 921.500 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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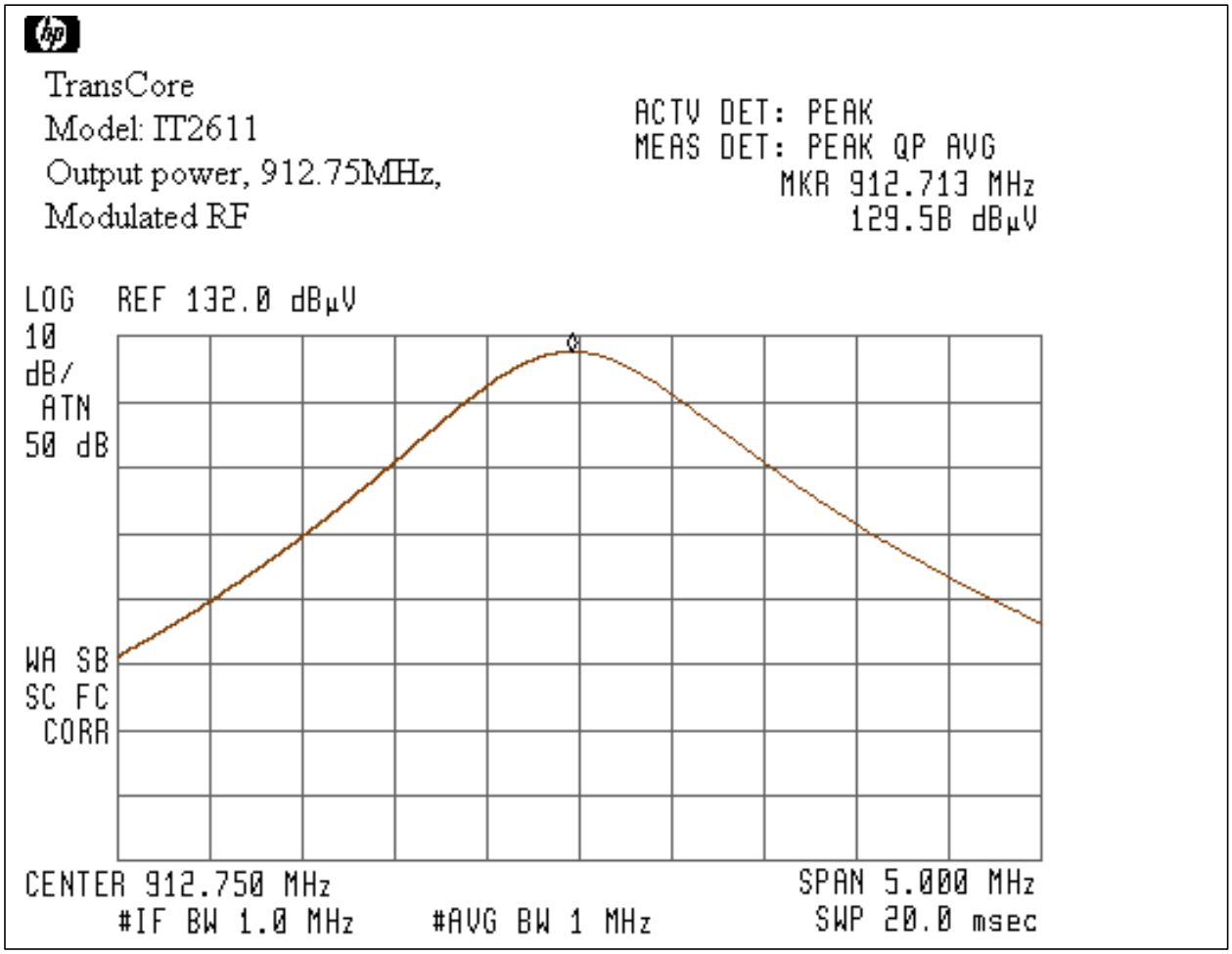
Graph # 3-1-7


TransCore
Model: IT2611
Output power, 912.75MHz,
Modulated RF
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 912.713 MHz
129.58 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
WA SB
SC FC
CORR
CENTER 912.750 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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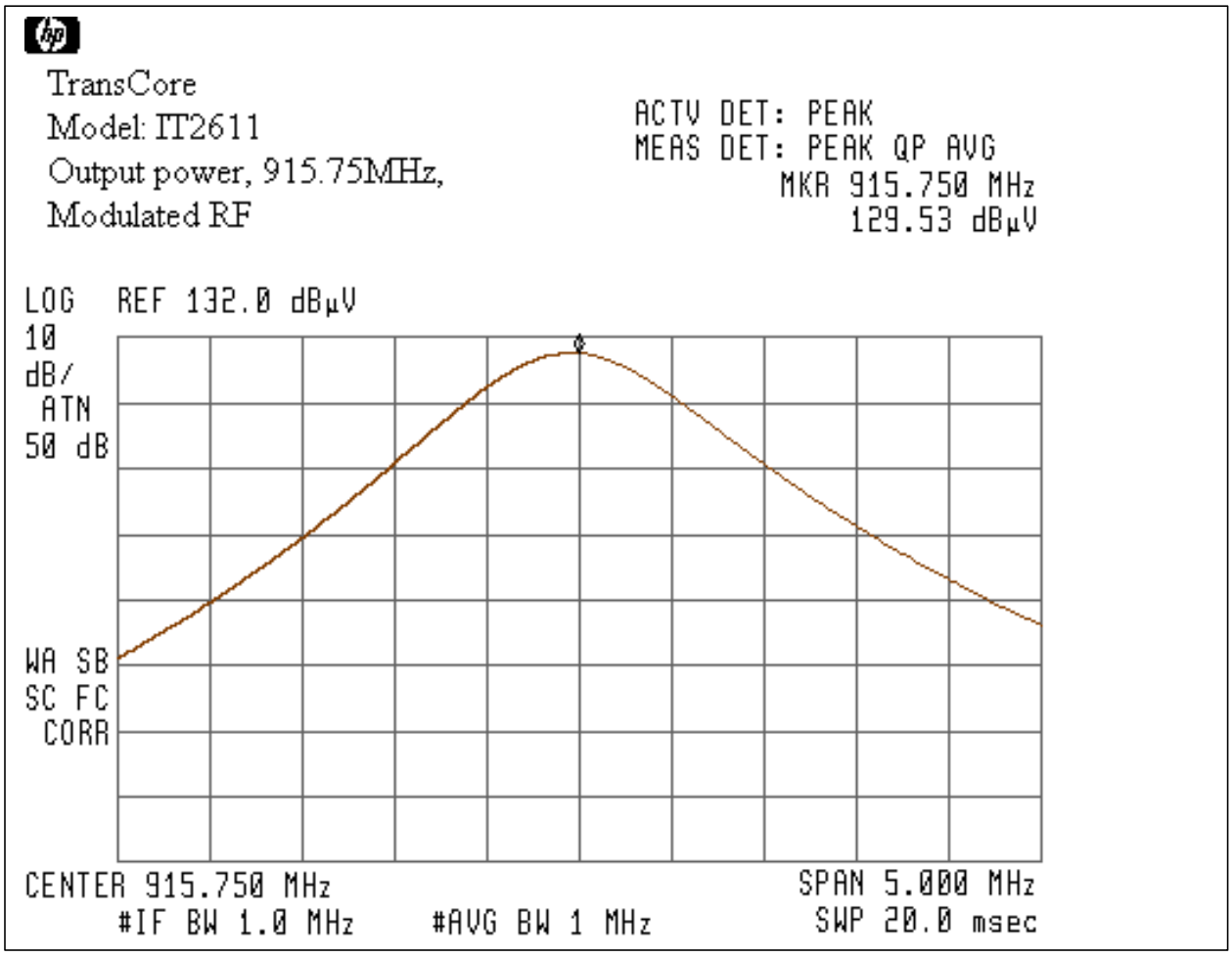
Graph # 3-1-8


TransCore
Model: IT2611
Output power, 915.75MHz,
Modulated RF
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 915.750 MHz
129.53 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
WA SB
SC FC
CORR
CENTER 915.750 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SPAN 5.000 MHz
SWP 20.0 msec

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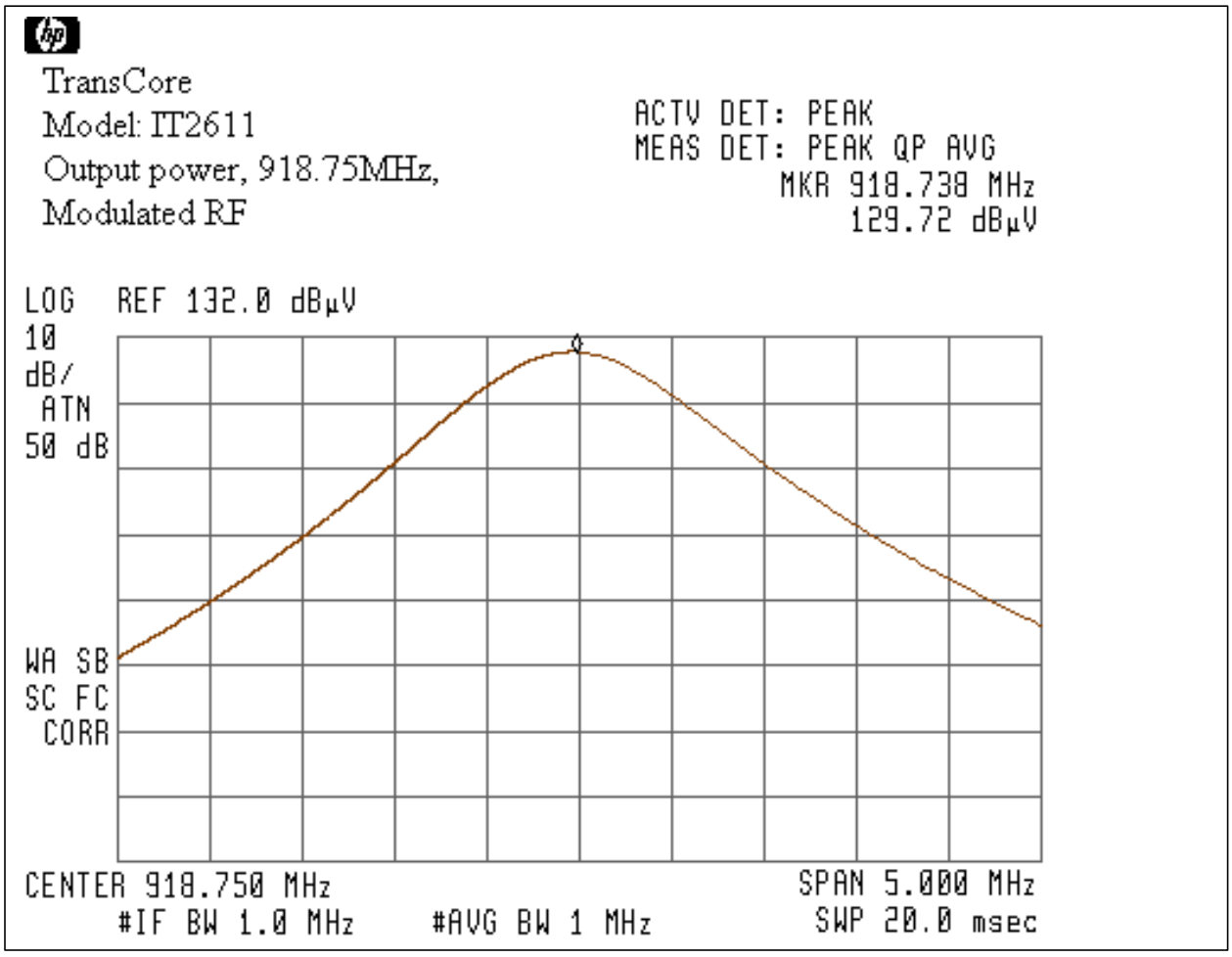
Graph # 3-1-9


TransCore
Model: IT2611
Output power, 918.75MHz,
Modulated RF
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 918.738 MHz
129.72 dBµV
LOG REF 132.0 dBµV
10
dB/
ATN
50 dB
WA SB
SC FC
CORR
CENTER 918.750 MHz
SPAN 5.000 MHz
#IF BW 1.0 MHz
#AVG BW 1 MHz
SWP 20.0 msec

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3.2 Occupied Bandwidth, FCC 90.209(b)(5), 2.1049

Occupied Bandwidth measurements were made for frequencies 902.25MHz, 903.0MHz, 903.75MHz, 910.0MHz, 915.75MHz, and 921.5MHz with unmodulated signal (CW) and for frequencies 912.75MHz, 915.75MHz, and 918.75MHz with modulated RF signal.

Test Procedure

The Occupied Bandwidth for the device was measured at the maximum power transmission condition. The transmitter antenna port was connected to the Spectrum analyzer via the attenuator. The Occupied Bandwidth was measured based on the analyzer 99% power measurement option.

The measured Occupied Bandwidth was compared with the maximum allowed bandwidth of 2MHz in frequency range from 902 to 904MHz and 12MHz in frequency range 909.75 to 921.75MHz according to FCC 90.209(b)(5).

Table and graphs below show the Occupied Bandwidth test result.
Note: Emission level shown in the Graphs does not include 6.2dB attenuation factor of the attenuator.

According to FCC 2.202 and type of modulation, the Necessary Bandwidth was determined from the Occupied Bandwidth measurements (See Table # 3-2-1).

The Necessary Bandwidth is:

850Hz - for unmodulated signal (240KN0N Emissions Designator)

1.025MHz – for modulated signal (1M03L1D Emissions Designator)

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Occupied Bandwidth **Date:** 01-03-2002
Company: TransCore
Model: IT2611
Test Engineer: Norman Shpilsher
Special Config. Info: The EUT antenna terminal was connected to the Spectrum Analyzer through the attenuator 6.2dB (including cable loss).
Standard: FCC Part 90.209(b)(5) and Part 2.1049

Table # 3-2-1

Output Freq. MHz	Measured Bandwidth with 99% Power kHz	Maximum Bandwidth MHz	Test Result
902.25 (CW)	0.80	2.0	Pass
903.00 (CW)	0.85	2.0	Pass
903.75 (CW)	0.85	2.0	Pass
910.00 (CW)	0.85	12.0	Pass
915.75 (CW)	0.85	12.0	Pass
921.50 (CW)	0.85	12.0	Pass
912.75 (Mod)	1020	12.0	Pass
915.75 (Mod)	1010	12.0	Pass
918.75 (Mod)	1025	12.0	Pass

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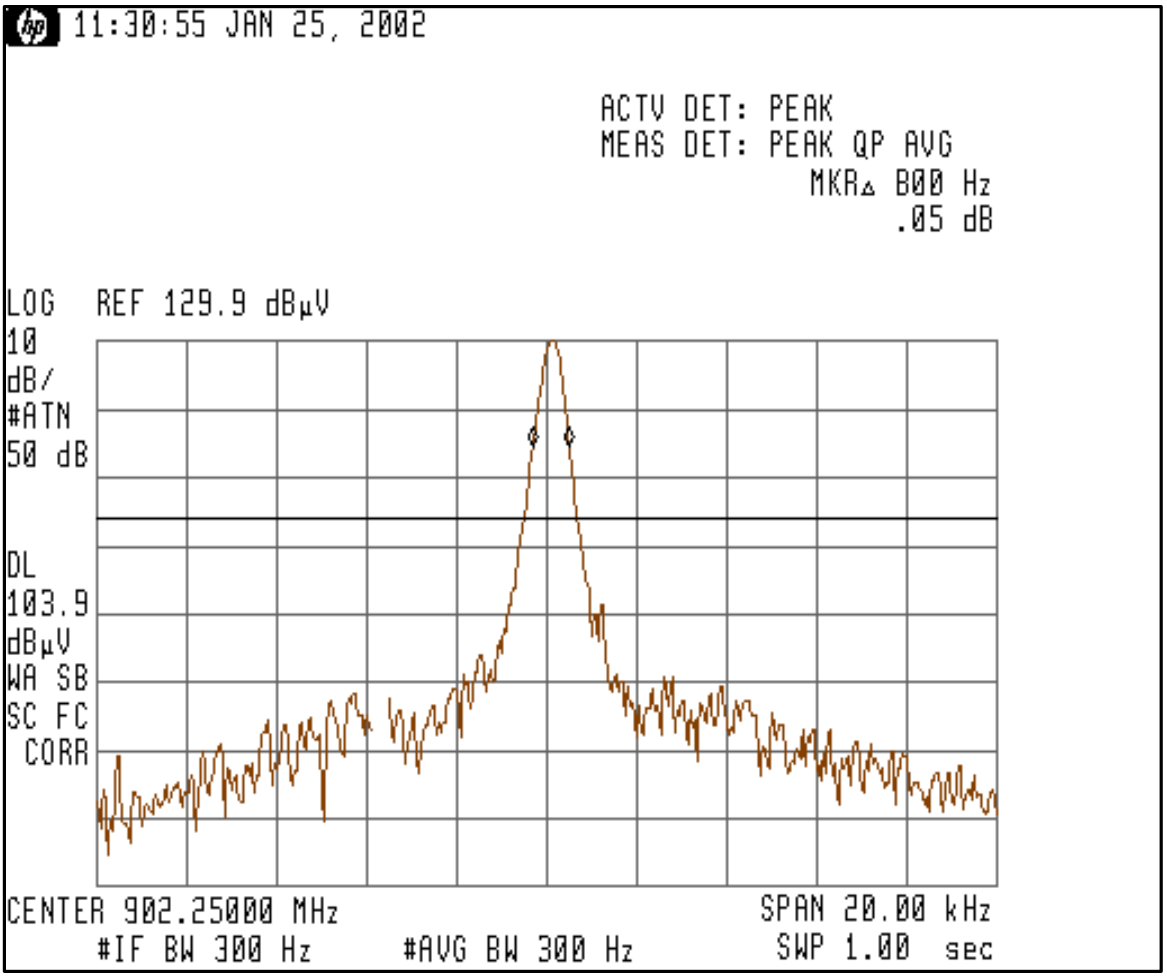
Graph # 3-2-1


