



TEST REPORT

Report Number: 101039189MIN-001B

Project Number: G101039189

**Testing performed on the
AdvisorOne
AVO-BTWI, WiFi**

**FCC ID: B4Z-958F-BTWI
Industry Canada ID: 1175C-958FBTWI**

**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
UTC Fire & Security Americas Corporation, Inc.**

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TABLE OF CONTENTS

1.0	GENERAL DESCRIPTION.....	3
1.1	Product Description; Test Facility	4
1.3	Environmental conditions.....	5
1.4	Measurement uncertainty	6
1.5	Field Strength Calculation.....	6
2.0	TEST SUMMARY.....	7
3.0	TEST CONDITIONS AND RESULTS.....	8
3.1	6dB Emission bandwidth (EBW) of the digital modulation	8
3.2	Maximum peak output power.....	18
3.3	Power spectral density	30
3.4	Antenna conducted spurious emissions.....	42
3.5	Radiated spurious emissions.....	76
3.6	RF Exposure Compliance	114
3.7	Transmitter power line conducted emissions	115
3.8	Receiver/digital device radiated emissions.....	118
3.9	Digital device conducted emissions.....	122
4.0	TEST EQUIPMENT.....	125



1.0 GENERAL DESCRIPTION

Model:	AdvisorOne
Type of EUT:	Security Alarm
FCC ID:	B4Z-958F-BTWI
Industry Canada ID:	1175C-958FBTWI
Related Submittal(s) Grants:	None
Company:	UTC Fire & Security Americas Corporation, Inc.
Customer:	Mr. Kevin Flanders
Address:	1275 Red Fox Road Arden Hills, MN 55112 USA
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Test Standards:	☒ 47 CFR, Part 15:2010, §15.247 ☒ RSS-210, Issue 8, 2010 ☒ 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:	February 28, 2013
Test Work Started:	February 28, 2013
Test Work Completed:	April 30, 2013
Test Sample Conditions:	☐ Damaged ☐ Poor (Usable) ☒ Good



1.1 Product Description; Test Facility

Product Description:	AVO-BTWI, WiFi
Board Revision:	55-958
Transmitter Type:	☐ FHSS ☐ Digital Modulation ☒ WiFi ☐ Blue Tooth
Operating Frequency Range(s):	From 2412.0 to 2462.0 MHz
Number of Channels:	11
Modulation:	802.11b-DSSS 802.11g-OFDM 802.11n-OFDM
Emission Designator:	802.11b-DSSS: 10M1GXW 802.11g-OFDM: 16M3GXW 802.11n-OFDM: 17M8GXW
Antenna(s) Info:	High Efficiency loop antenna Gain: 2.5dBi
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter power configuration:	☐ Internal battery ☒ External power source ☒ 120VAC ☐ 230VAC ☐ 400VAC ☐ [redacted] VDC ☐ Other: [redacted] [redacted] Amp. ☐ 50Hz ☒ 60Hz
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	Test was performed at low channel, middle channel, and upper channel

Cables:

No.	Type	Length	Designation	Note
1	RJ45, not shielded	<100ft	Ethernet WAN cable	
2	RJ45, not shielded	<100ft	Ethernet LAN cable	
3	RJ45, not shielded	>100ft	Home telephone connection cable	
4	2-wire not shielded DC power	6ft	Battery Connection	
5	2-wire not shielded DC power	>100ft	Telephone bell	
6	Zones 1, 2, 3, 4,5	>100ft	Superbus	
7	External antenna cable	<6ft	319.5MHz receive antenna	
8	External antenna cable	<6ft	GSM-GPRS antenna	

Support equipment/Services:

No.	Item	Description
1	None	

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(μ V/m)

RA = Receiver Amplitude in dB(μ V)

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(μ V) 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(μ V/m).

$$RA = 48.1 \text{ dB}(\mu V)$$

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

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

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu V/m)$$

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(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	Pass
15.109 / ICES-003	Receiver/digital device radiated emissions	Pass
15.107 / ICES-003	Digital device conducted emissions	Pass



