TEST REPORT

Report Number: 3161155MIN-001
Project Number: 3161155

Testing performed on the
TXB-ZB
FCC ID: MMURTI1300
Industry Canada ID: 3166-RTI1300

to
47 CFR Part 15. 247:2007
RSS- 210, Issue 7, 2007

For
Remote Technologies Inc.

Test Performed by:	Test Authorized by:
Intertek Testing Services NA Inc.	Remote Technologies Inc.
7250 Hudson Blvd., Suite 100	5775 12th Avenue East, Suite 180
Oakdale, MN 55128	Shakopee, MN 55379

Prepared by: _____ Date: November 18, 2008
Norman Shpilsher

Reviewed by: _____ Date: November 18, 2008
Uri Spector

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1.0 GENERAL DESCRIPTION

Model:	TXB-ZB
Type of EUT:	RF Module
Serial Number:	N/A
FCC ID:	MMURTI1300
Industry Canada ID:	3166-RTI1300
Related Submittal(s) Grants:	N/A
Company:	Remote Technologies Inc.
Customer:	Mr. Mark Melville
Address:	5775 12th Avenue East, Suite 180 Shakopee, MN 55379
Phone:	(952) 253-3116
Fax:	(952) 253-3131
Test Standards:	☒ 47 CFR, Part 15:2007, §15.247 ☐ RSS–210, Issue 7, 2007 ☐ RSS-Gen, Issue 2, 2007 ☐ 47 CFR, Part 15:2007, §15.107 and §15.109, Class ☐ Other
Type of radio:	☐ Stand -alone ☒ Module ☐ Hybrid
Date Sample Submitted:	October 24, 2008
Test Work Started:	October 24, 2008
Test Work Completed:	November 3, 2008
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	ZigBee RF Transceiver Module
Transmitter Type:	☐ FHSS ☒ Digital Modulation ☐ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	From 2400 to 2483.5 MHz
Number of Channels:	16 (from 11 to 26)
Modulation:	Offset Quadrature Phase Shift Keying
Emission Designator:	
Antenna(s) Info:	Integral Antenna Gain: 1.8 dBi
Antenna Installation:	☐ User ☐ Professional ☐ Factory
Transmitter power configuration:	☐ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 3.3 VDC ☐ Other: Amp. ☐ 50Hz ☐ 60Hz
Special Test Arrangement:	As a potential hand-held device the EUT was rotated through three orthogonal axes to determine and tested with the maximum emissions
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.4-2003 and FCC Public Notice DA 00-705

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

☐ - Standby
☒ - Continuous transmissions (modulated signal)
☒ - Continuous transmissions (un-modulated signal)
☐ - Continuous receiving
☐ - Test program (customer specific)
☐ -

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel, middle channel, and upper channel
2	EUT with the regular integral antenna was tested, device with antenna connector instead of the integral antenna was tested for antenna conducted tests
3	EUT was ran in specific channels with CW or un-modulated signal using test program running on the Remote PC

Cables:

No.	Type	Length	Designation	Note
1	N/A			
2				

Support equipment/Services:

No.	Item	Description
1	Dell Laptop	Remote PC
2	Interface Board	Test Interface between EUT and Remote PC (disconnected from the EUT after setting an operation mode)
3	LASCAR PSU 130	DC Power Supply

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ **Normal**

Temperature:	+15 to +35 ° C
Humidity:	20-75 %
Atmospheric pressure:	86-106 kPa

☐ **Extreme**

☐ **Temperature:**	-20 to +50 ° C
☐ **Supply voltage:**	85% to +115%

1.4 Measurement uncertainty

The expanded uncertainty (k = 2) for radiated measurements has been determined to be:
±4 dB at 10m and ±5.4 dB at 3m
The expanded uncertainty (k = 2) for conducted measurements at antenna terminal has been determined to be:
±1.0 dB
The expanded uncertainty (k = 2) for line conducted measurements has been determined to be:
±2.6 dB

1.5 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)

General notes:

2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.247(b), (c) / RSS-210 A8.4	Maximum peak output power	Pass
15.247(a) / RSS-210 A8.2	6dB bandwidth of the digital modulation system	Pass
15.247/(e) / RSS-210 A8.2	Power spectral density	Pass
15.247(d) / RSS-210 A8.5	Antenna conducted spurious emissions	Pass
15.247(d) / RSS-210 A8.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass
15.207 / RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	Pass
15.109 / ICES-003	Receiver/digital device radiated emissions	Pass

3.0 TEST CONDITIONS AND RESULTS

3.1 Maximum peak output power

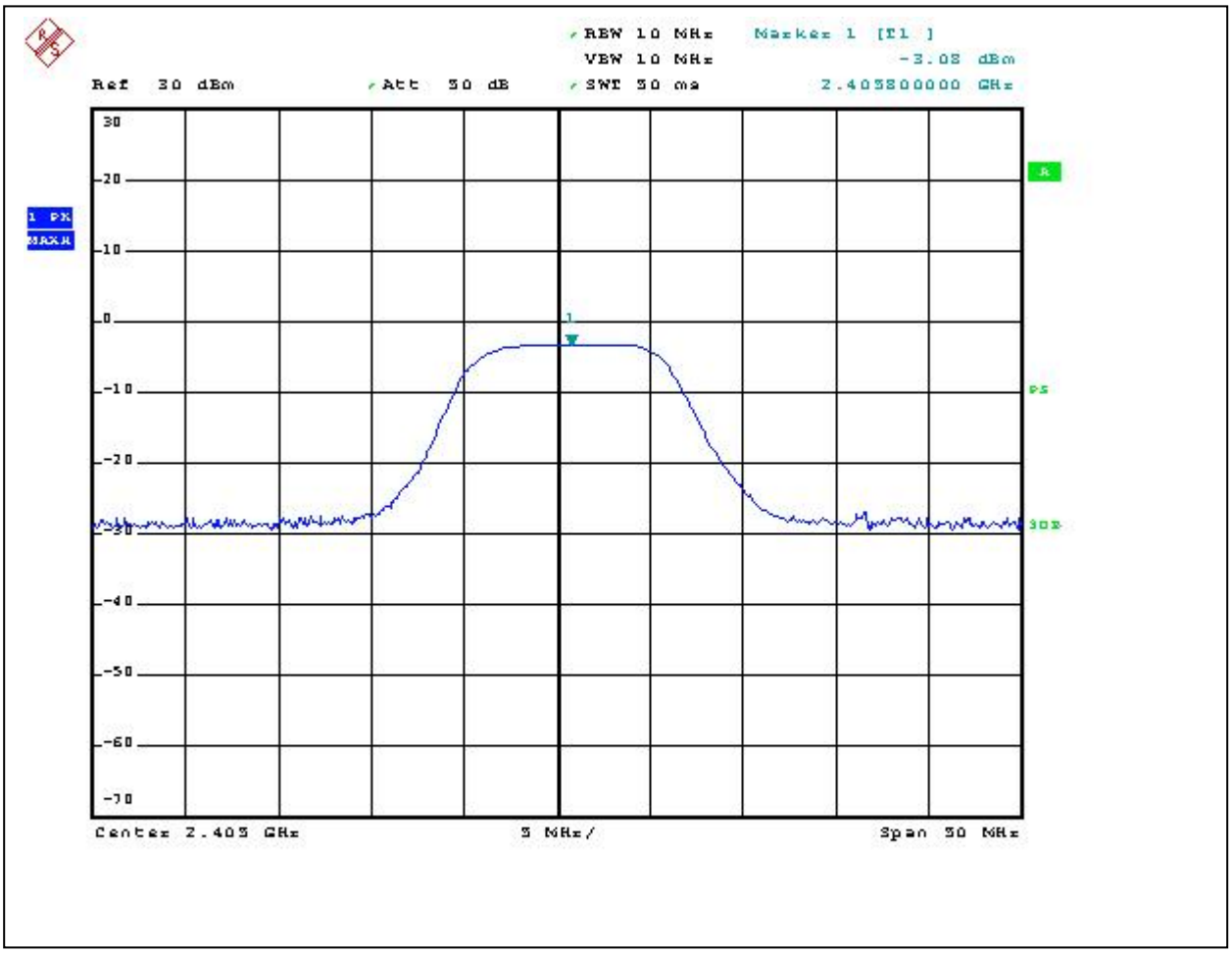
Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

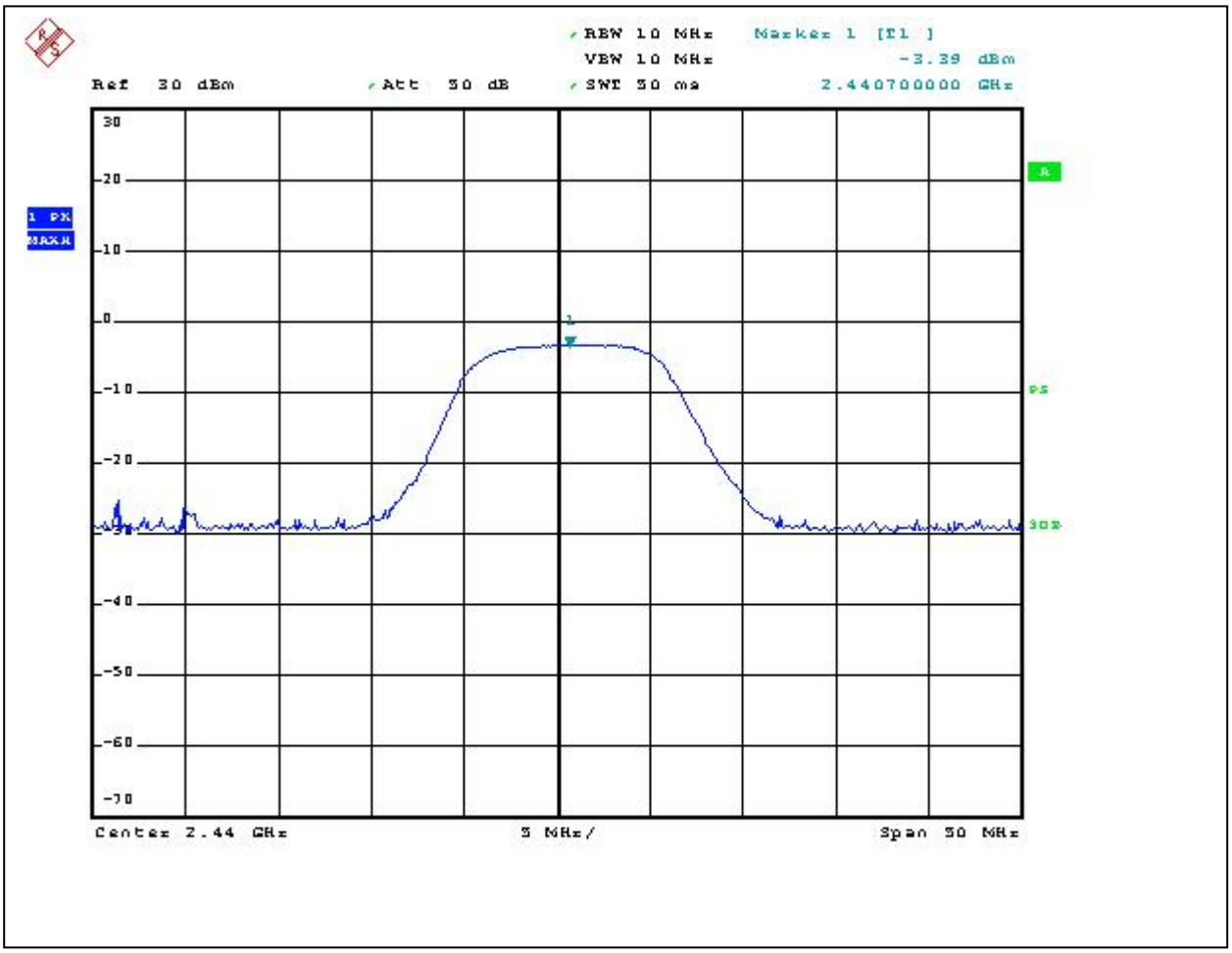
Max. Margin: 33.2 dB below the limits

Power Output:	**Conducted**					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency	**Measured power dBm**	**Attenuaton dB**	**Power at Antenna dBm**	**Limit dBm**	**Limit Reduction dB**	**Margin dB**
Channel 11	-3.08	0.1	-3.18	30	0	-33.2
Middle Frequency						
Channel 18	-3.39	0.1	-3.49	30	0	-33.5
Upper Frequency						
Channel 26	-3.66	0.1	-3.76	30	0	-33.8
RBW:	☐ 1MHz	☐ 3MHz	☒ 10MHz			
VBW:	☐ 1MHz	☐ 3MHz	☒ 10MHz			
Antenna Gain:	☒ < 6dBi	☐ >6dBi and =	dBi, Output power reduction = 0 dB			