11:30:55 JAN 25, 2002
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 800 Hz
.05 dB
LOG REF 129.9 dBµV
10
dB/
#ATN
50 dB
DL
103.9
dBµV
WA SB
SC FC
CORR
CENTER 902.25000 MHz
SPAN 20.00 kHz
#IF BW 300 Hz
#AVG BW 300 Hz
SWP 1.00 sec

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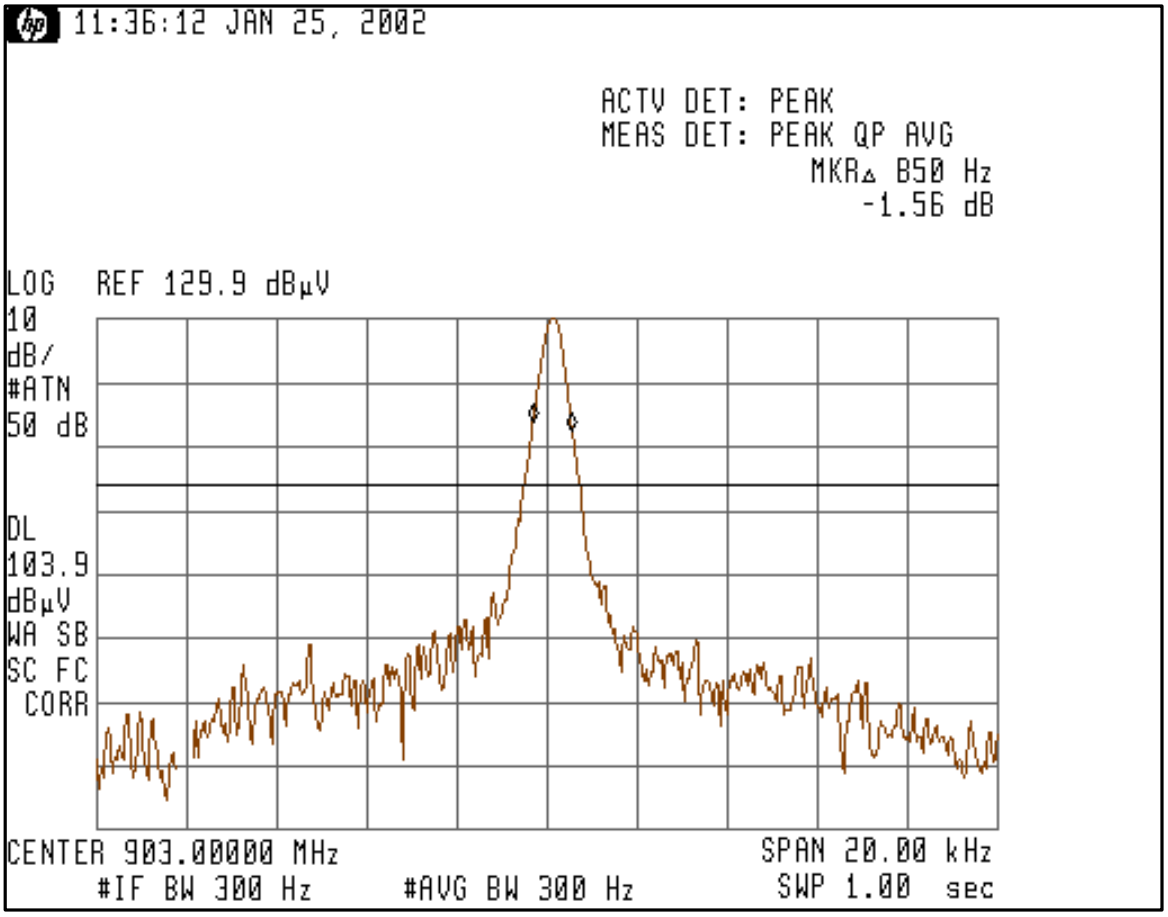
Graph # 3-2-2


11:36:12 JAN 25, 2002
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 850 Hz
-1.56 dB
LOG REF 129.9 dBµV
10
dB/
#ATN
50 dB
DL
103.9
dBµV
WA SB
SC FC
CORR
CENTER 903.00000 MHz
SPAN 20.00 kHz
#IF BW 300 Hz
#AVG BW 300 Hz
SWP 1.00 sec

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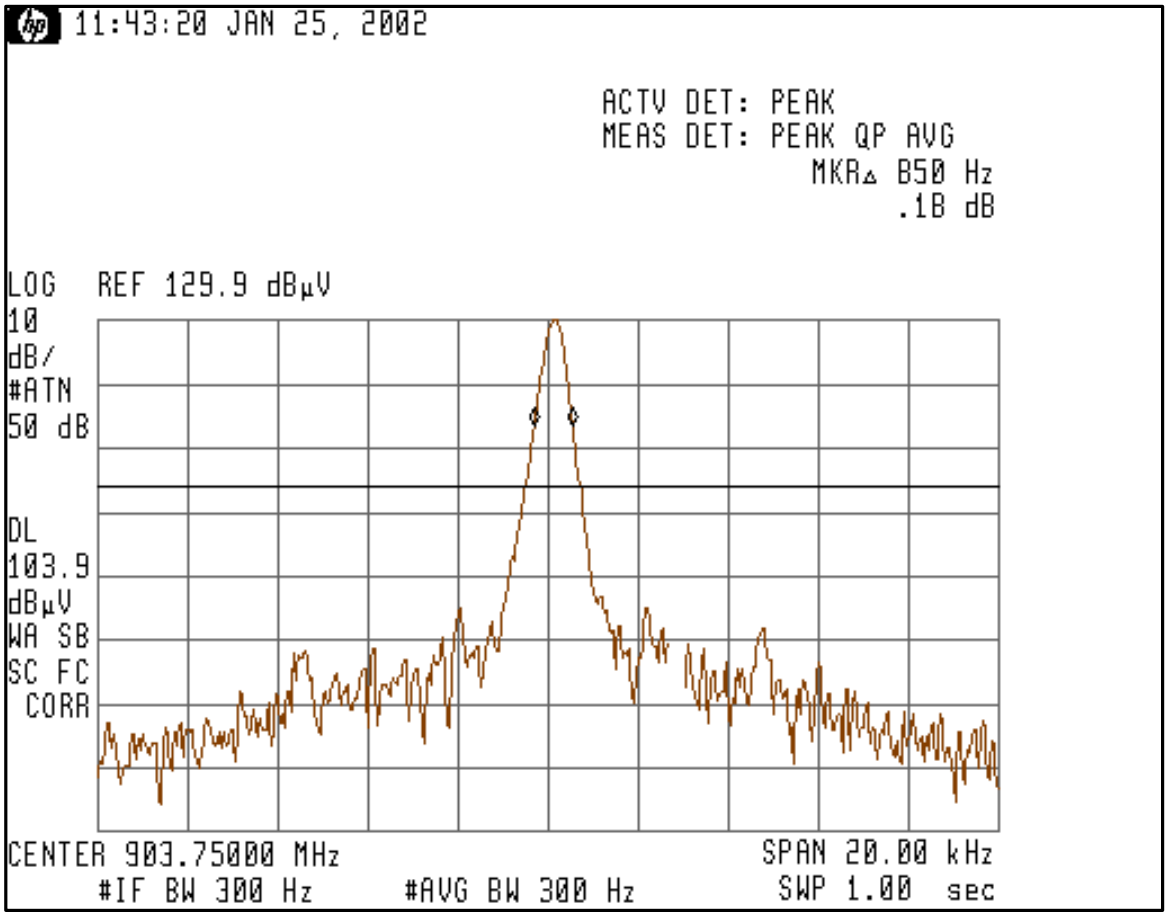
Graph # 3-2-3


11:43:20 JAN 25, 2002
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ B50 Hz
.1B dB
LOG REF 129.9 dBµV
10
dB/
#ATN
50 dB
DL
103.9
dBµV
WA SB
SC FC
CORR
CENTER 903.75000 MHz
SPAN 20.00 kHz
#IF BW 300 Hz
#AVG BW 300 Hz
SWP 1.00 sec

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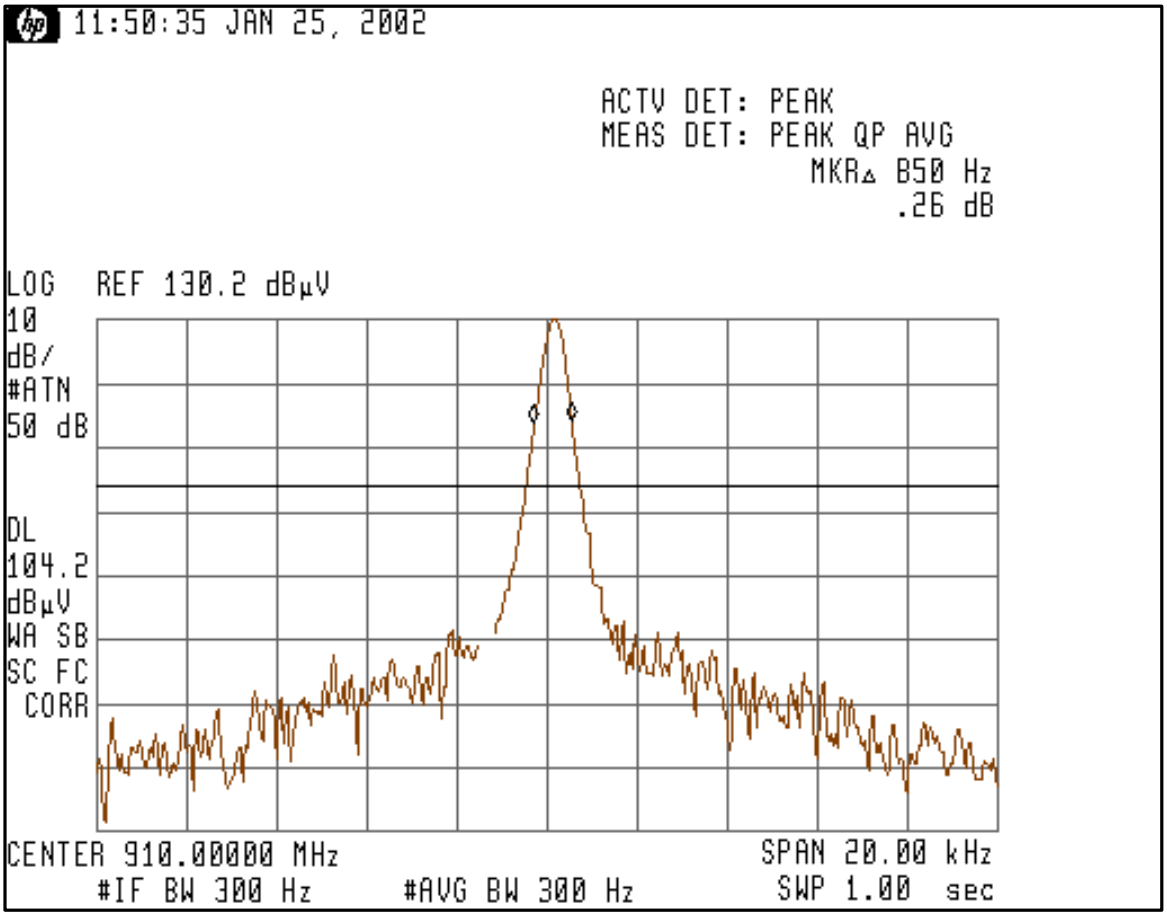
Graph # 3-2-4


11:50:35 JAN 25, 2002
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ B50 Hz
.26 dB
LOG REF 130.2 dBµV
10
dB/
#ATN
50 dB
DL
104.2
dBµV
WA SB
SC FC
CORR
CENTER 910.00000 MHz
SPAN 20.00 kHz
#IF BW 300 Hz
#AVG BW 300 Hz
SWP 1.00 sec

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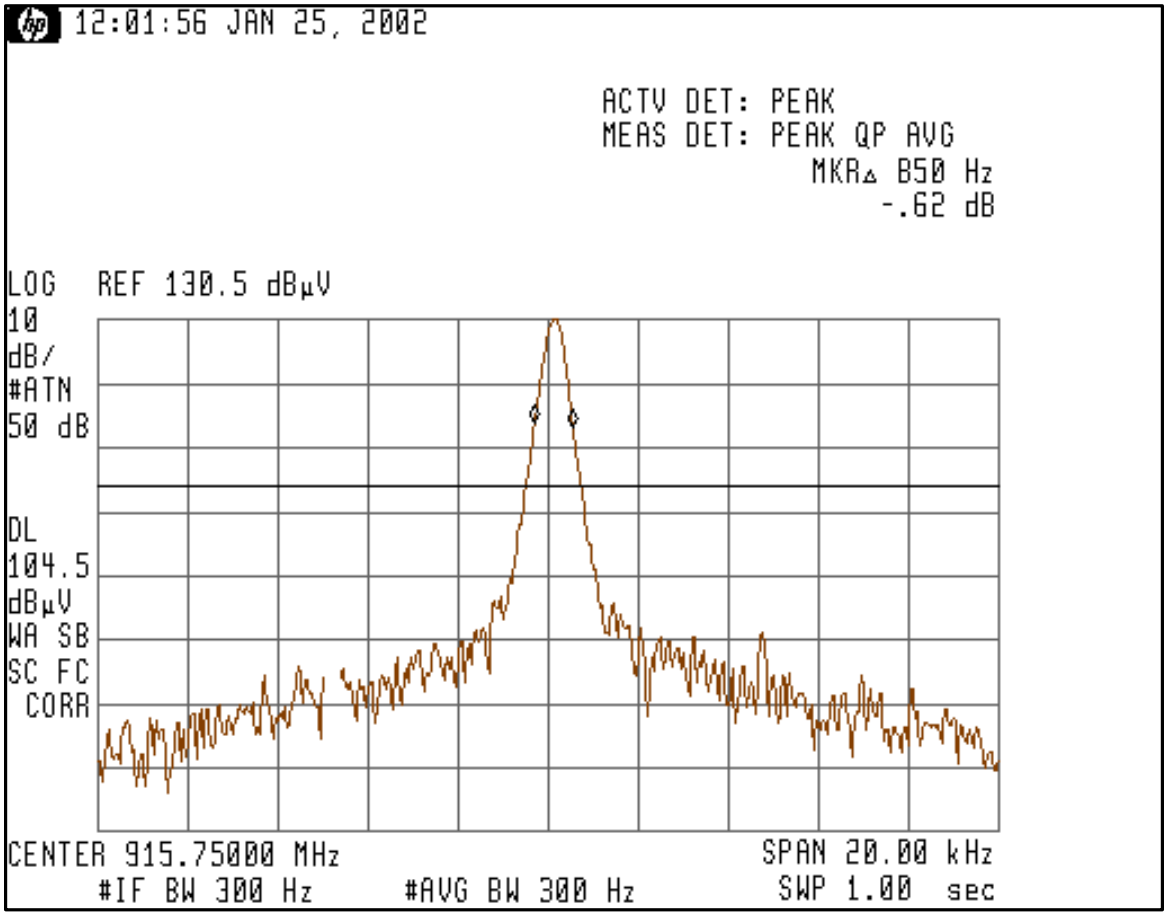
Graph # 3-2-5


12:01:56 JAN 25, 2002
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ B50 Hz
-.62 dB
LOG REF 130.5 dBµV
10
dB/
#ATN
50 dB
DL
104.5
dBµV
WA SB
SC FC
CORR
CENTER 915.75000 MHz
SPAN 20.00 kHz
#IF BW 300 Hz
#AVG BW 300 Hz
SWP 1.00 sec