3.0 TEST CONDITIONS AND RESULTS

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

802.11b

Low Frequency Channel MHz	Middle Frequency Channel MHz	Upper Frequency Channel MHz	Minimum Bandwidth kHz	Result
10.14	10.12	10.08	500	Pass
RBW: VBW:	☒ 300kHz ☒ 1MHz			

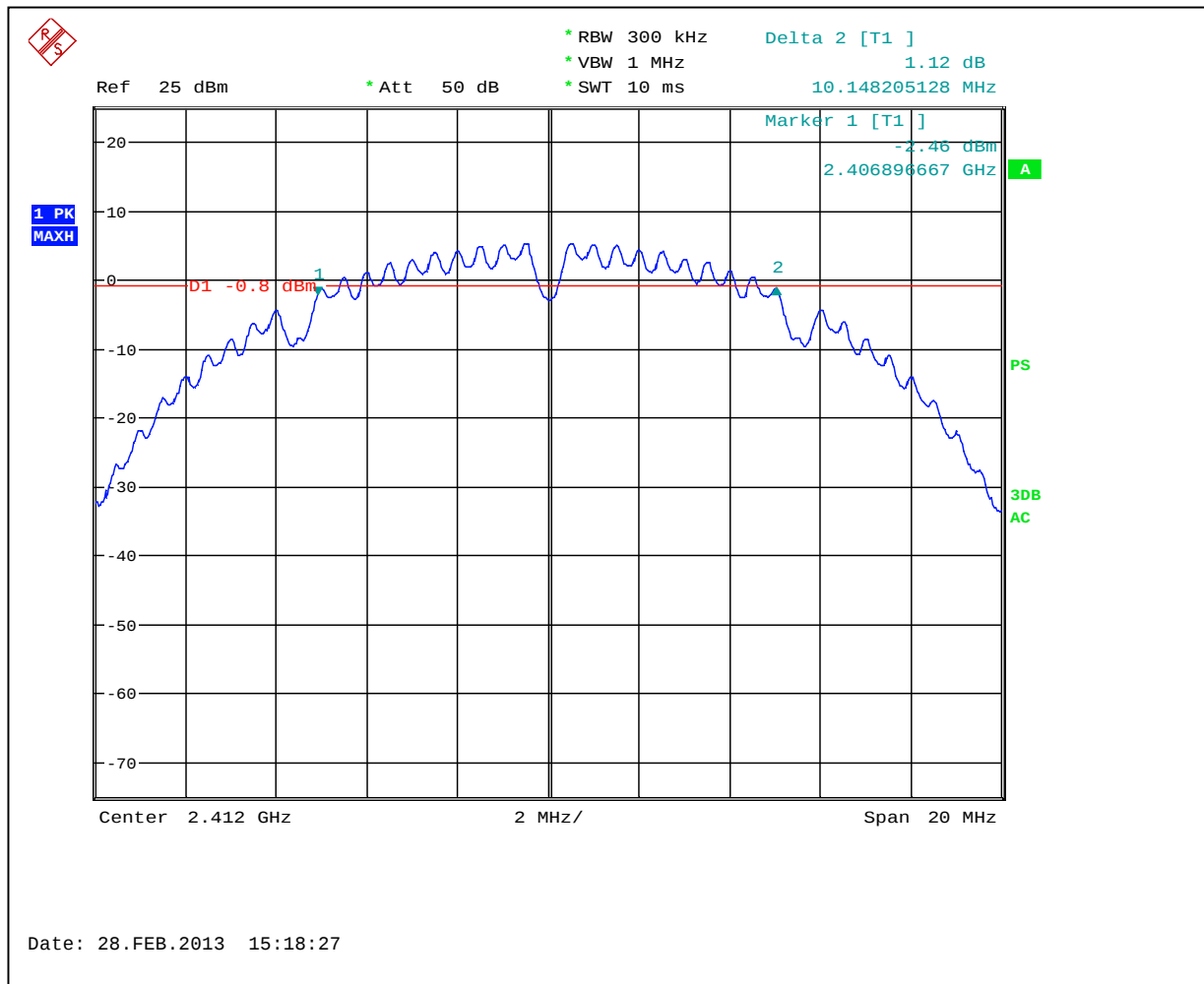
802.11g

Low Frequency Channel MHz	Middle Frequency Channel MHz	Upper Frequency Channel MHz	Minimum Bandwidth kHz	Result
16.25	16.22	16.10	500	Pass
RBW: VBW:	☒ 500kHz ☒ 3MHz			