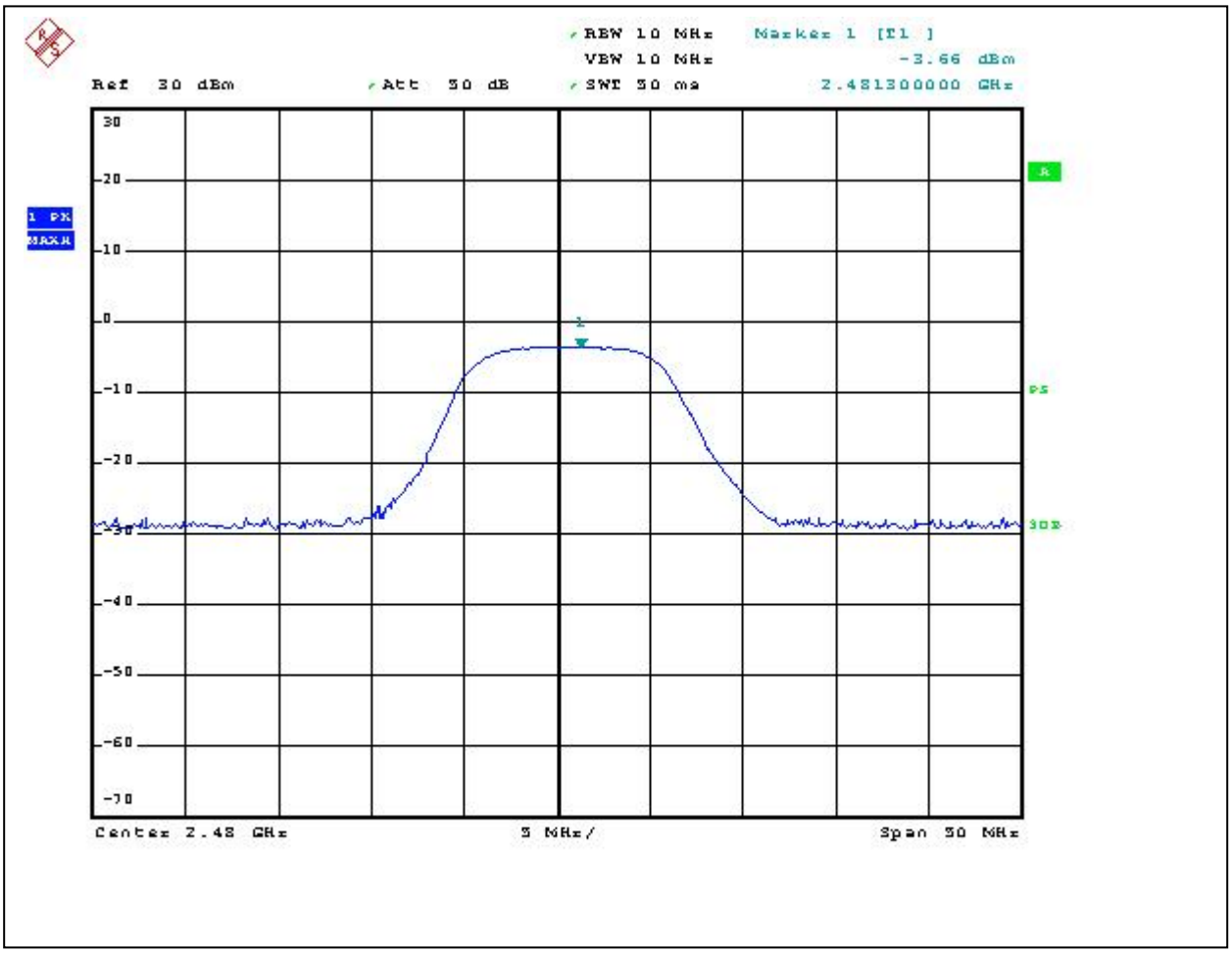
Notes: None


RBW 10 MHz
VBW 10 MHz
SWT 50 ms
Marker 1 [T1]
-3.08 dBm
2.405800000 GHz
Ref 30 dBm
Att 50 dB
1 PK
MAXH
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.405 GHz
5 MHz/
Span 50 MHz

Graph 3.1.1


RBW 10 MHz
VBW 10 MHz
SWT 50 ms
Marker 1 [T1]
-3.39 dBm
2.440700000 GHz
Ref 30 dBm
Att 50 dB
1 PK
MAXH
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
A
PS
3DB
Center 2.44 GHz
5 MHz/
Span 50 MHz

Graph 3.1.2

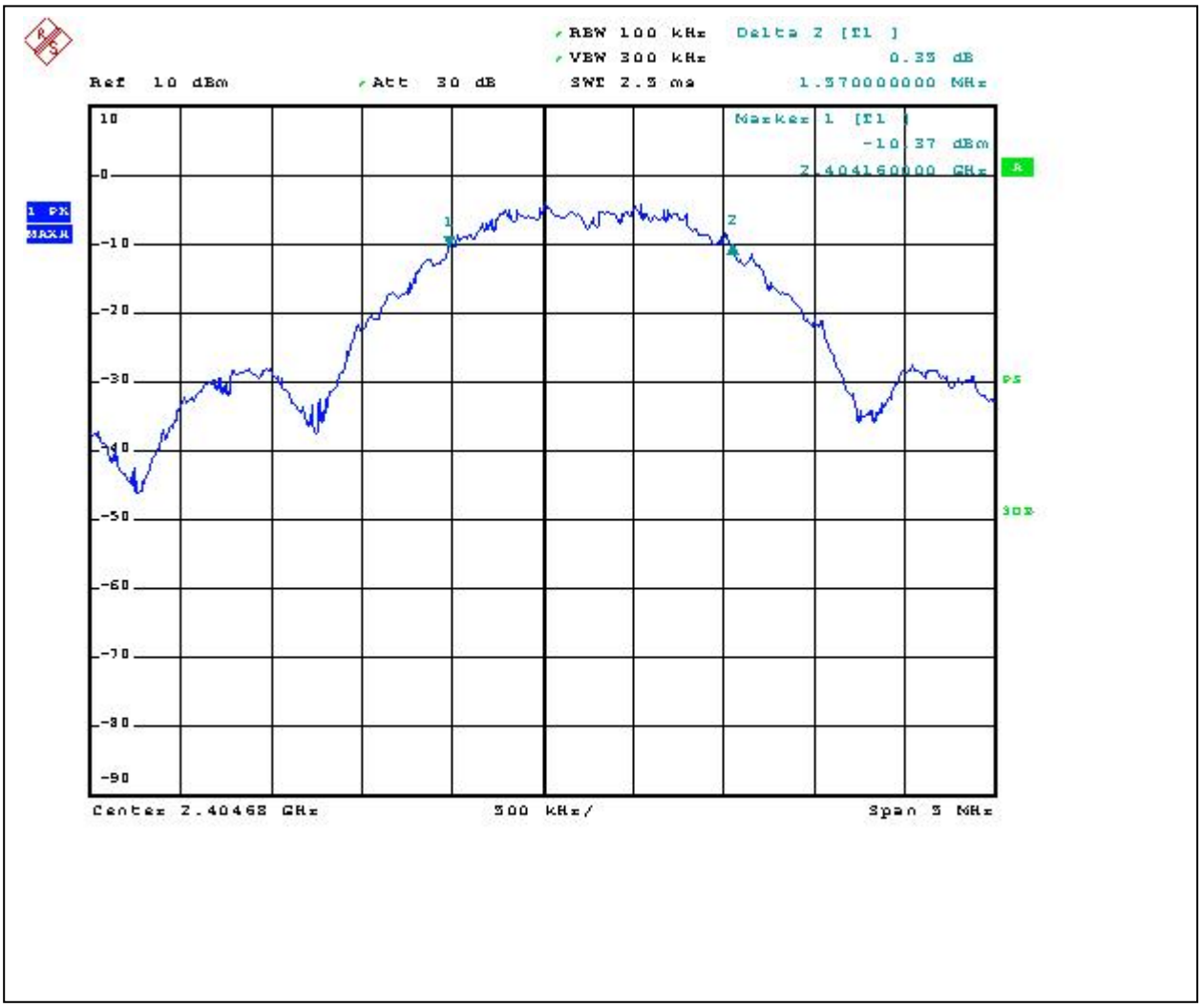

RBW 10 MHz
VBW 10 MHz
SWT 50 ms
Marker 1 [T1]
-3.66 dBm
2.481300000 GHz
Ref 30 dBm
Att 50 dB
1 PK
MAXH
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.48 GHz
5 MHz/
Span 50 MHz

Graph 3.1.3

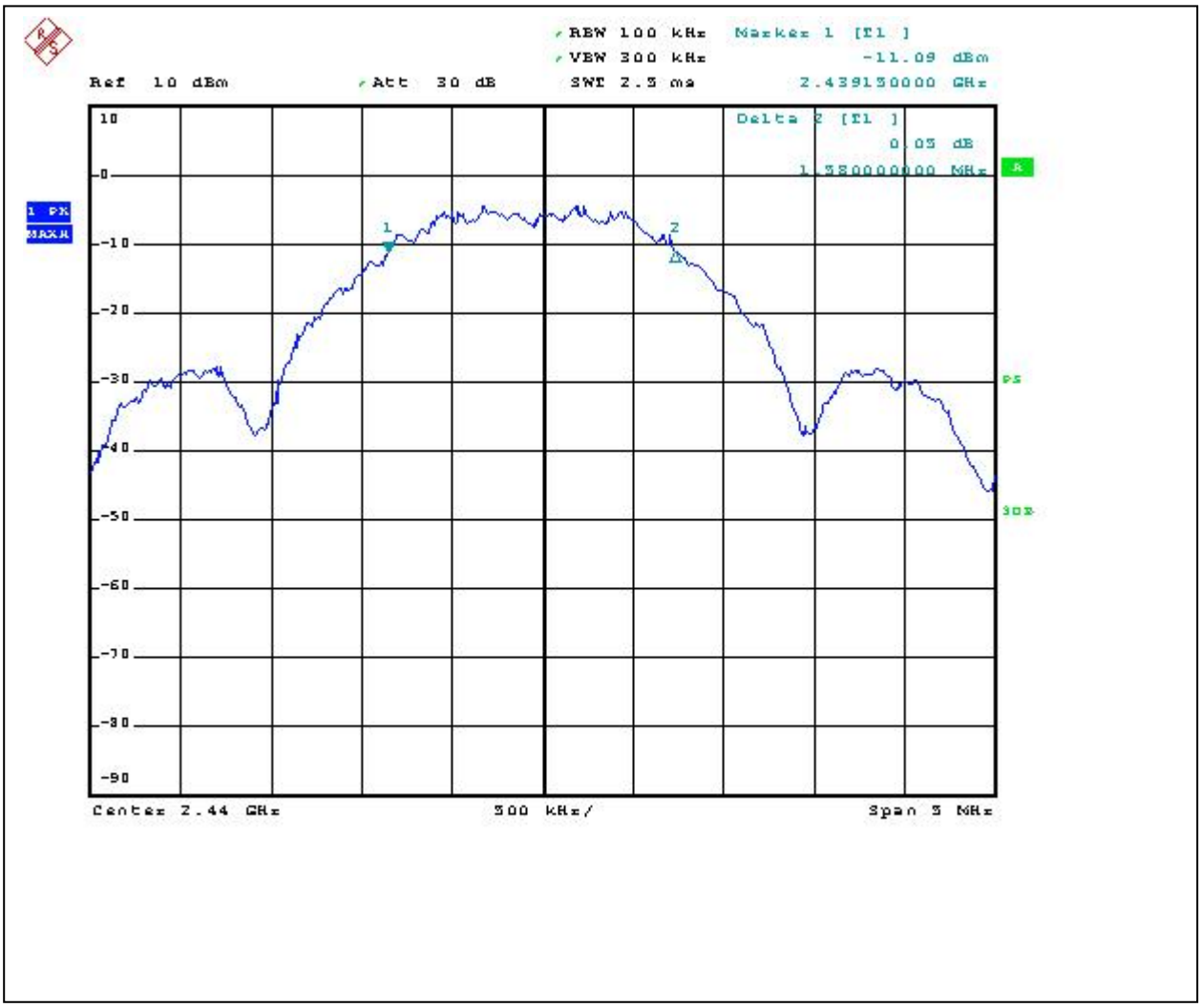
3.2 6dB bandwidth of the digital modulation