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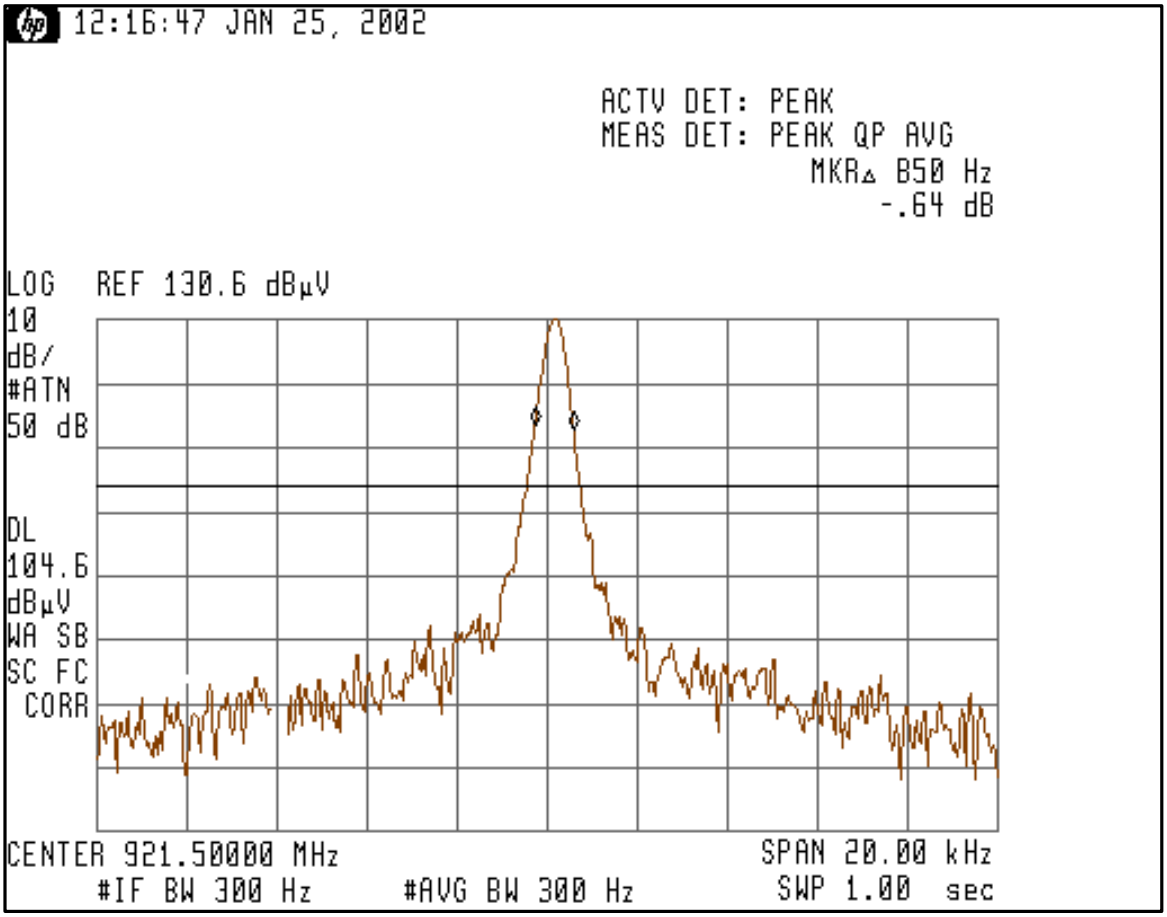
Graph # 3-2-6


12:16:47 JAN 25, 2002
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 850 Hz
-.64 dB
LOG REF 130.6 dBµV
10
dB/
#ATN
50 dB
DL
104.6
dBµV
WA SB
SC FC
CORR
CENTER 921.50000 MHz
SPAN 20.00 kHz
#IF BW 300 Hz
#AVG BW 300 Hz
SWP 1.00 sec

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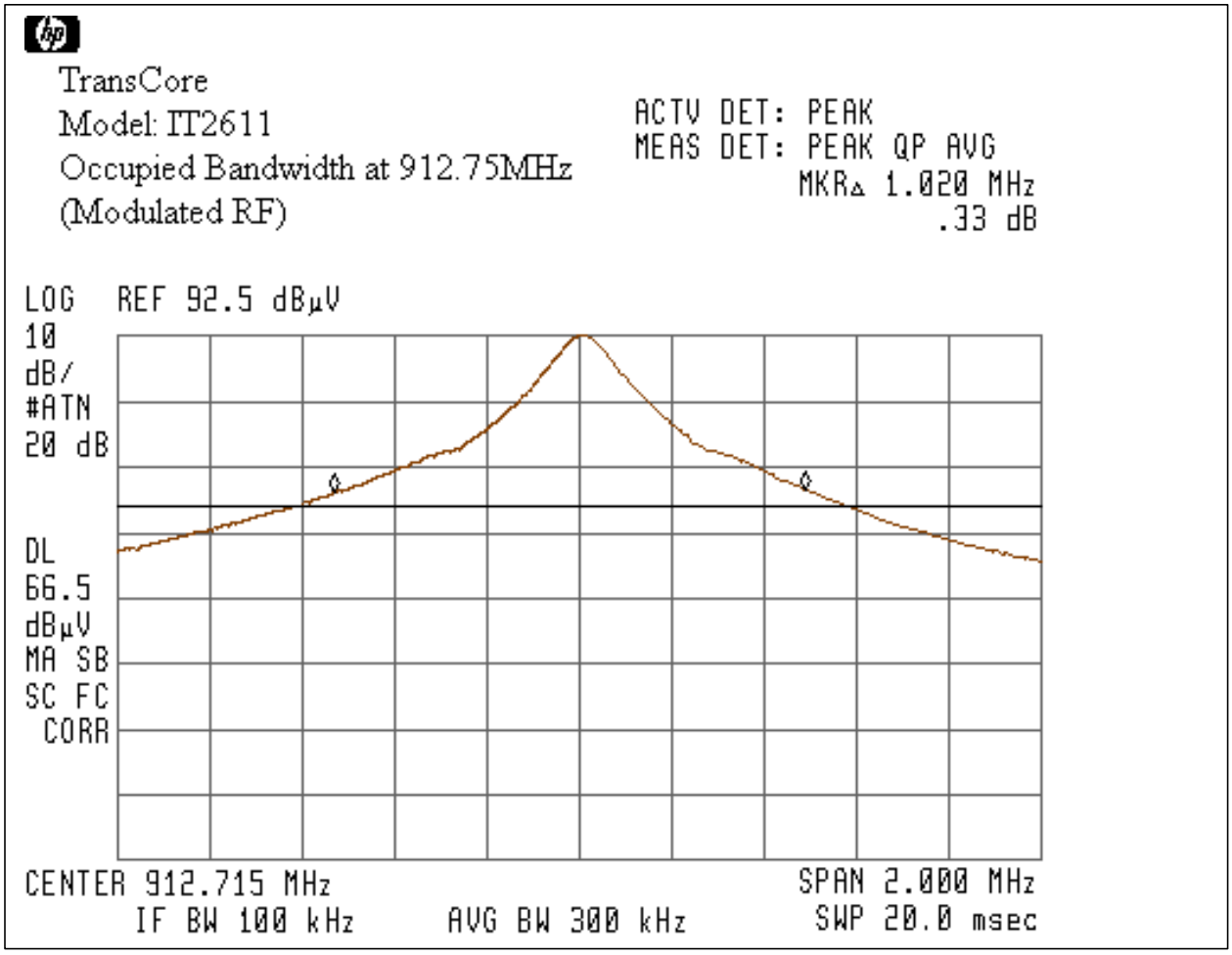
Graph # 3-2-7


TransCore
Model: IT2611
Occupied Bandwidth at 912.75MHz
(Modulated RF)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.020 MHz
.33 dB
LOG REF 92.5 dBµV
10
dB/
#ATN
20 dB
DL
66.5
dBµV
MA SB
SC FC
CORR
CENTER 912.715 MHz
SPAN 2.000 MHz
IF BW 100 kHz
AVG BW 300 kHz
SWP 20.0 msec

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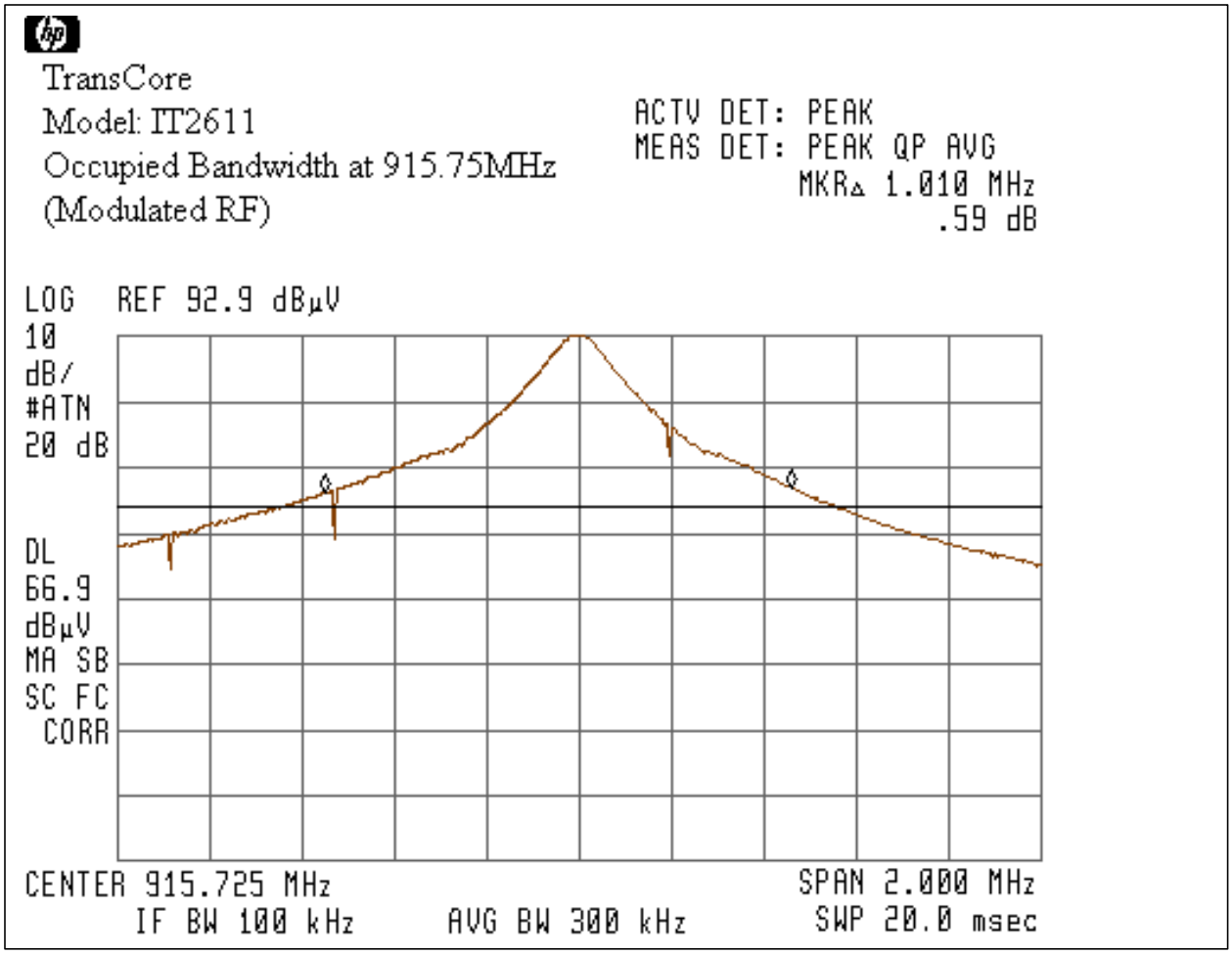
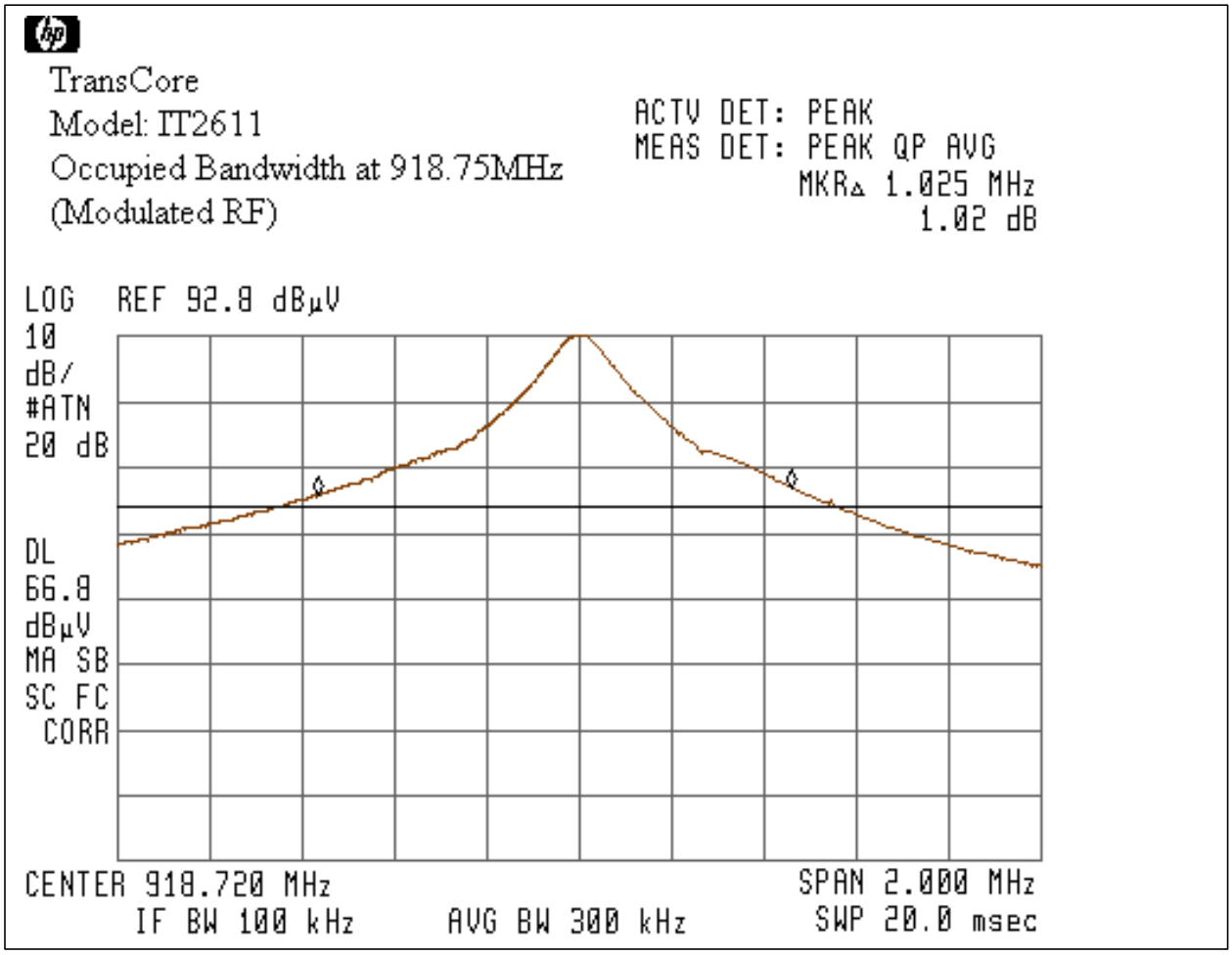
Graph # 3-2-8


TransCore
Model: IT2611
Occupied Bandwidth at 915.75MHz
(Modulated RF)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.010 MHz
.59 dB
LOG REF 92.9 dBµV
10
dB/
#ATN
20 dB
DL
66.9
dBµV
MA SB
SC FC
CORR
CENTER 915.725 MHz
SPAN 2.000 MHz
IF BW 100 kHz
AVG BW 300 kHz
SWP 20.0 msec

A

Graph # 3-2-9


TransCore
Model: IT2611
Occupied Bandwidth at 918.75MHz
(Modulated RF)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 1.025 MHz
1.02 dB
LOG REF 92.8 dBµV
10
dB/
#ATN
20 dB
DL
66.8
dBµV
MA SB
SC FC
CORR
CENTER 918.720 MHz
SPAN 2.000 MHz
IF BW 100 kHz
AVG BW 300 kHz
SWP 20.0 msec

A

3.3 Spurious Emissions at Antenna Terminal, FCC 90.210(k)(3)(ii), 2.1051

Spurious Emissions at antenna terminal was measured in frequency range up to 10 GHz (10^{th} harmonic).

Test Procedure

The Spurious Emissions at Antenna Terminal for the device was measured at the maximum power transmission condition. The transmitter antenna port was connected to the Spectrum analyzer via the attenuator.