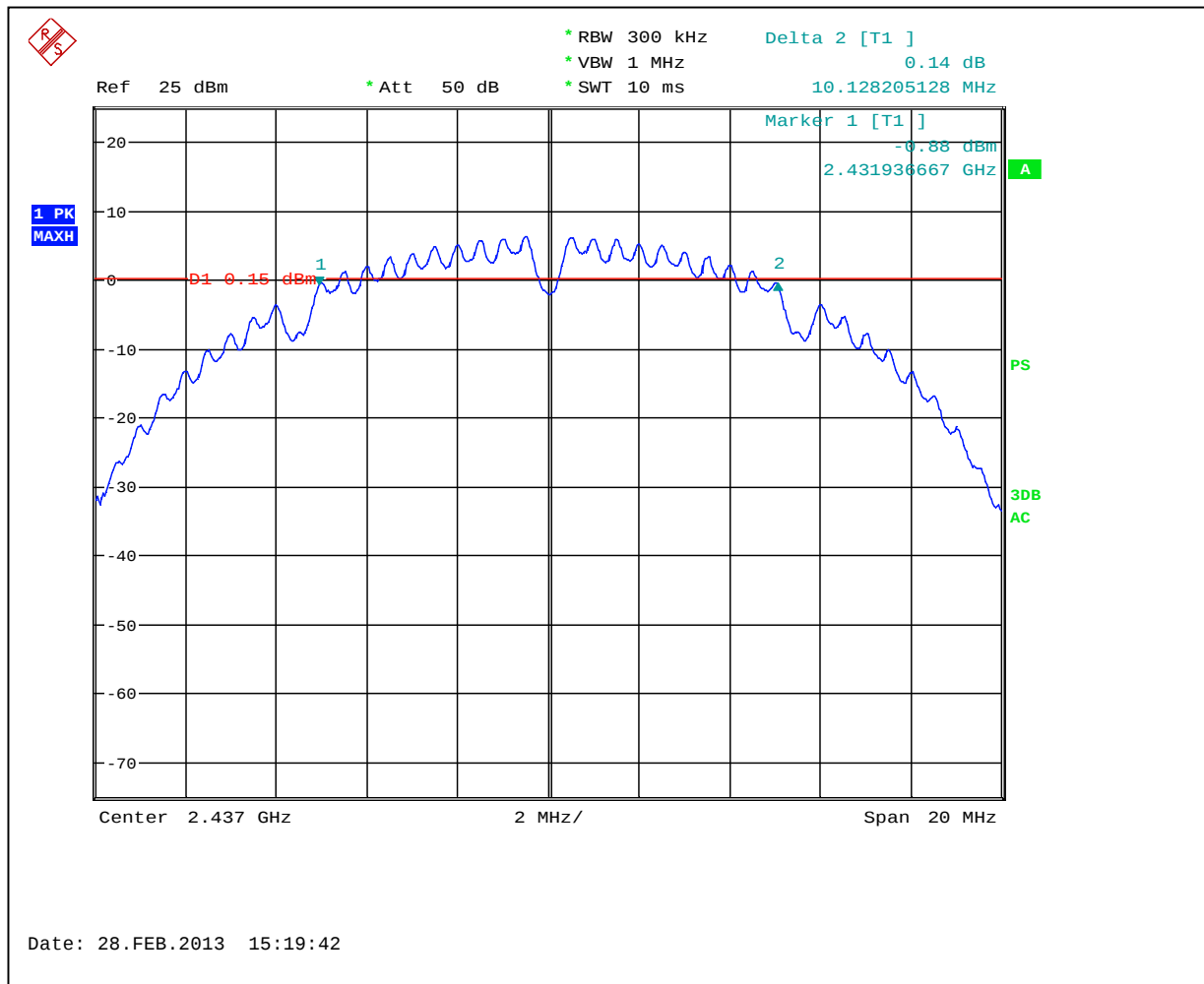
802.11n

Low Frequency Channel MHz	Middle Frequency Channel MHz	Upper Frequency Channel MHz	Minimum Bandwidth kHz	Result
17.40	17.39	17.76	500	Pass
RBW: VBW:	☒ 500kHz ☒ 3MHz			

