TEST REPORT

Report Number: 101120352MIN-001
Project Number: G101120352

Testing performed on the
ISW-ZPR1-WP13 / ISW-ZDL1-WP11G
(Zigbee radio)
FCC ID: T3X-ZIGB01
Industry Canada ID: 1249A-ZIGB01

to
47 CFR Part 15. 247:2010
RSS- 210, Issue 8, 2010
RSS-Gen, Issue 3, 2010
47 CFR, Part 15:2010, §15.107 and §15.109, Class / ICES-003, Issue 5:2012

For
Bosch Security Systems

Test Performed by:
Intertek Testing Services NA, Inc.
7250 Hudson Blvd., Suite 100
Oakdale, MN 55128 USA

Test Authorized by:
Bosch Security Systems
130 Perinton Parkway
Fairport, NY 14450, USA

Prepared by: Richard Blonigen — Date: September 6, 2013

Reviewed by: Simon Khazon — Date: September 6, 2013

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1.0 GENERAL DESCRIPTION

Model:	ISW-ZPR1-WP13 ISW-ZDL1-WP11G
Type of EUT:	Motion Passive IR (PIR) Detector (ISW-ZPR1-WP13) Dual Motion (PIR and Microwave) Detector (ISW-ZDL1-WP11G)
Intertek Sample ID:	MIN1305161051-001 (ISW-ZPR1-WP13) MIN1305161051-003 (ISW-ZDL1-WP11G)
FCC ID:	T3X-ZIGB01
Industry Canada ID:	1249A-ZIGB01
Related Submittal(s) Grants:	None
Company:	Bosch Security Systems
Customer:	Mr. Peter Namisnak
Address:	130 Perinton Parkway Fairport, NY 14450, USA
Phone:	(585) 678-3462
Fax:	(585) 421-4263
e-mail:	peter.namisnak@us.bosch.com
Test Standards:	☒ 47 CFR, Part 15:2010, §15.247 ☒ RSS–210, Issue 8, 20010 ☒ RSS-Gen, Issue 3, 2010 ☒ 47 CFR, Part 15:2010, §15.107 and §15.109, Class B ☒ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☐ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	May 22, 2013
Test Work Started:	May 23, 2013
Test Work Completed:	June 25, 2013
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Product Description:	Dual Motion Detector
Transmitter Type:	☐ FHSS ☒ Digital Modulation ☐ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	2400 – 2483.5 MHz
Number of Channels:	15 (Channel 11- 25)
Modulation:	OQPSK
Emission Designator:	1M6G1DD(X)
Antenna(s) Info:	Integral, 3dBi, Ceramic Antenna (Antenna A) Integral, 3dBi, Trace Antenna (Antenna B)
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☒ Internal battery ☐ External power source ☒ 6.0 VDC (4 AA-size batteries) Note: Dual Sensor use additional 2 AA-size batteries for microwave sensor Amp. ☐ 50Hz ☐ 60Hz
Special Test Arrangement:	None
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009 and FCC 558074 D01 DTS Measurement Guidance

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	The device was pre-programmed to transmit continuously in three separate frequency channels, low, middle, and upper frequency channel, one channel being transmitted at a given time. The device was also pre-programmed to operate in receive/stand-by mode.

Cables:

No.	Type	Length	Designation	Note
1	None			

Support equipment/Services:

No.	Item	Description
1	None	

General notes: Both the ZRP1 and ZDL1 devices use identical RF portions and slightly different digital / interface portion related with using passive IR detector, or dual (passive IR and microwave) detector. Both the ZRP1 and ZDL1 devices use identical (3dBi gain) integral antennas: Antenna A – ceramic antenna, Antenna B – trace antenna, one antenna of two works at a given time.
Therefore testing and report covers the both devices related to FCC and Industry Canada requirements; the unit ZPR1 was tested with operated Antenna A, the unit ZDL1 was tested with operated Antenna B
For unintentional radiation the both devices were tested separately.

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)

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(a) / RSS-210 A8.2	6dB emissions bandwidth of the digital modulation	Pass
15.247(b), (c) / RSS-210 A8.4	Maximum peak output power	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	N/A
15.109 / ICES-003 / RSS-Gen 2.2 and 4.10	Receiver/digital device radiated emissions	Pass
15.107 / ICES-003	Digital device conducted emissions	N/A

3.0 TEST CONDITIONS AND RESULTS

3.1 6dB Emission bandwidth (EBW) of the digital modulation

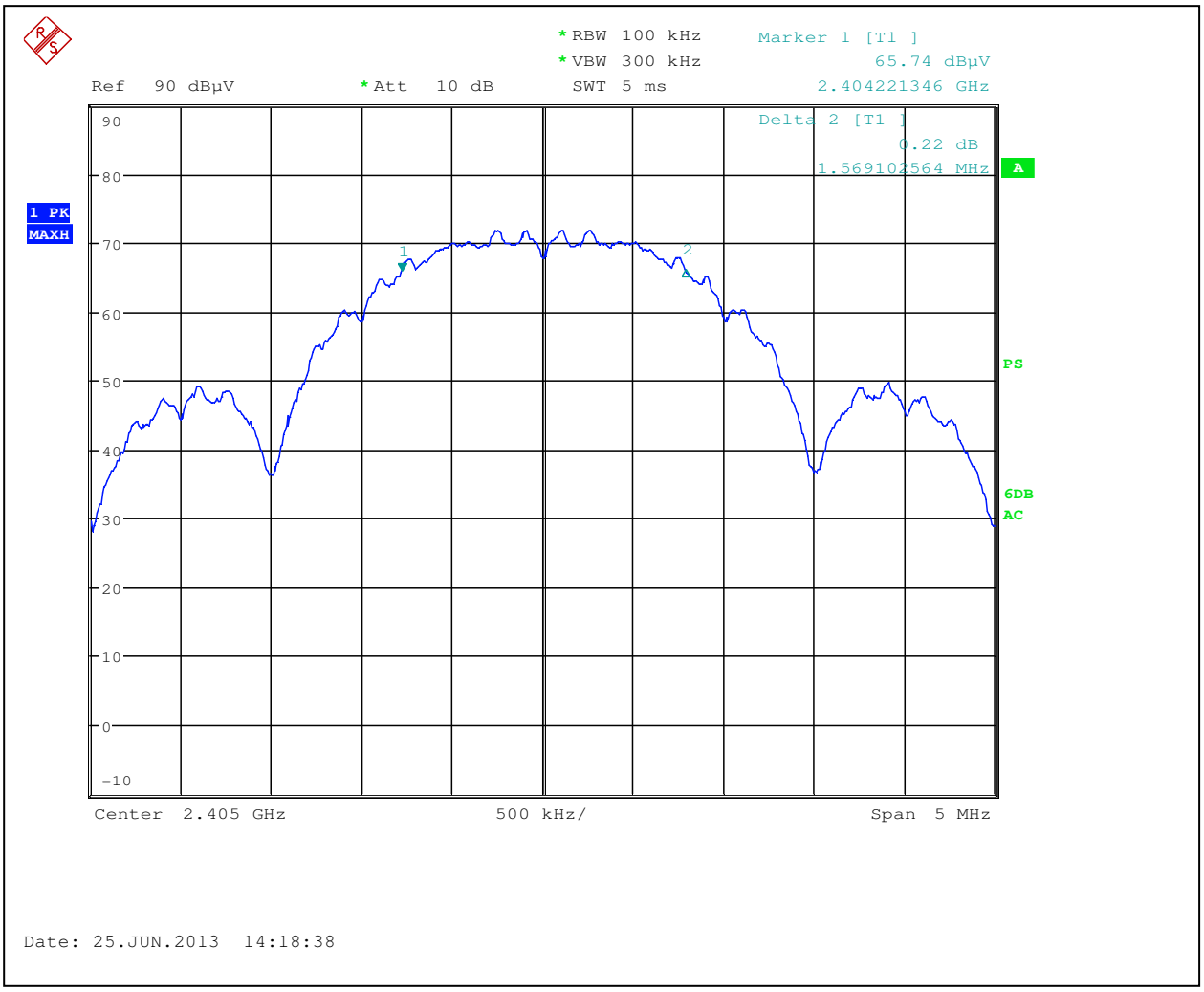
Antenna A

Low Frequency Channel 2405MHz	Middle Frequency Channel 2445MHz	Upper Frequency Channel 2475MHz	Minimum Bandwidth	Result
1569 kHz	1569 kHz	1609 kHz	500 kHz	**Pass**
RBW: **VBW:**	☒ 100kHz ☒ 300kHz			

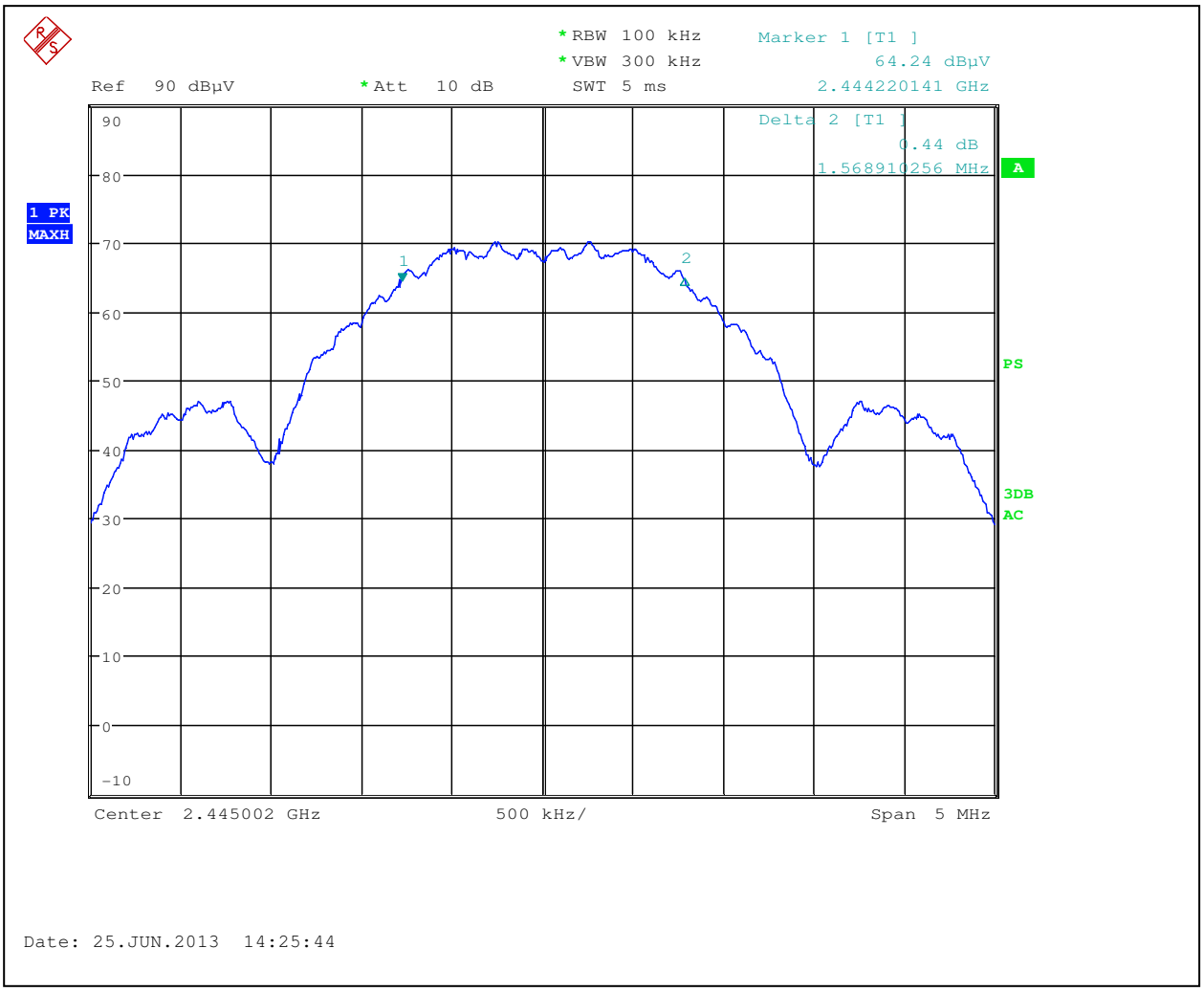
Antenna B

Low Frequency Channel 2405MHz	Middle Frequency Channel 2445MHz	Upper Frequency Channel 2475MHz	Minimum Bandwidth	Result
1591 kHz	1586 kHz	1581 kHz	500 kHz	**Pass**
RBW: **VBW:**	☒ 100kHz ☒ 300kHz			

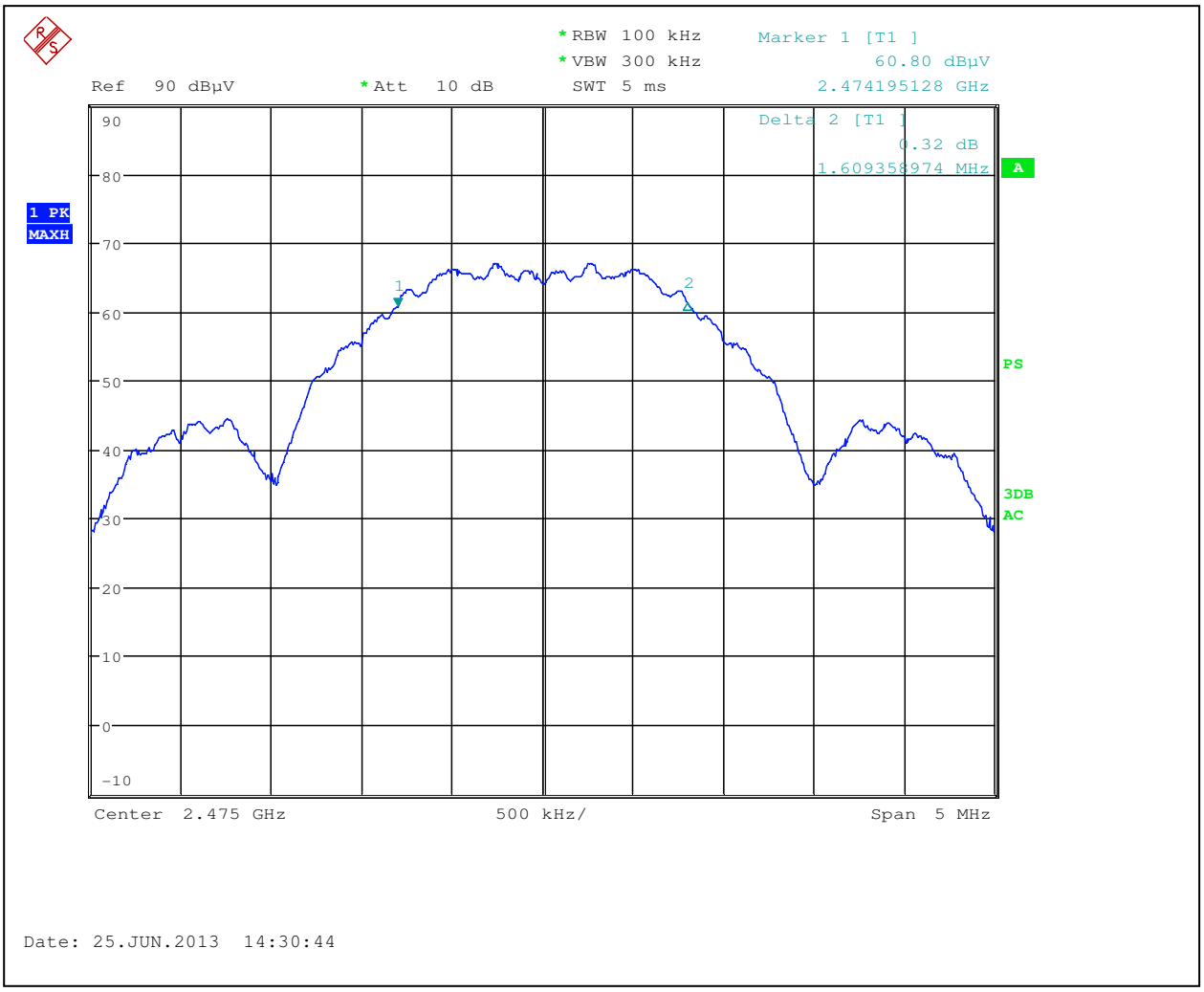
Notes: Graphs 3.1.1 – 3.1.3 show Antenna A Emission Bandwidth
Graphs 3.1.4 – 3.1.6 show Antenna B Emission Bandwidth


*RBW 100 kHz
*VBW 300 kHz
Ref 90 dBµV
*Att 10 dB
SWT 5 ms
Marker 1 [T1]
65.74 dBµV
2.404221346 GHz
Delta 2 [T1]
0.22 dB
1.569102564 MHz
A
1 PK
MAXH
PS
6DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.405 GHz
500 kHz/
Span 5 MHz
Date: 25.JUN.2013 14:18:38

Graph 3.1.1


*RBW 100 kHz
*VBW 300 kHz
Ref 90 dBµV
*Att 10 dB
SWT 5 ms
Marker 1 [T1]
64.24 dBµV
2.444220141 GHz
Delta 2 [T1]
0.44 dB
1.568910256 MHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.445002 GHz
500 kHz/
Span 5 MHz
Date: 25.JUN.2013 14:25:44

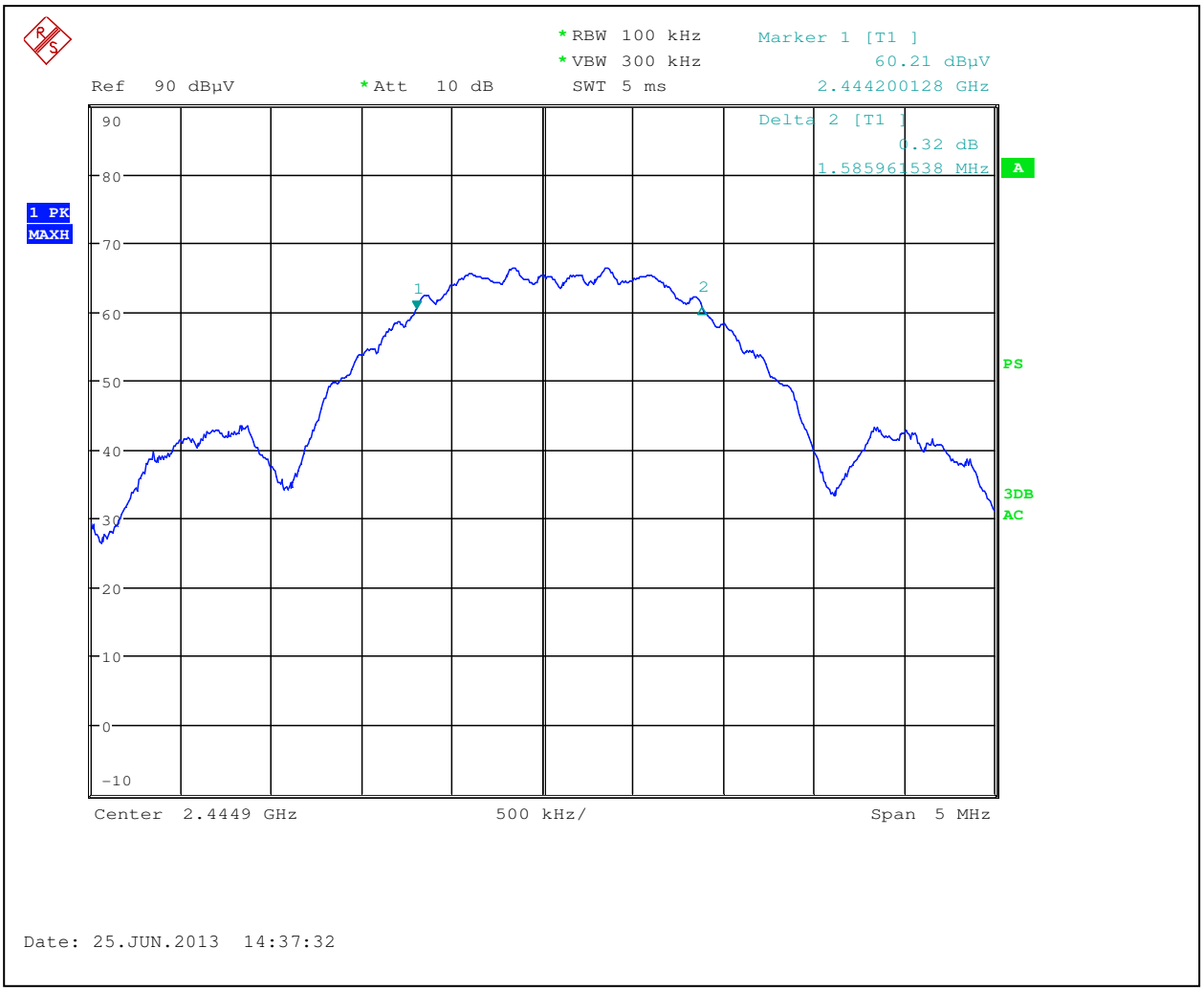
Graph 3.1.2


*RBW 100 kHz
*VBW 300 kHz
Ref 90 dBµV
*Att 10 dB
SWT 5 ms
Marker 1 [T1]
60.80 dBµV
2.474195128 GHz
Delta 2 [T1]
0.32 dB
1.609358974 MHz
A
1 PK
MAXH
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.475 GHz
500 kHz/
Span 5 MHz
Date: 25.JUN.2013 14:30:44

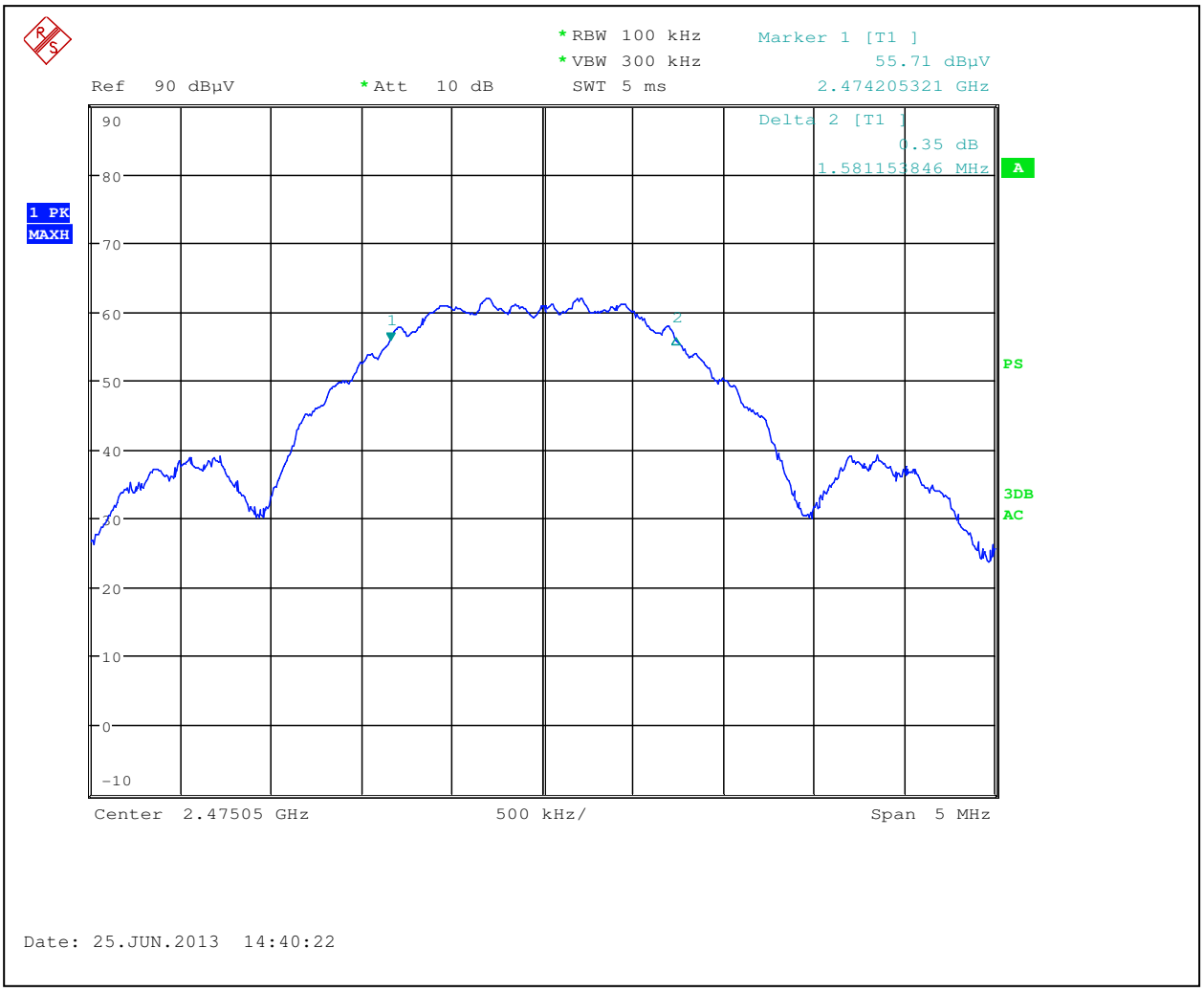
Graph 3.1.3


*RBW 100 kHz
*VBW 300 kHz
Ref 90 dBµV
*Att 10 dB
SWT 5 ms
Marker 1 [T1]
62.51 dBµV
2.404208141 GHz
Delta 2 [T1]
-0.17 dB
1.591346154 MHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.405 GHz
500 kHz/
Span 5 MHz
Date: 25.JUN.2013 14:34:06