Total Emissions level was calculated from Measured Power adding 6.2dB of the external-of-analyzer attenuator.

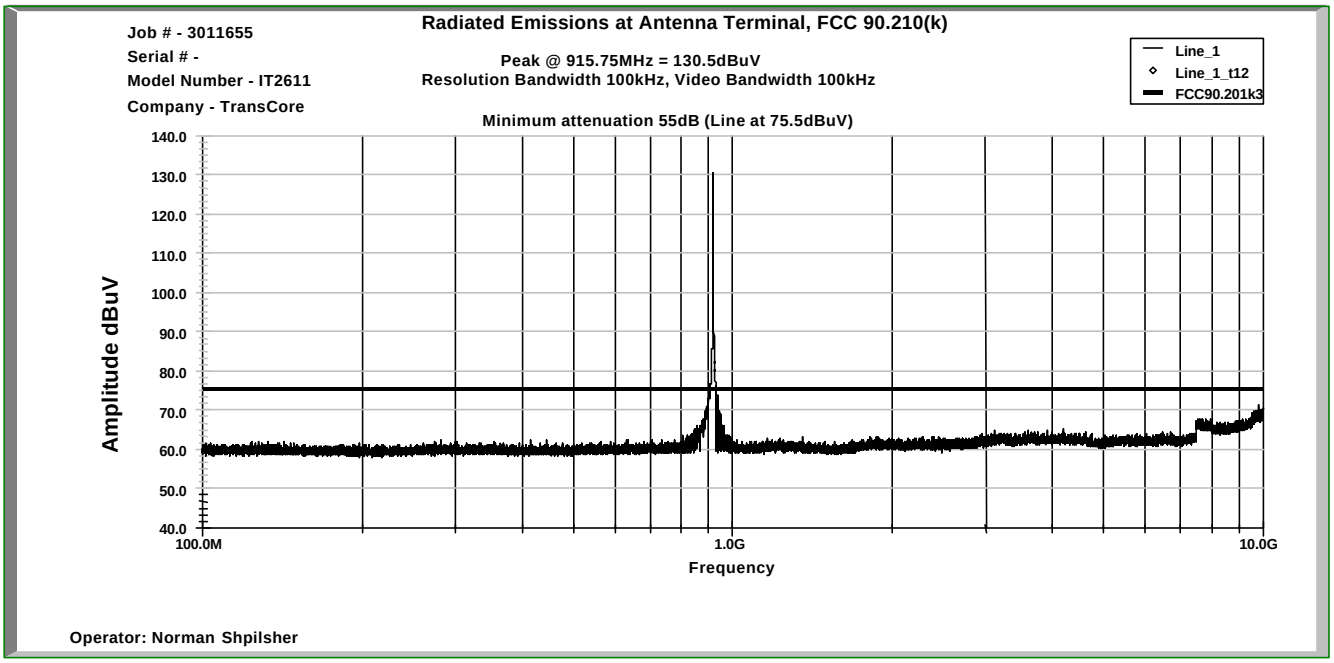
The Minimum Emission Attenuation calculation
The minimum emissions attenuation was calculated using the maximum output power P (Watt):
Minimum Attenuation = 55 + 10log (P)
The maximum measured output power in Section 3.1 is 29.5dBm, or 0.891 Watt
According to the client specification, the maximum output power at antenna terminal is 1 Watt, or 30dBm.
As a worse case, the Minimum Attenuation based on 1Watt maximum output power is chosen as a reference level:
Minimum Attenuation = 55 + 10log (P) = 55 + 10log(1Watt) = 55dB

No spurious or harmonics emissions were observed at antenna terminal in frequency range up to 10GHz (10^{th} harmonic).

Graph below shows the spurious emissions at antenna terminal.
Note: Emission level shown in the Graphs does not include 6.2dB attenuation factor of the attenuator.

A

Graph # 3-3-1


Radiated Emissions at Antenna Terminal, FCC 90.210(k)
Job # - 3011655
Serial # -
Model Number - IT2611
Company - TransCore
Peak @ 915.75MHz = 130.5dBuV
Resolution Bandwidth 100kHz, Video Bandwidth 100kHz
Minimum attenuation 55dB (Line at 75.5dBuV)
Line_1
Line_1_t12
FCC90.201k3
Amplitude dBuV
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
100.0M
1.0G
10.0G
Frequency
Operator: Norman Shpilsher

A

3.4 Out of Band Spurious Emissions at Antenna Terminal, FCC 90.210(k)(3)(ii), 2.1051

Out-of-band measurements were made for frequencies:
- 902MHz
- 904MHz
- 909.5MHz
- 921.75MHz.

Output frequencies of the EUT was set to:
- 902.25MHz (CW)
- 903.75MHz (CW)
- 910.00MHz (CW)
- 921.50MHz (CW)
- 912.75MHz (Modulated RF)
- 918.75MHz (Modulated RF)

Test Procedure

The Spurious Emissions at Antenna Terminal for the device was measured at the maximum power transmission condition. The transmitter antenna port was connected to the Spectrum analyzer via the attenuator.

Total Emissions level was calculated from Measured Power adding 6.2dB of the external-of-analyzer attenuator.

The Minimum Emission Attenuation calculation
The minimum emissions attenuation was calculated using the maximum output power P (Watt):
Minimum Attenuation = 55 + 10log (P)
The maximum measured output power in Section 3.1 is 29.5dBm, or 0.891 Watt
According to the client specification, the maximum output power at antenna terminal is 1 Watt, or 30dBm.
As a worse case, the Minimum Attenuation based on 1Watt maximum output power is chosen as a reference level:
Minimum Attenuation = 55 + 10log (P) = 55 + 10log(1Watt) = 55dB

Measurements were taken using 100kHz Resolution Bandwidth (RBW) of the Analyzer, for frequencies within 1MHz of the Bandedge 300Hz RBW was used.

Table and graphs below show the out-of-band spurious emissions at antenna terminal
Note: Emission level shown in the Graphs does not include 6.2dB attenuation factor of the attenuator.

A

Out-of-band Spurious Emissions at Antenna Terminal **Date:** 01-14-2001

Company: TransCore

Model: IT2611

Test Engineer: Norman Shpilsher

Special Config. Info: The EUT antenna terminal was connected to the Spectrum Analyzer through the attenuator 6.2dB (including cable loss).

Standard: FCC Part 90.210(k)(3)(ii) and Part 2.1051

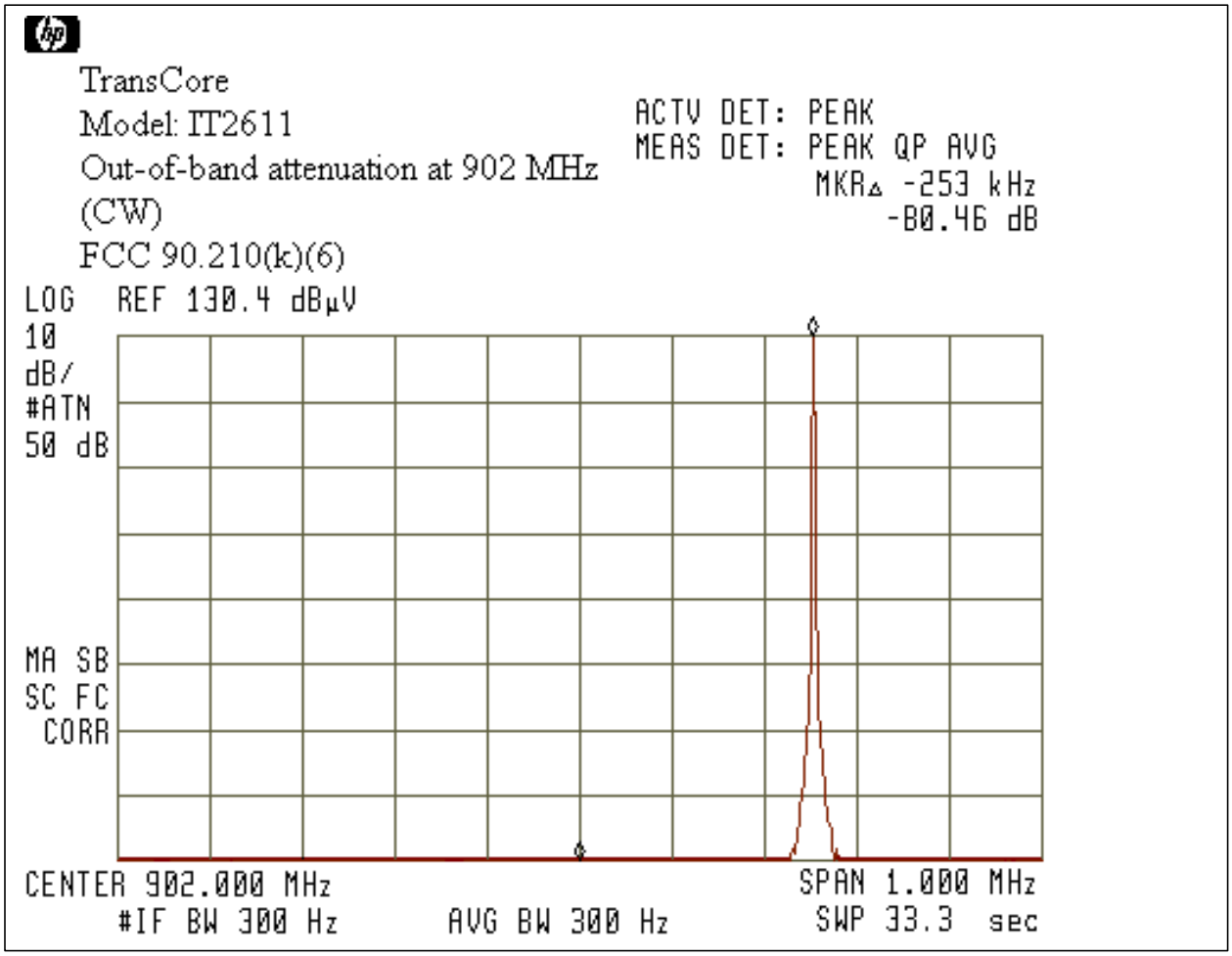
Note: Measurements were taken using 100kHz Resolution Bandwidth (RBW) of the Analyzer, for frequencies within 1MHz of the Bandedge 300Hz RBW was used (indicated in the Table).

Table # 3-4-1

Output Freq. MHz	Edge Freq. MHz	Maximum Output Power Watt	Minimum Atten. dB	Measured Atten.	Margin dB	Comments
902.25 (CW)	902.00	1.0	55.0	80.5	-25.5	RBW 300Hz
903.75 (CW)	904.00	1.0	55.0	79.8	-24.8	RBW 300Hz
910.00 (CW)	909.50	1.0	55.0	82.4	-27.4	RBW 300Hz
921.50 (CW)	921.75	1.0	55.0	80.4	-25.4	RBW 300Hz
912.75 (Mod)	909.50	1.0	55.0	63.0	-8.0	
918.75 (Mod)	921.75	1.0	55.0	59.3	-4.3	

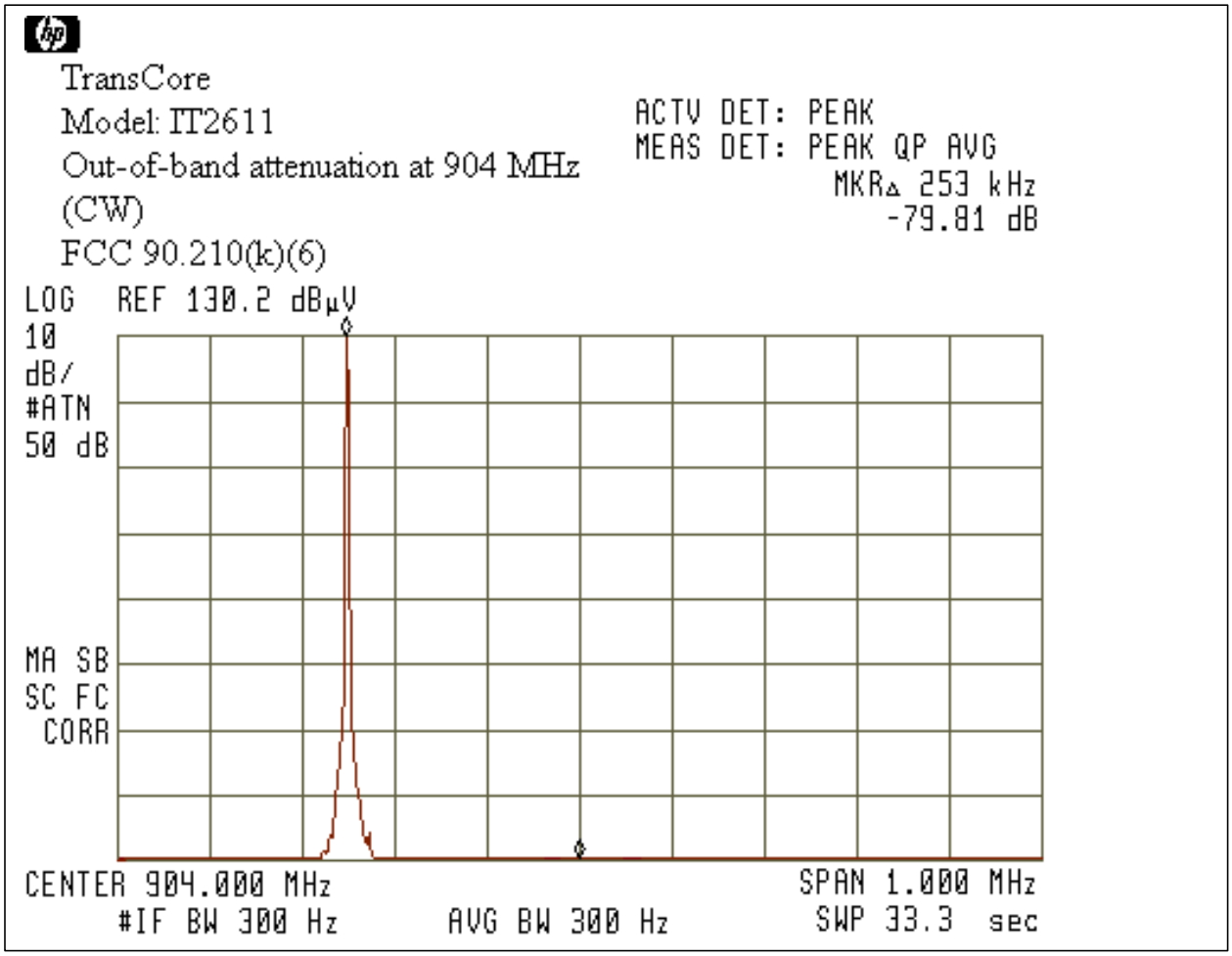
A

Graph # 3-4-1


TransCore
Model: IT2611
Out-of-band attenuation at 902 MHz
(CW)
FCC 90.210(k)(6)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -253 kHz
-80.46 dB
LOG REF 130.4 dBµV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
CENTER 902.000 MHz
SPAN 1.000 MHz
#IF BW 300 Hz
AVG BW 300 Hz
SWP 33.3 sec