Low Frequency Channel kHz	Middle Frequency Channel kHz	Upper Frequency Channel kHz	Minimum Bandwidth kHz	Result
1570	1580	1590	500	**Pass**
RBW: **VBW:**	☒ 100kHz ☐ other kHz ☐ 100kHz ☒ 300kHz ☐ other kHz			

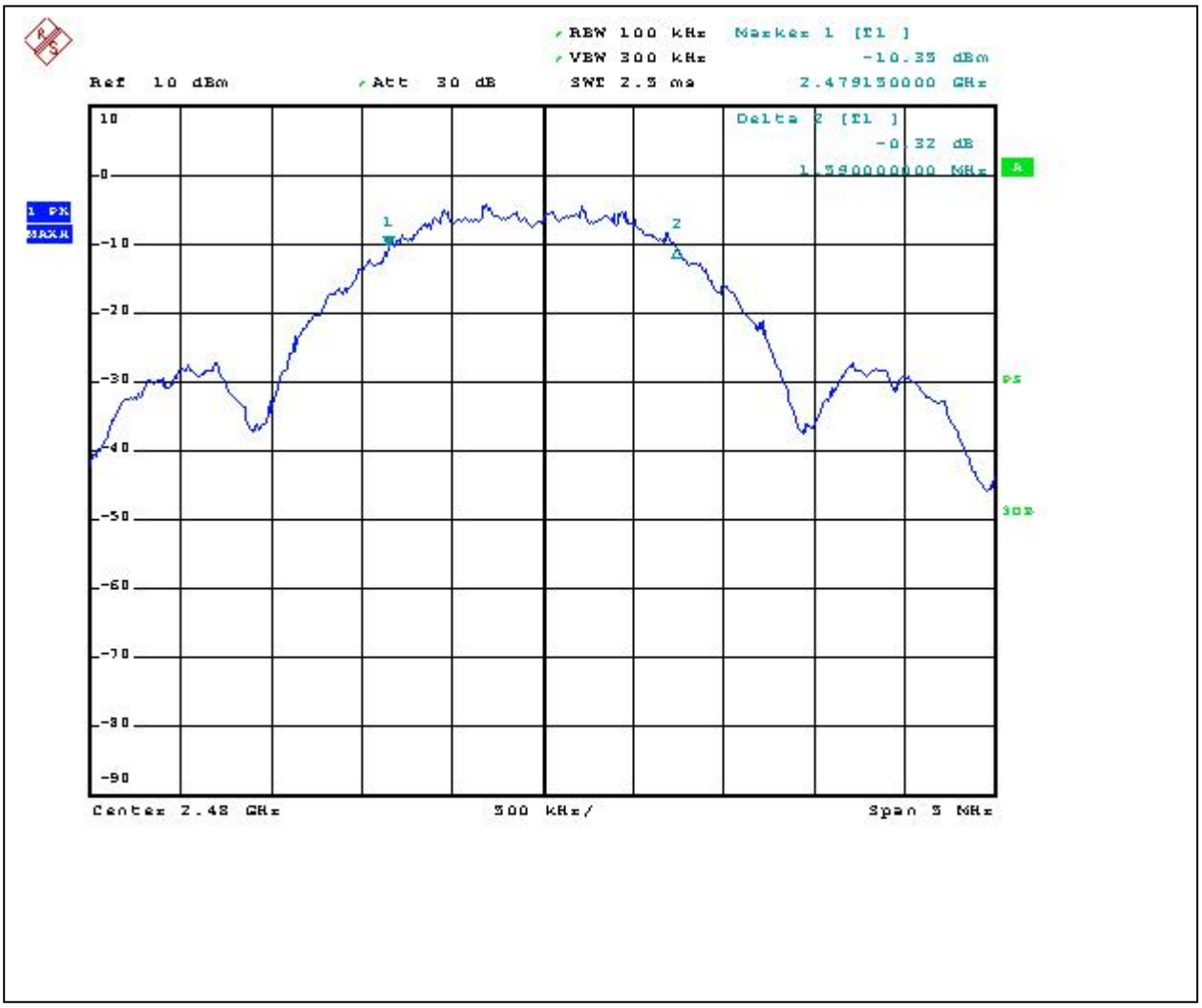
Notes: None


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
0.35 dB
1.570000000 MHz
Ref 10 dBm
Att 30 dB
Marker 1 [T1]
-10.37 dBm
2.404160000 GHz
1 PK
MAXH
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.40468 GHz
500 kHz/
Span 5 MHz

Graph 3.2.1


RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
-11.09 dBm
2.439150000 GHz
Ref 10 dBm
Att 30 dB
Delta 2 [T1]
0.05 dB
1.380000000 MHz
1 PK
MAXH
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.44 GHz
500 kHz/
Span 5 MHz

Graph 3.2.2

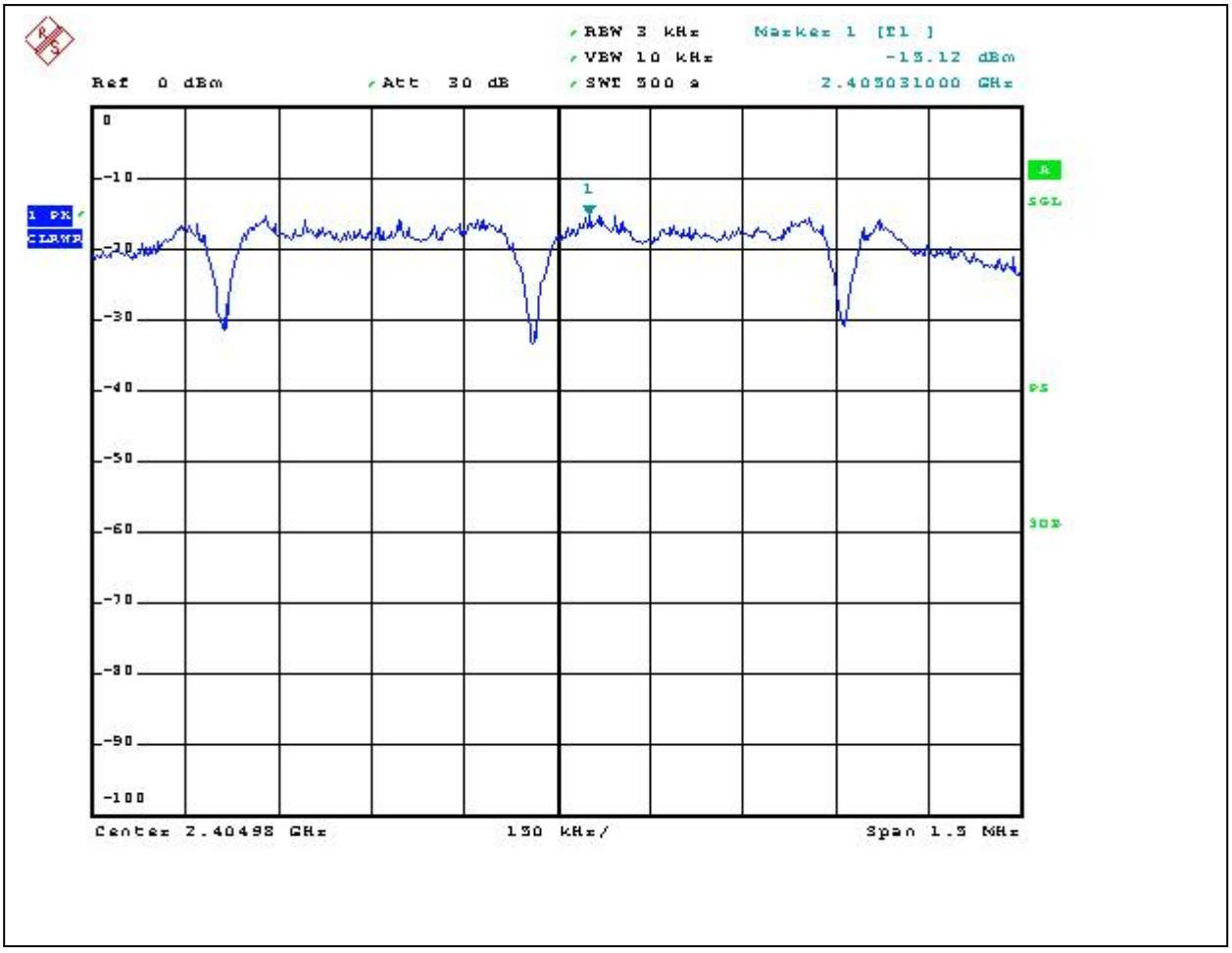

RBW 100 kHz
VBW 300 kHz
SWT 2.5 ms
Marker 1 [T1]
-10.35 dBm
2.479150000 GHz
Ref 10 dBm
Att 30 dB
Delta 2 [T1]
-0.32 dB
1.590000000 MHz
1 PK
MAXH
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.48 GHz
500 kHz/
Span 5 MHz

Graph 3.2.3

3.3 Power spectral density

Power Output:	☐ Conducted ☒ Radiated			
	Measured Density dBm or **dBµV/m**	**Power Spectral Density dBm**	**Limit dBm**	**Margin dB**
Low Frequency Channel 11	-15.12	-15.22	8	-23.2
Analyzer Settings:	☒ RBW=3KHz ☒ VBW=10KHz ☒ Span=1.5MHz ☒ Sweep=500sec			
Antenna Gain:	☒ < 6dBi and = 1.8 dBi ☐ >6dBi and = dBi, limit reduction = 0 dB			