Graph 3.1.4


*RBW 100 kHz
*VBW 300 kHz
Ref 90 dBµV
*Att 10 dB
SWT 5 ms
Marker 1 [T1]
60.21 dBµV
2.444200128 GHz
Delta 2 [T1]
0.32 dB
1.585961538 MHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.4449 GHz
500 kHz/
Span 5 MHz
Date: 25.JUN.2013 14:37:32

Graph 3.1.5


*RBW 100 kHz
*VBW 300 kHz
Ref 90 dBµV
*Att 10 dB
SWT 5 ms
Marker 1 [T1]
55.71 dBµV
2.474205321 GHz
Delta 2 [T1]
0.35 dB
1.581153846 MHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.47505 GHz
500 kHz/
Span 5 MHz
Date: 25.JUN.2013 14:40:22

Graph 3.1.6

3.2 Maximum peak output power

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. Margin: 12.7 dB below the limits

Date:	June 25, 2013	**Result:** **Pass**
Standard:	FCC Part 15.247	
Tested by:	Richard Blonigen	
Test Point:	Emissions at Fundamental	
Operation mode:	See Page 5	
Note:	None	

Table 3.2.1

Frequency MHz	Antenna Polarity	Reading dBµV	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Total @ 3m dBµV/m	Power W	Power dBm	Limit dBm	Margin
Antenna A										
2404.50	V	78.4	28.3	2.9	0.0	109.6	0.01366	11.4	30.0	-18.6
2404.50	H	77.0	28.3	2.9	0.0	108.2	0.00990	10.0	30.0	-20.0
2440.52	V	79.3	28.4	2.9	0.0	110.6	0.01727	12.4	30.0	-17.6
2440.52	H	77.3	28.4	2.9	0.0	108.6	0.01089	10.4	30.0	-19.6
2475.50	V	77.8	28.5	3.0	0.0	109.2	0.01255	11.0	30.0	-19.0
2475.50	H	77.1	28.5	3.0	0.0	108.5	0.01068	10.3	30.0	-19.7
Antenna B										
2405.53	V	82.0	28.3	2.9	0.0	113.2	0.03132	15.0	30.0	-15.0
2405.53	H	84.3	28.3	2.9	0.0	115.5	0.05319	17.3	30.0	-12.7
2444.48	V	79.9	28.4	2.9	0.0	111.2	0.01988	13.0	30.0	-17.0
2444.48	H	83.6	28.4	2.9	0.0	114.9	0.04661	16.7	30.0	-13.3
2475.49	V	79.0	28.5	3.0	0.0	110.4	0.01654	12.2	30.0	-17.8
2475.49	H	83.8	28.5	3.0	0.0	115.2	0.04996	17.0	30.0	-13.0

Notes: The Maximum Peak Output Power was calculated from equitation $P=(E \times d)^2/30G$, where P is the power in watts; E is the measured field strength in V/m; d is the measurement distance and = 3m; G is the numerical antenna gain of the transmitter = 2 (or 3dBi)

3.2.1 Average correction factor calculation

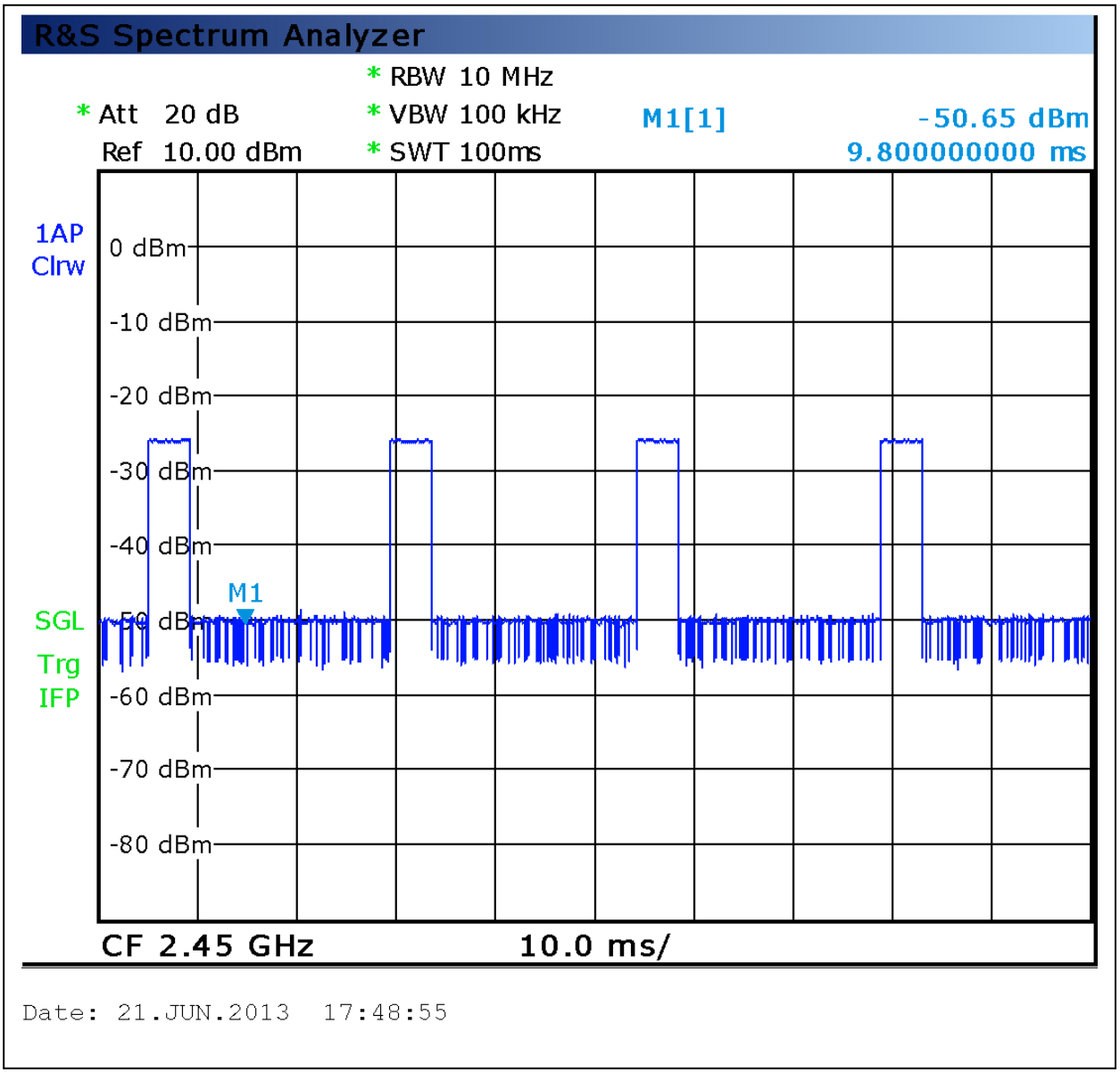
An Average correction factor is calculated by averaging one complete pulse train.

Complete pulses train, including blanking intervals over 100ms is 18ms

Average Correction Factor = 20Log(18ms/100ms) = -14.9dB

Graph 3-2-1 below shows pulse train timing.

Graph 3.2.2



3.3 Power spectral density

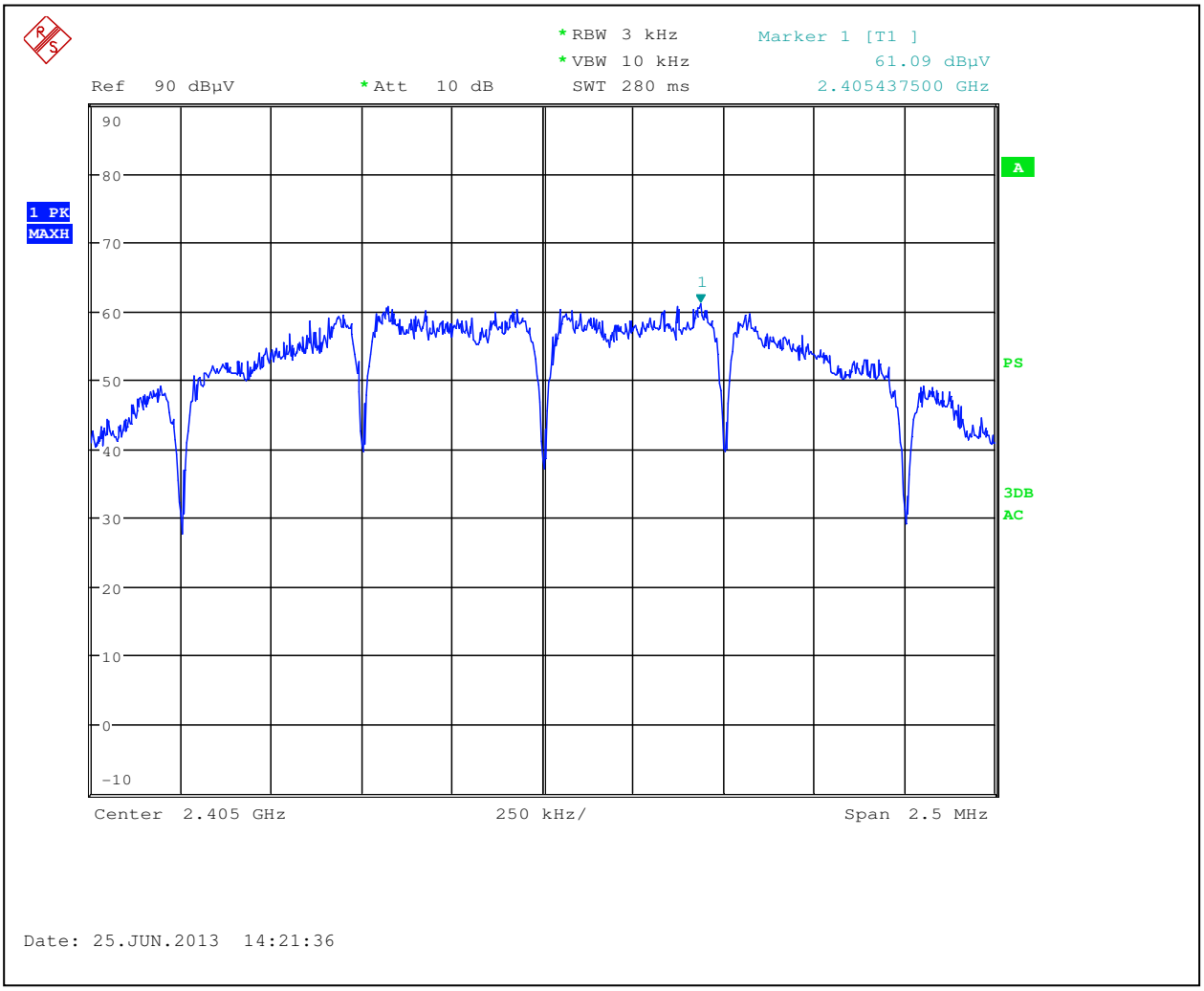
Date:	June 25, 2013	**Result:** **Pass**
Standard:	FCC Part 15.247	
Tested by:	Richard Blonigen	
Test Point:	Emissions at Fundamental	
Operation mode:	See Page 5	
Note:	None	

Table 3.3.1

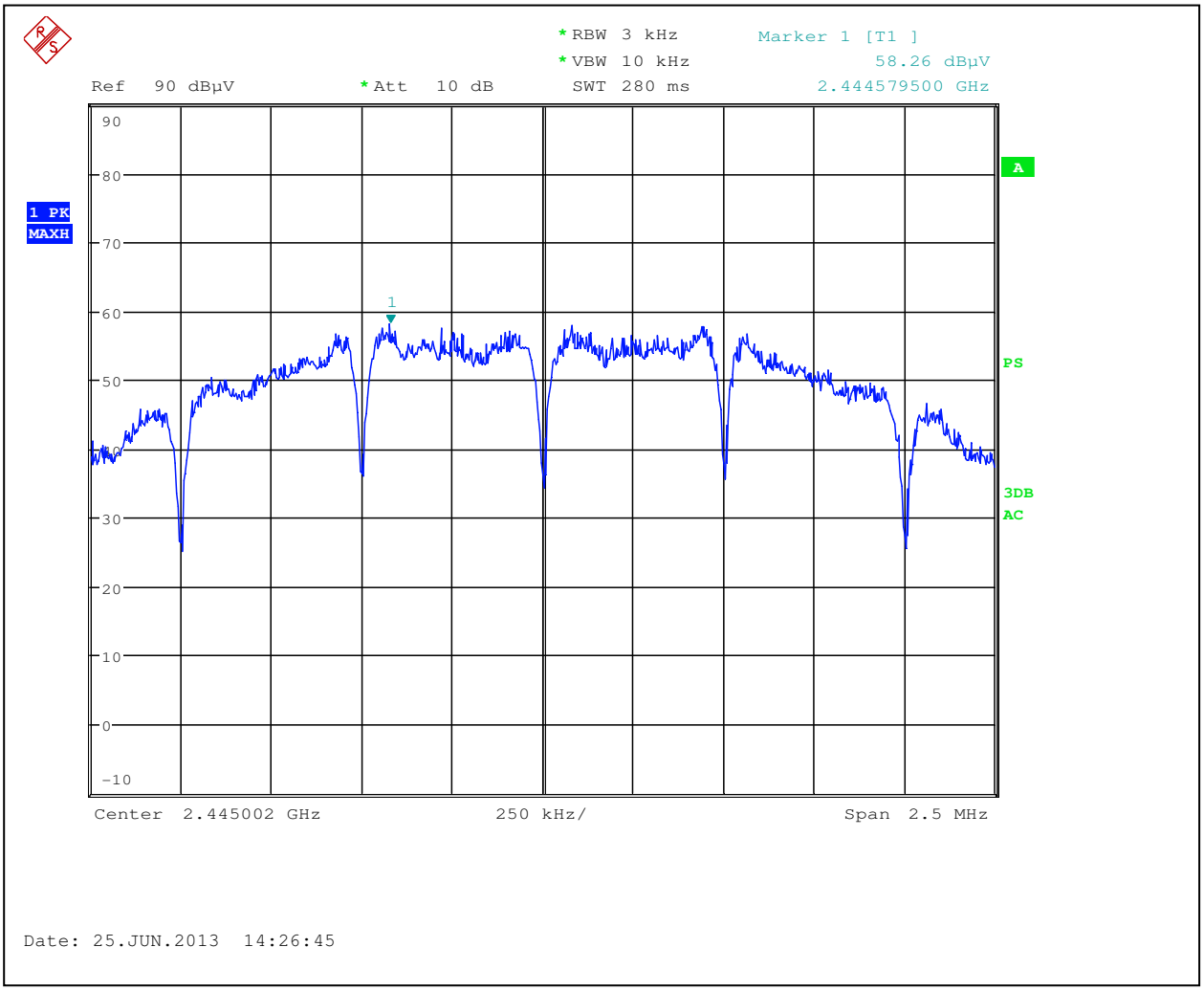
Frequency MHz	Reading dBµV	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Total @ 3m dBµV/m	Power W	Power dBm	Limit dBm	Margin dBm
Antenna A									
2405.00	61.09	28.3	2.9	0.0	92.3	0.0002539	-6.0	8.0	-14.0
2445.00	58.26	28.4	2.9	0.0	89.6	0.0001364	-8.7	8.0	-16.7
2475.00	54.55	28.5	3.0	0.0	86.0	0.0000594	-12.3	8.0	-20.3
Antenna B									
2405.00	56.99	28.3	2.9	0.0	88.2	0.0000988	-10.1	8.0	-18.1
2445.00	54.39	28.4	2.9	0.0	85.7	0.0000559	-12.5	8.0	-20.5
2475.00	49.48	28.5	3.0	0.0	80.9	0.0000185	-17.3	8.0	-25.3

Notes:

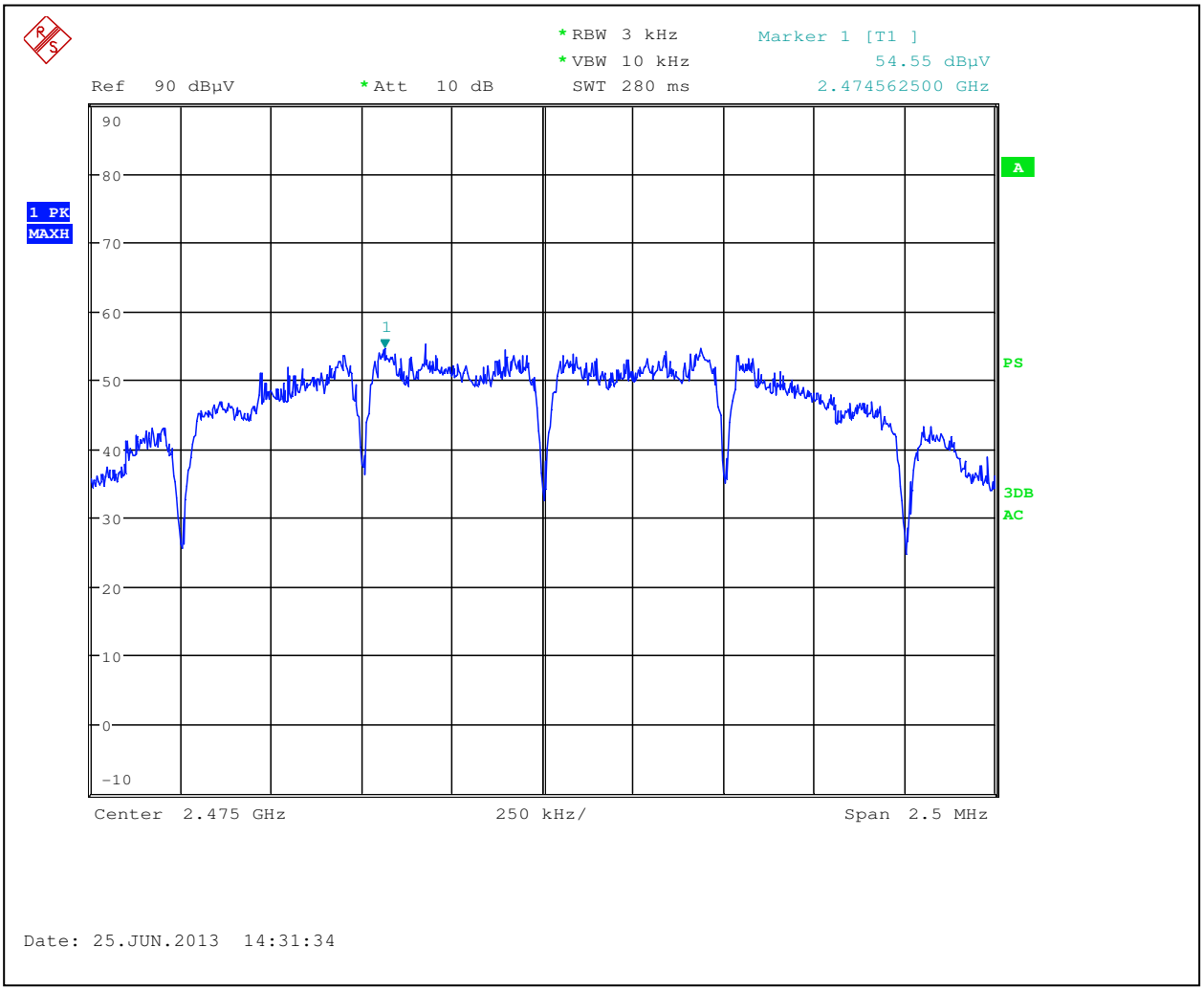
1. The measured Power Spectral Density was calculated from equitation $P=(E \times d)^2/30G$, where P is the power in watts; E is the measured field strength of Power Spectral Density in V/m; d is the measurement distance and = 3m; G is the numerical antenna gain of the transmitter = 2 (3 dBi)
2. Graphs 3.3.1 – 3.3.3 show Power Spectral Density of Antenna A
3. Graphs 3.3.4 – 3.3.6 show Power Spectral Density of Antenna B


*RBW 3 kHz
*VBW 10 kHz
Marker 1 [T1]
61.09 dBµV
Ref 90 dBµV
*Att 10 dB
SWT 280 ms
2.405437500 GHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.405 GHz
250 kHz/
Span 2.5 MHz
Date: 25.JUN.2013 14:21:36

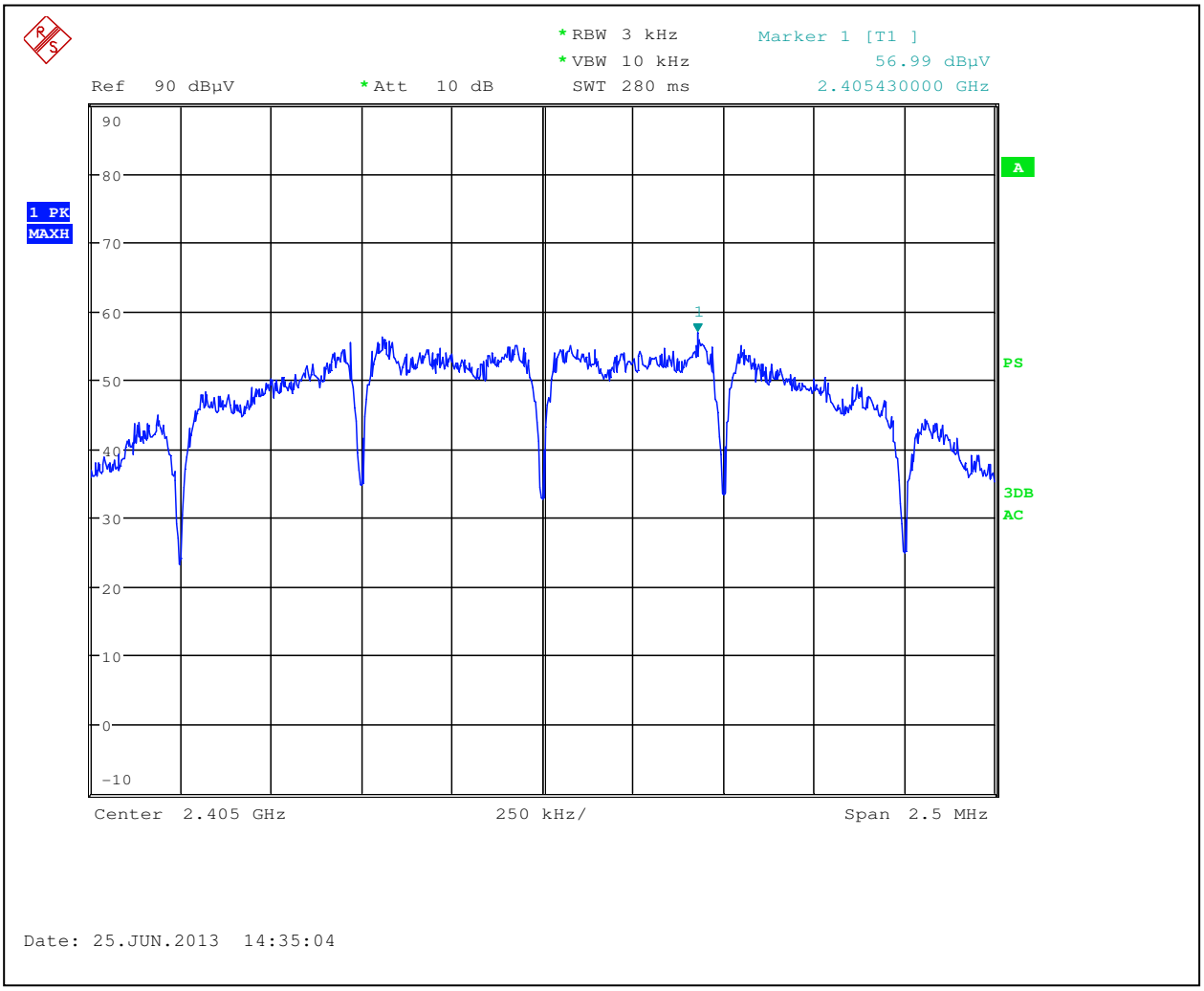
Graph 3.3.1


*RBW 3 kHz
*VBW 10 kHz
SWT 280 ms
Marker 1 [T1]
58.26 dBµV
2.444579500 GHz
Ref 90 dBµV
*Att 10 dB
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.445002 GHz
250 kHz/
Span 2.5 MHz
Date: 25.JUN.2013 14:26:45