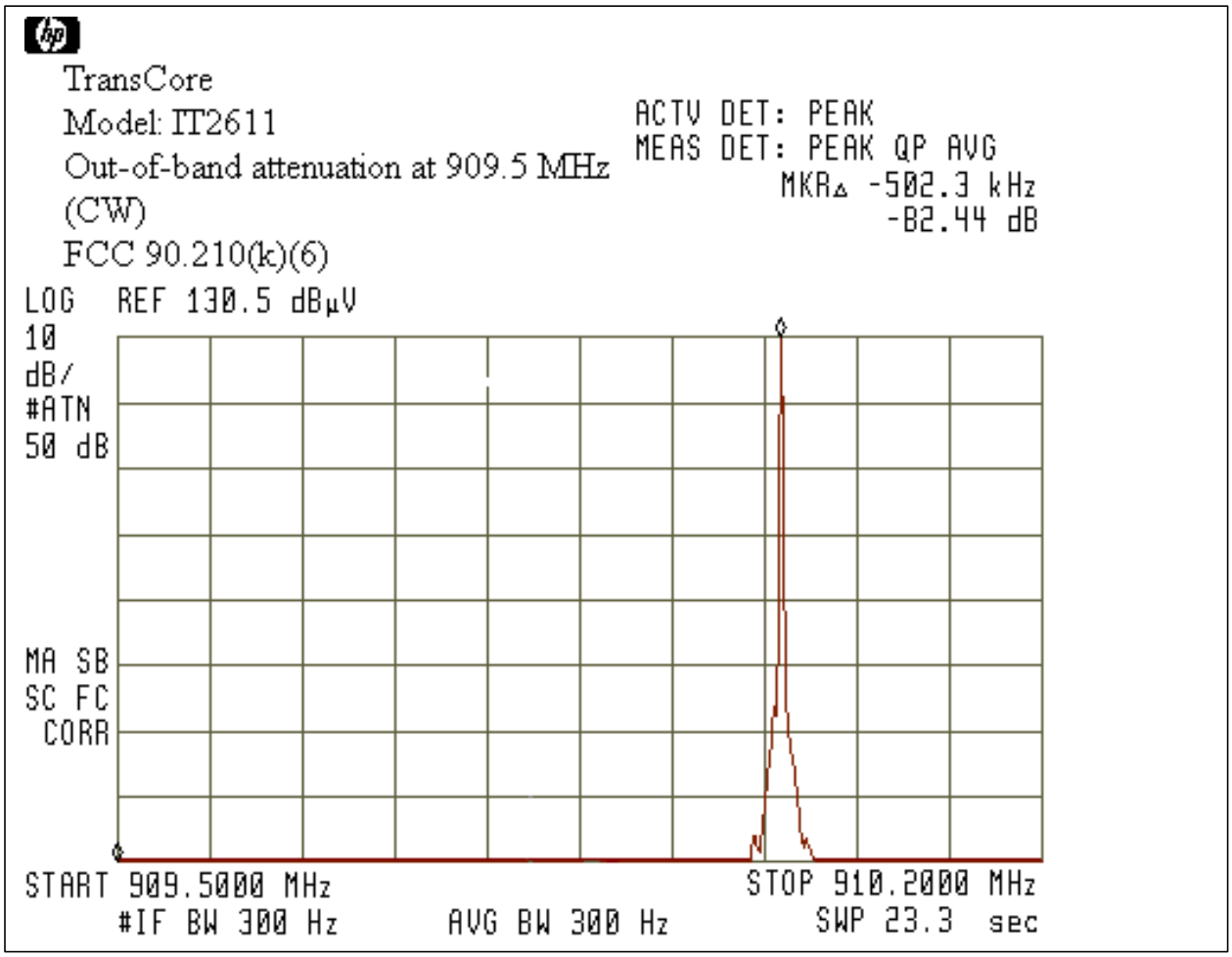
A

Graph # 3-4-2


TransCore
Model: IT2611
Out-of-band attenuation at 904 MHz
(CW)
FCC 90.210(k)(6)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 253 kHz
-79.81 dB
LOG REF 130.2 dBµV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
CENTER 904.000 MHz
SPAN 1.000 MHz
#IF BW 300 Hz
AVG BW 300 Hz
SWP 33.3 sec

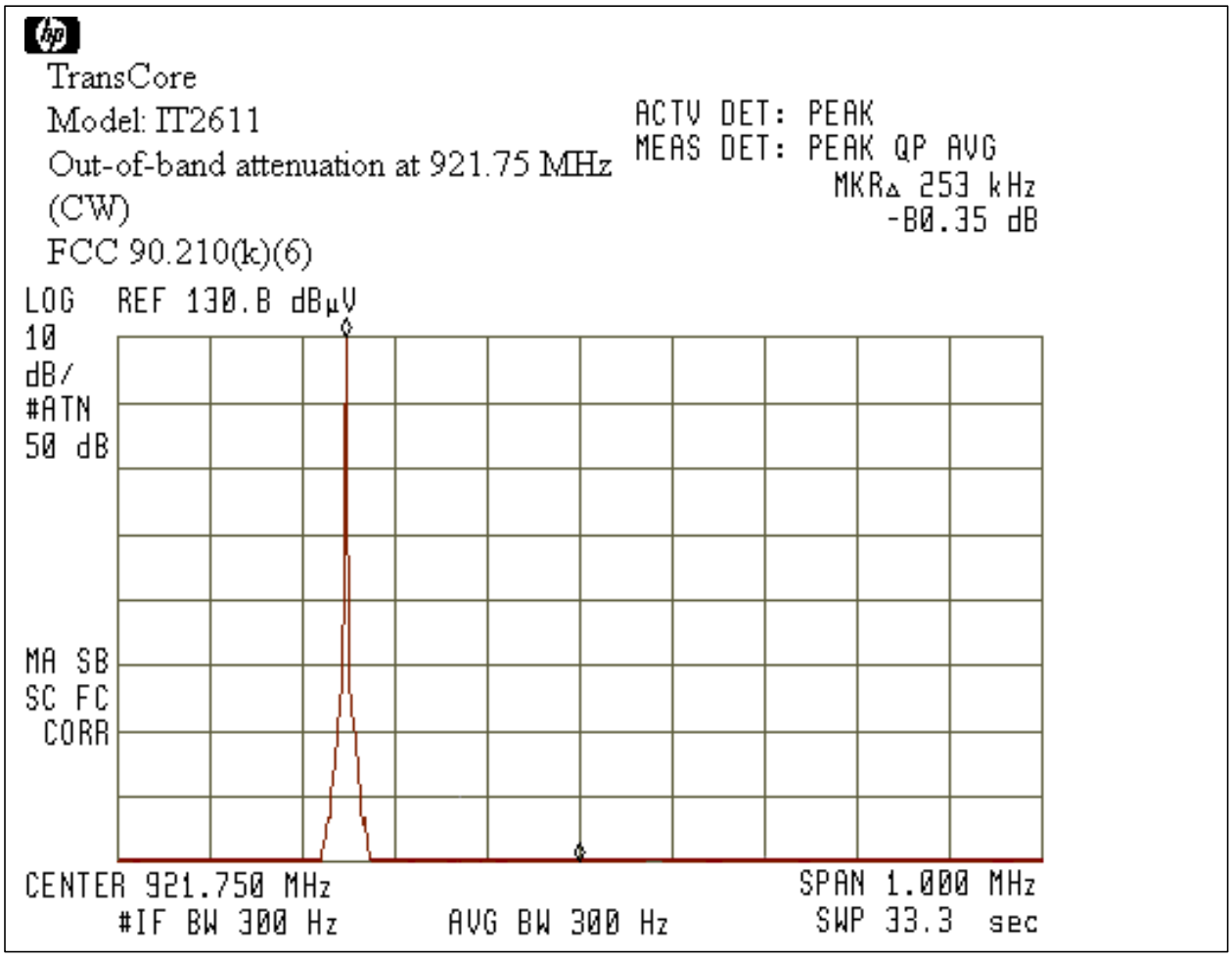
A

Graph # 3-4-3


TransCore
Model: IT2611
Out-of-band attenuation at 909.5 MHz
(CW)
FCC 90.210(k)(6)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -502.3 kHz
-82.44 dB
LOG REF 130.5 dBμV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
START 909.5000 MHz
#IF BW 300 Hz
AVG BW 300 Hz
STOP 910.2000 MHz
SWP 23.3 sec

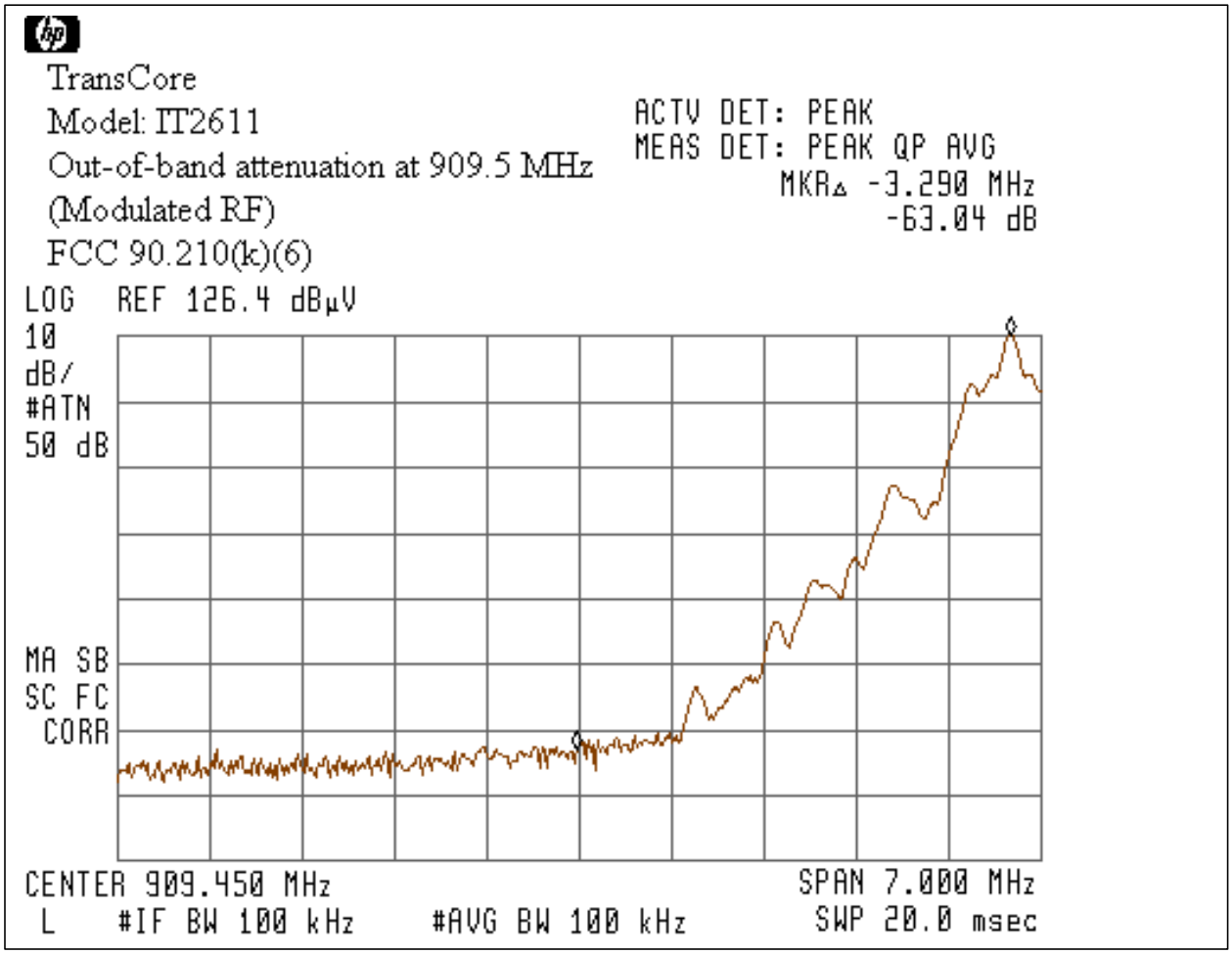
A

Graph # 3-4-4


TransCore
Model: IT2611
Out-of-band attenuation at 921.75 MHz
(CW)
FCC 90.210(k)(6)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 253 kHz
-80.35 dB
LOG REF 130.8 dBμV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
CENTER 921.750 MHz
#IF BW 300 Hz
AVG BW 300 Hz
SPAN 1.000 MHz
SWP 33.3 sec

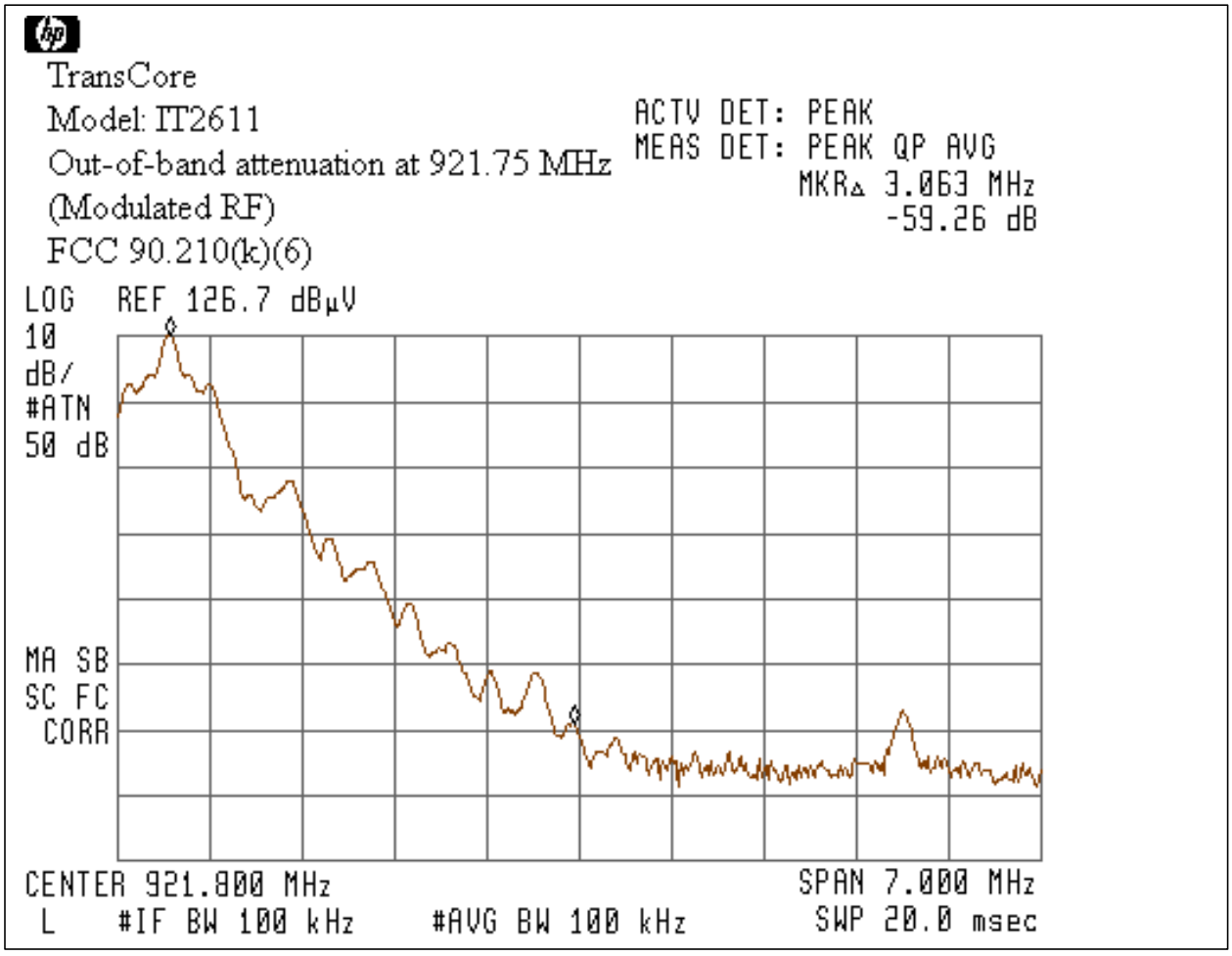
A

Graph # 3-4-5


TransCore
Model: IT2611
Out-of-band attenuation at 909.5 MHz
(Modulated RF)
FCC 90.210(k)(6)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -3.290 MHz
-63.04 dB
LOG REF 126.4 dBµV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
CENTER 909.450 MHz
SPAN 7.000 MHz
L #IF BW 100 kHz
#AVG BW 100 kHz
SWP 20.0 msec

A

Graph # 3-4-6


TransCore
Model: IT2611
Out-of-band attenuation at 921.75 MHz
(Modulated RF)
FCC 90.210(k)(6)
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 3.063 MHz
-59.26 dB
LOG REF 126.7 dBµV
10
dB/
#ATN
50 dB
MA SB
SC FC
CORR
CENTER 921.800 MHz
SPAN 7.000 MHz
L #IF BW 100 kHz
#AVG BW 100 kHz
SWP 20.0 msec

A

3.5 Field Strength of Spurious Emissions, FCC 90.210(k)(3)(ii), 2.1053

Field Strength of Spurious Emissions was measured in the Anechoic Chamber in the frequency range up to 10 GHz (10^{th} harmonic).
The substitution method of measurement was used for emissions with the level of field strength above the general limits for unintentional radiation for unlicensed devices (FCC 15.109, Class A).
The substitution method of measurement is based on the calculation of the minimum attenuation of the output ERP of the EUT.