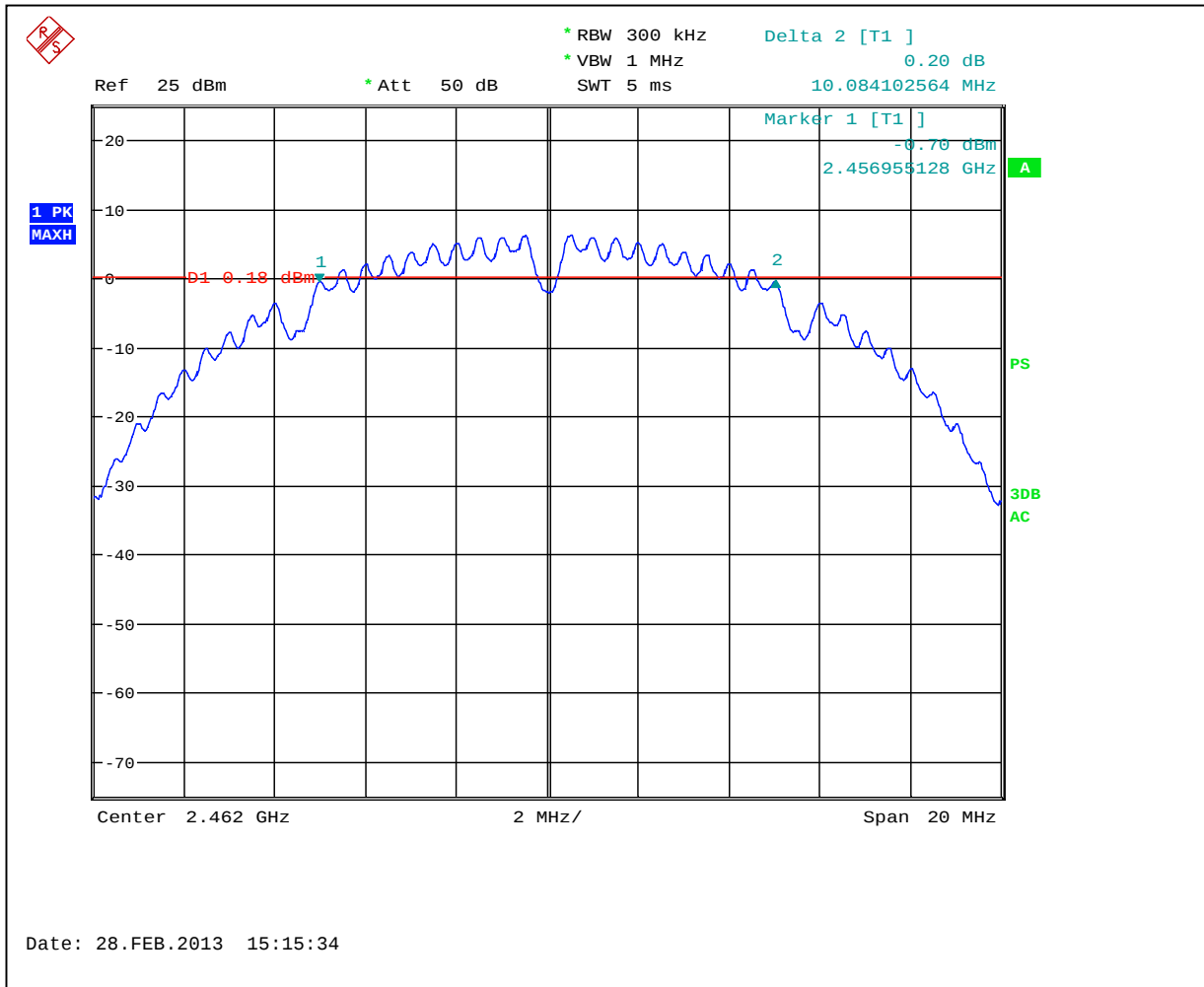
Notes: Graphs 3.1.1, 3.1.2, 3.1.3 for 802.11b
 Graphs 3.1.4, 3.1.5, 3.1.6 for 802.11g
 Graphs 3.1.7, 3.1.8, 3.1.9 for 802.11n