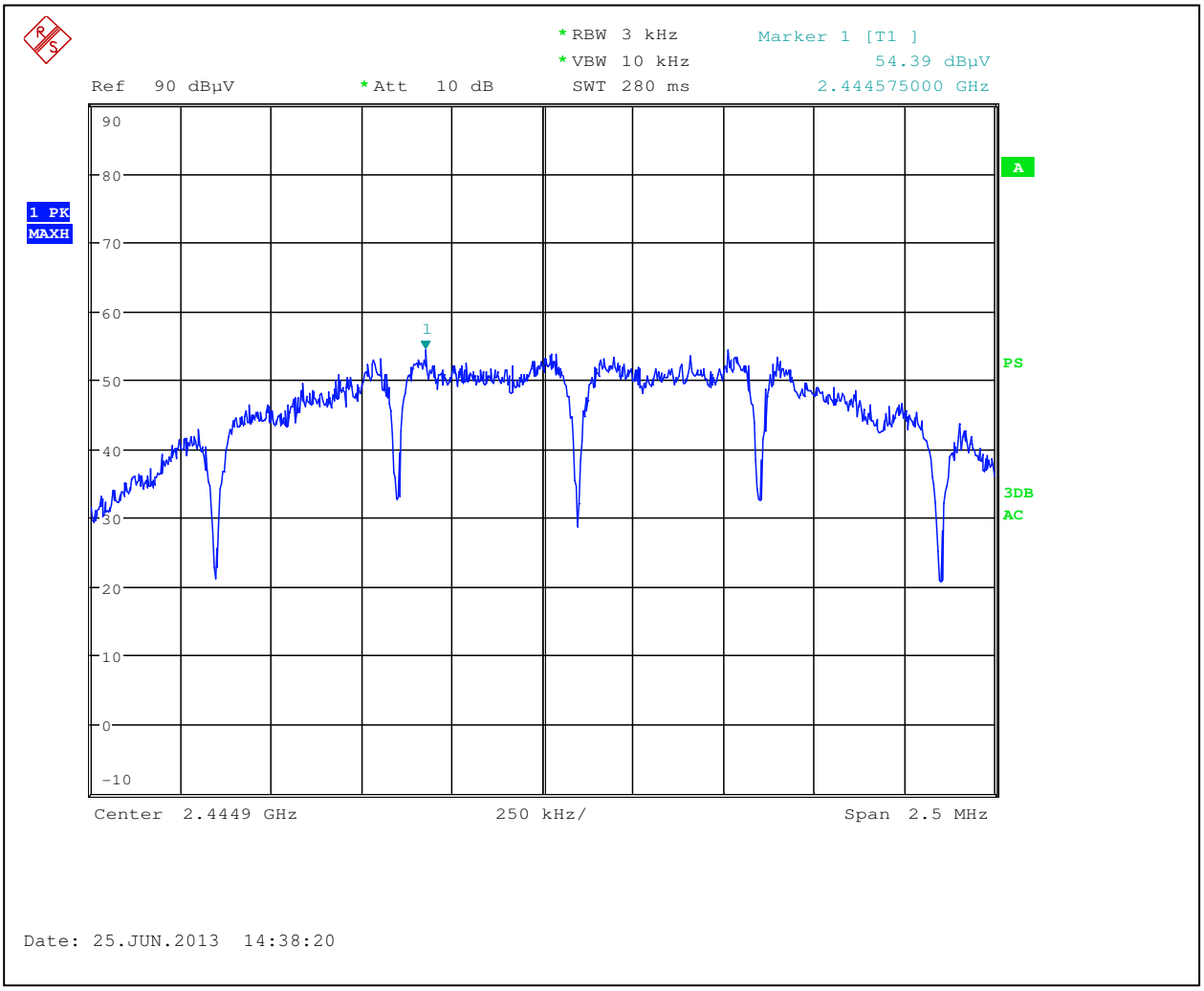
Graph 3.3.2


*RBW 3 kHz
*VBW 10 kHz
SWT 280 ms
Marker 1 [T1]
54.55 dBµV
2.474562500 GHz
Ref 90 dBµV
*Att 10 dB
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.475 GHz
250 kHz/
Span 2.5 MHz
Date: 25.JUN.2013 14:31:34

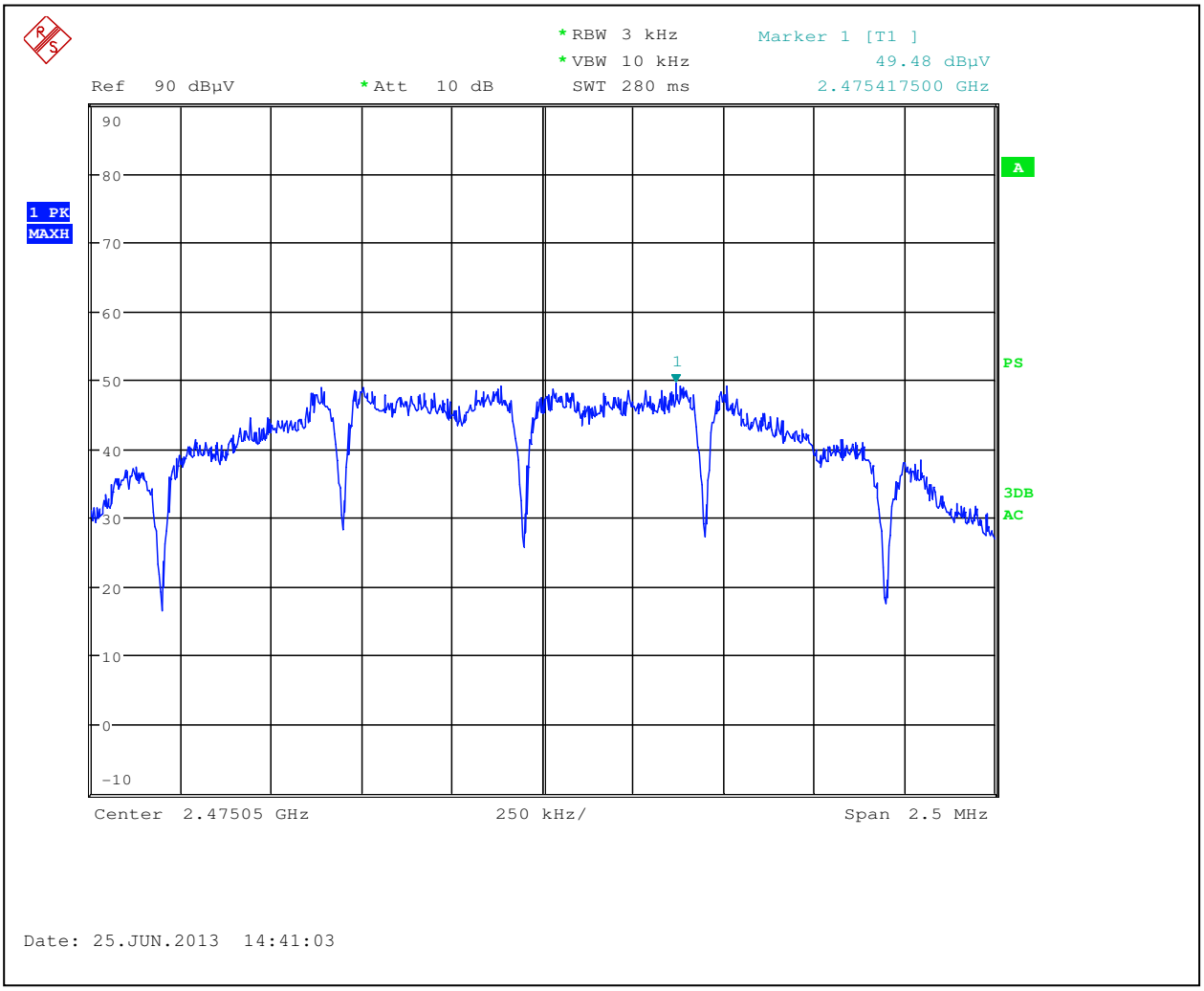
Graph 3.3.3


*RBW 3 kHz
*VBW 10 kHz
SWT 280 ms
Marker 1 [T1]
56.99 dBµV
2.405430000 GHz
Ref 90 dBµV
*Att 10 dB
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.405 GHz
250 kHz/
Span 2.5 MHz
Date: 25.JUN.2013 14:35:04

Graph 3.3.4


*RBW 3 kHz
*VBW 10 kHz
Ref 90 dBµV
*Att 10 dB
SWT 280 ms
Marker 1 [T1]
54.39 dBµV
2.444575000 GHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.4449 GHz
250 kHz/
Span 2.5 MHz
Date: 25.JUN.2013 14:38:20

Graph 3.3.5


*RBW 3 kHz
*VBW 10 kHz
Ref 90 dBµV
*Att 10 dB
SWT 280 ms
Marker 1 [T1]
49.48 dBµV
2.475417500 GHz
1 PK
MAXH
A
PS
3DB
AC
90
80
70
60
50
40
30
20
10
0
-10
Center 2.47505 GHz
250 kHz/
Span 2.5 MHz
Date: 25.JUN.2013 14:41:03

Graph 3.3.6

3.4 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. Margin: 0.9 dB below the limits

Date:	May 28, 2013	**Result:** **Pass**
Standard:	FCC part 15.247(d)	
Tested by:	Richard Blonigen	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Antenna A (Ant 0 on the plots below in this Section)	

Table 3.4.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	AVG Reading	Total @ 3m	Limit	Corr Factor	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dB	dB	
Channel 11											
4809.00	V	100	33.0	4.1	39.2	46.3	44.3	54.0	0.0	-9.7	
7216.60	V	143	35.7	4.9	38.2	39.8	42.3	54.0	0.0	-11.7	
9622.15	V	117	38.0	5.8	37.1	35.5	42.2	54.0	0.0	-11.8	
12027.66	V	138	39.4	6.7	37.2	41.7	50.6	54.0	0.0	-3.4	
4809.00	H	100	33.0	4.1	39.2	50.3	48.3	54.0	0.0	-5.7	
7216.60	H	140	35.7	4.9	38.2	42.2	44.7	54.0	0.0	-9.3	
9662.15	H	170	38.0	5.8	37.1	36.7	43.5	54.0	0.0	-10.5	
12027.66	H	143	39.4	6.7	37.2	38.9	47.8	54.0	0.0	-6.2	
Channel 19											
4891.08	V	100	33.1	4.2	39.1	52.3	50.5	54.0	0.0	-3.5	
7333.55	V	119	36.0	5.0	38.1	42.5	45.4	54.0	0.0	-8.5	
9782.07	V	127	38.2	5.9	37.1	43.3	50.3	54.0	0.0	-3.7	
12222.50	V	177	39.1	6.7	37.3	43.3	51.8	54.0	0.0	-2.1	
14667.06	V	126	41.8	7.0	38.6	36.8	47.0	54.0	0.0	-7.0	
4891.08	H	100	33.1	4.2	39.1	43.7	41.9	54.0	0.0	-12.1	
7333.55	H	100	36.0	5.0	38.1	44.0	46.9	54.0	0.0	-7.0	
9782.07	H	126	38.2	5.9	37.1	38.9	45.9	54.0	0.0	-8.1	
12222.50	H	145	39.1	6.7	37.3	38.9	47.4	54.0	0.0	-6.5	
14667.06	H	156	41.8	7.0	38.6	40.9	51.1	54.0	0.0	-2.9	
Channel 25											
4949.00	V	100	33.1	4.2	39.0	53.1	51.4	54.0	0.0	-2.6	
7423.56	V	151	36.3	5.0	38.0	40.8	44.1	54.0	0.0	-9.9	
9901.97	V	123	38.3	5.9	37.0	43.0	50.2	54.0	0.0	-3.8	
12372.55	V	149	38.9	6.7	37.4	44.8	53.0	54.0	0.0	-0.9	
14847.05	V	100	41.1	7.0	38.4	35.2	44.9	54.0	0.0	-9.1	
4949.00	H	175	33.1	4.2	39.0	48.2	46.5	54.0	0.0	-7.5	
7423.56	H	127	36.3	5.0	38.0	44.4	47.7	54.0	0.0	-6.3	
9901.97	H	159	38.3	5.9	37.0	35.9	43.1	54.0	0.0	-10.9	
12372.55	H	112	38.9	6.7	37.4	39.6	47.8	54.0	0.0	-6.1	
14847.05	H	130	41.1	7.0	38.4	36.9	46.6	54.0	0.0	-7.4	

Date:	May 29, 2013	**Result: Pass**
Standard:	FCC part 15.247(d)	
Tested by:	Richard Blonigen	
Test Point:	Enclosure with antenna	
Operation mode:	See Page 5	
Note:	Antenna B (Ant 1 on the plots below in this Section)	

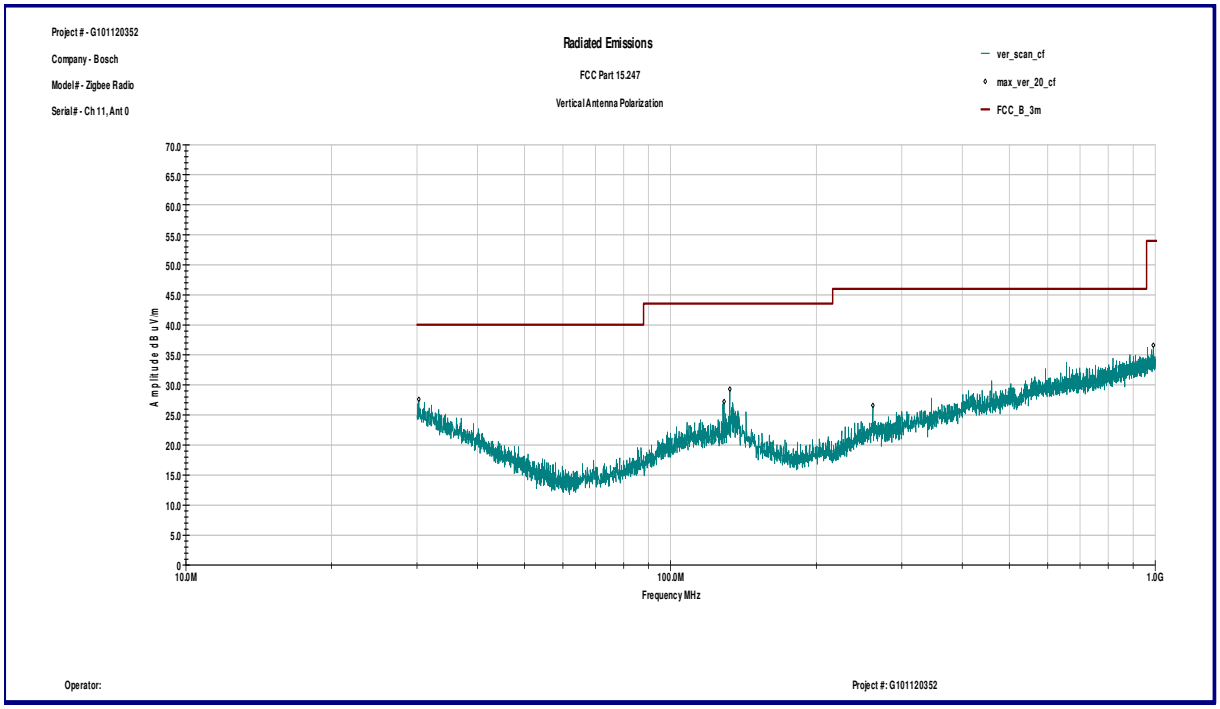
Table 3.4.2

Frequency MHz	Antenna Polarity	Antenna Hts(cm)	Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dBµV	Total @ 3m dBµV/m	Limit dBµV/m	Corr Factor dB	Margin dB	Comments
Channel 11											
4808.98	V	103	33.0	4.1	39.2	64.0	62.0	54.0	14.9	-6.9	*
7216.47	V	116	35.7	4.9	38.2	39.0	41.5	54.0	0.0	-12.5	
9618.04	V	170	38.0	5.8	37.1	39.2	45.9	54.0	0.0	-8.1	
12022.50	V	175	39.4	6.7	37.2	41.1	50.0	54.0	0.0	-3.9	
14433.00	V	161	42.3	7.0	38.8	40.0	50.5	54.0	0.0	-3.5	
4808.98	H	117	33.0	4.1	39.2	66.7	64.7	54.0	14.9	-4.2	*
7216.47	H	137	35.7	4.9	38.2	43.0	45.5	54.0	0.0	-8.5	
9618.04	H	126	38.0	5.8	37.1	37.9	44.6	54.0	0.0	-9.4	
12022.50	H	150	39.4	6.7	37.2	41.7	50.6	54.0	0.0	-3.3	
14433.00	H	163	42.3	7.0	38.8	39.3	49.8	54.0	0.0	-4.2	
Channel 19											
4888.96	V	160	33.1	4.2	39.1	48.1	46.3	54.0	0.0	-7.7	
7333.45	V	160	36.0	5.0	38.1	39.1	42.0	54.0	0.0	-11.9	
9778.05	V	142	38.2	5.9	37.1	39.2	46.2	54.0	0.0	-7.8	
12227.50	V	118	39.1	6.7	37.3	39.0	47.5	54.0	0.0	-6.5	
14673.00	V	116	41.7	7.0	38.6	34.3	44.5	54.0	0.0	-9.5	
4888.96	H	129	33.1	4.2	39.1	53.7	51.9	54.0	0.0	-2.1	
7333.45	H	100	36.0	5.0	38.1	44.9	47.8	54.0	0.0	-6.1	
9778.05	H	137	38.2	5.9	37.1	38.0	45.0	54.0	0.0	-9.0	
12227.50	H	153	39.1	6.7	37.3	40.7	49.2	54.0	0.0	-4.8	
14673.00	H	140	41.7	7.0	38.6	35.7	45.9	54.0	0.0	-8.1	
Channel 25											
4951.00	V	134	33.1	4.2	39.0	45.6	43.9	54.0	0.0	-10.1	
7423.52	V	170	36.3	5.0	38.0	39.6	42.9	54.0	0.0	-11.1	
9902.05	V	135	38.3	5.9	37.0	38.2	45.4	54.0	0.0	-8.6	
12372.55	V	173	38.9	6.7	37.4	40.0	48.2	54.0	0.0	-5.7	
14847.10	V	136	41.1	7.0	38.4	33.8	43.5	54.0	0.0	-10.5	
4951.00	H	118	33.1	4.2	39.0	52.4	50.7	54.0	0.0	-3.3	
7423.52	H	100	36.3	5.0	38.0	45.3	48.6	54.0	0.0	-5.4	
9902.05	H	132	38.3	5.9	37.0	37.5	44.7	54.0	0.0	-9.3	
12372.55	H	154	38.9	6.7	37.4	38.4	46.6	54.0	0.0	-7.3	
14847.10	H	106	41.1	7.0	38.4	32.4	42.1	54.0	0.0	-11.9	

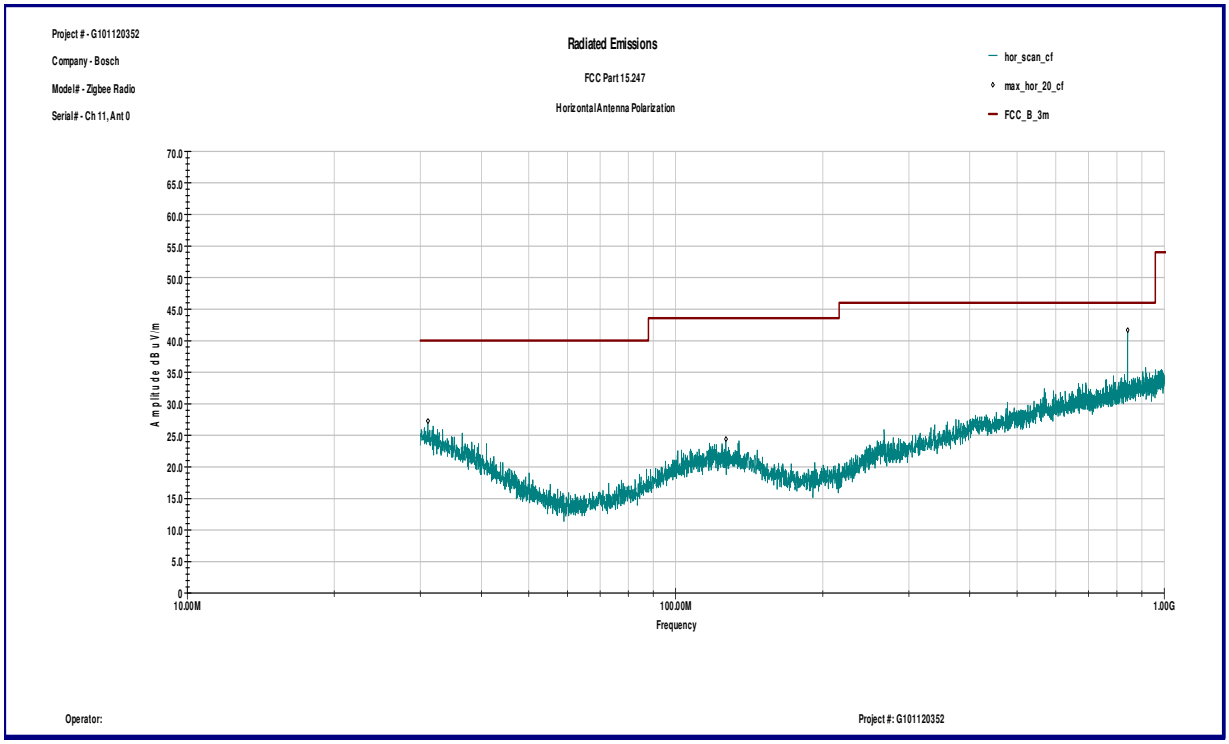
Comments: Readings were taken using an Average Detector, or using Peak detector with Average Correction Factor applied (marked *)