Notes: None

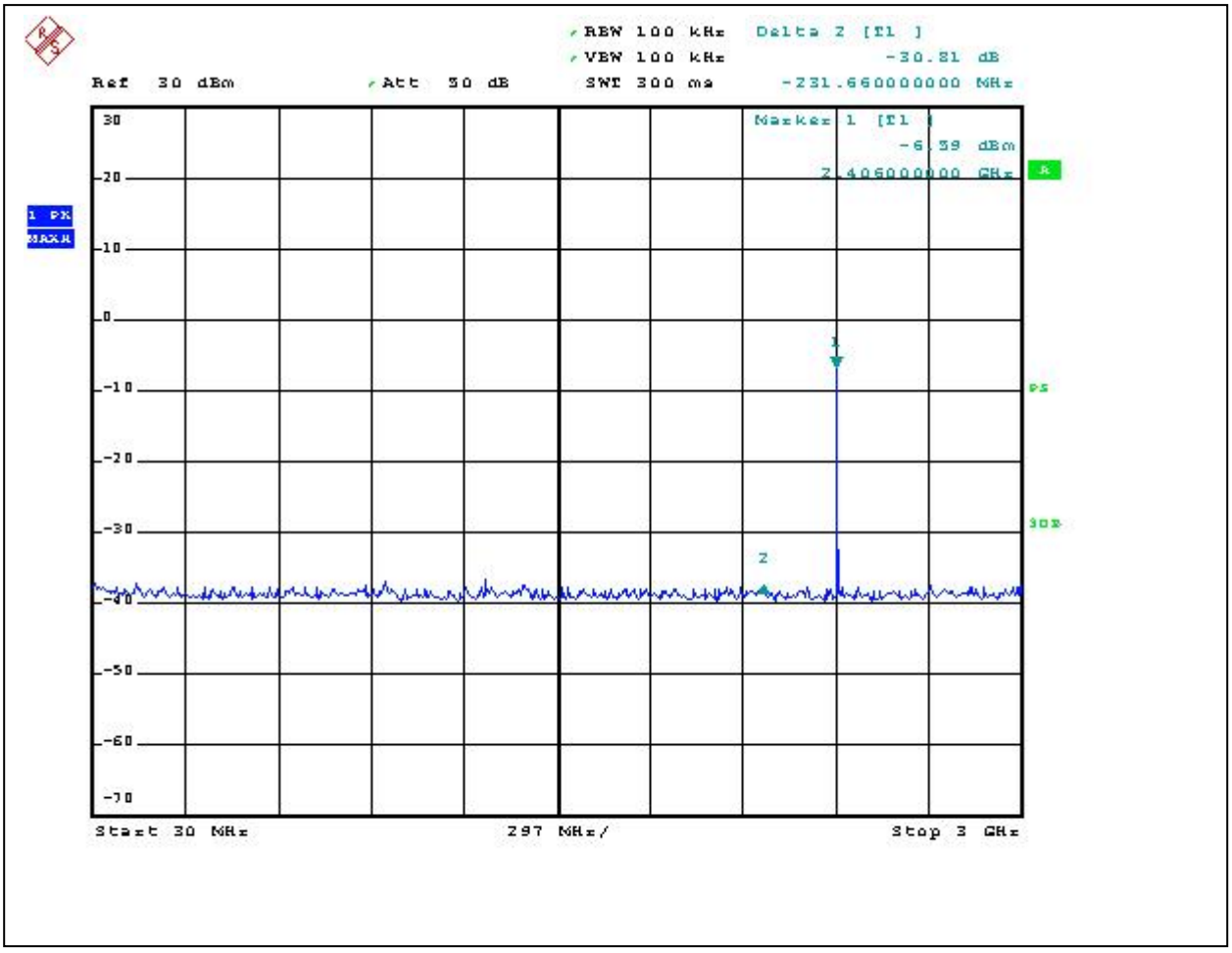

RBW 3 kHz
VBW 10 kHz
SWT 500 s
Marker 1 [T1]
-15.12 dBm
2.405031000 GHz
Ref 0 dBm
Att 30 dB
1 PK
CLRWR
1
SGL
PS
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Center 2.40498 GHz
150 kHz/
Span 1.5 MHz

Graph 3.3.1

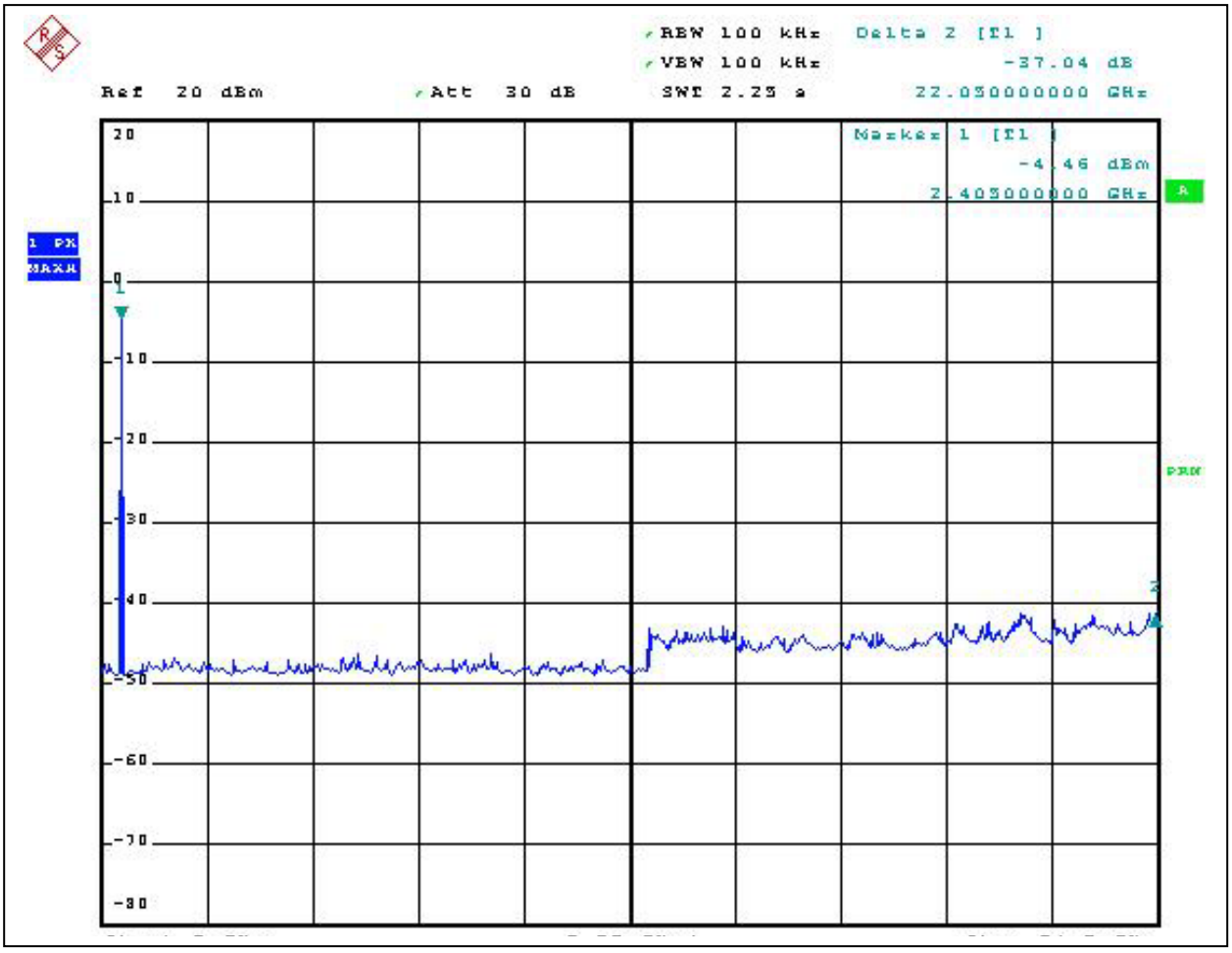
3.4 Antenna conducted spurious emissions

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	30.8	20	-10.8
Middle Frequency Channel	28.9	20	-8.9
Upper Frequency Channel	29.9	20	-9.9
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

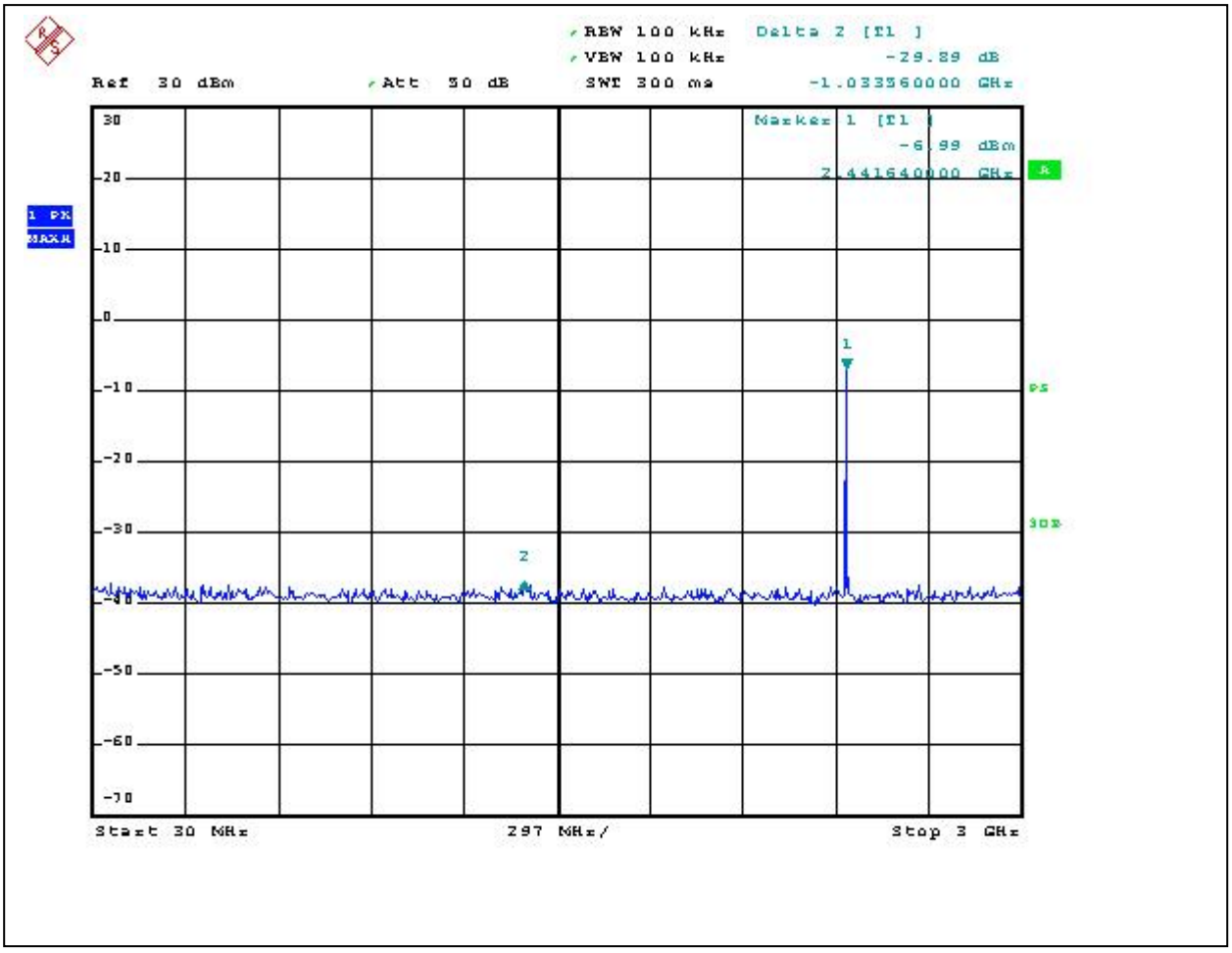
Notes: Spurious Emissions for Channel 11 are shown in Graphs 4.3.1 and 4.3.2;
Spurious Emissions for Channel 18 are shown in Graphs 4.3.3 and 4.3.4;
Spurious Emissions for Channel 26 are shown in Graphs 4.3.5 and 4.3.6


RBW 100 kHz
VBW 100 kHz
SWT 300 ms
Delta 2 [T1]
-30.81 dB
-231.660000000 MHz
Ref 30 dBm
Att 50 dB
Marker 1 [T1]
-6.39 dBm
2.406000000 GHz
1 PK
MAXH
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
297 MHz/
Stop 3 GHz