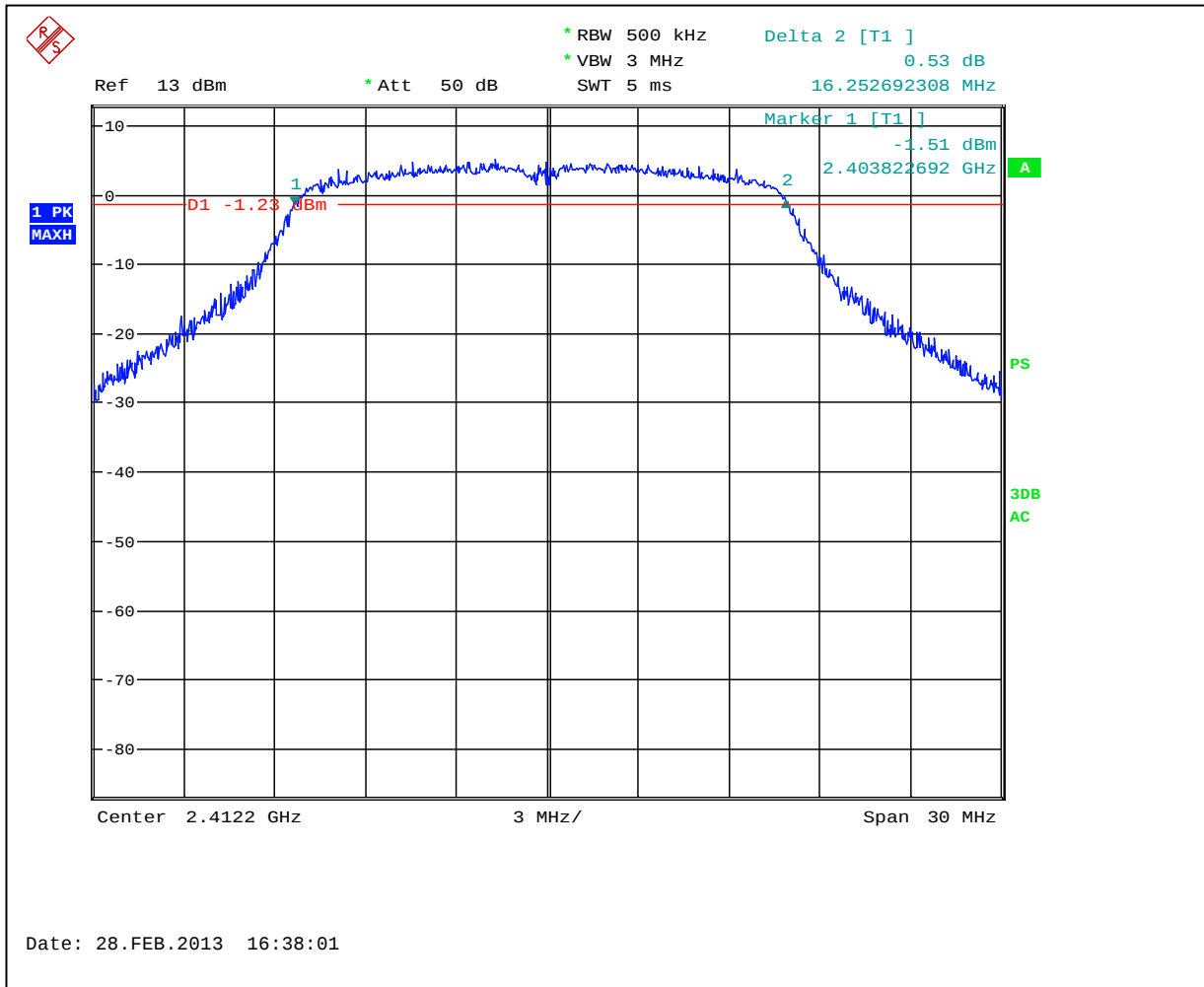
Graph 3.1.1