Graph 3.4.1

Vertical antenna polarization

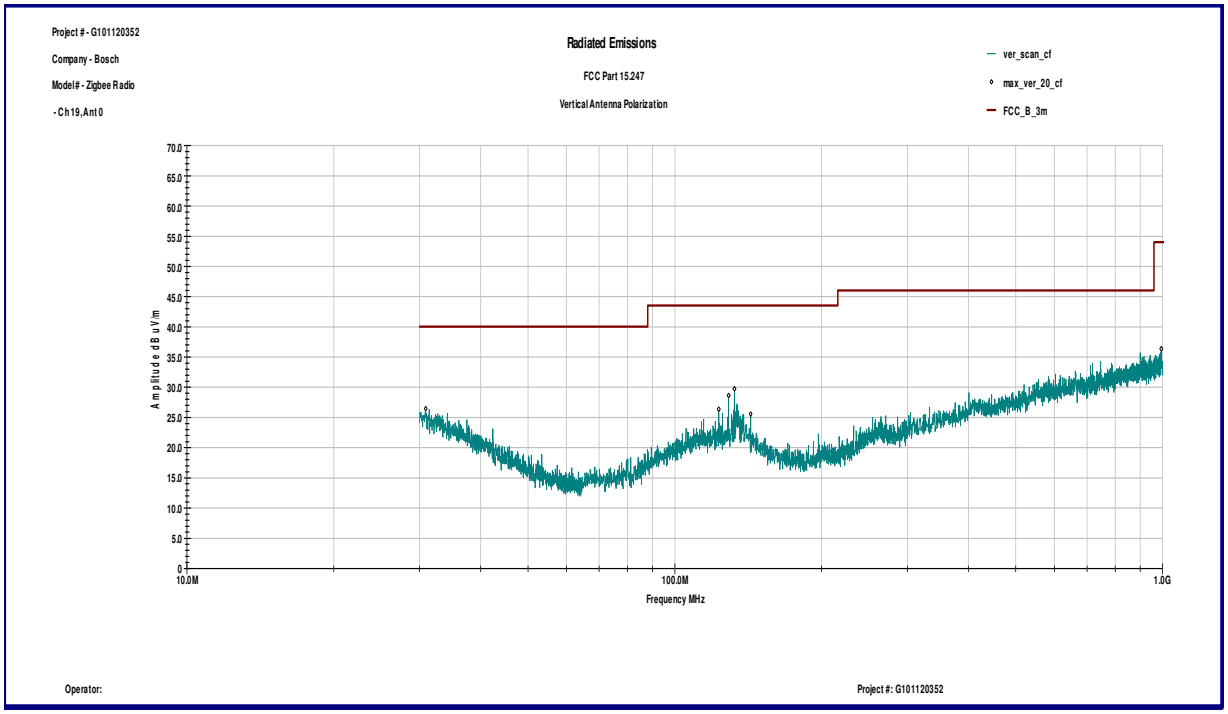


Horizontal antenna polarization

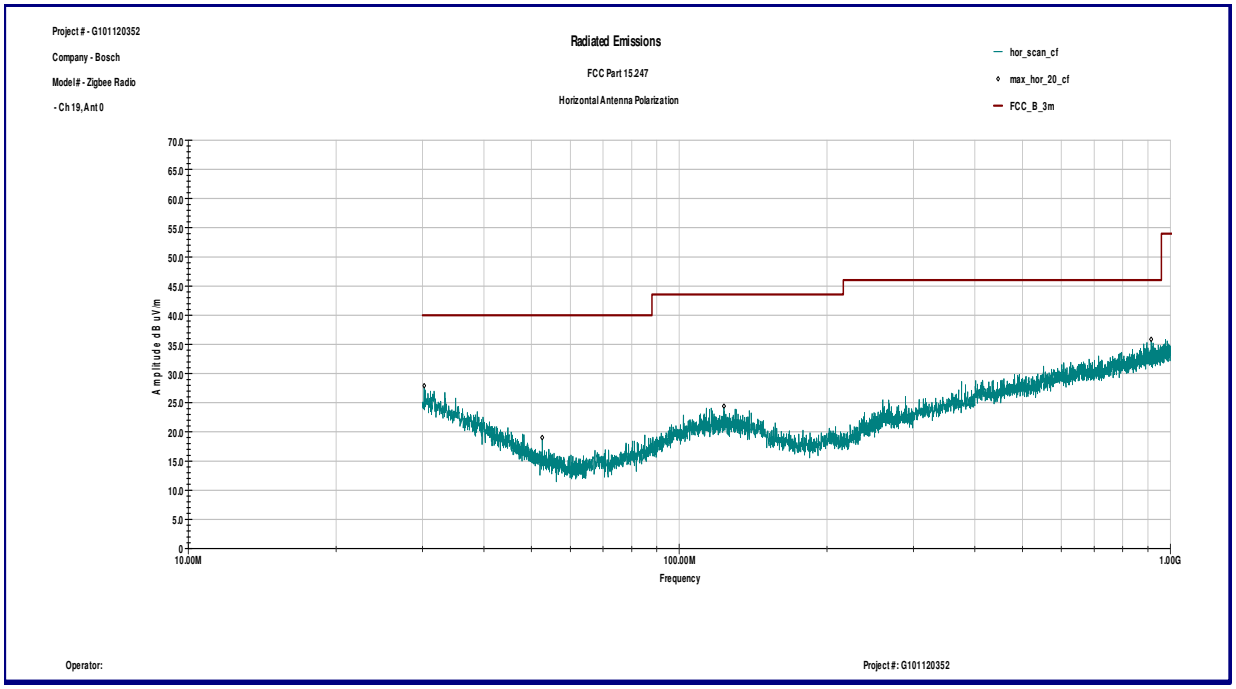


Graph 3.4.2

Vertical antenna polarization

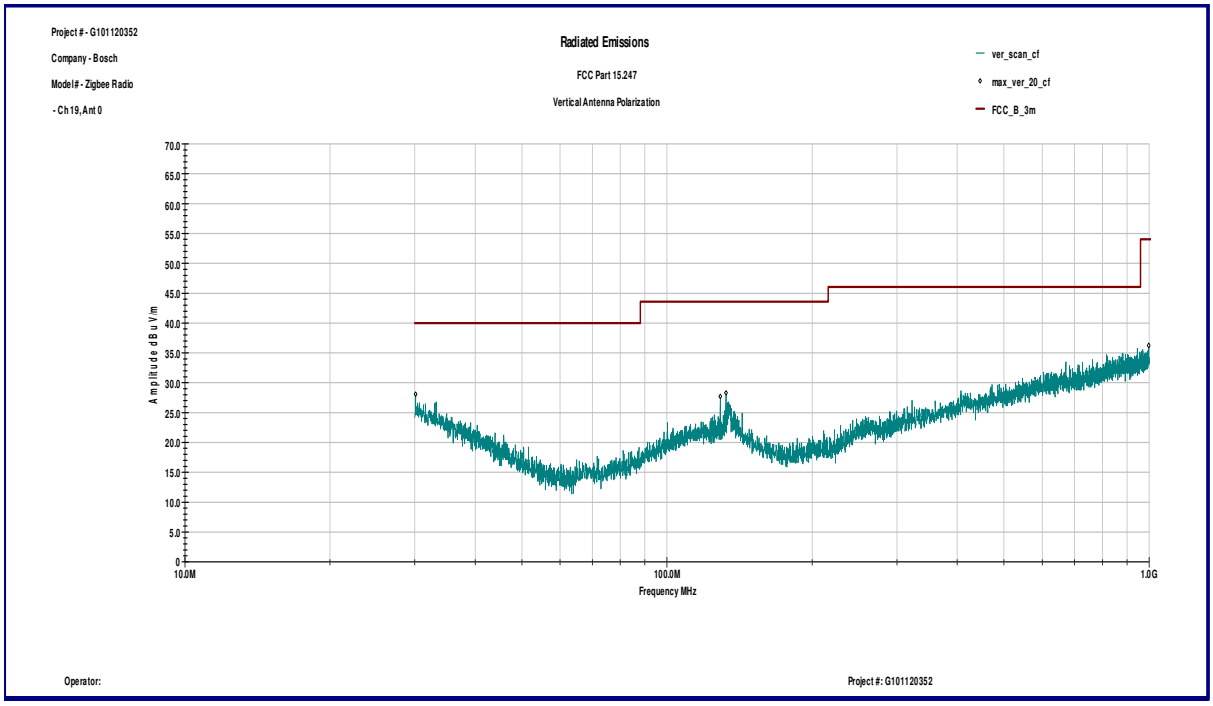


Horizontal antenna polarization

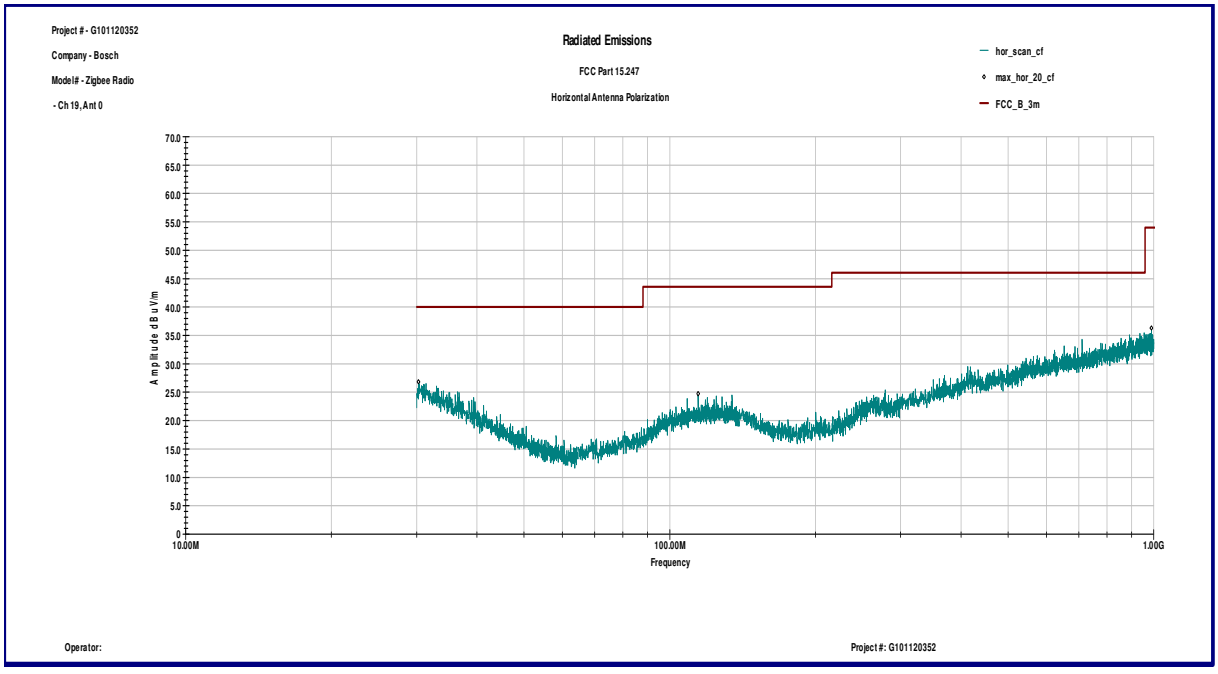


Graph 3.4.3

Vertical antenna polarization

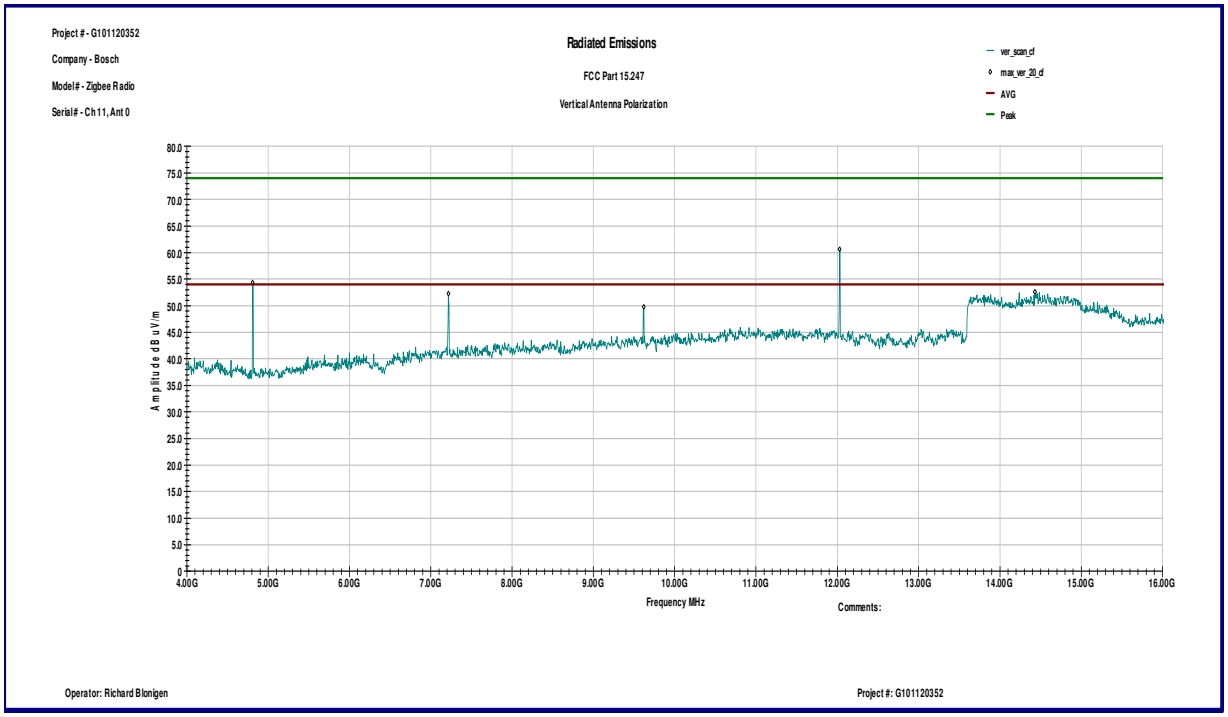


Horizontal antenna polarization

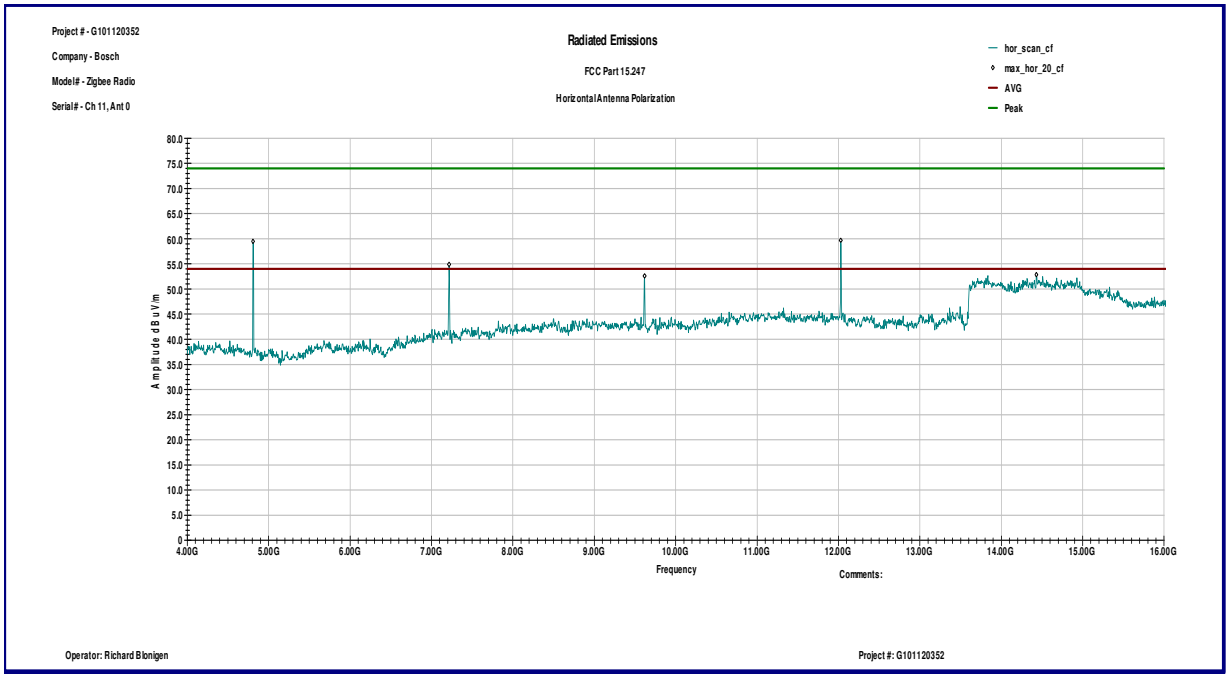


Graph 3.4.4

Vertical antenna polarization

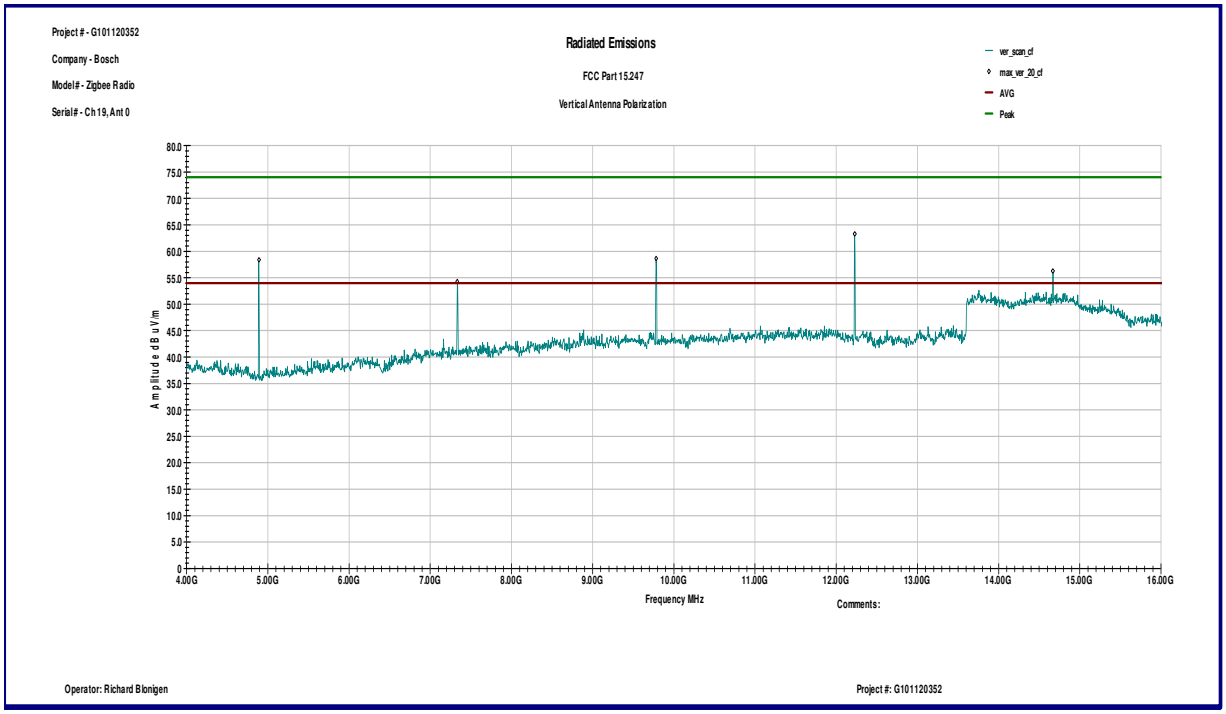


Horizontal antenna polarization

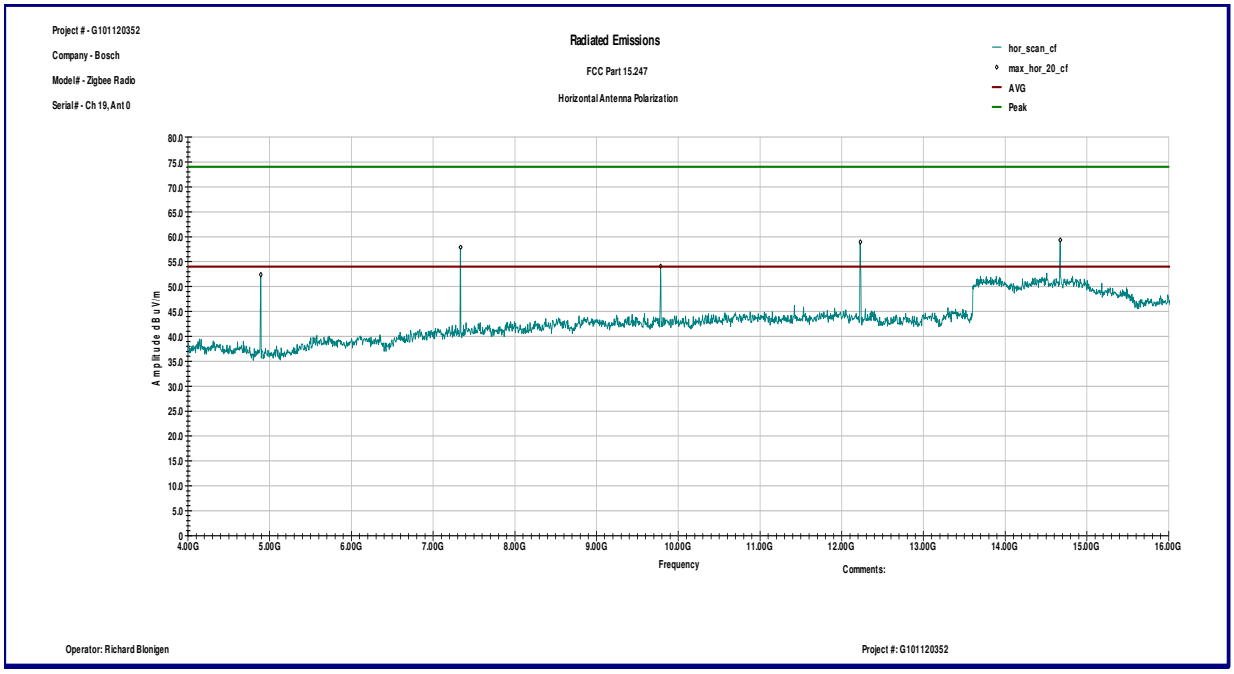


Graph 3.4.5

Vertical antenna polarization

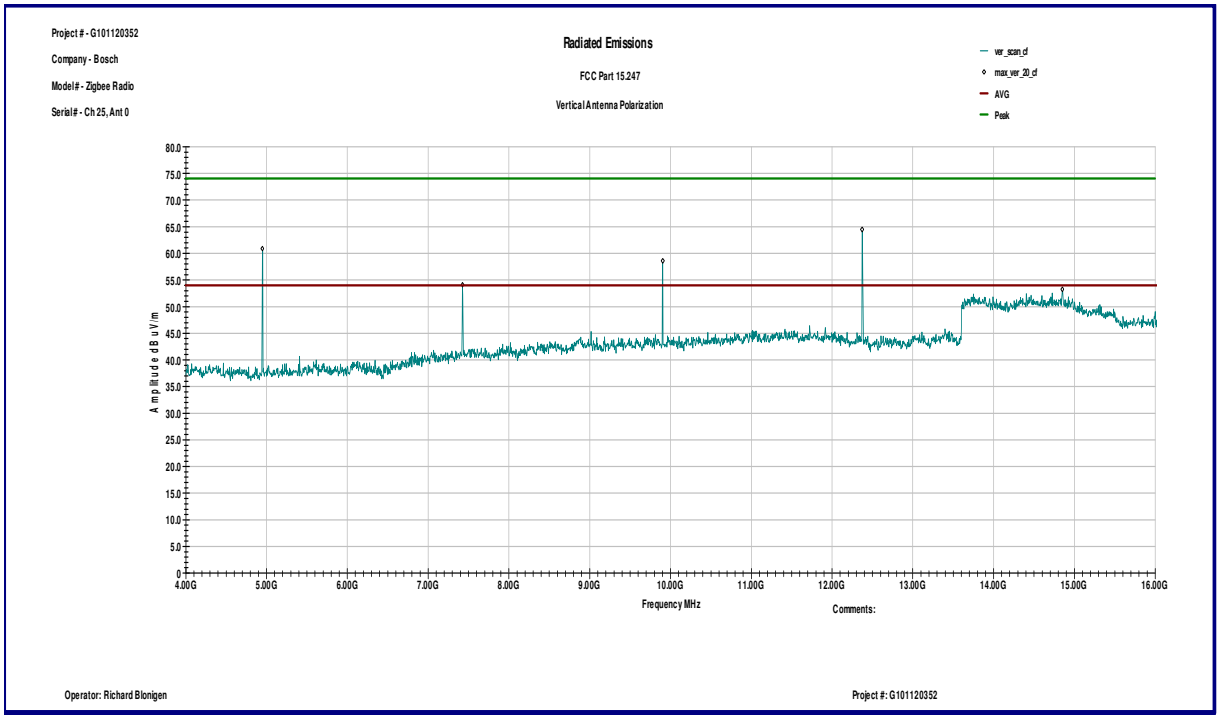


Horizontal antenna polarization

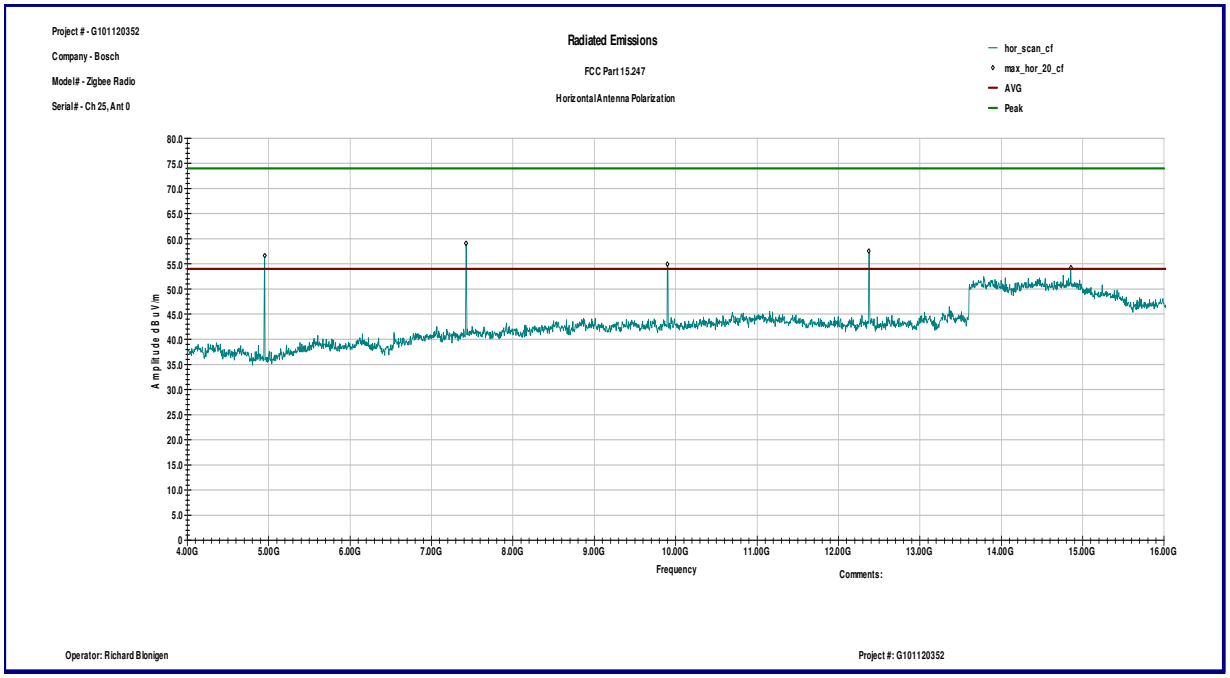


Graph 3.4.6

Vertical antenna polarization

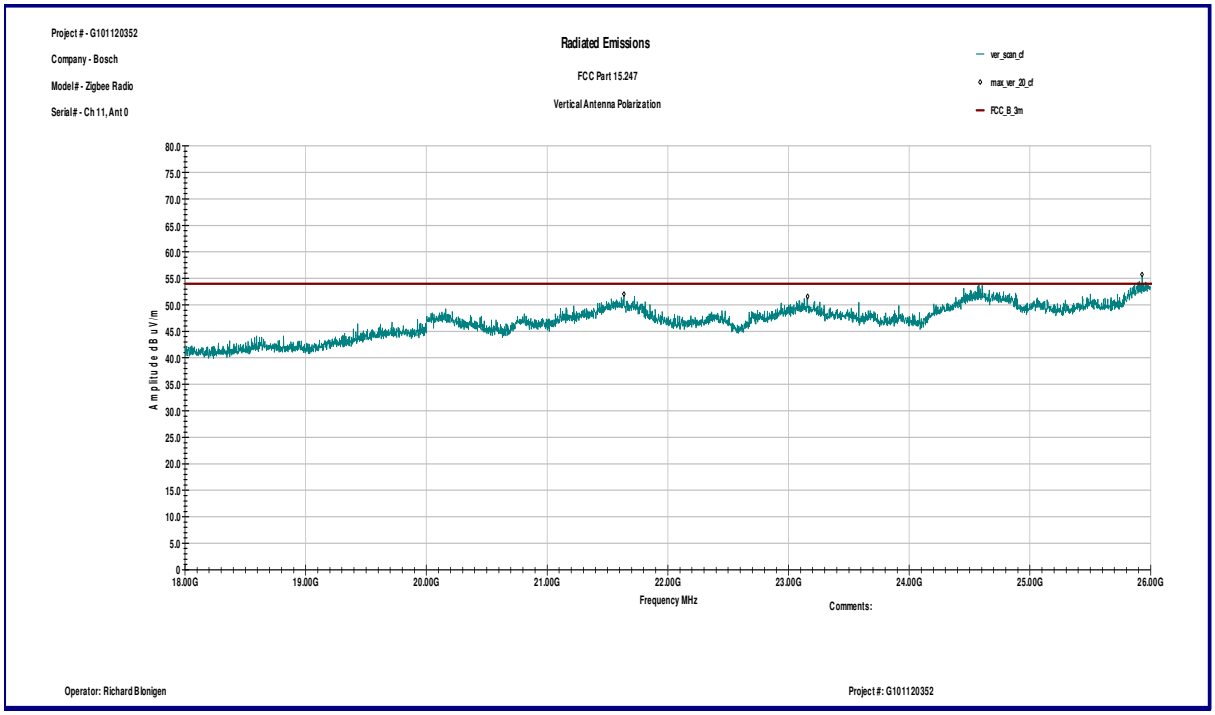


Horizontal antenna polarization