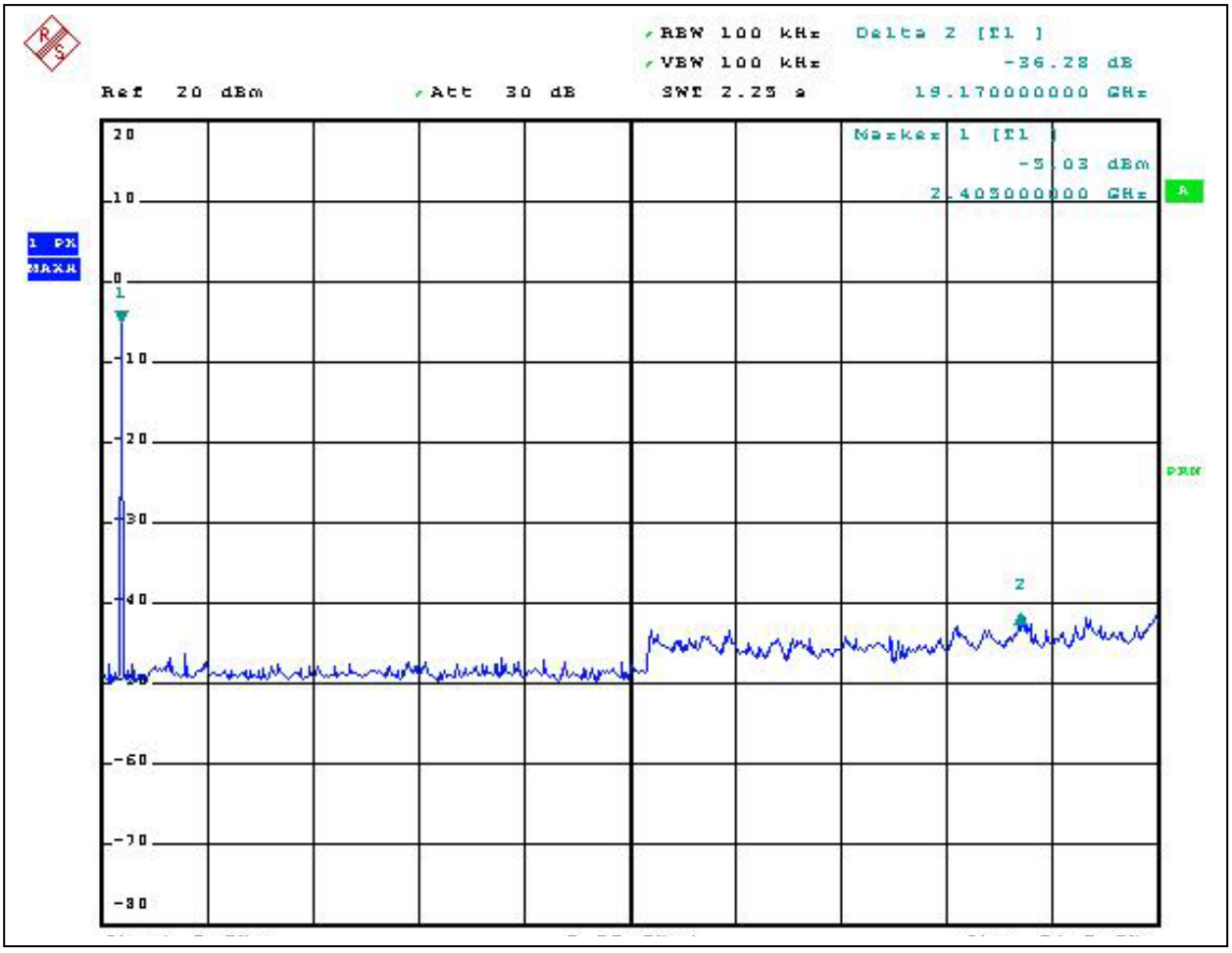
Graph 3.4.1


RBW 100 kHz
VBW 100 kHz
SWT 2.25 s
Delta 2 [T1]
-37.04 dB
22.050000000 GHz
Ref 20 dBm
Att 30 dB
Marker 1 [T1]
-4.46 dBm
2.405000000 GHz
1 PK
MAXH
PRN
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80

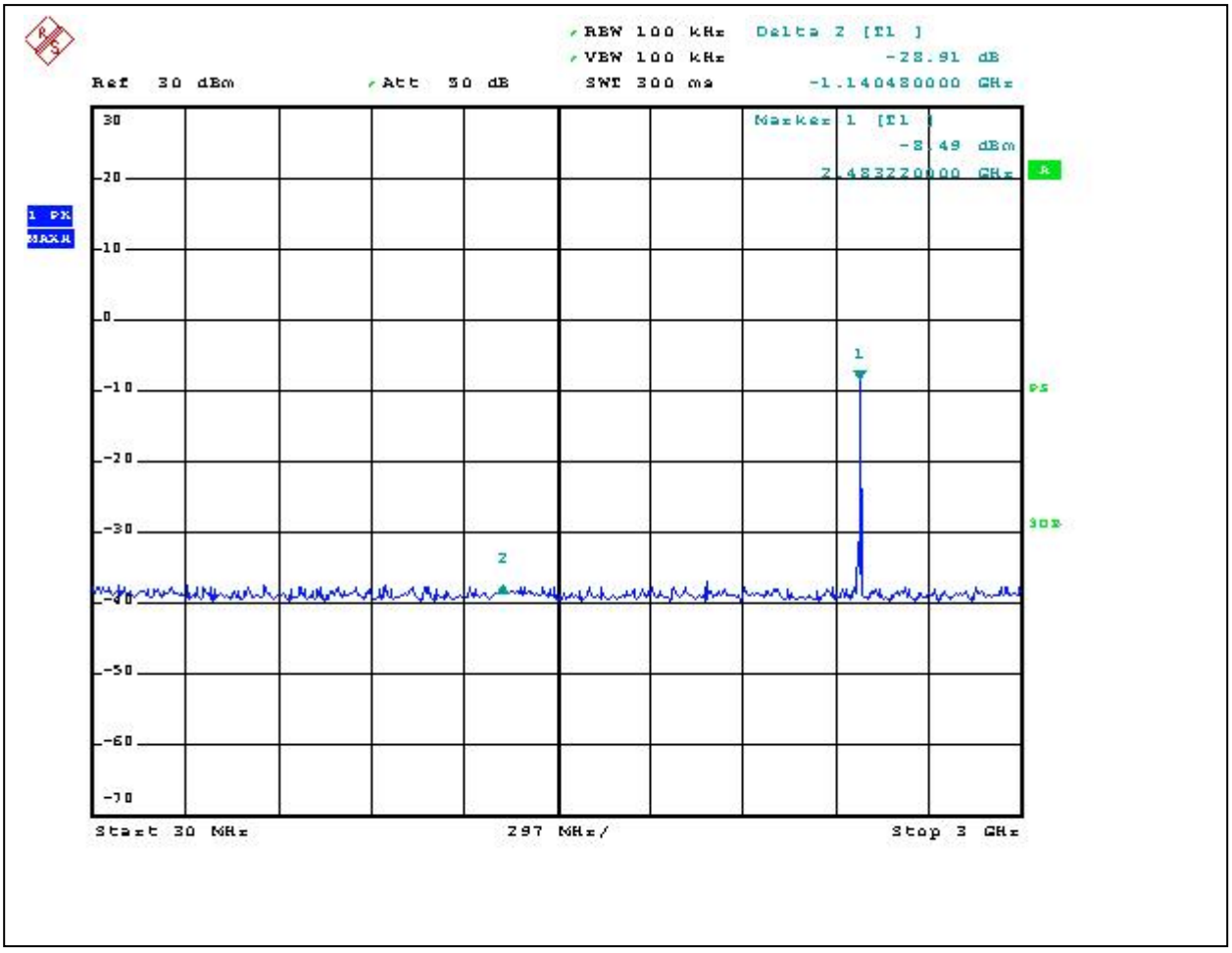
Graph 3.4.2


RBW 100 kHz
VBW 100 kHz
SWT 300 ms
Delta 2 [T1]
-29.89 dB
-1.033560000 GHz
Ref 30 dBm
Att 50 dB
Marker 1 [T1]
-6.99 dBm
2.441640000 GHz
1 PK
MAXH
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
297 MHz/
Stop 3 GHz

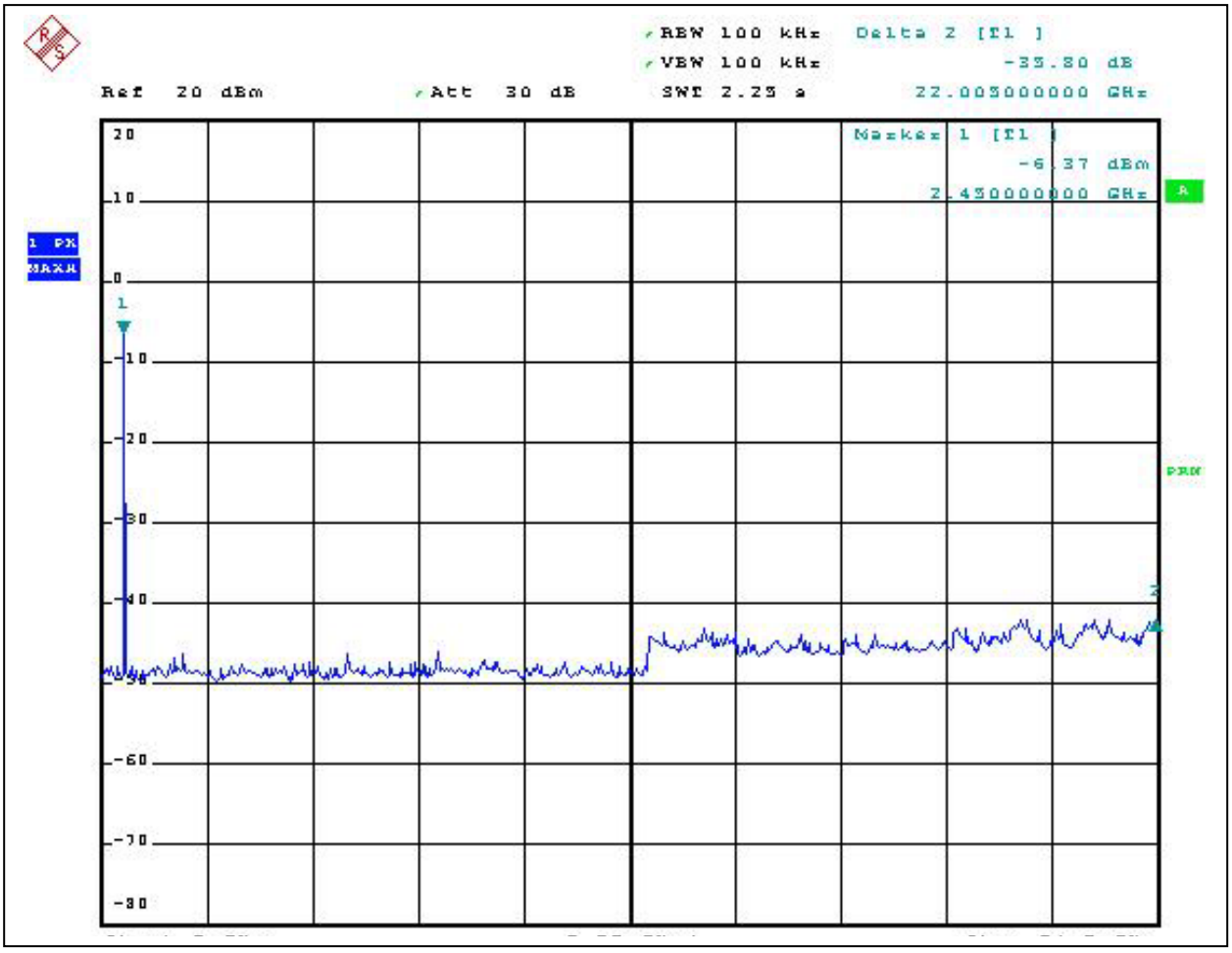
Graph 3.4.3


RBW 100 kHz
VBW 100 kHz
SWT 2.25 s
Delta 2 [T1]
-36.28 dB
19.170000000 GHz
Ref 20 dBm
Att 30 dB
Marker 1 [T1]
-5.03 dBm
2.405000000 GHz
1 PK
MAXH
PRN
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80