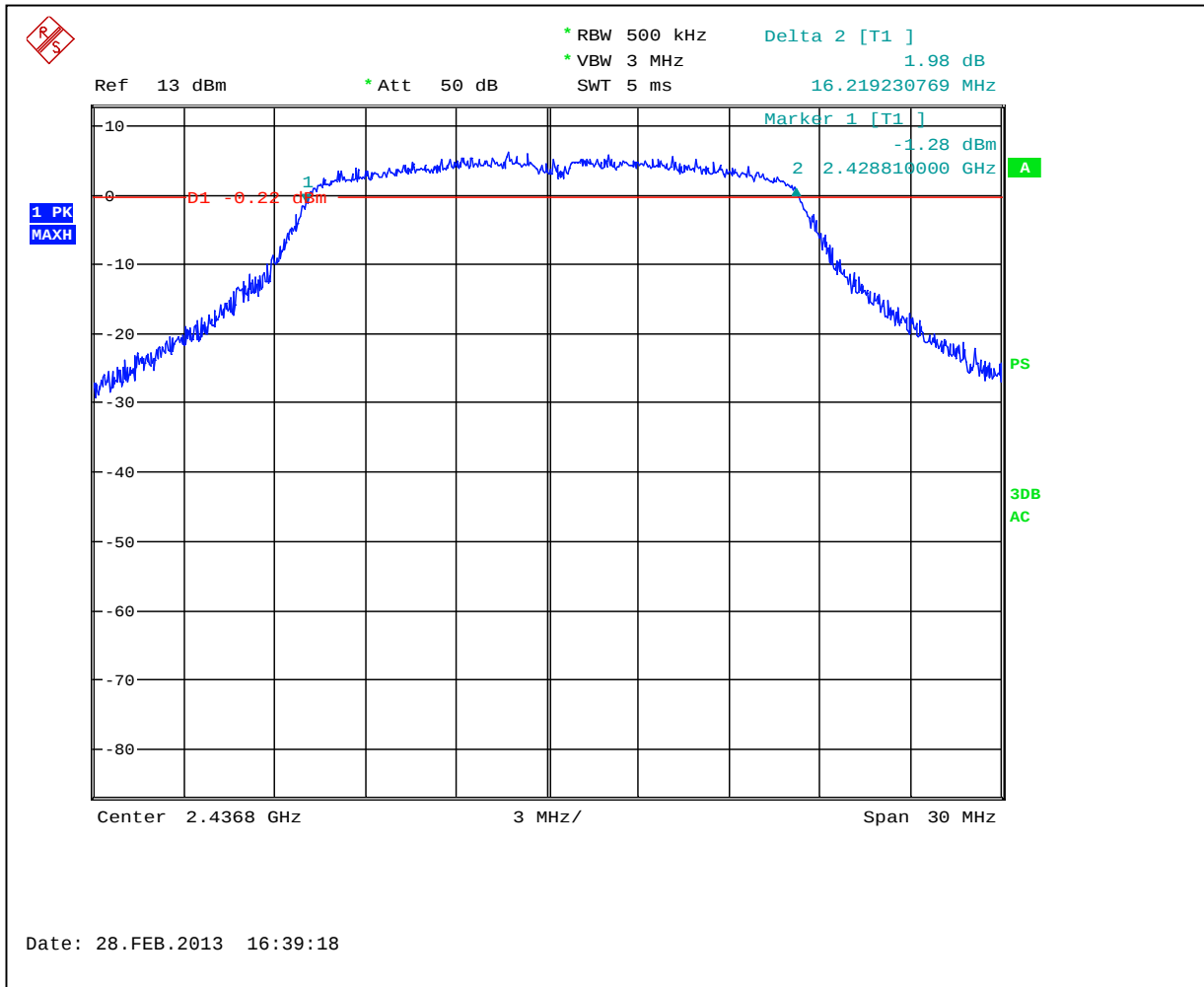
Graph 3.1.2