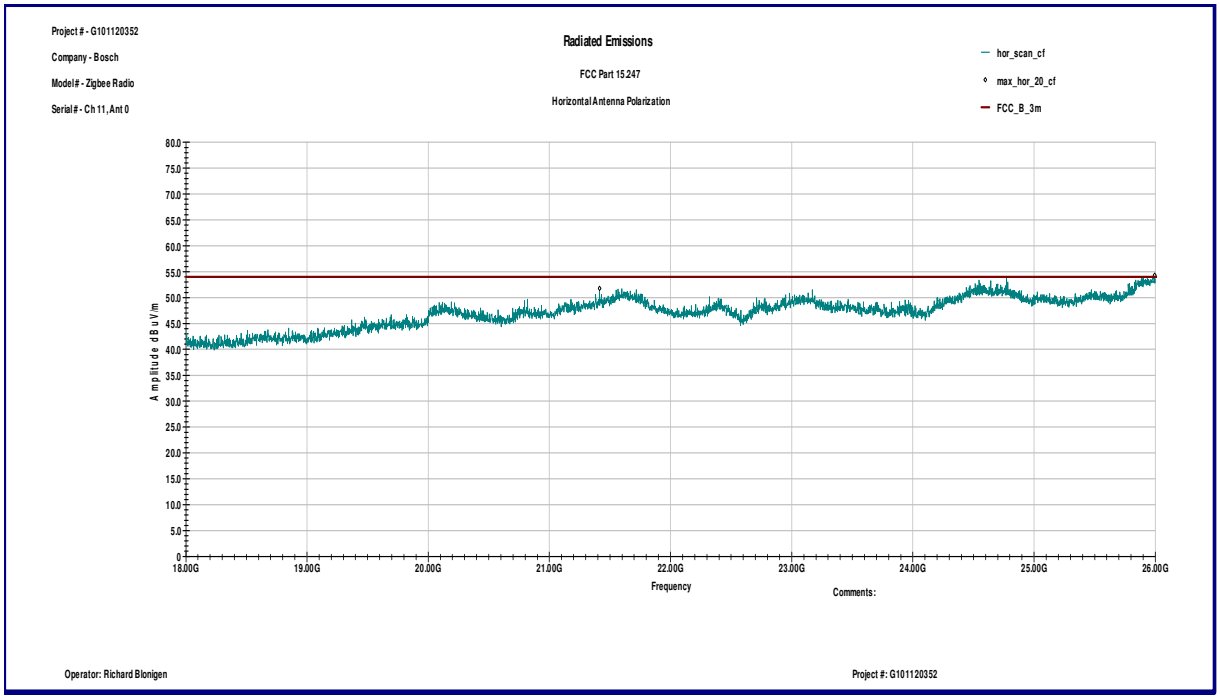


Graph 3.4.7

Vertical antenna polarization

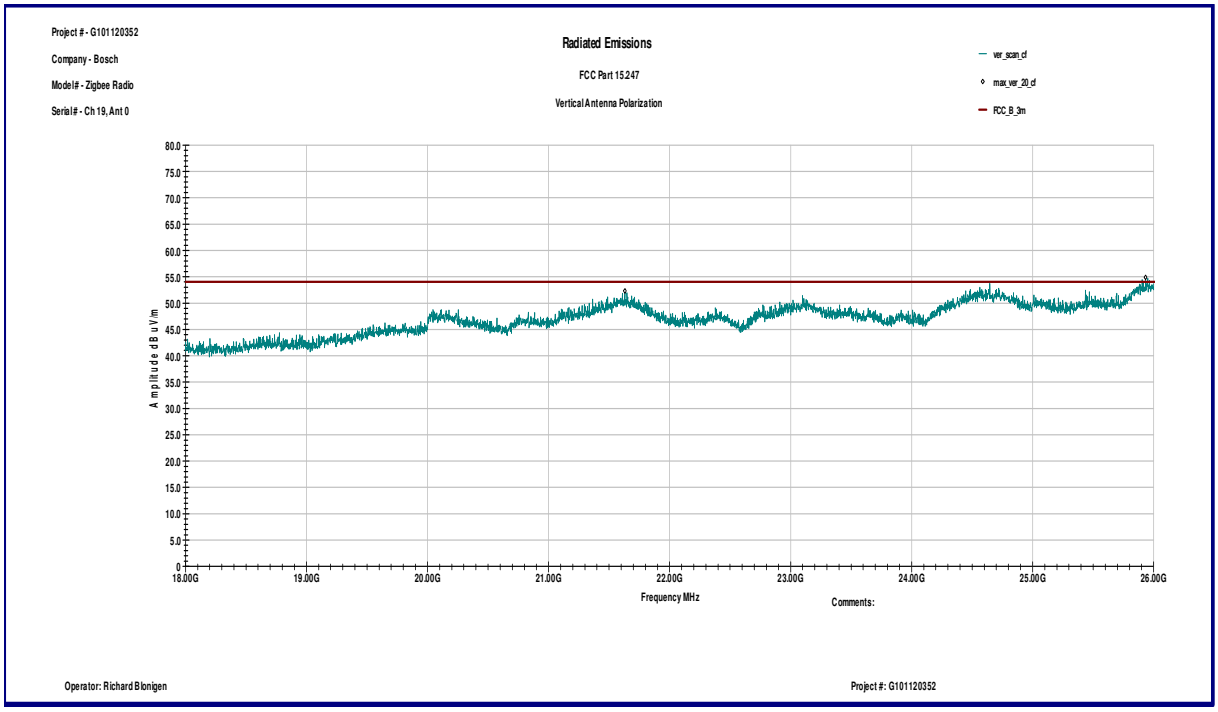


Horizontal antenna polarization

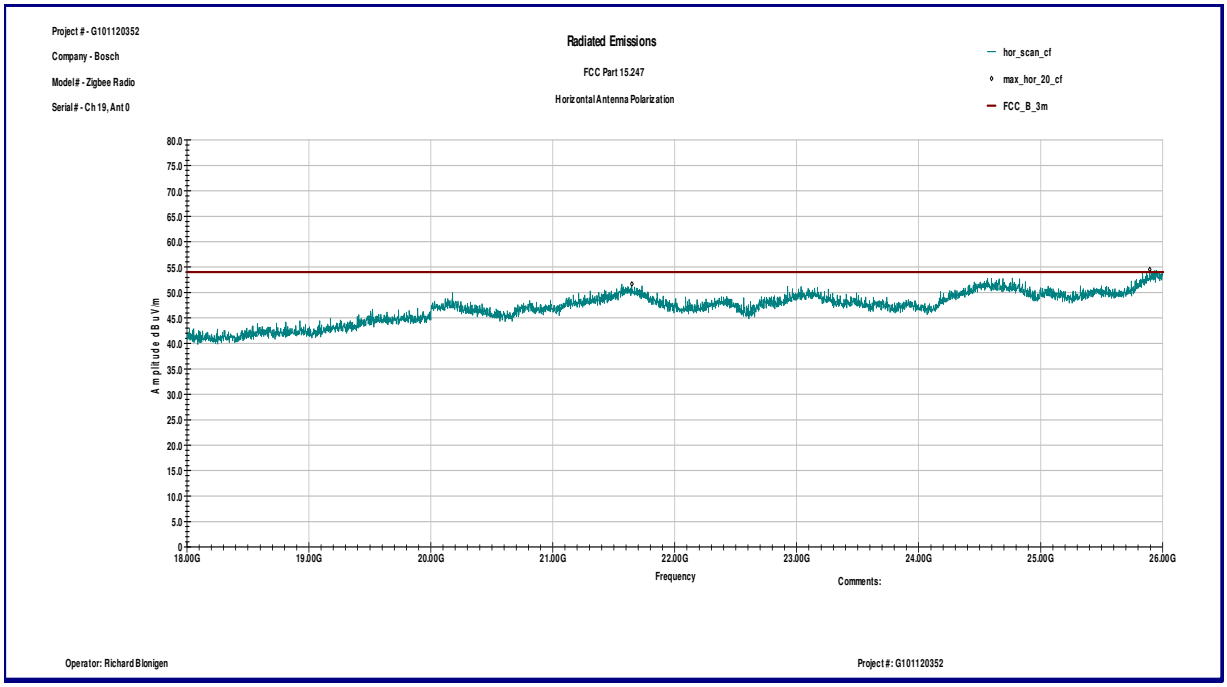


Graph 3.4.8

Vertical antenna polarization

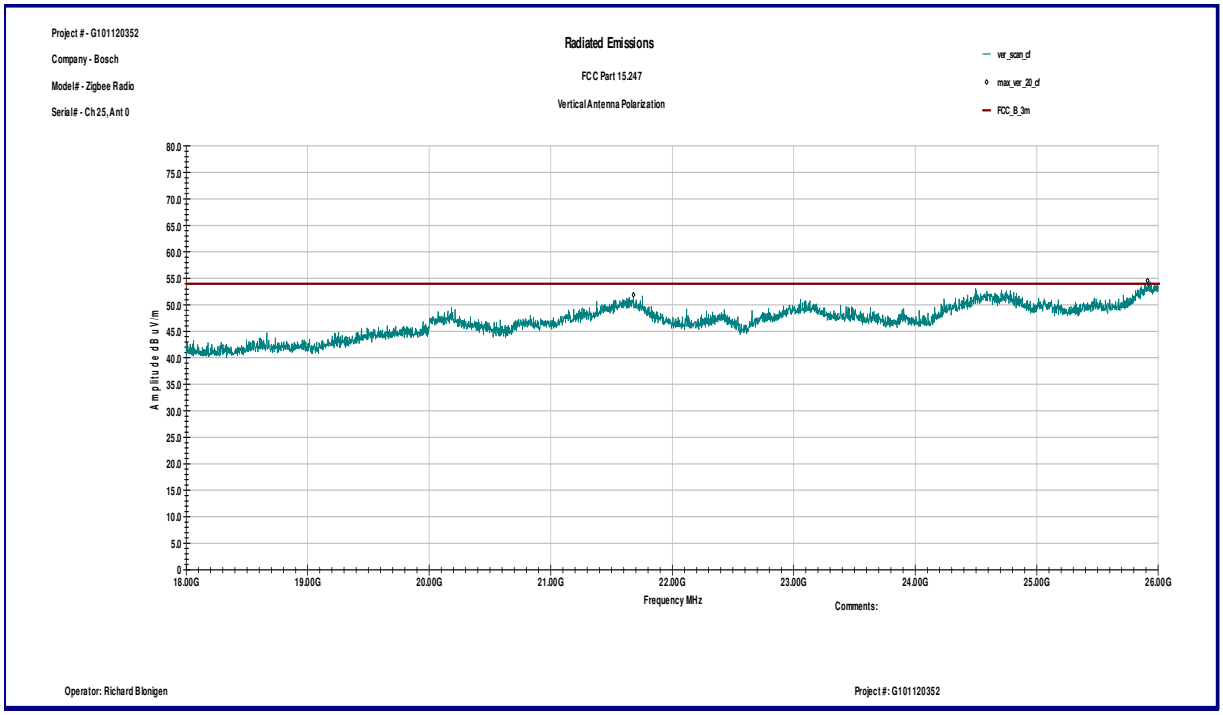


Horizontal antenna polarization

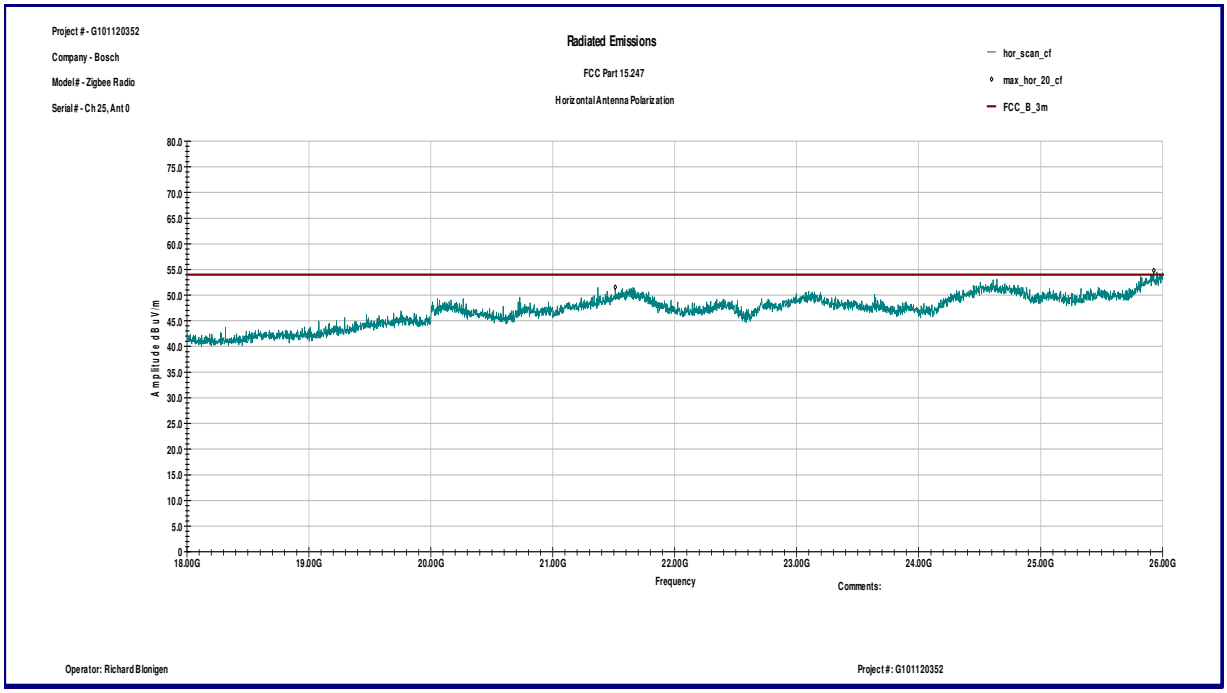


Graph 3.4.9

Vertical antenna polarization

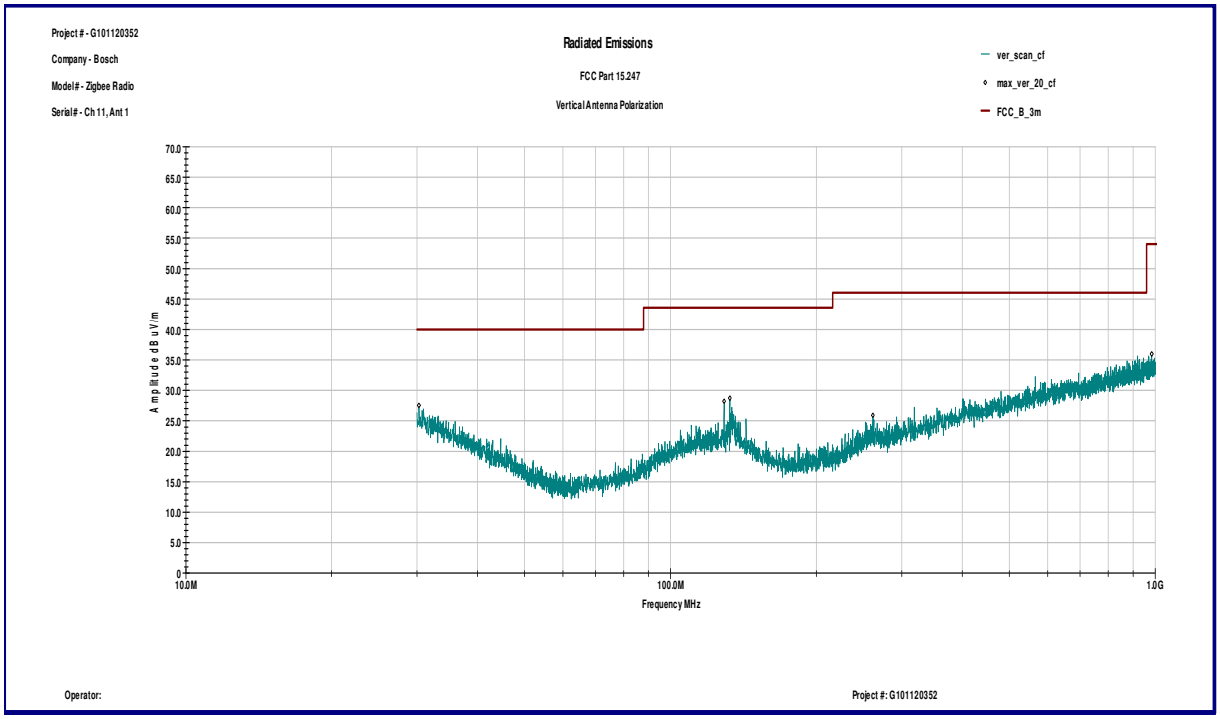


Horizontal antenna polarization

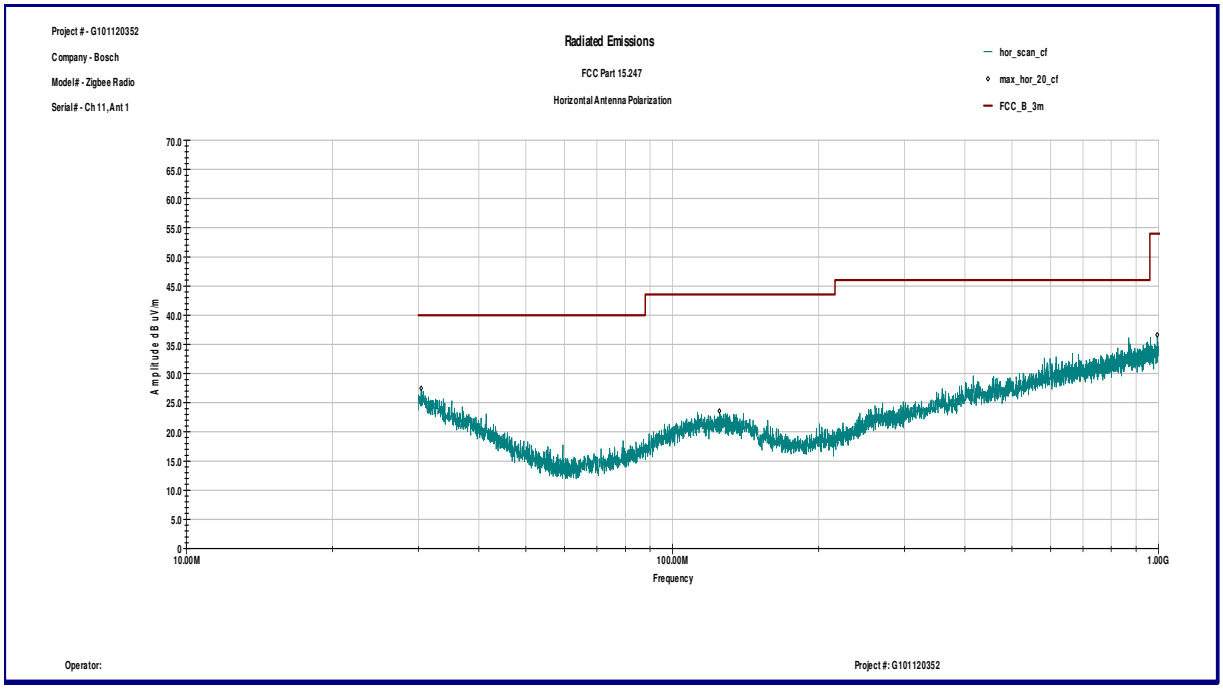


Graph 3.4.10

Vertical antenna polarization

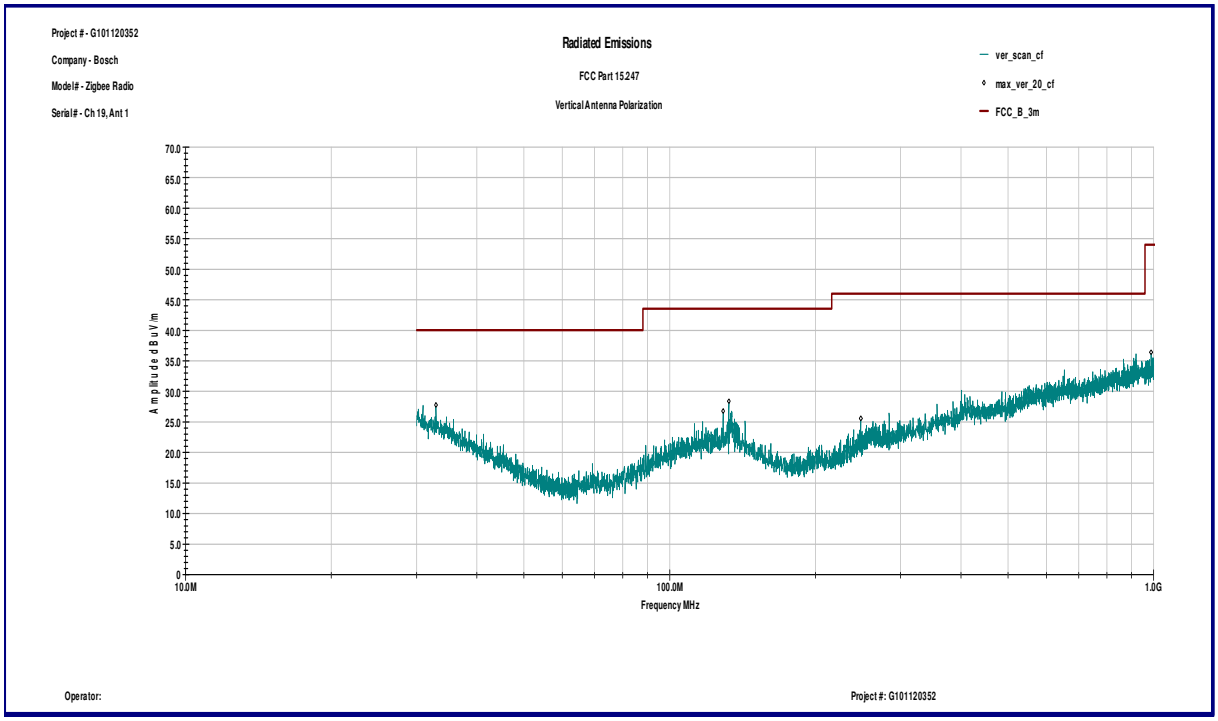


Horizontal antenna polarization

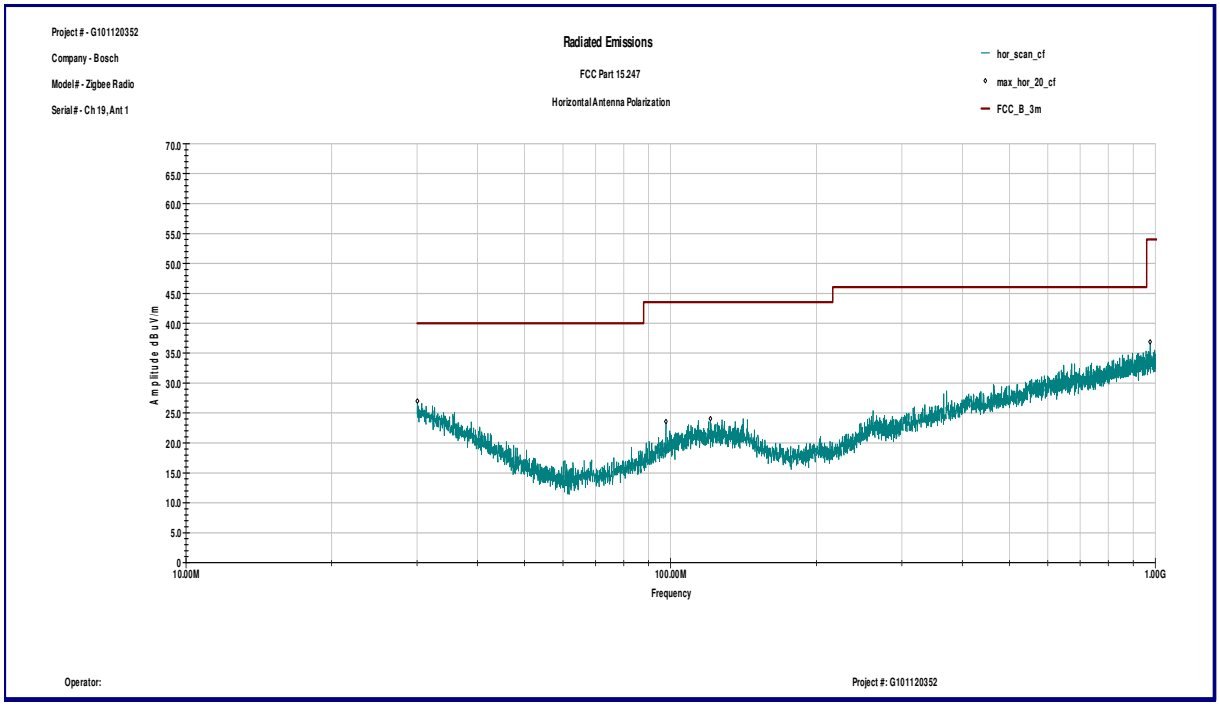


Graph 3.4.11

Vertical antenna polarization

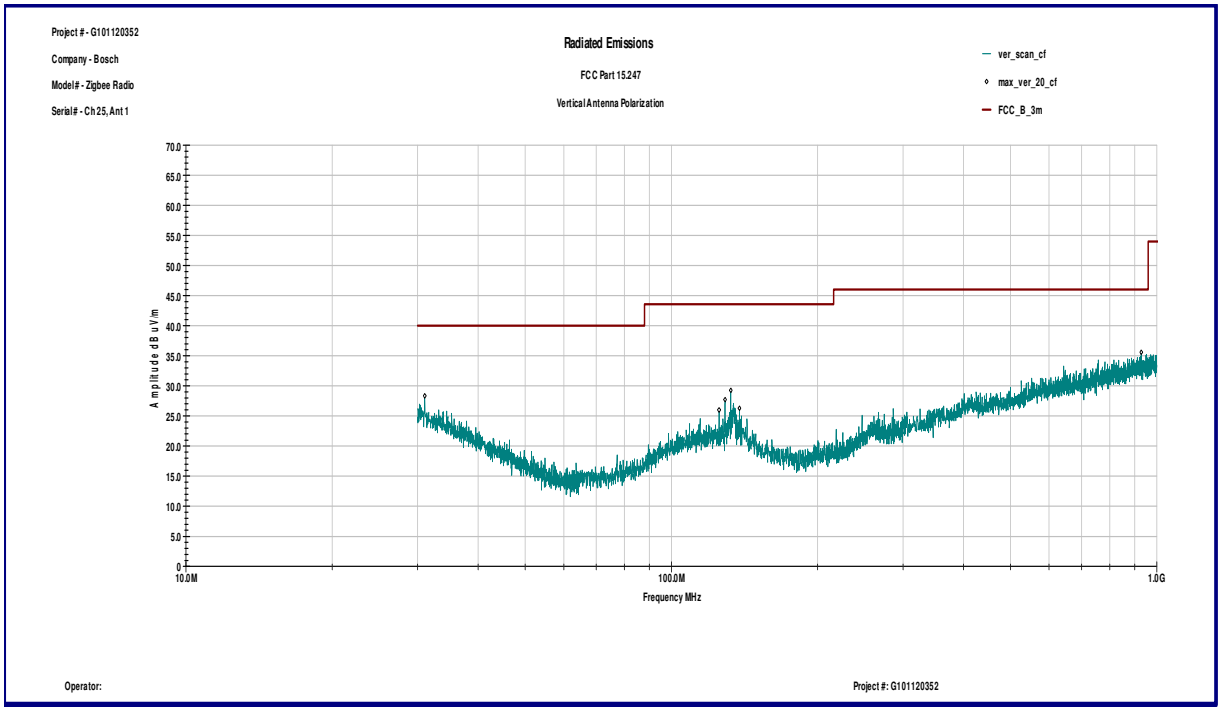


Horizontal antenna polarization

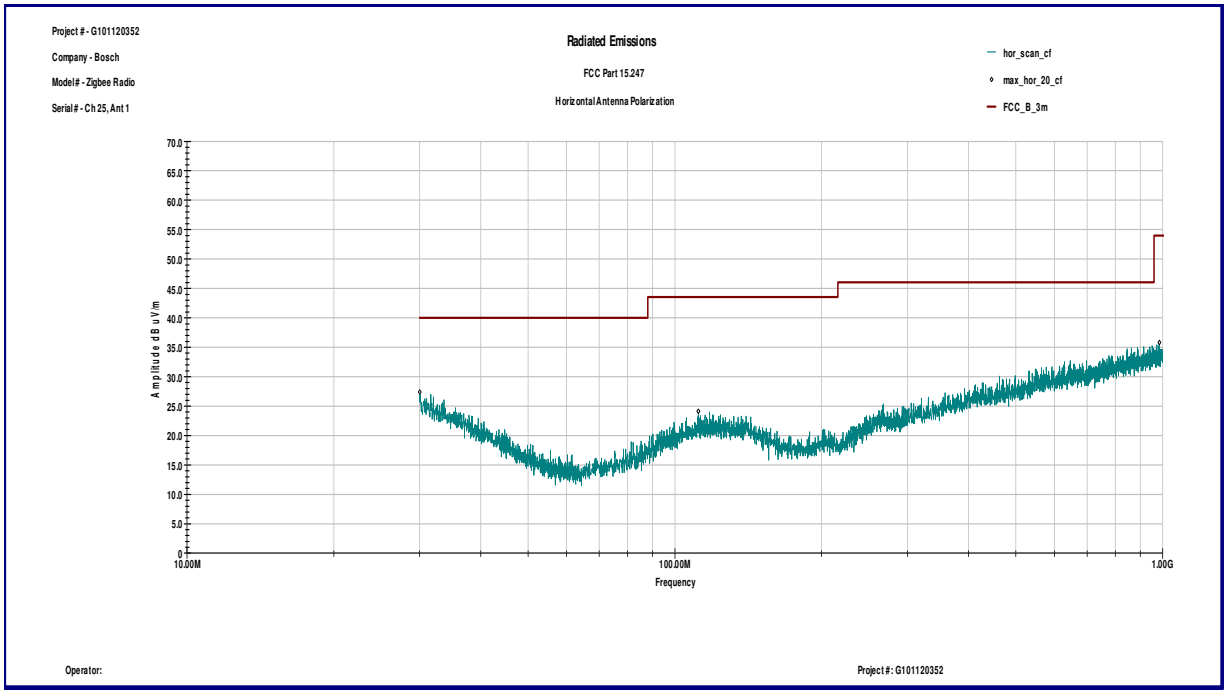


Graph 3.4.12

Vertical antenna polarization