Calculation of the minimum attenuation for antenna AA3152 Universal Toll Antenna
Output ERP = Pmax-at –antenna-terminal + Gantenna-gain
The measured in Section 3.1 maximum emission at antenna terminal *Pmax-at –antenna-terminal* is 29.5dBm, as a worse case 30dBm (according to the manufacturer specification) is chosen.
Output ERP = Pmax-at –antenna-terminal + Gantenna-gain = 30dBm + 13dBi = 43dbm = 20W
Minimum Attenuation = 55 + 10log (P) = 55 + 10log(20Watt) = 68dB
Maximum Spurious Emissions = Output ERP – Minimum Attenuation = 43dBm –68dB = -25dBm

Calculation of the minimum attenuation for antenna AA3153 Toll Antenna
Output ERP = Pmax-at –antenna-terminal + Gantenna-gain
The measured in Section 3.1 maximum emission at antenna terminal *Pmax-at –antenna-terminal* is 29.5dBm, as a worse case 30dBm (according to the manufacturer specification) is chosen.
Output ERP = Pmax-at –antenna-terminal + Gantenna-gain = 30dBm + 10.5dBi = 40.5dbm
Output ERP = 11.22W
Minimum Attenuation = 55 + 10log (P) = 55 + 10log(11.22Watt) = 65.5dB
Maximum Spurious Emissions = Output ERP – Minimum Attenuation = 40.5dBm – 65.5dB
Maximum Spurious Emissions = -25dBm

Test Procedure
The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anecoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at distance 3m. The radiated emissions were maximized by configuring the EUT, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Field strength was measured and calculated (See Section 3.7). The Emissions with the level of about 20dB below the *Maximum Spurious Emissions* were chosen for substitution method of measurement.
For substitution method the substitution antenna with the signal generator was placed instead of the EUT with the center of substitution antenna was at the same location as the center of transmitter. The substitution antenna was faced to measurement antenna with the same polarization as the measuring antenna. The level of the generator output was adjusted until the previously recorded maximum emission reading for this set of conditions is obtained. Substitution method of the Field Strength Calculation sees in Section 3.7.

The Table and Graphs below show the Field Strength of Spurious Radiation.

A

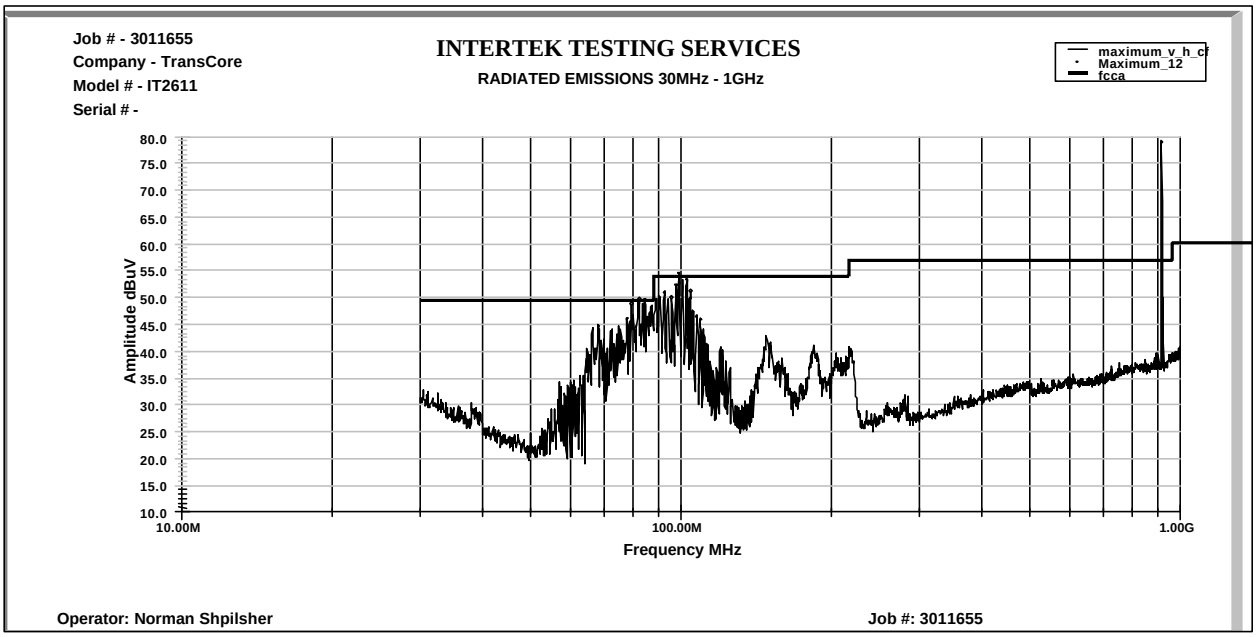
Radiated Emissions	**Date:** 01-04-2001
Company:	TransCore
Model:	IT2611
Test Engineer:	Norman Shpilsher
Special Config. Info:	Sabstitution Metod
Limits	FCC 90.210(k)(3)(ii)
Test Site:	3m Anechoic Chamber
Note:	The table shows the worst case radiated emissions

Table # 3-5-1

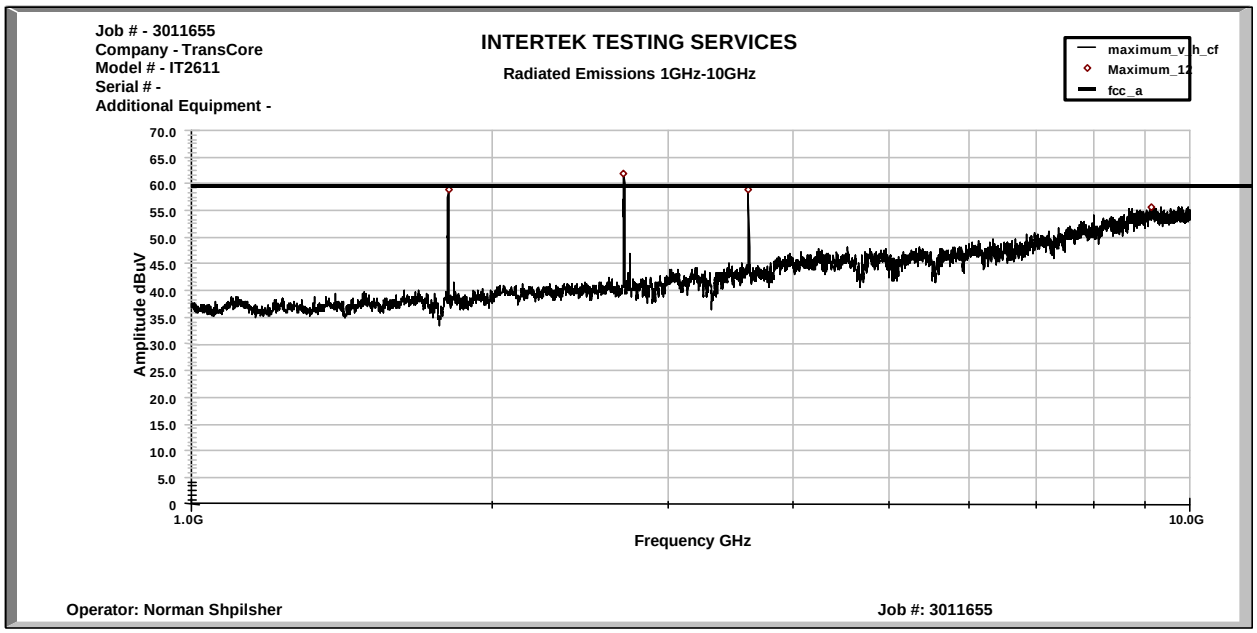
Frequency MHz	Measured Emissions dB□V	Substitution Antenna Power dBm	Substitution Antenna Gain dBi	Substitution Antenna EPR Power (dBm)	Limit dBm	Margin dB
1807.5	62.12	-47.5	8.4	-39.1	-25.0	-14.1
1829.8	48.44	-55.9	8.4	-47.5	-25.0	-22.5
2708.2	61.19	-39.5	9.4	-30.1	-25.0	-5.1
2745.4	57.09	-43.6	9.4	-34.2	-25.0	-9.2

A

Graph # 3-5-1



Graph # 3-5-2



A

3.6 Frequency Stability, FCC 90.213(a), 2.1055

Frequency Stability with variation of ambient temperature was measured from –30 degrees C to +50 degrees C at frequency 915.75MHz and rated power input 120VAC/60Hz.

Frequency Stability with variation of primary supply voltage was measured at 85% (102V) and 115% (138V) of rated AC Power Supply input voltage of 120V at frequency 915.75MHz.

Note: FCC 90.213(a) indicates that fixed non-multilateration transmitters with an authorized bandwidth that is more than 40kHz from the band edge is not subject to frequency tolerance restriction.

Table and below shows the frequency stability vs. temperature ambient and supply voltage.

Test Procedure

The EUT was placed in an environmental test chamber and powered such that control element received normal voltage and the transmitter provided maximum RF output. The Chamber was programmed to cool from room temperature to minus 30 degrees C and then step in 10-degree increments to plus 50 degrees C. For Frequency Stability testing with variation of primary supply voltage the EUT power supply was powered at rated supply voltage at 120VAC/60Hz and then at 102VAC/60Hz and 138VAC/60Hz

A

Frequency Stability **Date:** 01-11-2002
Company: TransCore
Model: IT2611
Special Config. Info: Enviromental Chamber (Frequency Stability testing)
Test Engineer: Norman Shpilsher
Standard: FCC 90.213(a), FCC 2.1055

Table # 3-6-1

Temperature Degree C	Output Frequency MHz	Frequency Stability Hz	Frequency Stability ppm	Minimum Freq. Stability ppm	Test Result
-30	915.75	445	0.5	2.5	Pass
-20	915.75	354	0.4	2.5	Pass
-10	915.75	234	0.3	2.5	Pass
0	915.75	94	0.1	2.5	Pass
10	915.75	22	0.0	2.5	Pass
20	915.75	0	0.0	2.5	Pass
30	915.75	84	0.1	2.5	Pass
40	915.75	178	0.2	2.5	Pass
50	915.75	218	0.2	2.5	Pass
Input Power AC Voltage V	Output Frequency MHz	Frequency Stability Hz	Frequency Stability ppm	Minimum Freq. Stability ppm	Test Result
102	915.75	10.0	0.0	2.5	Pass
120	915.75	0.0	0.0	2.5	Pass
138	915.75	10.0	0.0	2.5	Pass

A

3.7 Field Strength Calculation

Straight method
The field strength is calculated by adding the emissions reading on the EMI Receiver to the factors associated with preamplifiers (if any), antennas and cables. A sample calculation is included below.

FS = RA – AG + AF + CF

Where FS = Field Strength in dBì V/m
RA = Receiver Amplitude (including preamplifier) in dBì V
AG = Amplifier Gain in dBi
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB/m

Assume a receiver reading of 47 dBì V is obtained. The amplifier gain of 15 dBi is subtracted. The antenna factor of 19.5 dB/m and cable factor of 3.5 dB is added. The amplifier gain, antenna factor and cable factor combined to the Total CF. The net field strength for comparison to the appropriate limit is 52 dBì V/m.

Substitution method
The field strength is calculated by adding the power reading on the substitution generator to the antenna gain associated with substitution antenna, and cables. A sample calculation is included below.

FS = GP + AG - CF

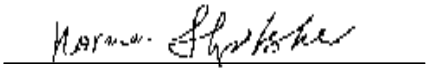
Where FS = Field Strength in dBm
GP = Generator Output Power in dBm
AG = Antenna Gain in dBi
CF = Cable Attenuation Factor in dB

Assume a generator output power reading of -40 dBm is obtained. The antenna gain is 13 dBi is added. The cable factor of 0.5 dB is subtracted. The field strength for comparison to the limit is –27.5 dBm.

Tested by:

Norman Shpilsher
EMC Project Engineer
Intertek Testing Services NA, Inc.

Agent for TransCore
Signature



Signature

Date: January 18, 2002

A

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP85462A Receiver RF Section	3325A00106	07/01	07/02	X
HP85460A RF Filter Section	3330A00109	07/01	07/02	X
Advantest Spectrum Analyzer R3271A	55050084	05/01	05/02	X
HP 83017A Microwave Amplifier	3123A00475	09/01	09/02	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Schaffner-Chase Bicono-Log Antenna	2468	11/01	11/02	X
EMCO Horn antenna 3115	9507-4513	09/01	09/02	X
EMCO Horn antenna 3115	6579	12/01	12/02	X

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
FCC LISN-2	316	01/25/01	01/25/02	
FCC-LISN-50-25-2	2014	04/01	04/02	

Generators, Power Source, Environmental Chamber

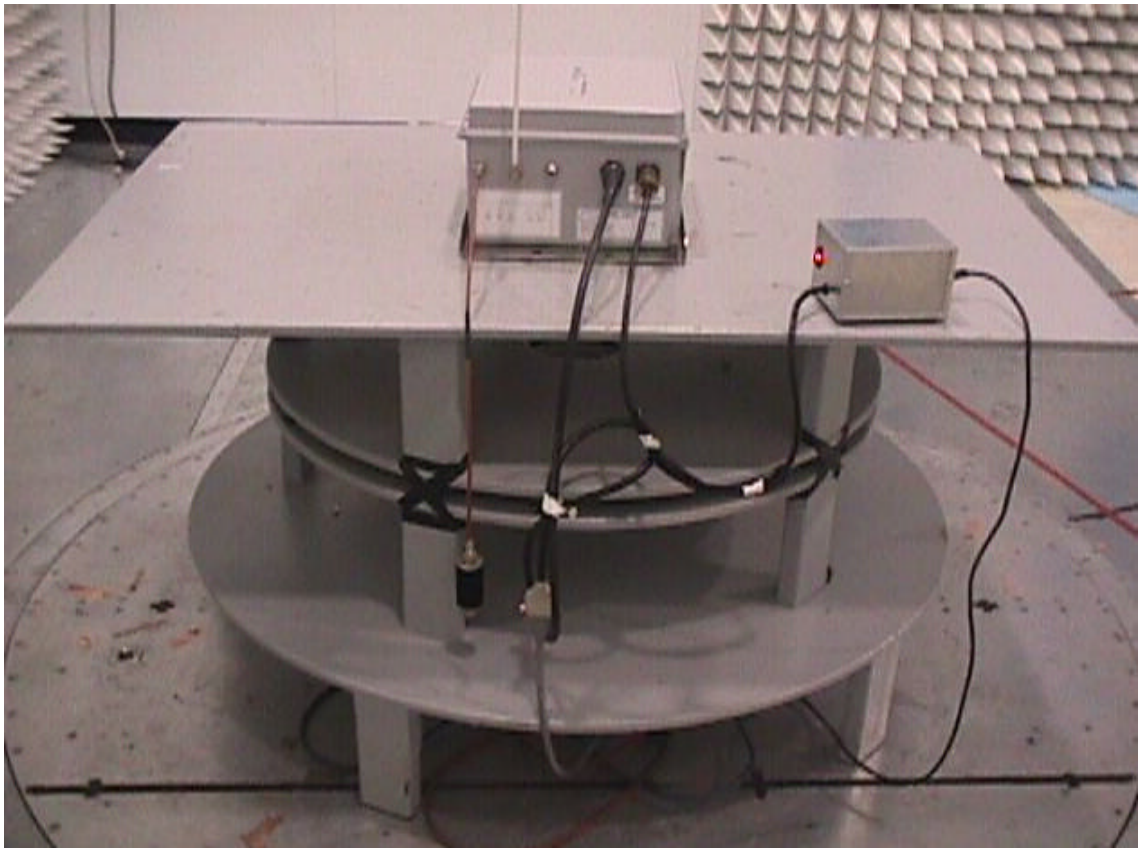
DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Rohde & Schwarz SMT 03, Signal Generator	DE12157	06/01	06/02	X
HP 6813B AC Power Source/Analyzer	3524A00552	07/01	07/02	X
ESPEC Environmental Chamber EWPH781-CCA	304469	10/01	10/02	X