Graph 3.4.4


RBW 100 kHz
VBW 100 kHz
SWT 300 ms
Delta 2 [T1]
-28.91 dB
-1.140480000 GHz
Ref 30 dBm
Att 50 dB
Marker 1 [T1]
-8.49 dBm
2.483220000 GHz
1 PK
MAXH
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Start 30 MHz
297 MHz/
Stop 3 GHz

Graph 3.4.5


RBW 100 kHz
VBW 100 kHz
SWT 2.25 s
Delta 2 [T1]
-35.80 dB
22.005000000 GHz
Ref 20 dBm
Att 30 dB
Marker 1 [T1]
-6.37 dBm
2.450000000 GHz
1 PK
MAXH
PRN
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80

Graph 3.4.6

3.5 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

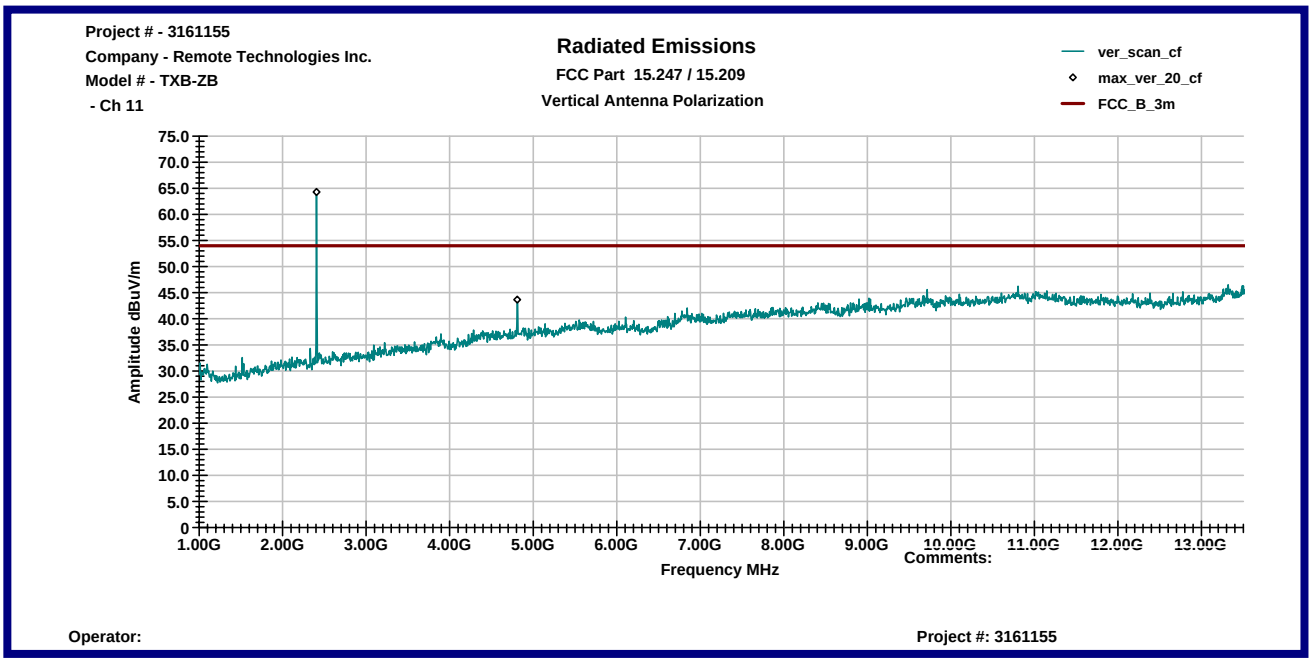
Test result: **Pass**

Max. Margin: 8.1 dB below the limits

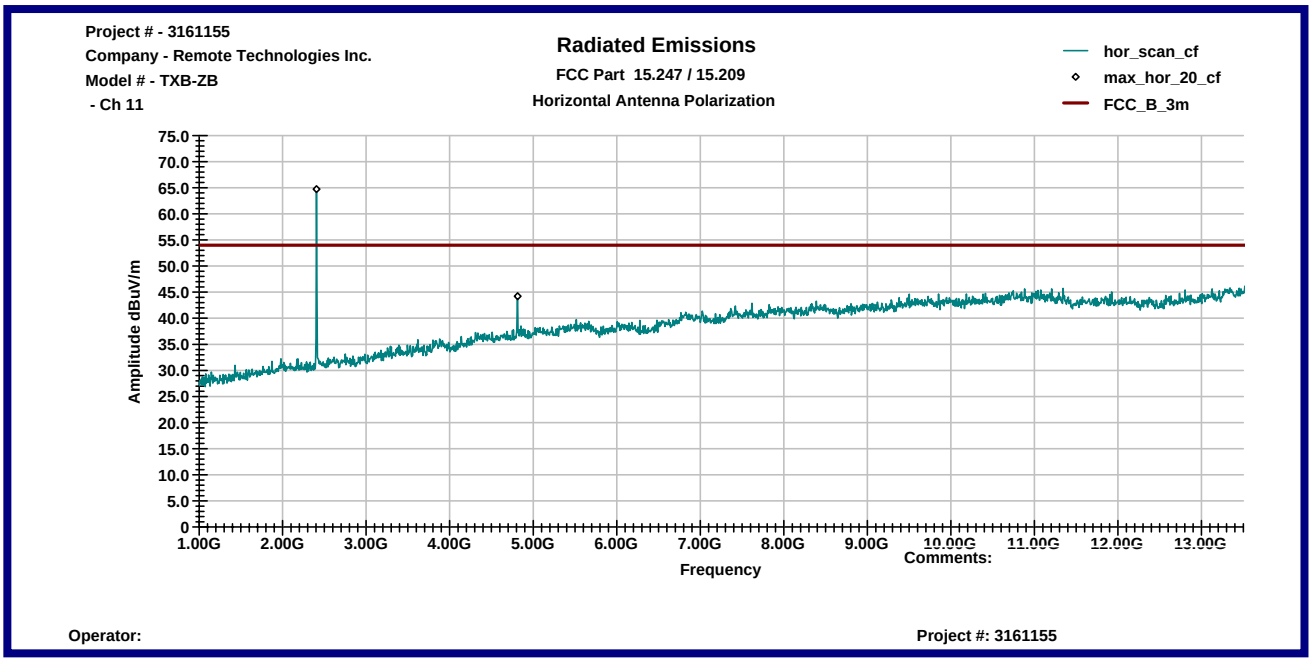
Date:	October 28-29, 2008	**Result:** **Pass**
Standard:	FCC part 15.247(d)	
Tested by:	Norman Shpilsher	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	No emissions above ambient were detected above the 2nd harmonics Emissions at fundamentals were excluded from the Table	

Table 3.5.1

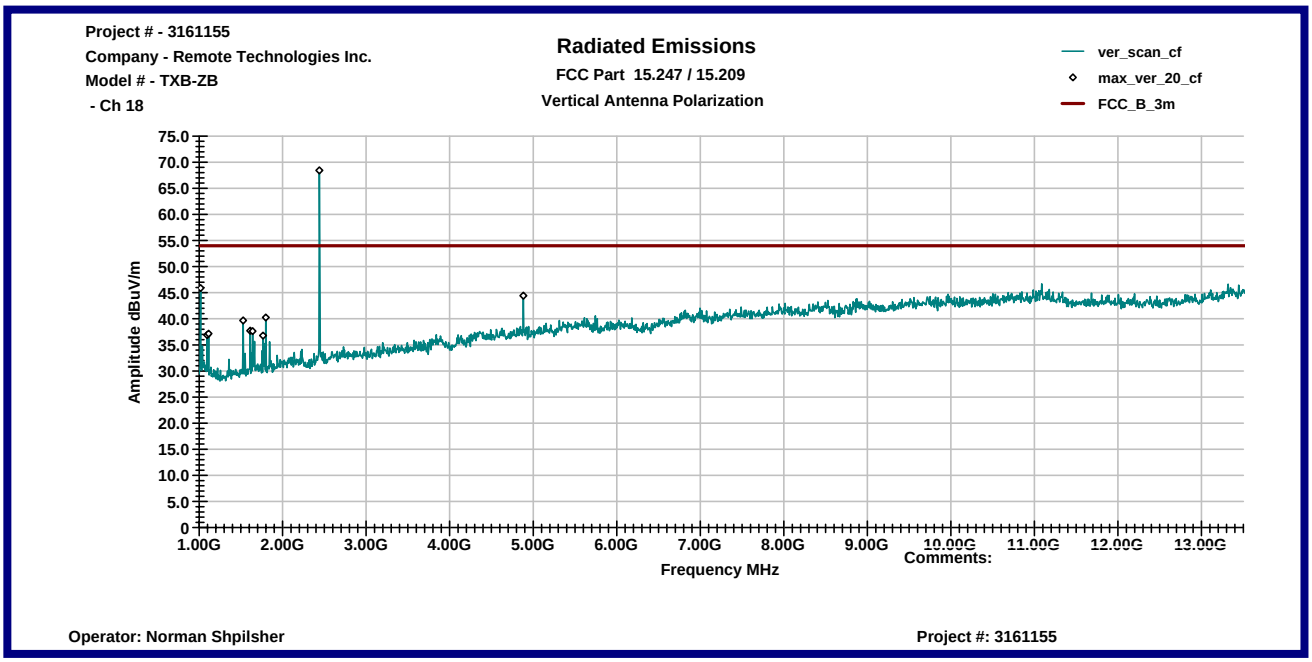
Frequency MHz	Antenna Polarity	Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
		Channel 11					
4.808 GHz	V	44.1	39.4	39.8	43.7	54.0	-10.3
4.8137 GHz	H	44.6	39.4	39.8	44.2	54.0	-9.8
		Channel 18					
1.017 GHz	V	60.8	26.4	41.4	45.9	54.0	-8.1
4.8817 GHz	V	44.7	39.5	39.8	44.4	54.0	-9.6
1.8443 GHz	H	48.1	30.3	40.5	37.9	54.0	-16.1
4.8817 GHz	H	43.5	39.5	39.8	43.3	54.0	-10.7
		Channel 26					
1.136 GHz	V	56.5	27.0	41.3	42.2	54.0	-11.8
4.961 GHz	V	43.4	39.7	39.7	43.4	54.0	-10.6
4.961 GHz	H	42.9	39.7	39.7	42.9	54.0	-11.1