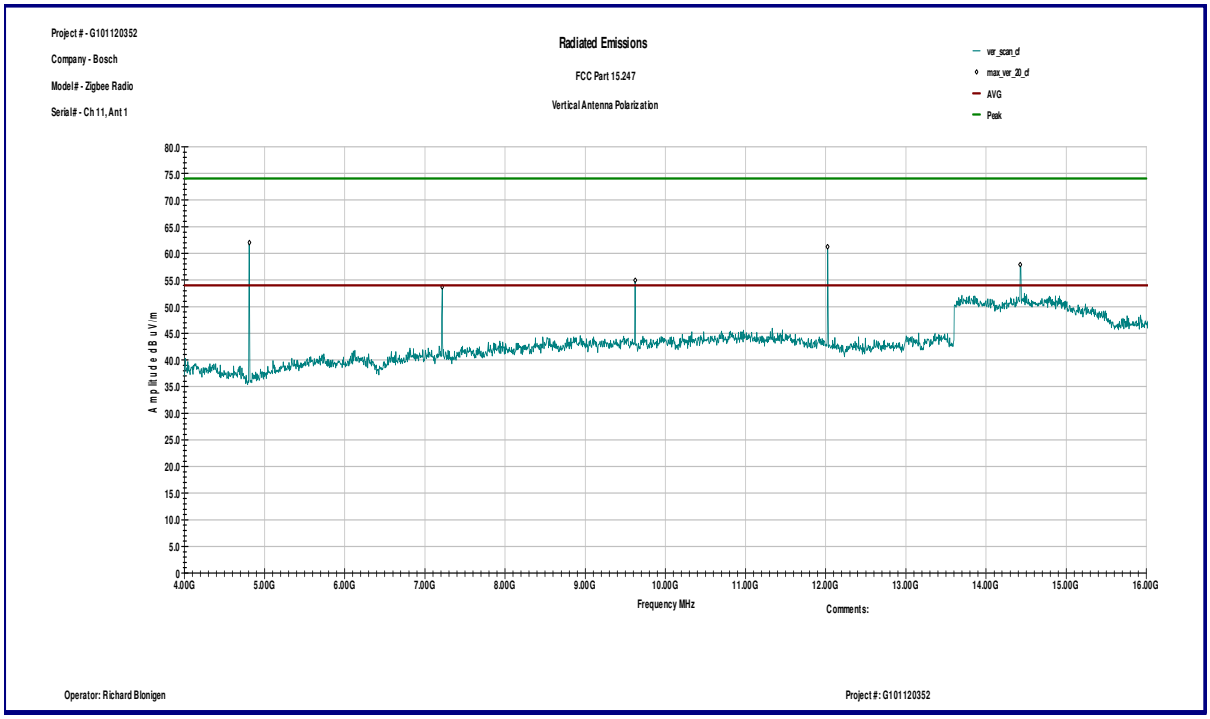


Horizontal antenna polarization

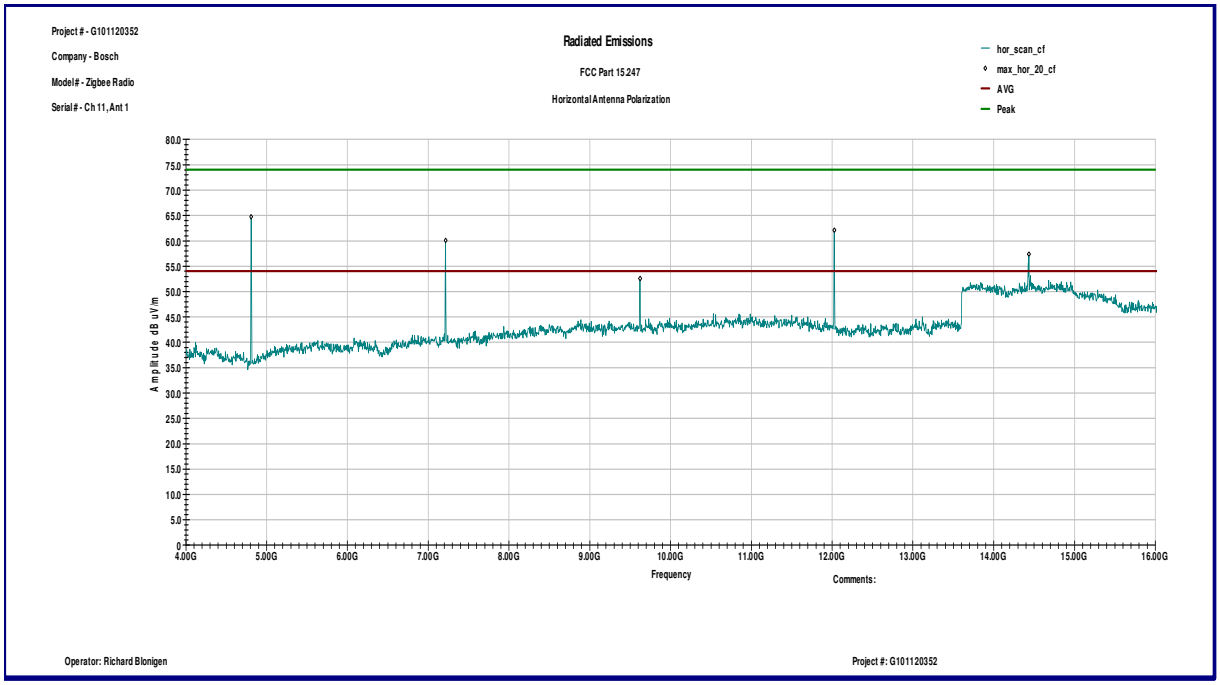


Graph 3.4.13

Vertical antenna polarization

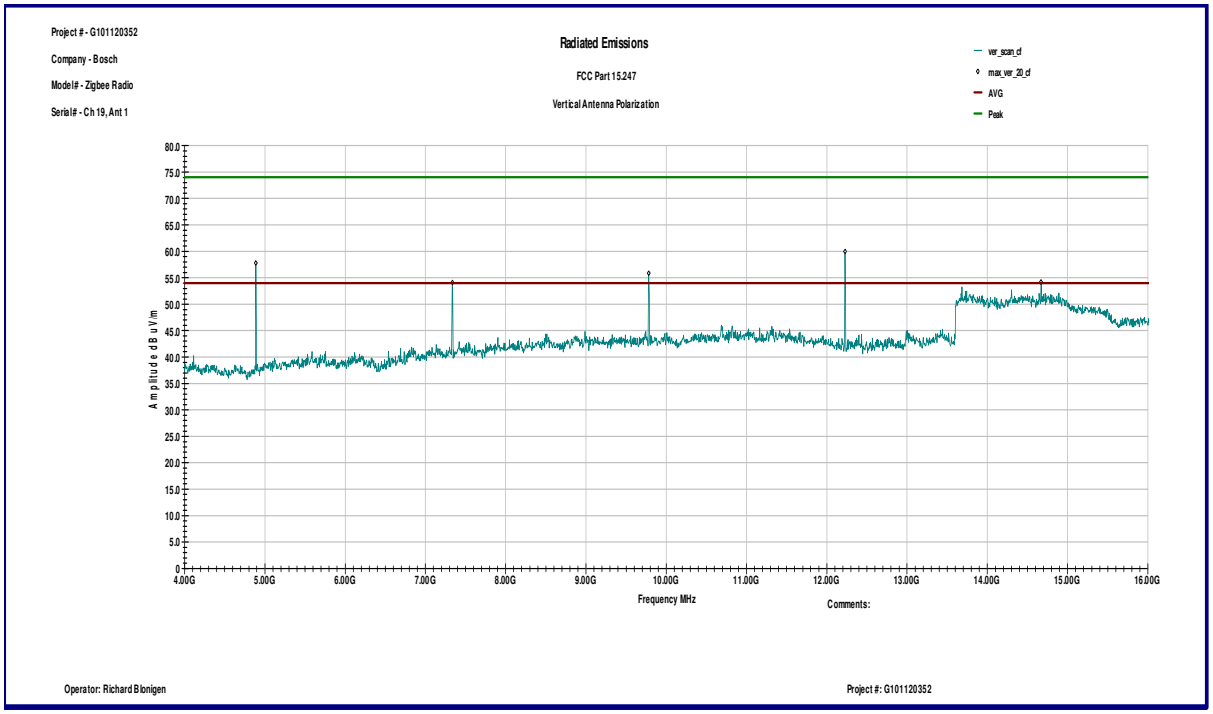


Horizontal antenna polarization

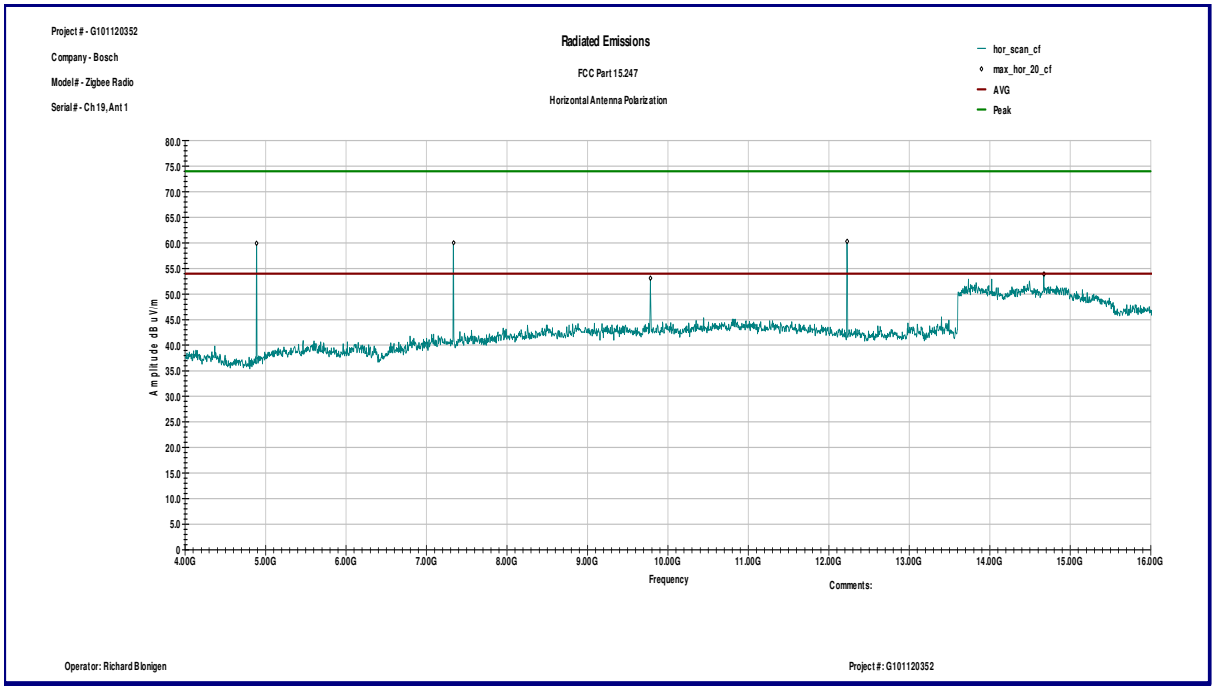


Graph 3.4.14

Vertical antenna polarization

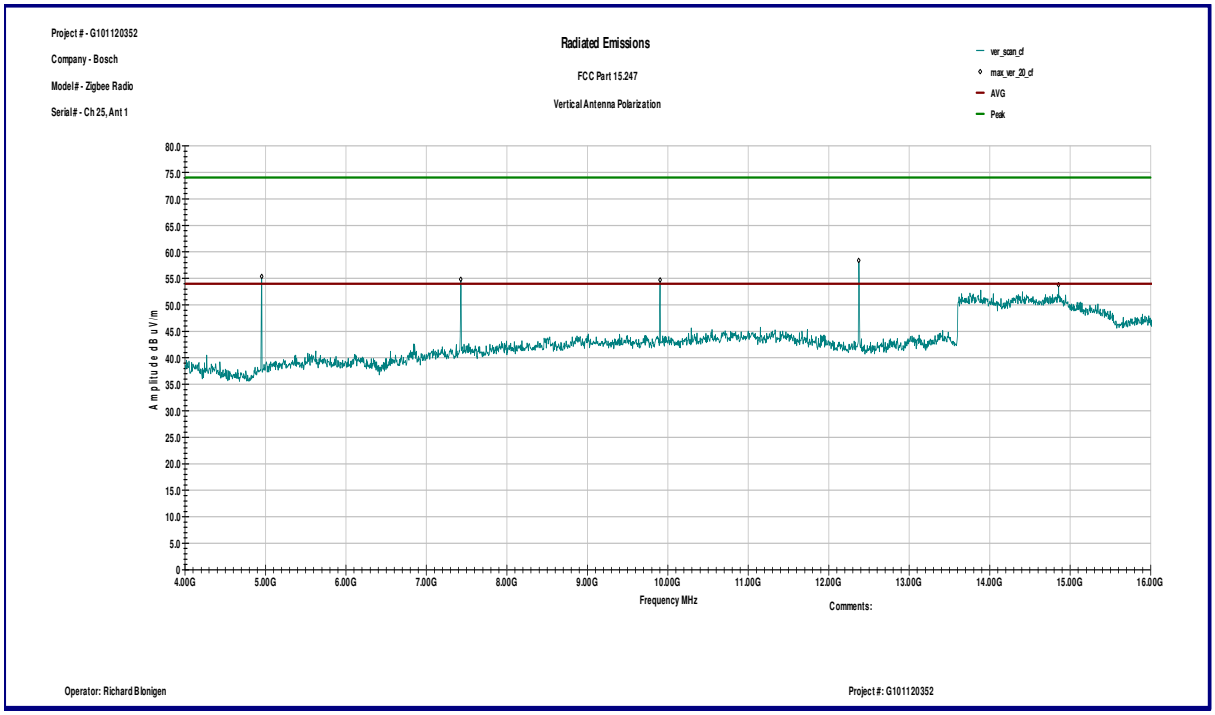


Horizontal antenna polarization

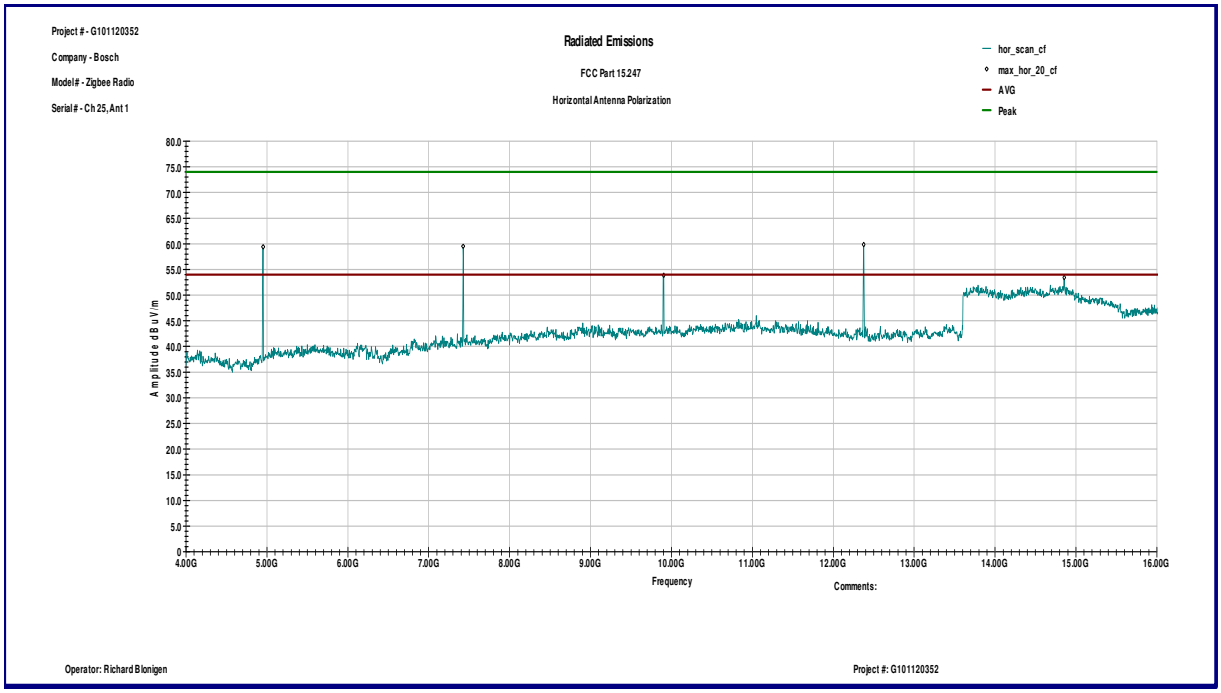


Graph 3.4.15

Vertical antenna polarization

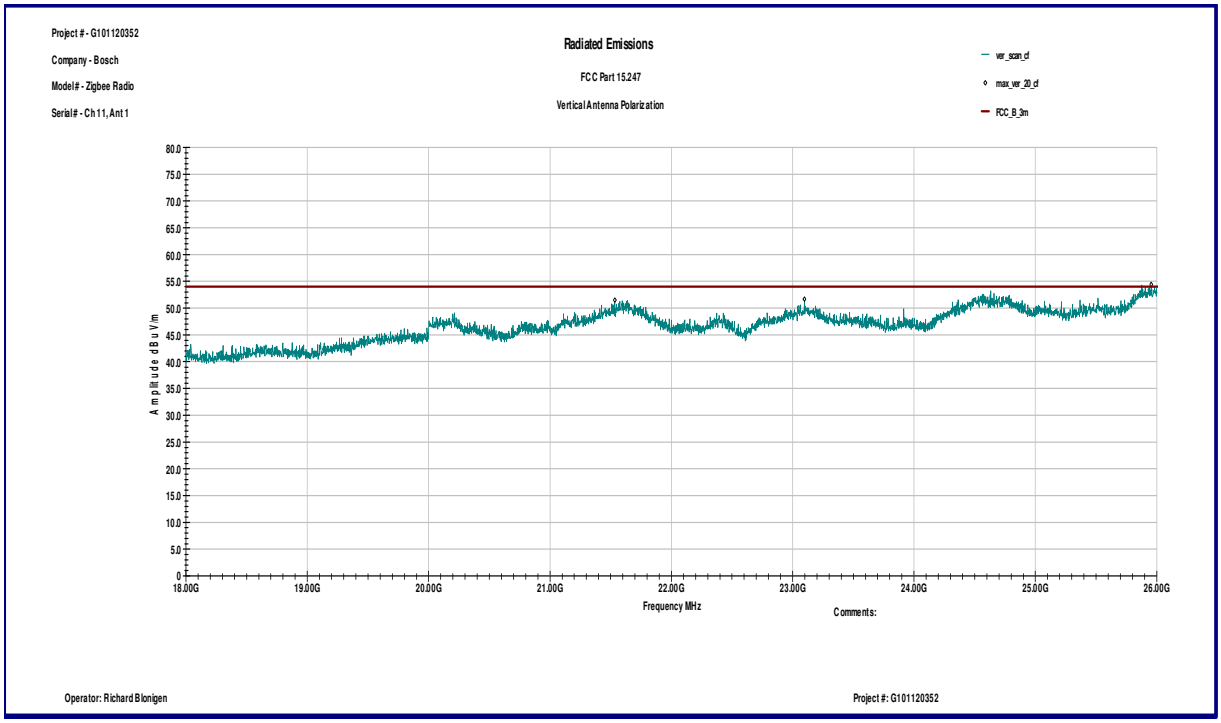


Horizontal antenna polarization

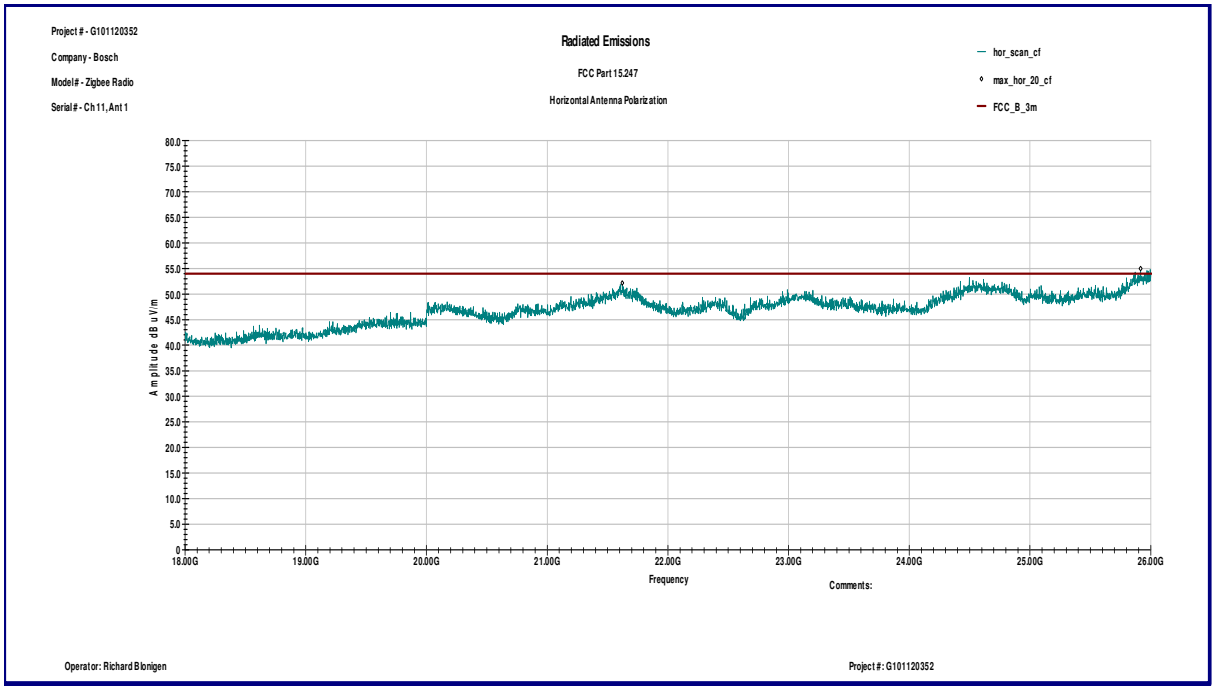


Graph 3.4.16

Vertical antenna polarization

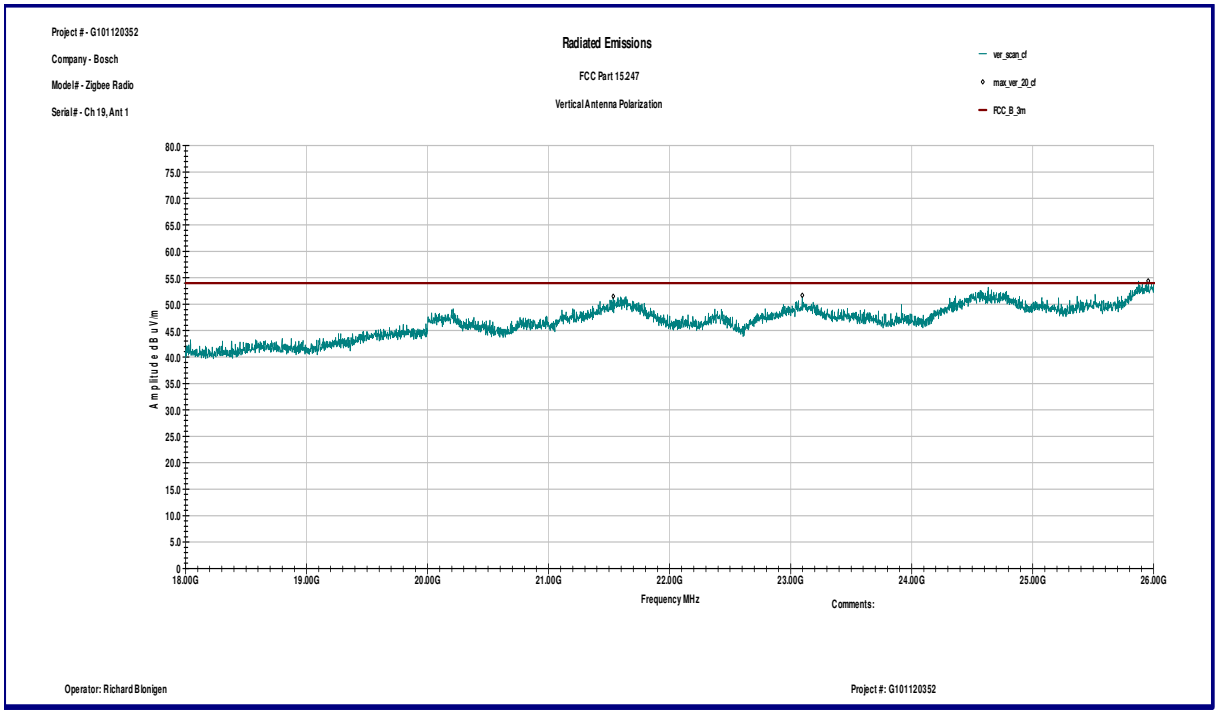


Horizontal antenna polarization

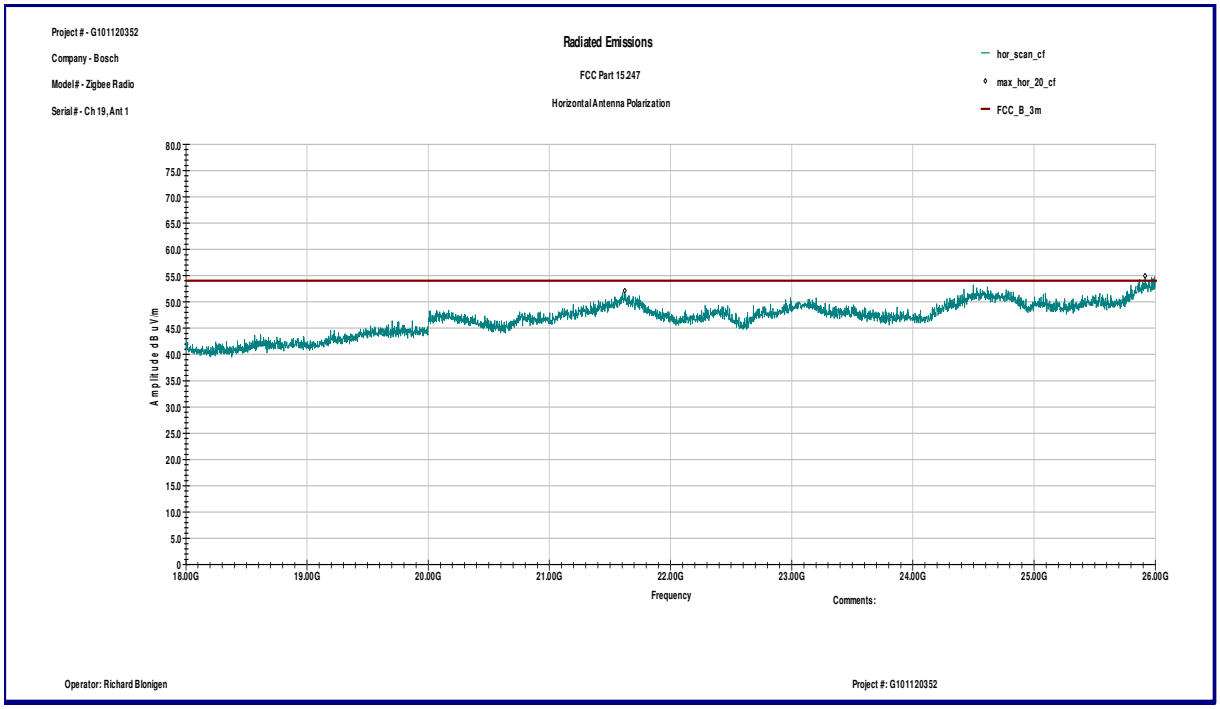


Graph 3.4.17

Vertical antenna polarization

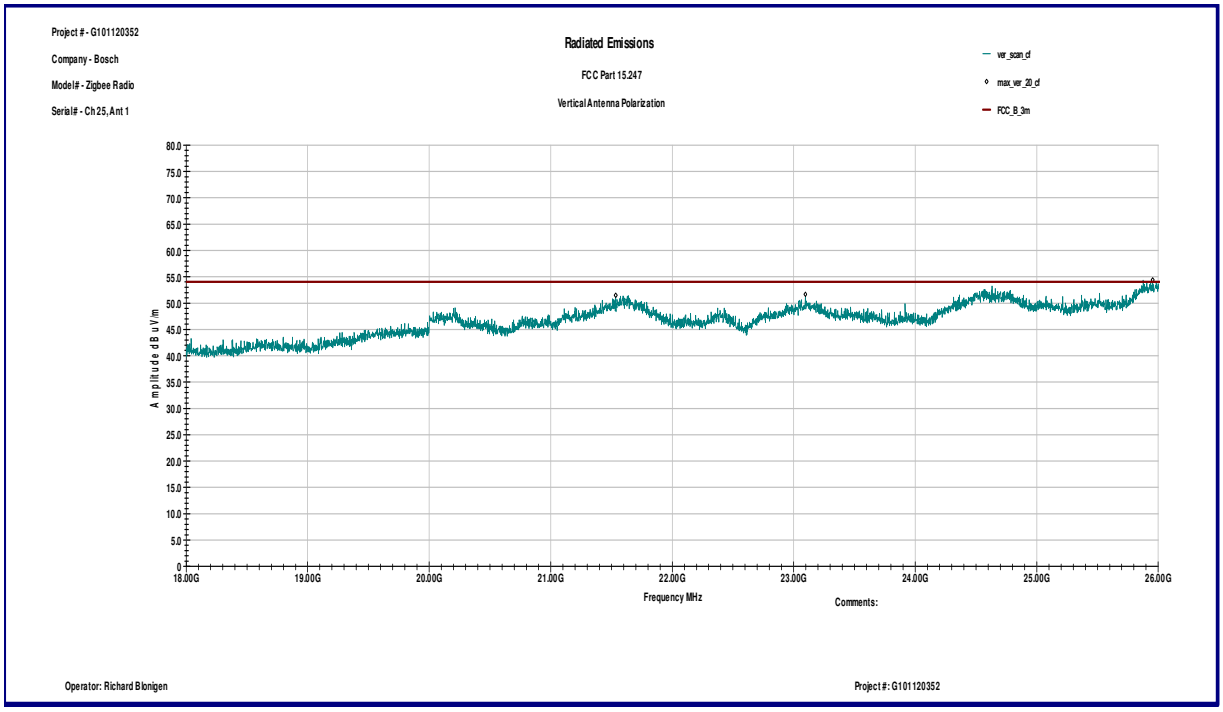


Horizontal antenna polarization

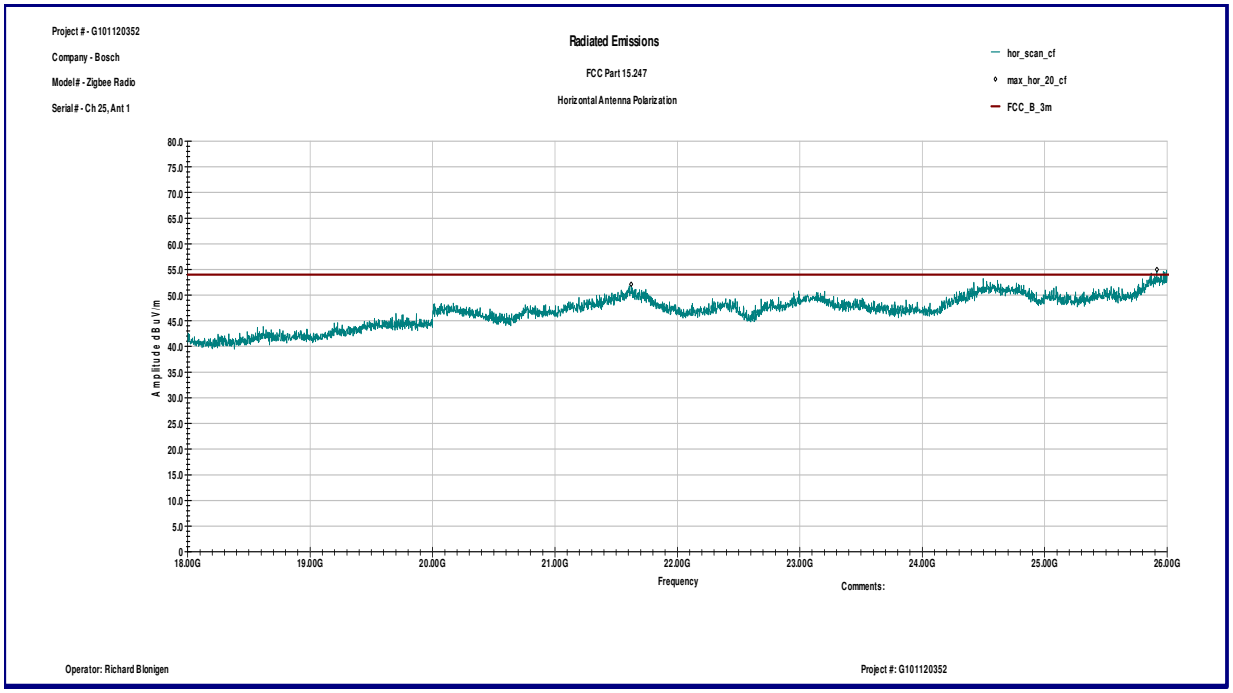


Graph 3.4.18

Vertical antenna polarization



Horizontal antenna polarization



3.5 RF Exposure Compliance

The maximum measured antenna Radiated power, P is 17.3dBm

The antenna gain, G is 3.0dBi

The maximum EIRP power = P + G
ERP = 17.3+ 3.0= 20.3dBm, or 107.15mW

The limits for Maximum Permissible Exposure (MPE) level of Transmitter Power Density at operating frequency S = 1mW/cm^2

The Power Density, S in mW/cm^2 is related to EIRP in mW and Antenna Separation Distance, D in cm with the equation:

$S = EIRP / 4\pi D^2$

Where

D is the antenna Safe Separation Distance = 20cm,

$S = 107.15 / 4\pi 20^2$,

S = 0.0213mW/cm^{2,}, or below the Maximum Permissible Exposure (MPE) of 1mW/cm^2

3.6 Transmitter power line conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: **N/A**

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 Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).