A

EXHIBIT I

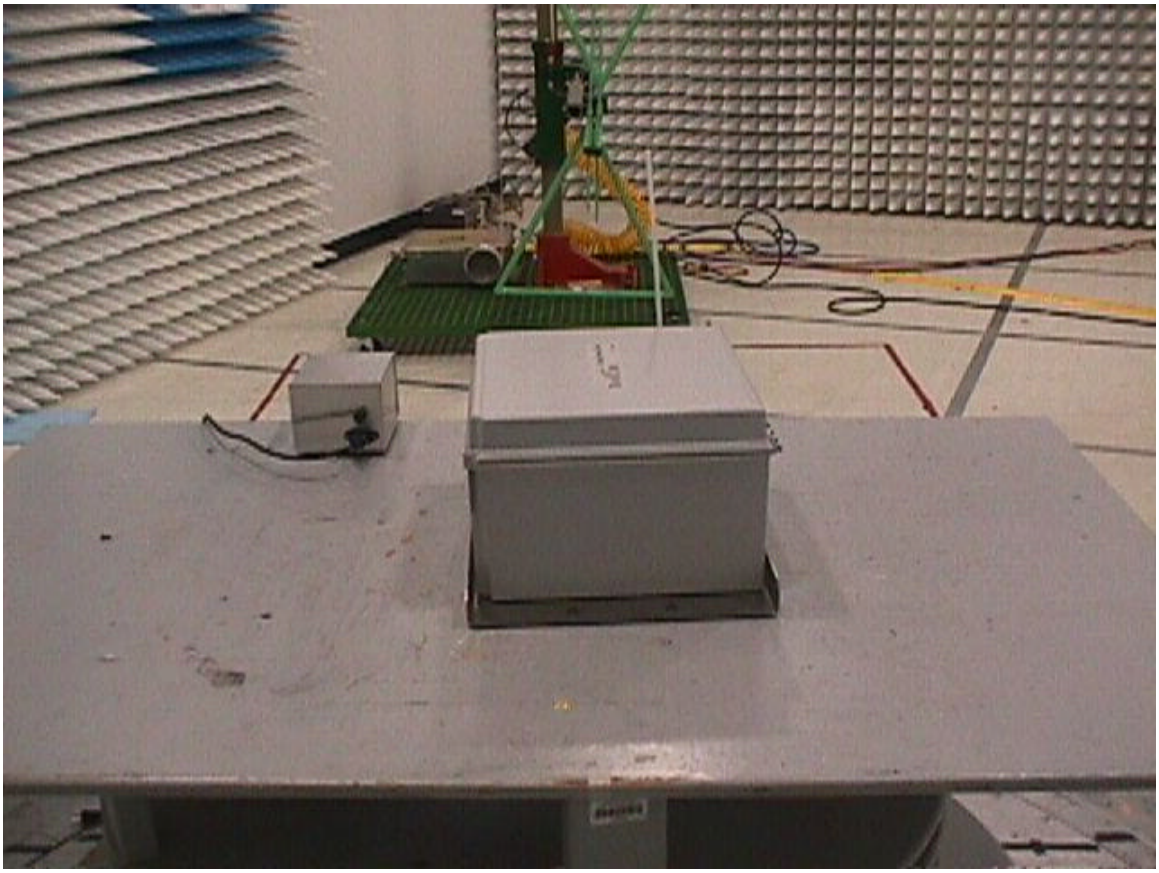
TEST SET UP PHOTOS

A



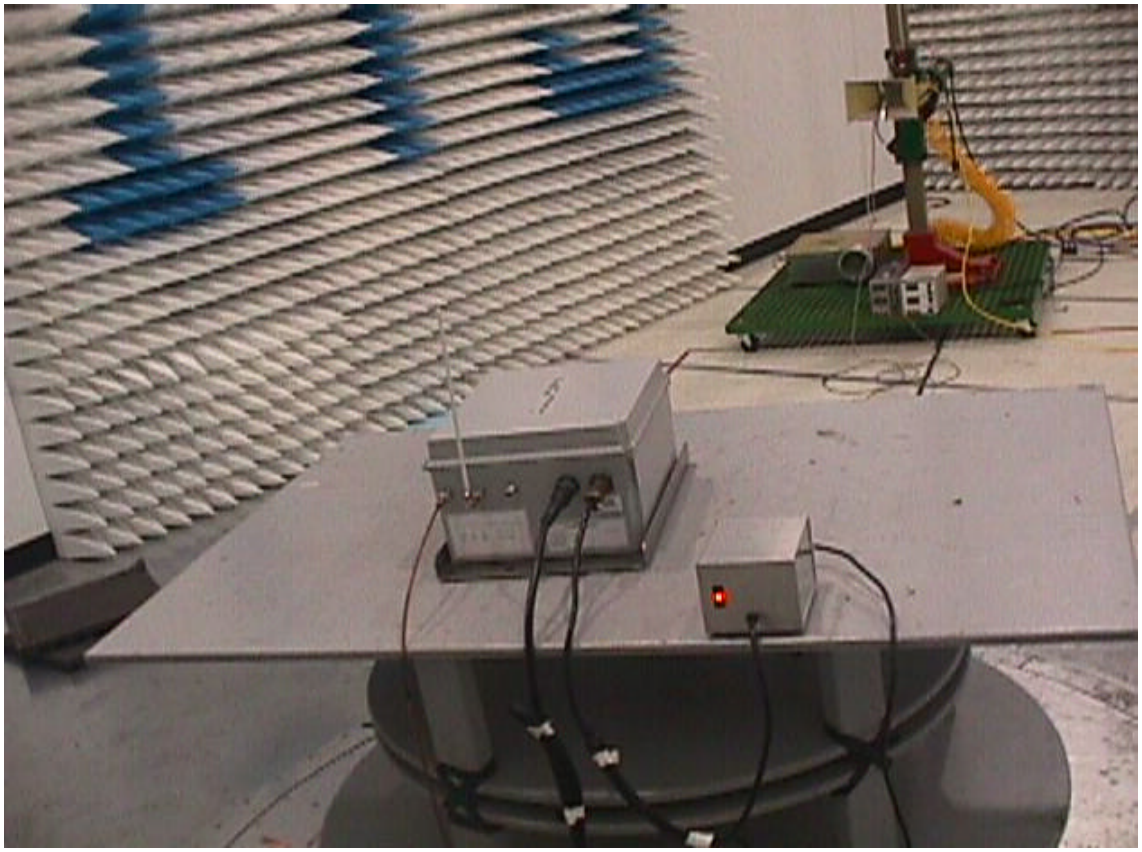
Radiated Emissions Test Configuration

A



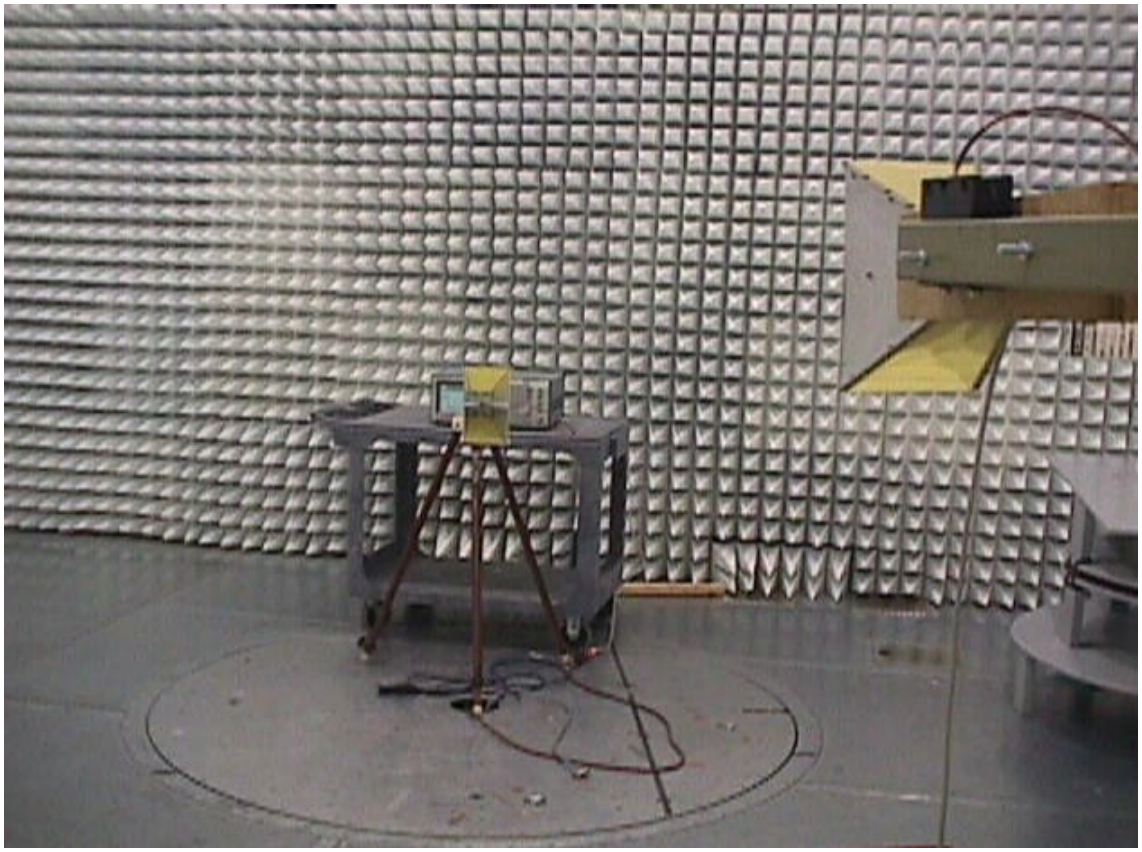
Radiated Emissions Test Configuration

A



Radiated Emissions Test Configuration

A



Radiated Emissions Test Configuration

A

EXHIBIT II

FCC ID LABEL LOCATION

(See ID Label/Location Info. Attachments)