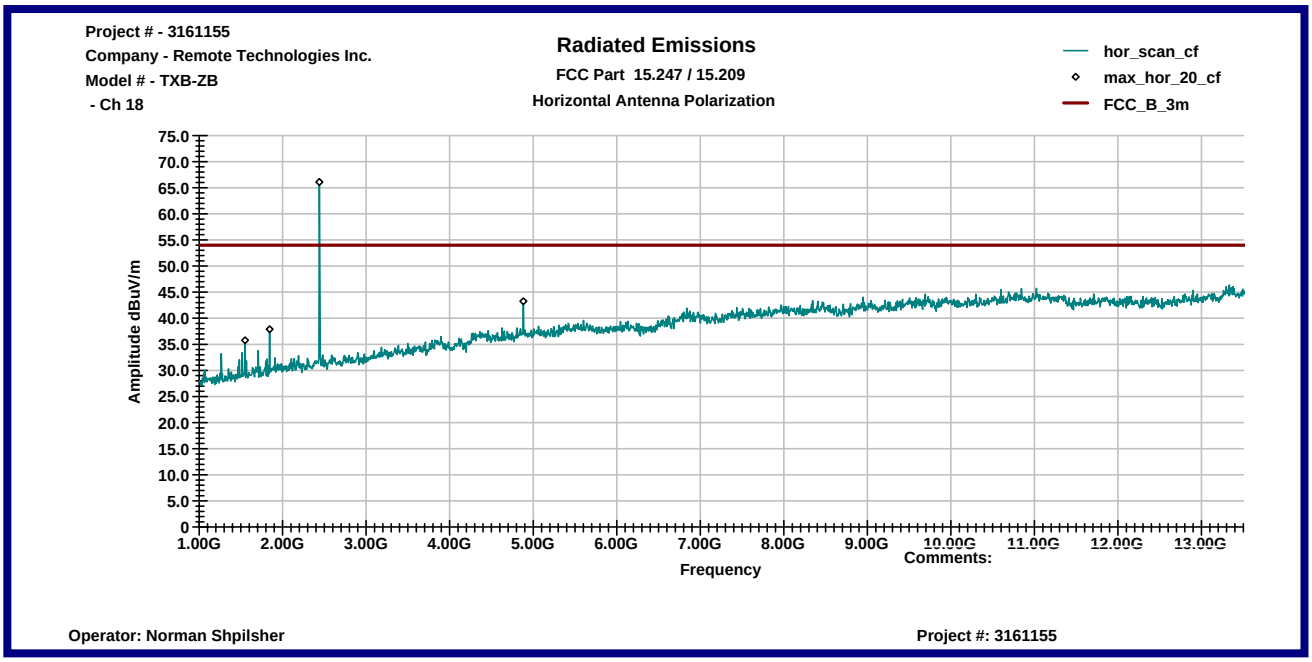
Graph 3.5.1



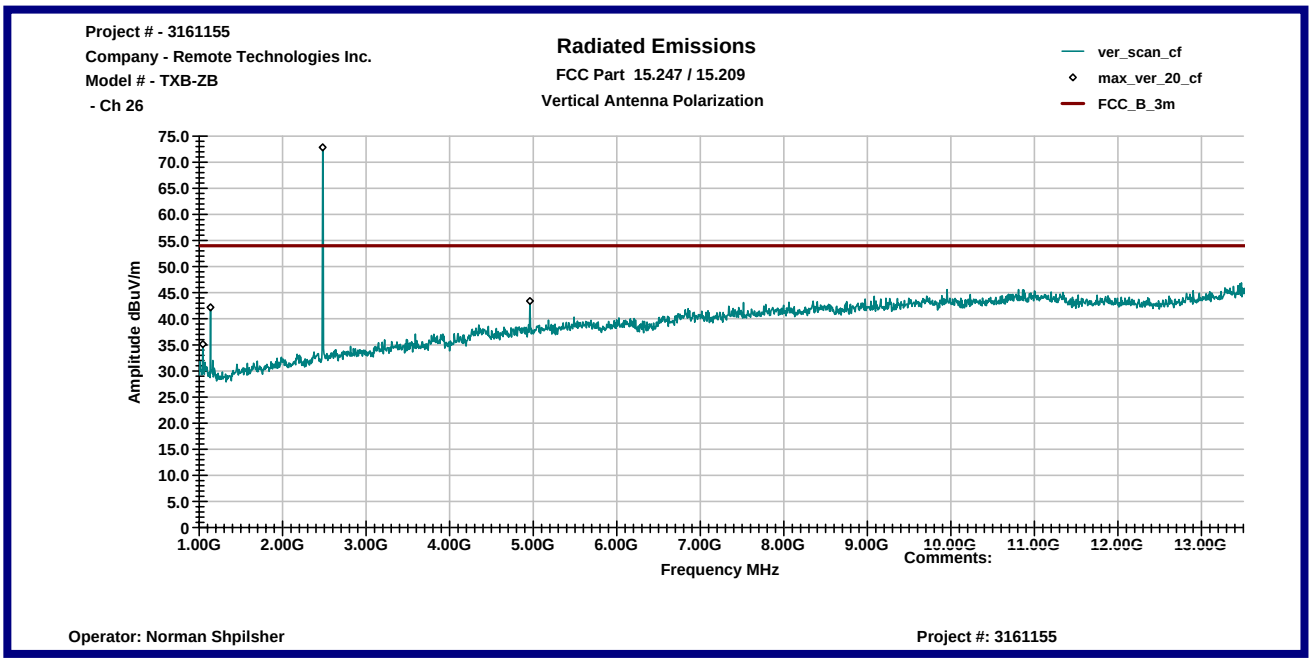
Graph 3.5.2



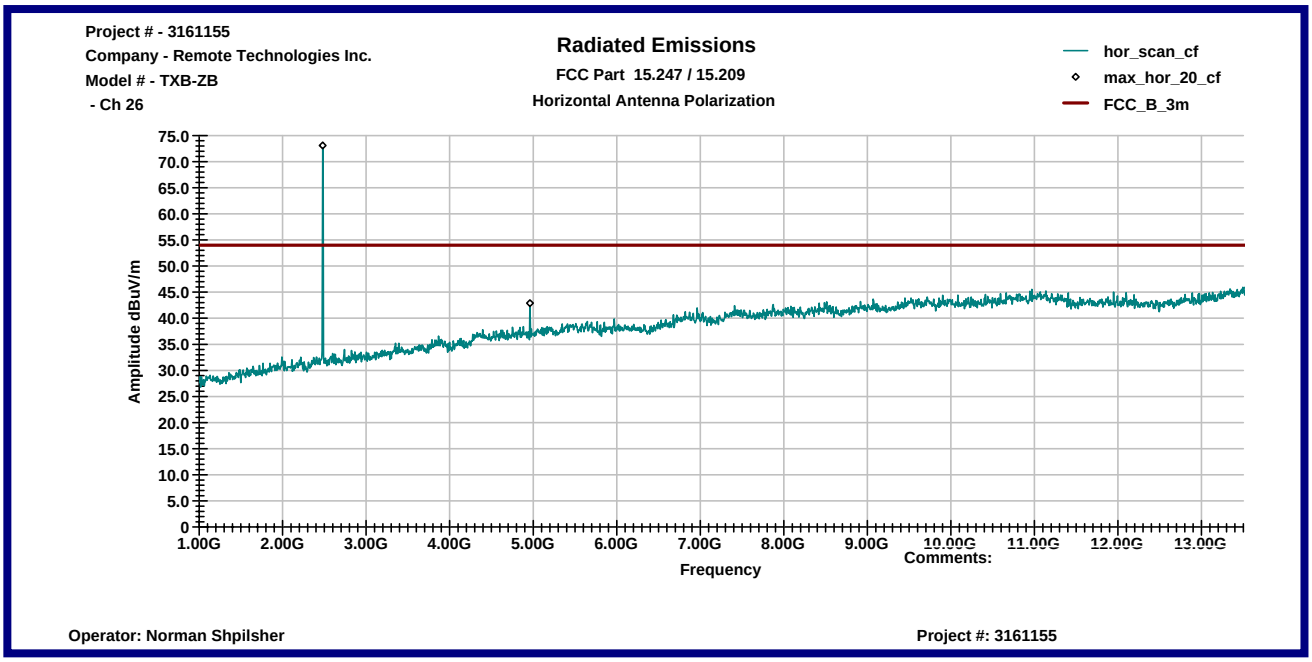
Graph 3.5.3



Graph 3.5.4



Graph 3.5.5



Graph 3.5.6

3.6 RF Exposure Compliance

The maximum measured antenna conducted power, P is –3.2dBm

The antenna gain, G is 1.8dBi

The maximum EIRP power = P + G
ERP = -3.2+ 1.8= -1.4dBm, or 0.000724W

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4GHz, MPE is $1mW/cm^2$, or $10W/m^2$

The Power Density is related to ERP with the equation:
$S = ERP / 4\pi D^2$, or $10 = 0.000724 / 4\pi D^2$, where
D is a separation distance in m.

The minimum safe separation distance, D = 2.4cm, which is below 20cm

3.7 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Notes: It was determined from consideration of the electrical characteristics and usage of particular apparatus that transmitter is powered at 3.3VDC from the Host device, however Conducted emissions measurements were performed at AC input of the Power Supply.

Date:	October 28, 2008	**Result:** **Pass**
Standard:	FCC 15.207	
Tested by:	Norman Shpilsher	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:		