3.7 Receiver/digital device radiated emissions

Test location: ☐ OATS ☒ Anechoic Chamber

Test distance: ☐ 10 meters ☒ 3 meters

Test result: **Pass**

Frequency range: 30MHz-13GHz

Max. Emissions margin: 8.1dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.7.1 & 3.7.2 and Graphs 3.7.1 - 3.7.4)

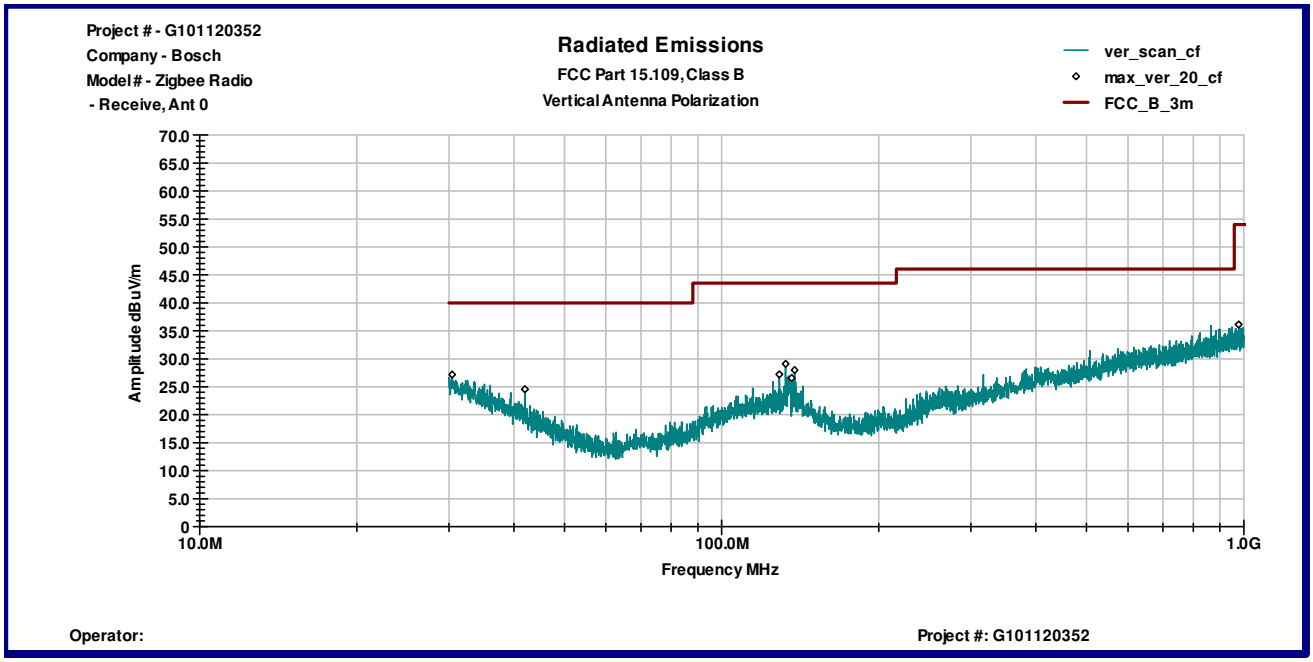
Date:	May 28, 2013	**Result:** **Pass**
Standard:	FCC Part 15.109, Class B / ICES-003 / RSS-Gen	
Tested by:	Richard Blonigen	
Test Point:	Enclosure	
Operation mode:	See page 5	
Note:	ZPR1 Unit Frequency Range 30MHz – 13GHz	

Table 3.7.1

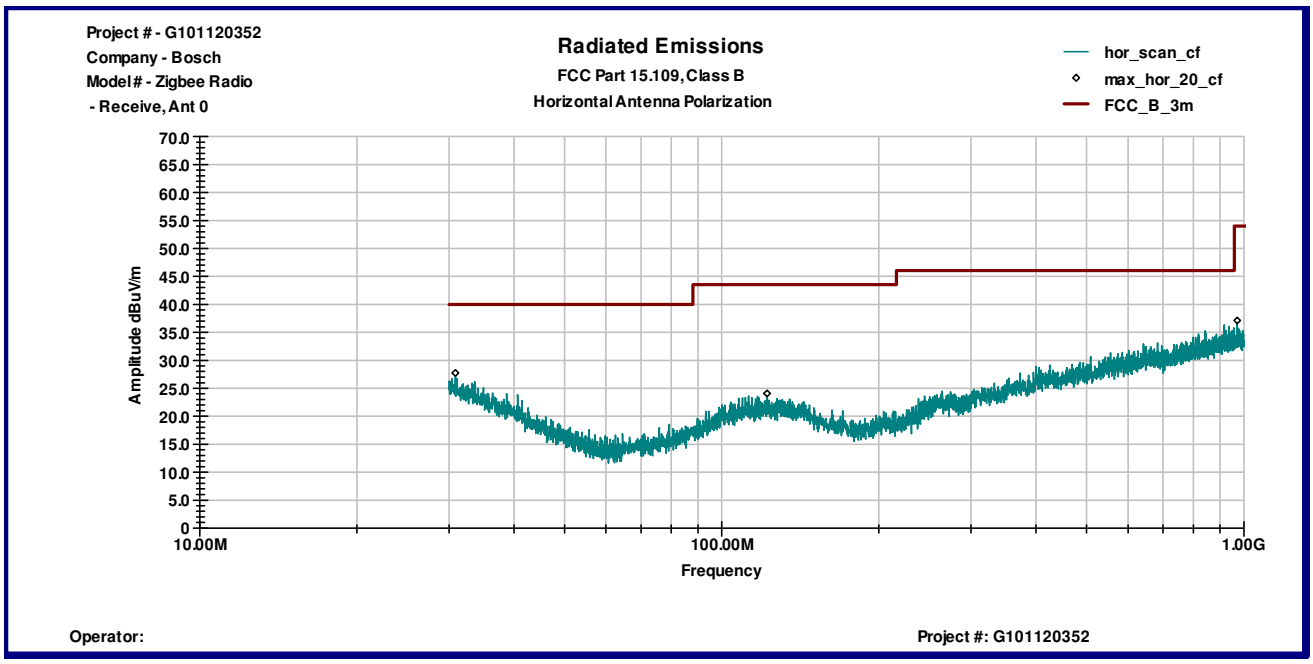
Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
30.45 MHz	V	7.2	20.0	0.0	27.2	40.0	-12.8
41.983 MHz	V	11.1	13.4	0.0	24.5	40.0	-15.5
128.95 MHz	V	13.2	14.0	0.0	27.2	43.5	-16.3
132.53 MHz	V	15.3	13.8	0.0	29.1	43.5	-14.4
136.11 MHz	V	13.0	13.5	0.0	26.5	43.5	-17.0
137.9 MHz	V	14.5	13.4	0.0	28.0	43.5	-15.6
978.07 MHz	V	10.1	26.0	0.0	36.1	54.0	-17.9
11.988 GHz	V	36.7	46.3	37.2	45.9	54.0	-8.1
30.866 MHz	H	8.0	19.7	0.0	27.7	40.0	-12.3
122.09 MHz	H	10.1	14.0	0.0	24.1	43.5	-19.5
971.35 MHz	H	11.1	26.0	0.0	37.1	54.0	-16.9
4.808 GHz	H	44.0	37.1	39.2	42.0	54.0	-12.0
10.876 GHz	H	36.7	46.0	37.1	45.6	54.0	-8.4

Graph 3.7.1

Vertical antenna polarization

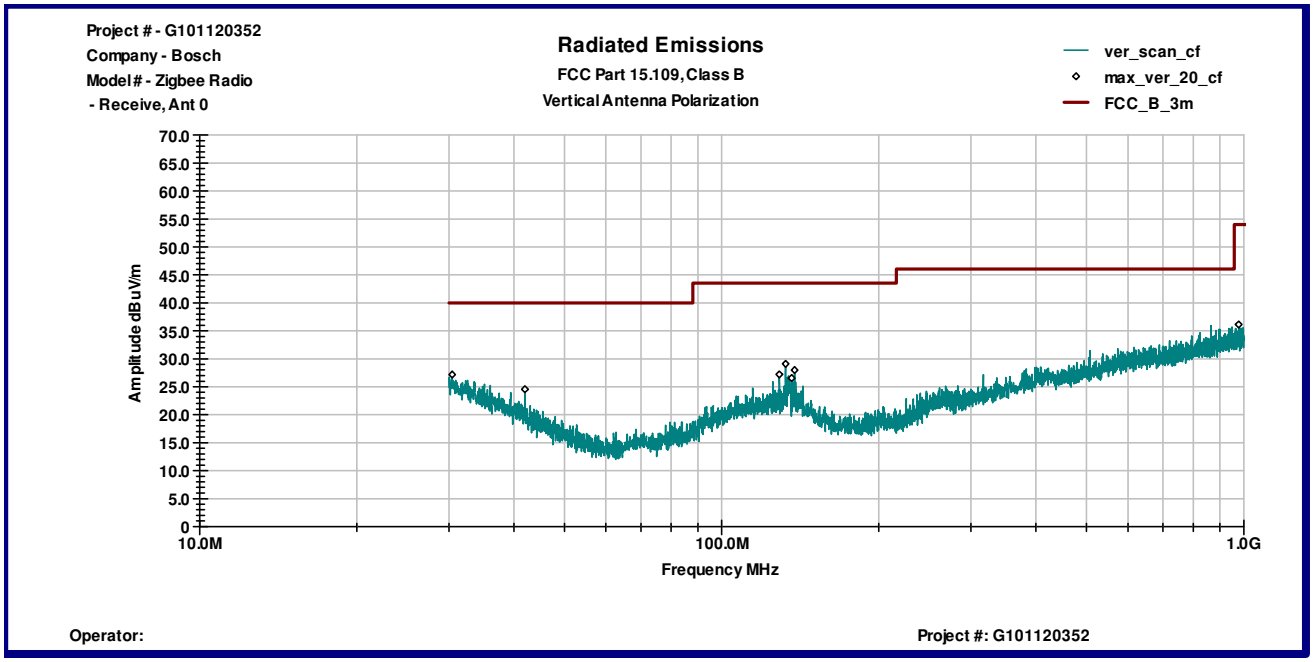


Horizontal antenna polarization

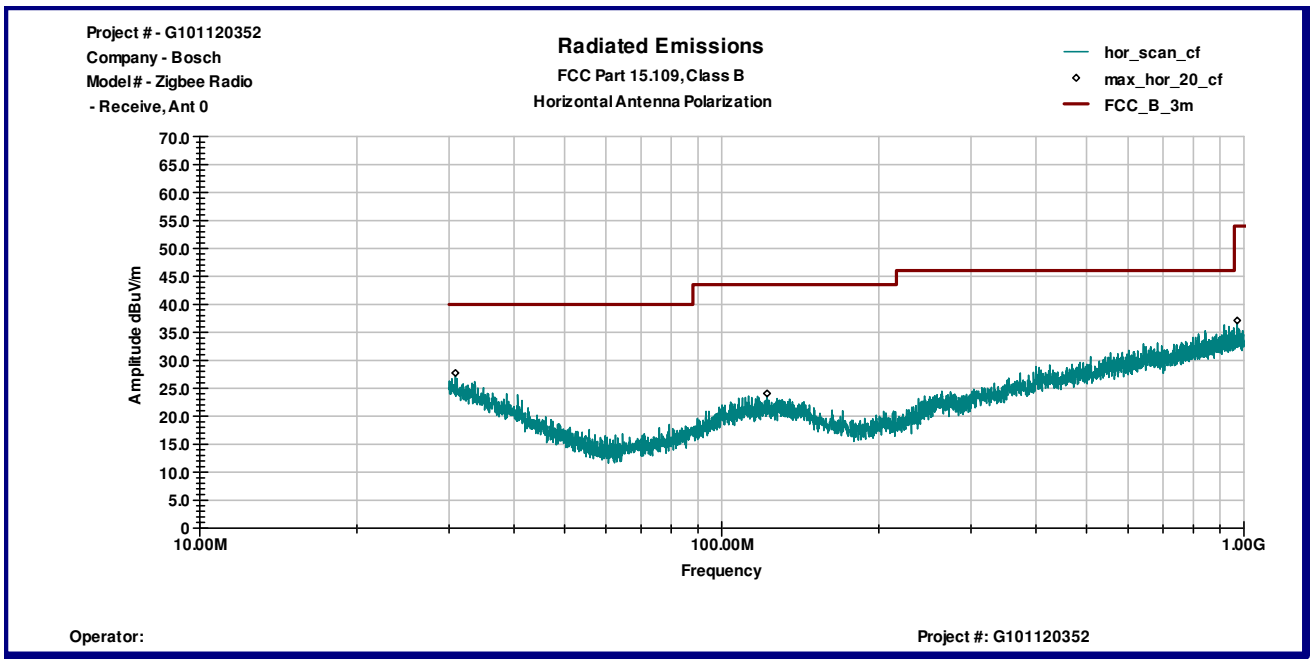


Graph 3.7.2

Vertical antenna polarization



Horizontal antenna polarization



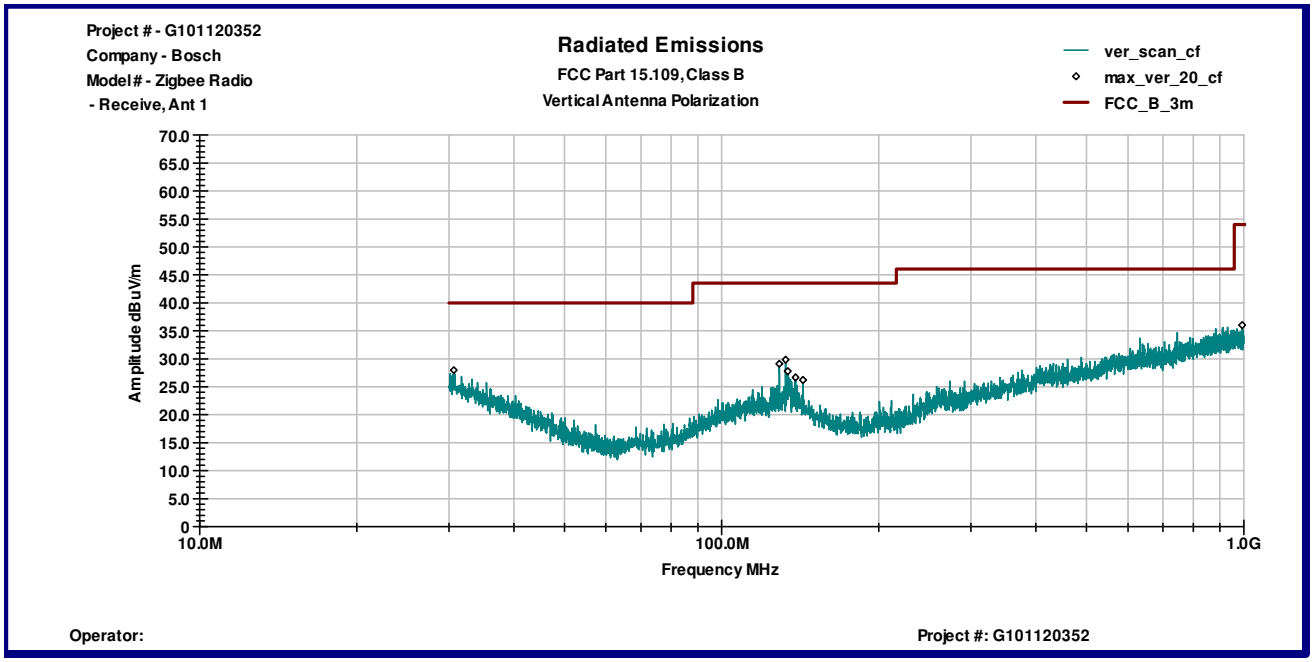
Date:	May 29, 2013	**Result:** **Pass**
Standard:	FCC Part 15.109, Class B / ICES-003 / RSS-Gen	
Tested by:	Richard Blonigen	
Test Point:	Enclosure	
Operation mode:	See page 5	
Note:	ZDL1 Unit Frequency Range 30MHz – 13GHz	

Table 3.7.2

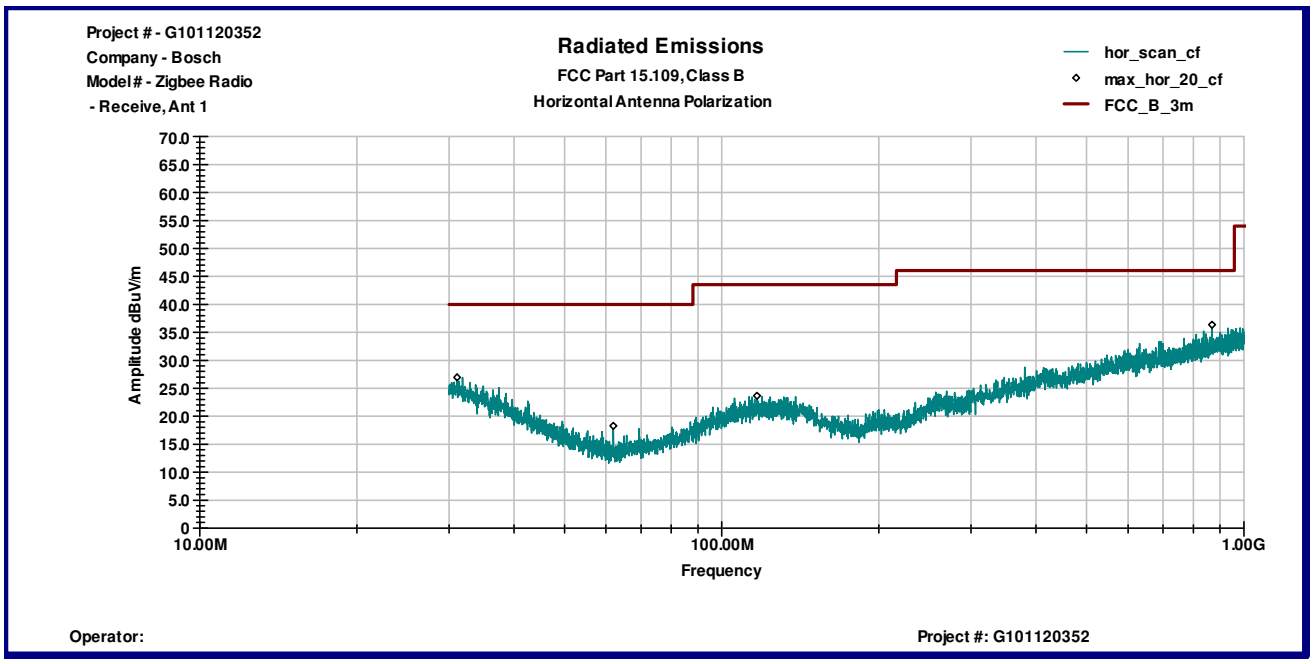
Frequency MHz	Antenna Polarity	Peak Reading dBµV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
30.658 MHz	V	8.1	19.8	0.0	28.0	40.0	-12.0
128.95 MHz	V	15.1	14.0	0.0	29.1	43.5	-14.4
132.53 MHz	V	16.1	13.8	0.0	29.8	43.5	-13.7
133.88 MHz	V	14.1	13.6	0.0	27.8	43.5	-15.8
138.5 MHz	V	13.3	13.4	0.0	26.7	43.5	-16.9
143.11 MHz	V	13.2	13.1	0.0	26.2	43.5	-17.3
993.28 MHz	V	9.8	26.2	0.0	36.0	54.0	-18.0
10.704 GHz	V	37.3	45.7	37.1	45.9	54.0	-8.1
31.108 MHz	H	7.4	19.6	0.0	26.9	40.0	-13.1
61.966 MHz	H	11.3	7.0	0.0	18.3	40.0	-21.8
116.79 MHz	H	9.8	13.8	0.0	23.7	43.5	-19.9
869.14 MHz	H	11.3	25.0	0.0	36.4	46.0	-9.7
10.68 GHz	H	37.3	45.5	37.1	45.7	54.0	-8.3

Graph 3.7.3

Vertical antenna polarization

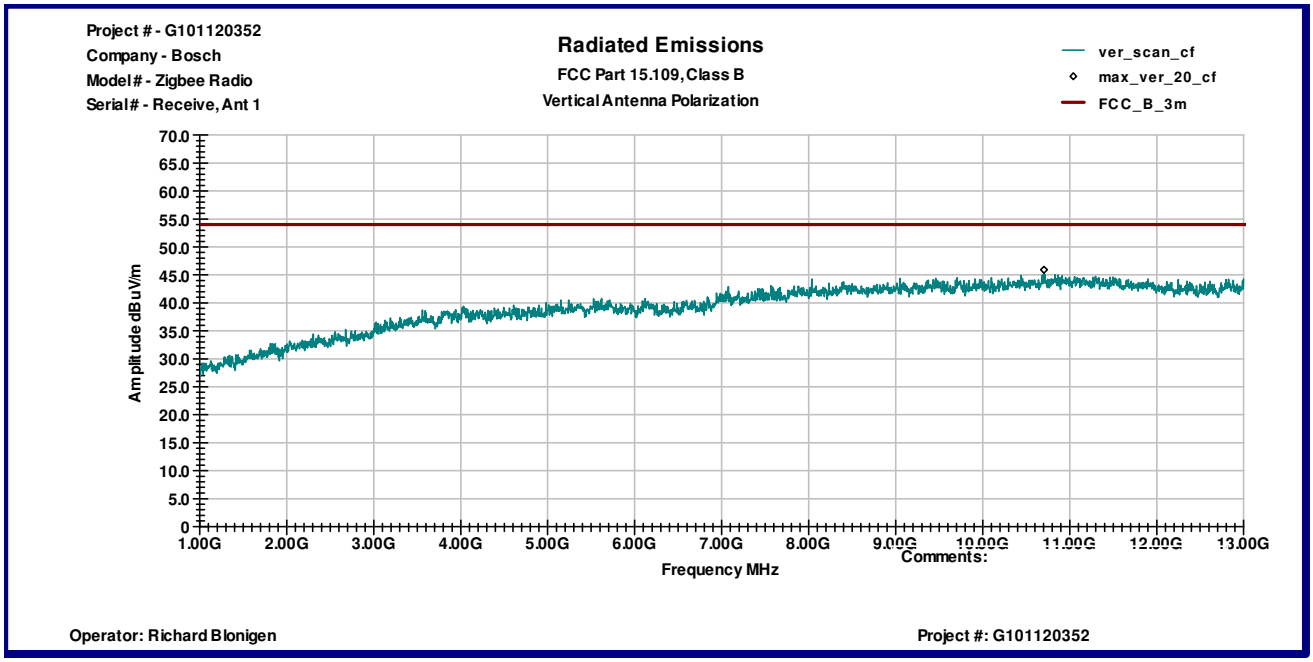


Horizontal antenna polarization

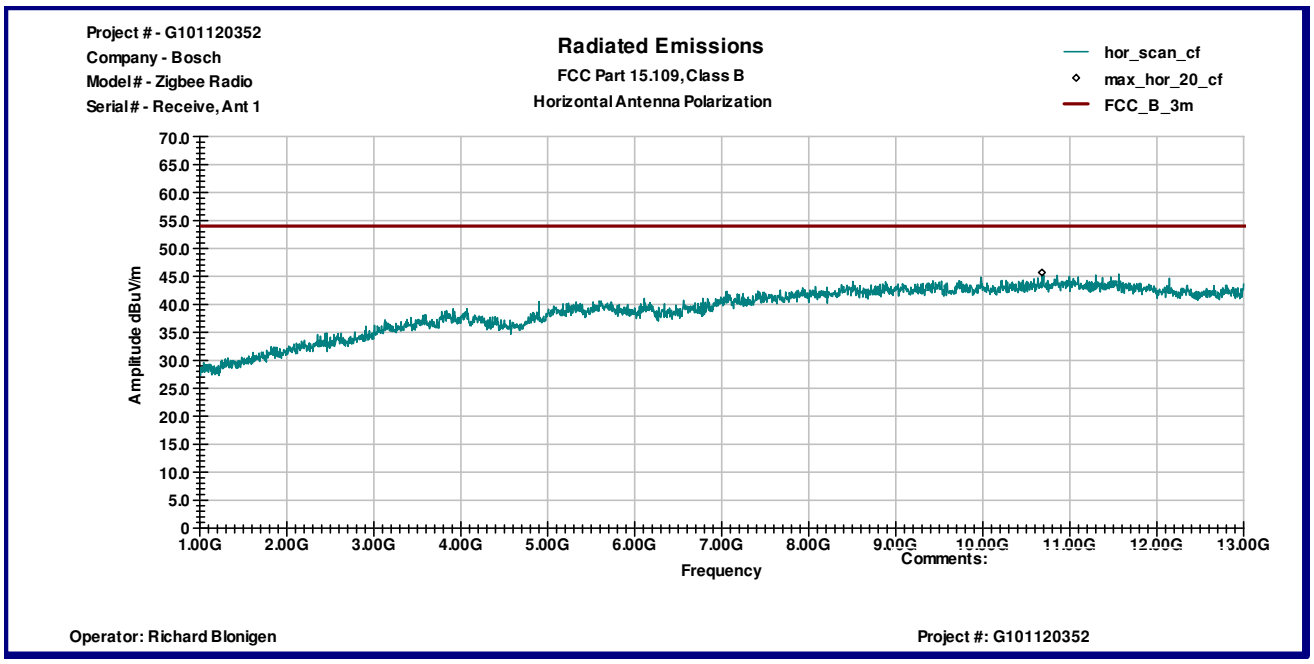


Graph 3.7.4

Vertical antenna polarization



Horizontal antenna polarization



3.8 Digital device conducted emissions

Test location: ☐ OATS ☐ Anechoic Chamber ☐ Other

Test result: **N/A**

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 Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).

4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/29/2013	☒
Spectrum Analyzer	R & S	ESU	100398	25283	12/19/2013	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	08/09/2013	☒
Horn Antenna	EMCO	3115	9507-4513	9936*	05/28/2014	☒
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	11/07/2013	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475*	11/01/2013	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/01/2013	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