A

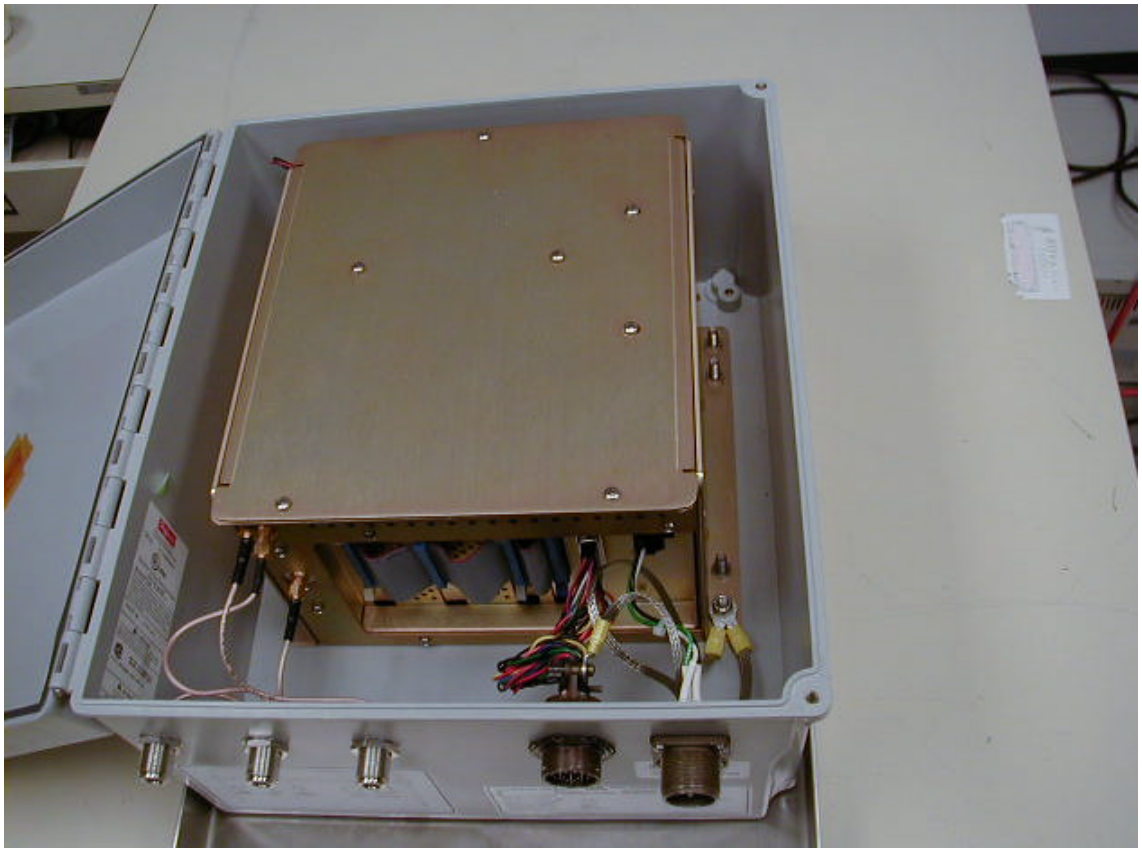
EXHIBIT III

EXTERNAL PHOTOS

A

External Photo

A



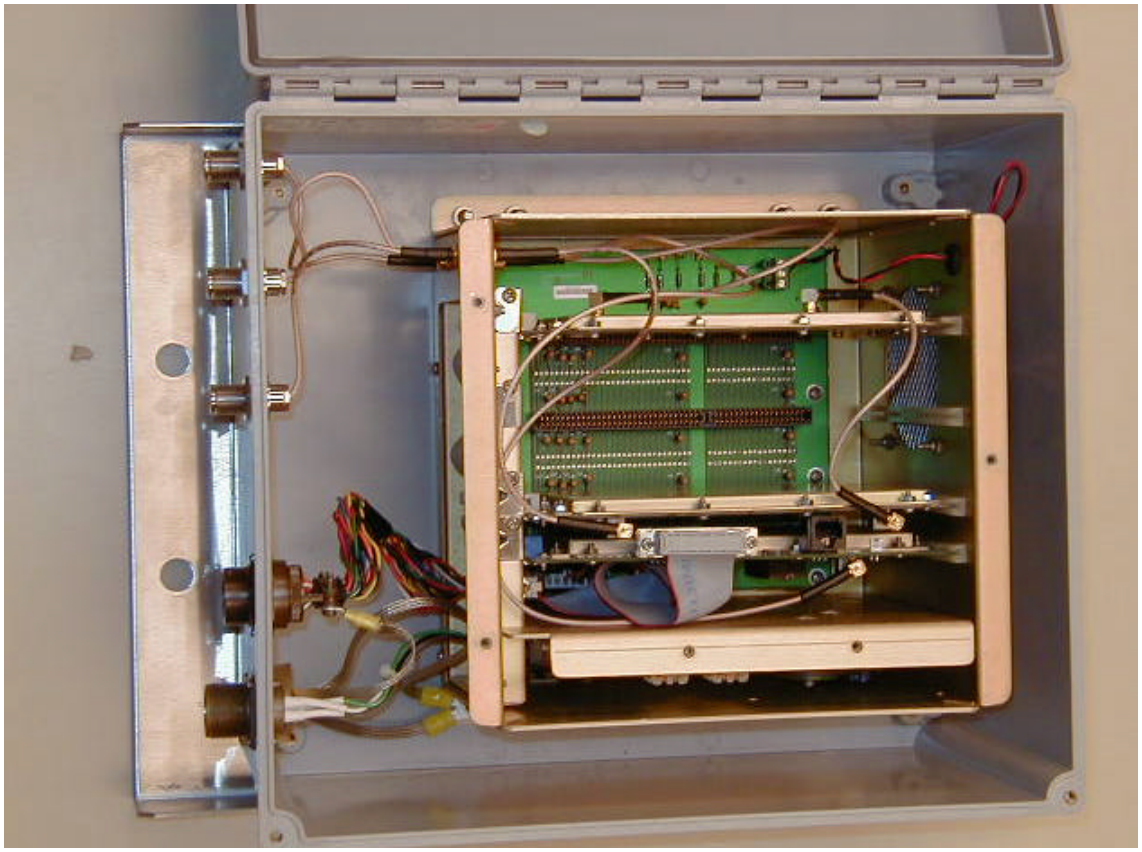
External Photo

A

EXHIBIT IV

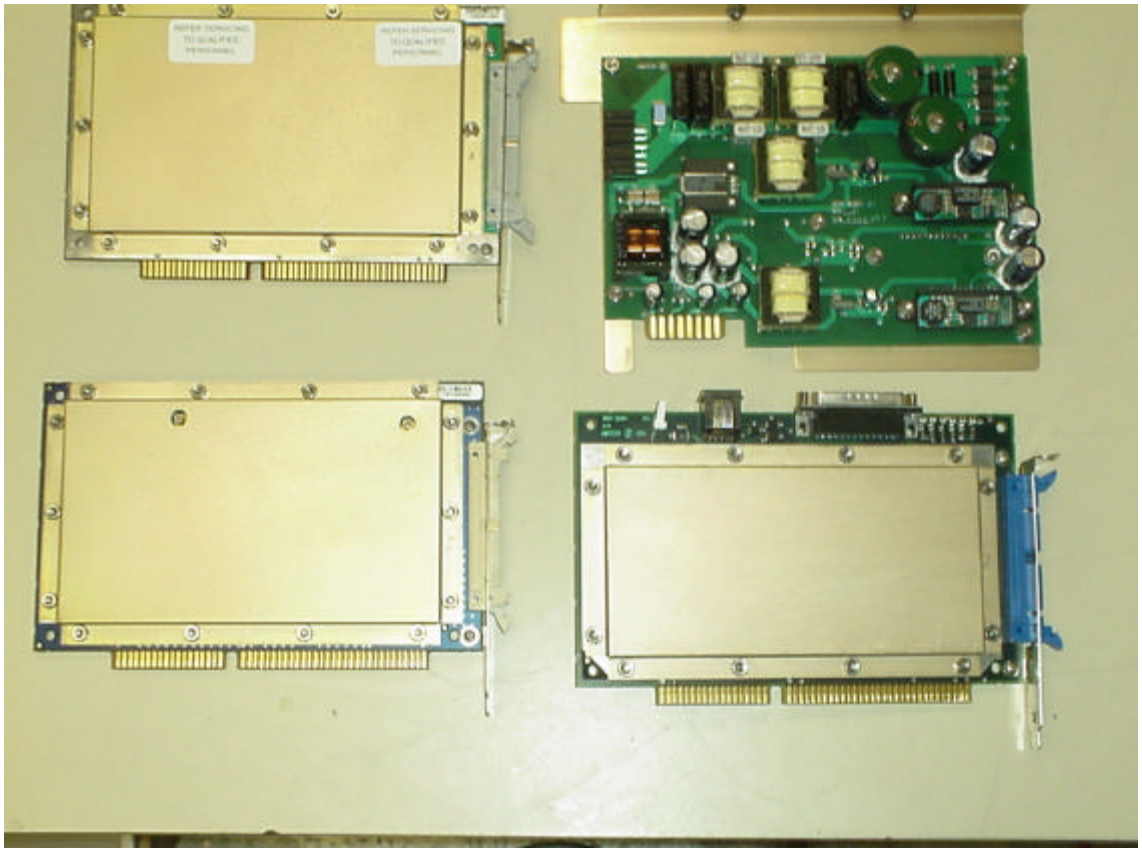
INTERNAL PHOTOS

A



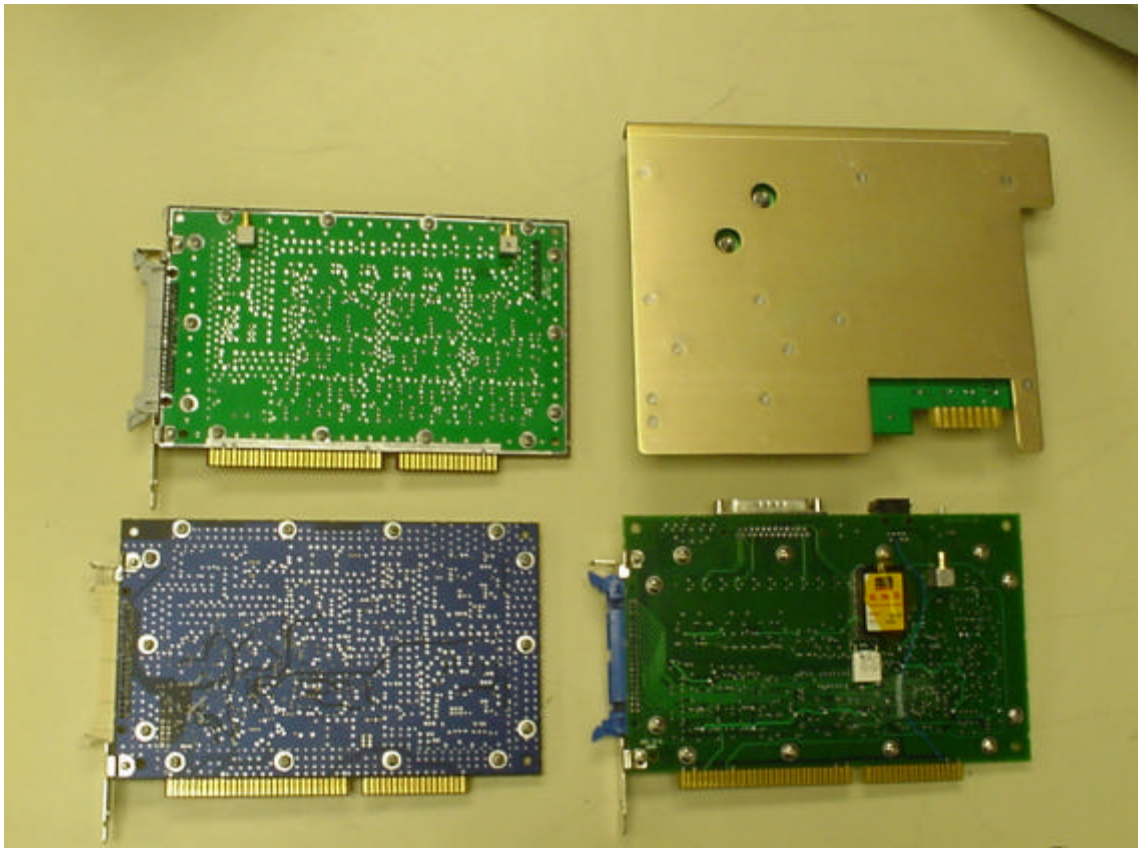
Internal Photo

A



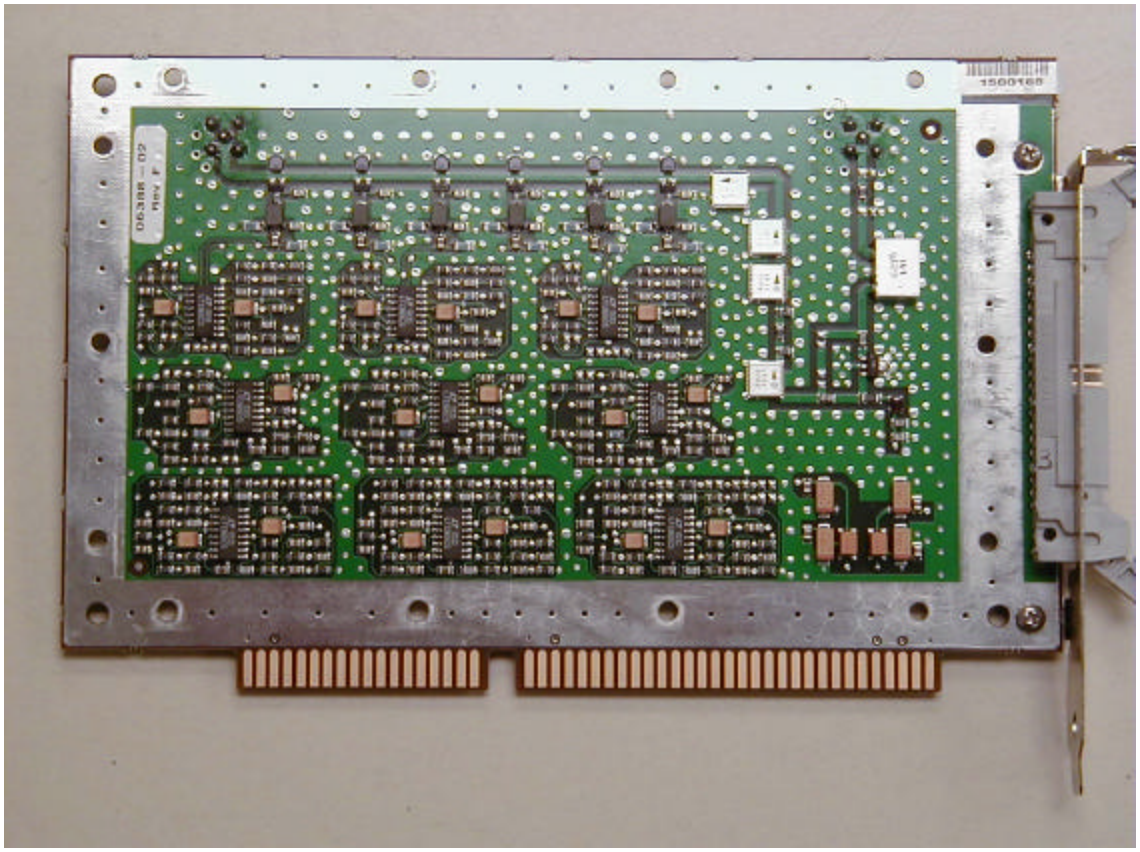
Internal Photo

A



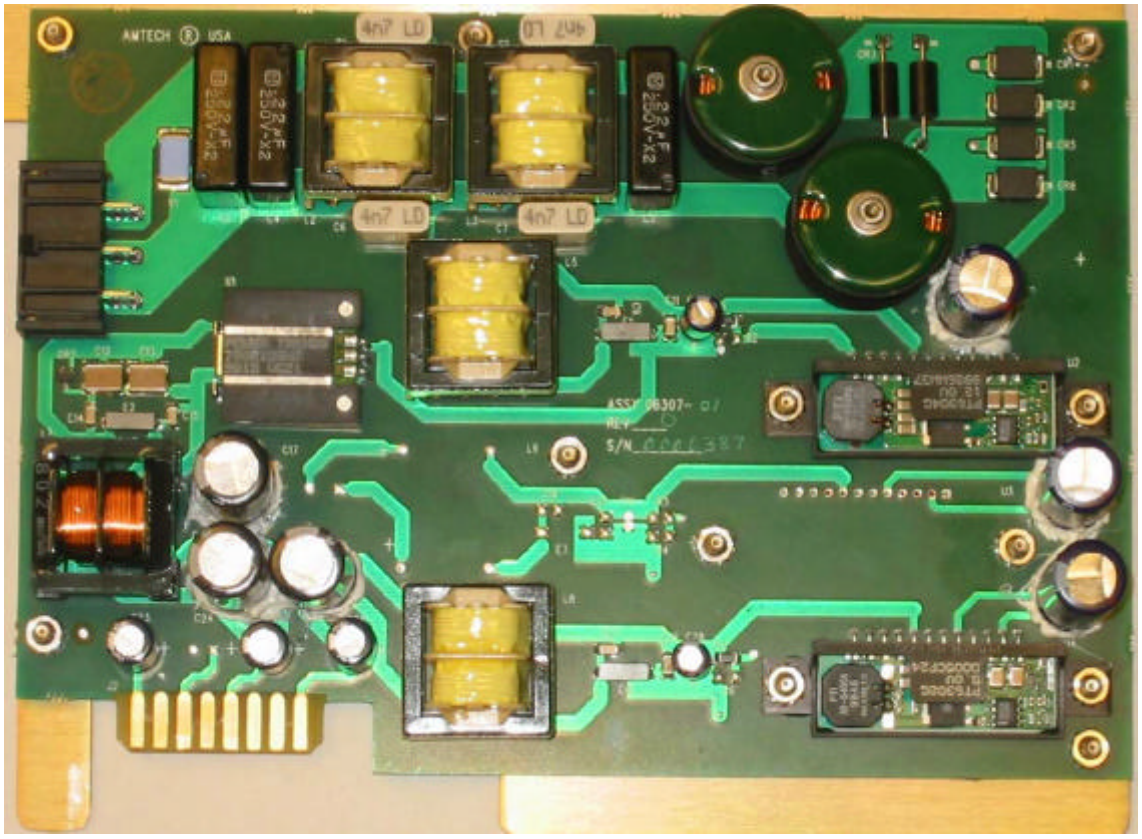
Internal Photo

A



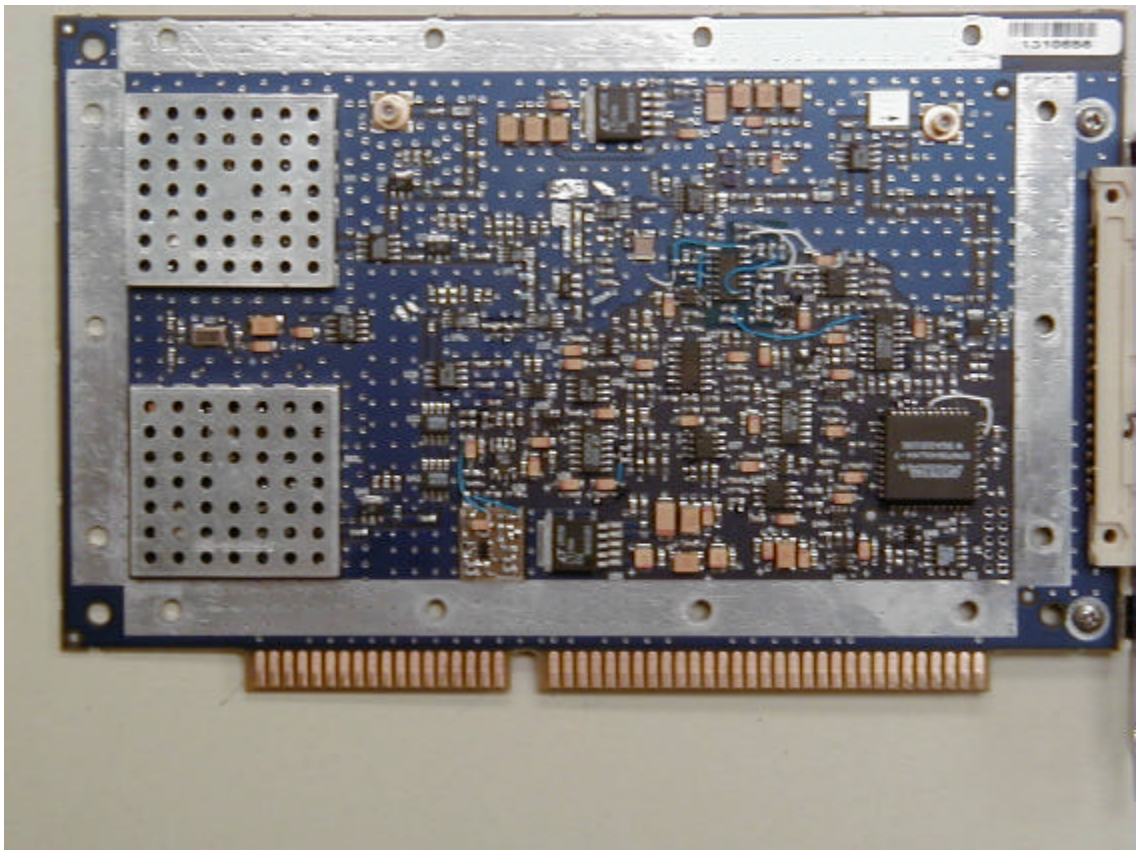
Internal Photo

A



Internal Photo

A



Internal Photo

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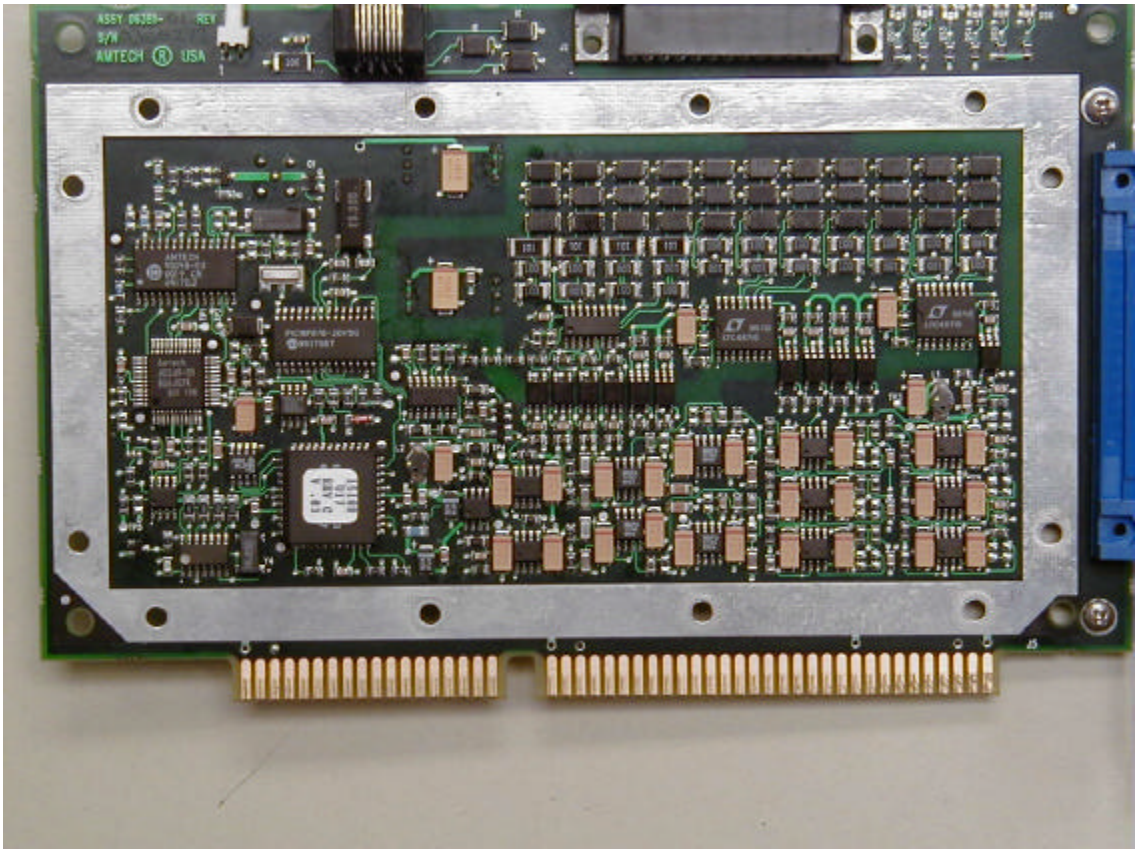

Internal Photo

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EXHIBIT V

ELECTRICAL SCHEMATICS AND BLOCK DIAGRAM

(See Block Diagram and Schematic Attachments)

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EXHIBIT VI

USER MANUAL AND OPERATIONAL DESCRIPTION

(See User Manual and Operational Description Attachments)