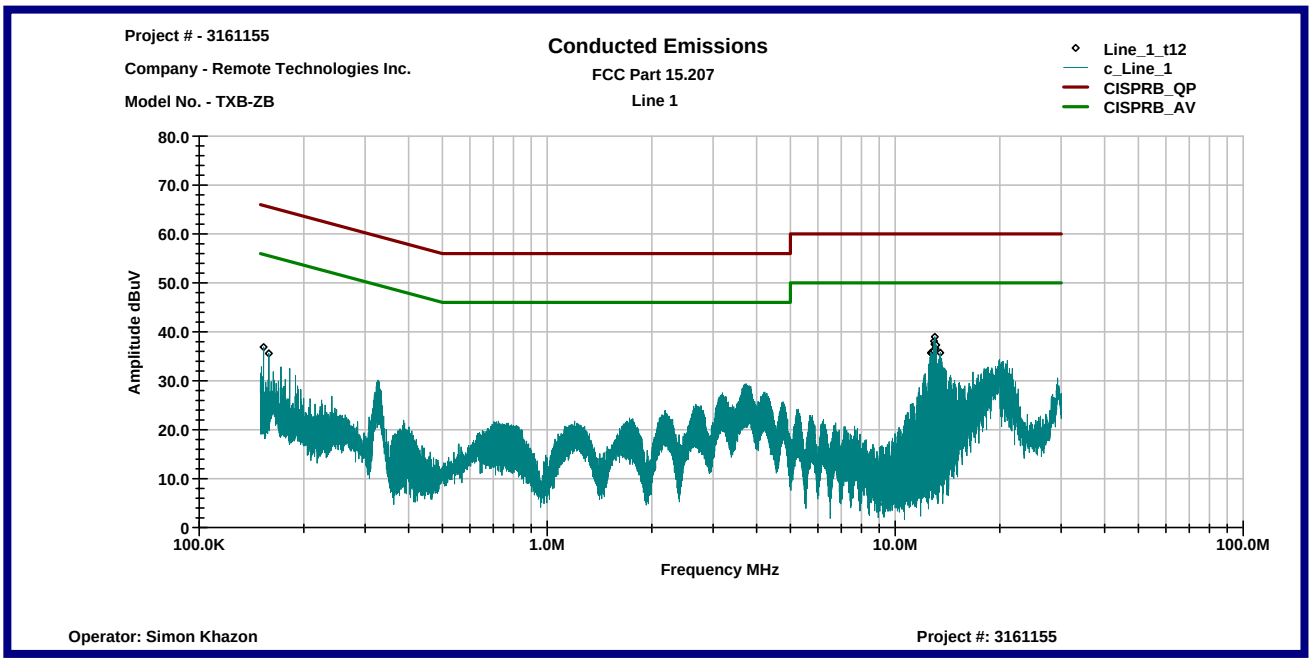
Table 3.7.1

Line 1

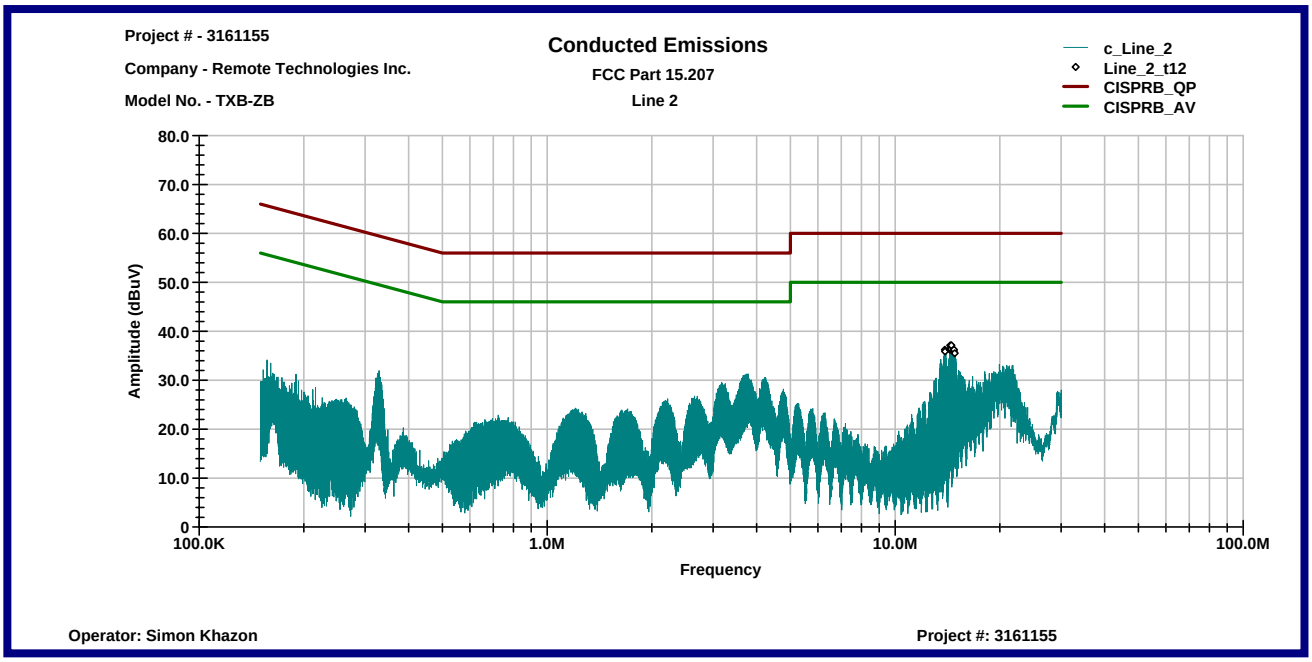
Frequency	Peak dBµV	QP Limit dBµV	AVG Limit dBµV	QP Margin dB	AVG Margin dB
153.18 KHz	36.9	65.8	55.8	-29.0	-19.0
158.62 KHz	35.6	65.5	55.5	-30.0	-20.0
12.662 MHz	35.7	60.0	50.0	-24.3	-14.3
12.723 MHz	35.6	60.0	50.0	-24.4	-14.4
12.908 MHz	36.1	60.0	50.0	-23.9	-13.9
12.927 MHz	38.1	60.0	50.0	-21.9	-11.9
12.97 MHz	37.5	60.0	50.0	-22.5	-12.5
12.989 MHz	39.0	60.0	50.0	-21.0	-11.0
13.032 MHz	36.6	60.0	50.0	-23.4	-13.4
13.05 MHz	37.2	60.0	50.0	-22.8	-12.8
13.112 MHz	37.3	60.0	50.0	-22.7	-12.7
13.464 MHz	35.7	60.0	50.0	-24.3	-14.3

Line 2

Frequency	Peak dBµV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
13.889 MHz	36.2	60.0	50.0	-23.8	-13.8
13.908 MHz	35.9	60.0	50.0	-24.1	-14.1
14.334 MHz	36.3	60.0	50.0	-23.8	-13.8
14.383 MHz	37.1	60.0	50.0	-22.9	-12.9
14.395 MHz	36.3	60.0	50.0	-23.7	-13.7
14.439 MHz	36.5	60.0	50.0	-23.6	-13.6
14.457 MHz	37.0	60.0	50.0	-23.0	-13.0
14.5 MHz	37.1	60.0	50.0	-22.9	-12.9
14.691 MHz	36.0	60.0	50.0	-24.0	-14.0
14.735 MHz	35.8	60.0	50.0	-24.2	-14.2
14.753 MHz	36.2	60.0	50.0	-23.8	-13.8
14.815 MHz	35.5	60.0	50.0	-24.5	-14.5



Graph 3.7.1



Graph 3.7.2

3.8 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-1000MHz

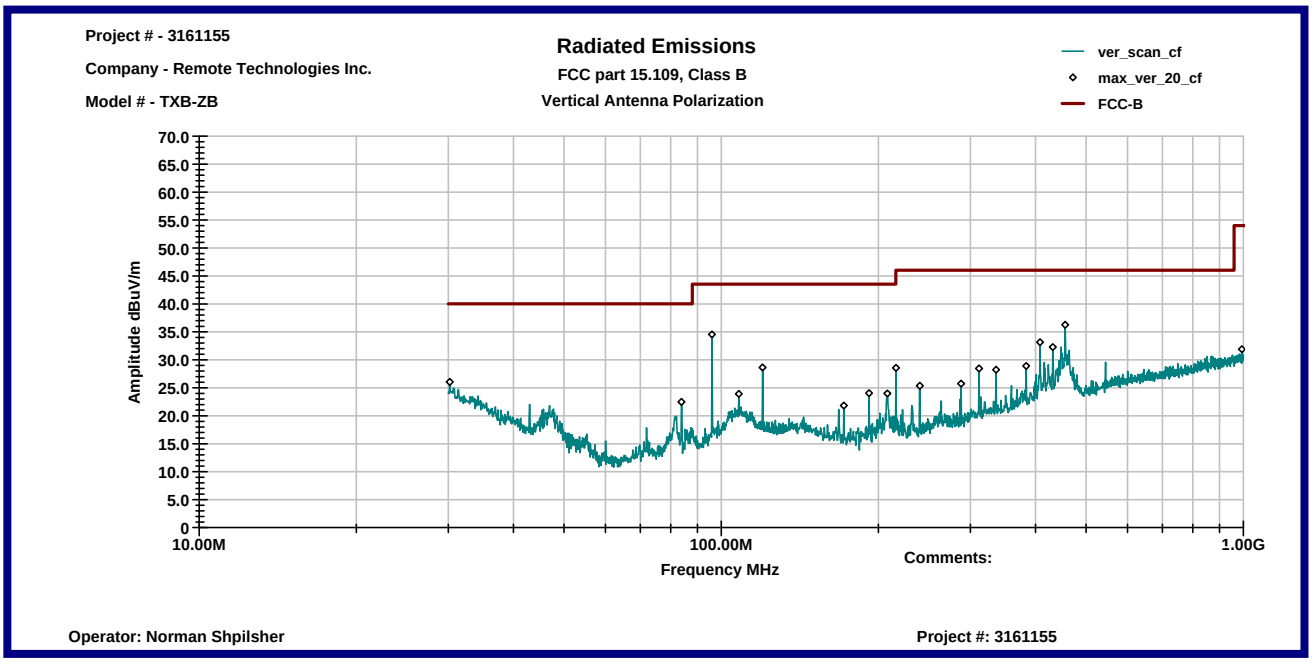
Max. Emissions margin: 9.0 dB below the limits

Notes: None

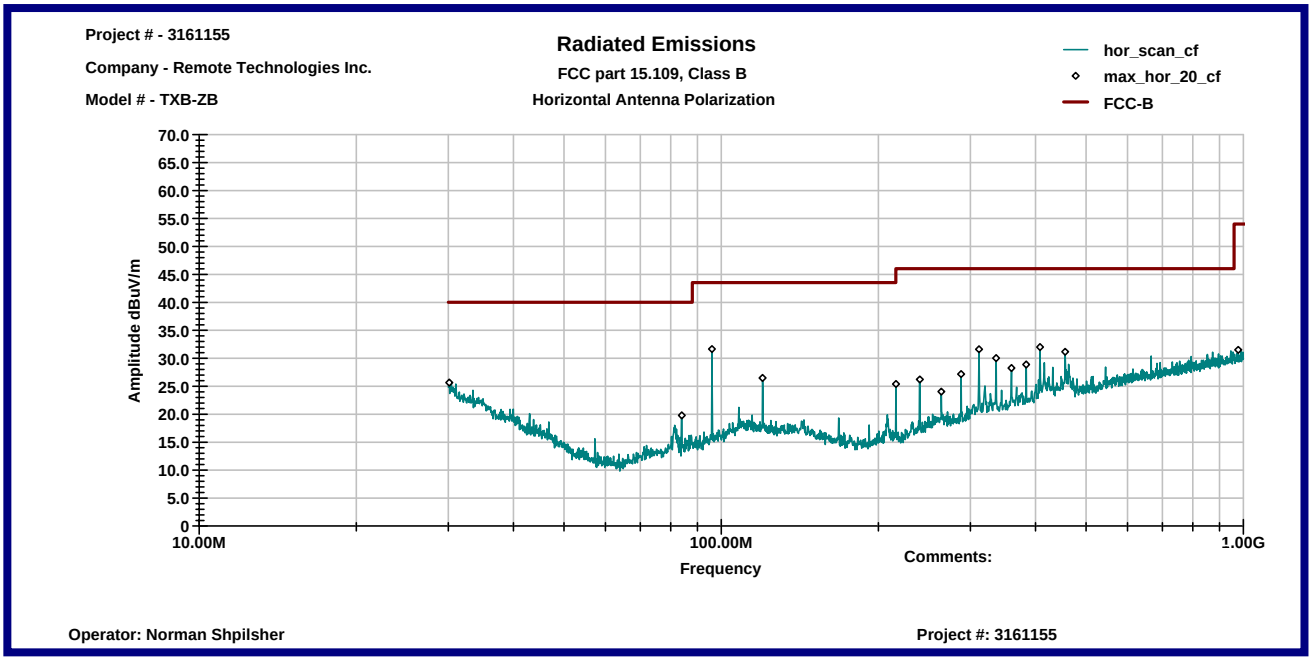
Date:	October 24, 2008	**Result:** **Pass**
Standard:	FCC Part 15.109, Class B	
Tested by:	Norman Shpilsher	
Test Point:	Enclosure	
Operation mode:	Standby Mode	
Note:		

Table 3.8.1

Frequency	Ant. Polarity	Peak Reading dBµV	Ant.Factor dB1/m	Total at 3m dBµV/m	QP Limit dBµV/m	Margin dB
30.208 MHz	V	5.1	21.0	26.0	40.0	-14.0
95.971 MHz	V	23.0	11.5	34.5	43.5	-9.0
120.0 MHz	V	14.7	13.9	28.6	43.5	-14.9
455.85 MHz	V	16.6	19.7	36.3	46.0	-9.8
30.139 MHz	H	4.6	21.0	25.6	40.0	-14.4
95.971 MHz	H	20.1	11.5	31.6	43.5	-11.9
120.0 MHz	H	12.5	13.9	26.5	43.5	-17.1
311.78 MHz	H	15.3	16.3	31.6	46.0	-14.4
408.06 MHz	H	12.7	19.3	32.0	46.0	-14.0
455.85 MHz	H	11.5	19.7	31.1	46.0	-14.9



Graph 3.8.1



Graph 3.8.2

4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Receiver RF Section	HP	85462A	3325A00106	9962	03/03/2009	☐
RF Filter Section	HP	85460A	3330A00109	9961	03/03/2009	☐
Spectrum Analyzer	R & S	FSP 40	100024	12559	08/22/2009	☒
Spectrum Analyzer	R & S	ESCI	100358	12909	05/07/2009	☒
Spectrum Analyzer	Agilent	E7402A	MY44212200	12660	11/13/2009	☐
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	08/27/2009	☒
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2630	14459	09/26/2009	☐
Horn Antenna	EMCO	3115	9507-4513	9936	02/13/2009	☒
Horn Antenna	EMCO	3115	6579	15580	03/20/2009	☐
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	08/12/2009	☒
Loop Antenna	A.H.Systems	SAS-200/562	215	9817	05/19/2009	☐
Loop Antenna	ETS	6512	00060486	19942	08/05/2009	☐
Monopole Antenna	A.H.Systems	SAS-200/550-1	692	9986	05/10/2009	☐
Monopole Antenna	ETS-Lindgren	3310B	0071915	MIN-0054	11/14/2009	☐
LISN	Fischer Custom Communications	FCC-LISN-2 MOD.SD	316	9945	10/28/2009	☐
LISN	Fischer Custom Communications	FCC-LISN-50-25-2	2014	9665	11/06/2009	☐
LISN	Fischer Custom Communications	FCC-LISN-50-32-2-01	97-01	9835	10/06/2009	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	06/05/2009	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	01/17/2009	☒
Pre-Amplifier	MITEQ	AMF-6F-26004000-40-8P	13224444	MIN-0064	11/13/2009	☐
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBU	☒
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	☒
5001ix	California Instruments System	5001	55864, 55863, 55862, 72277	17672	11/14/2009	☐
CTS 3.0.19	California Instruments Harmonic/Flicker Software	632		12723	11/14/2009	☐