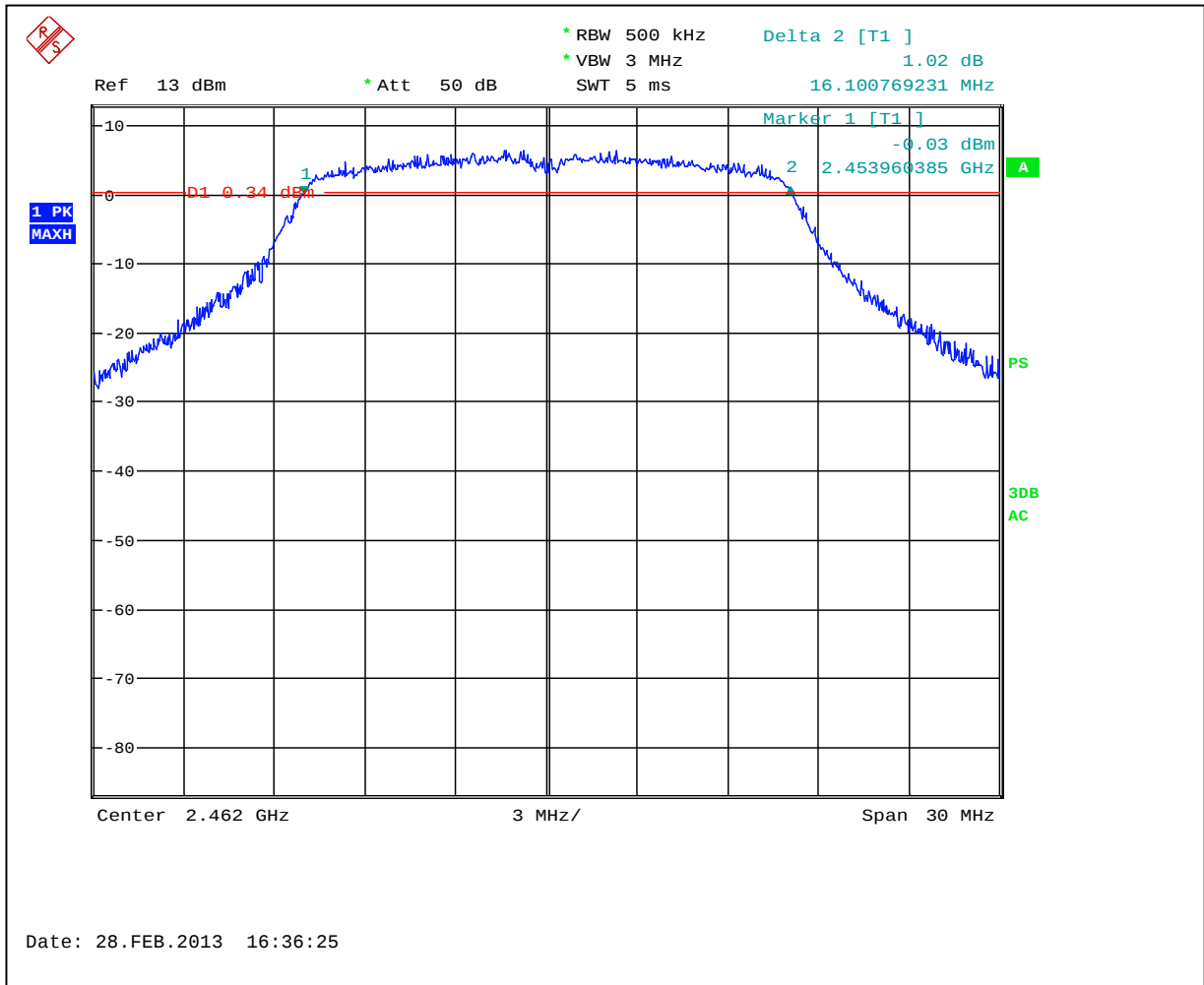
Graph 3.1.3



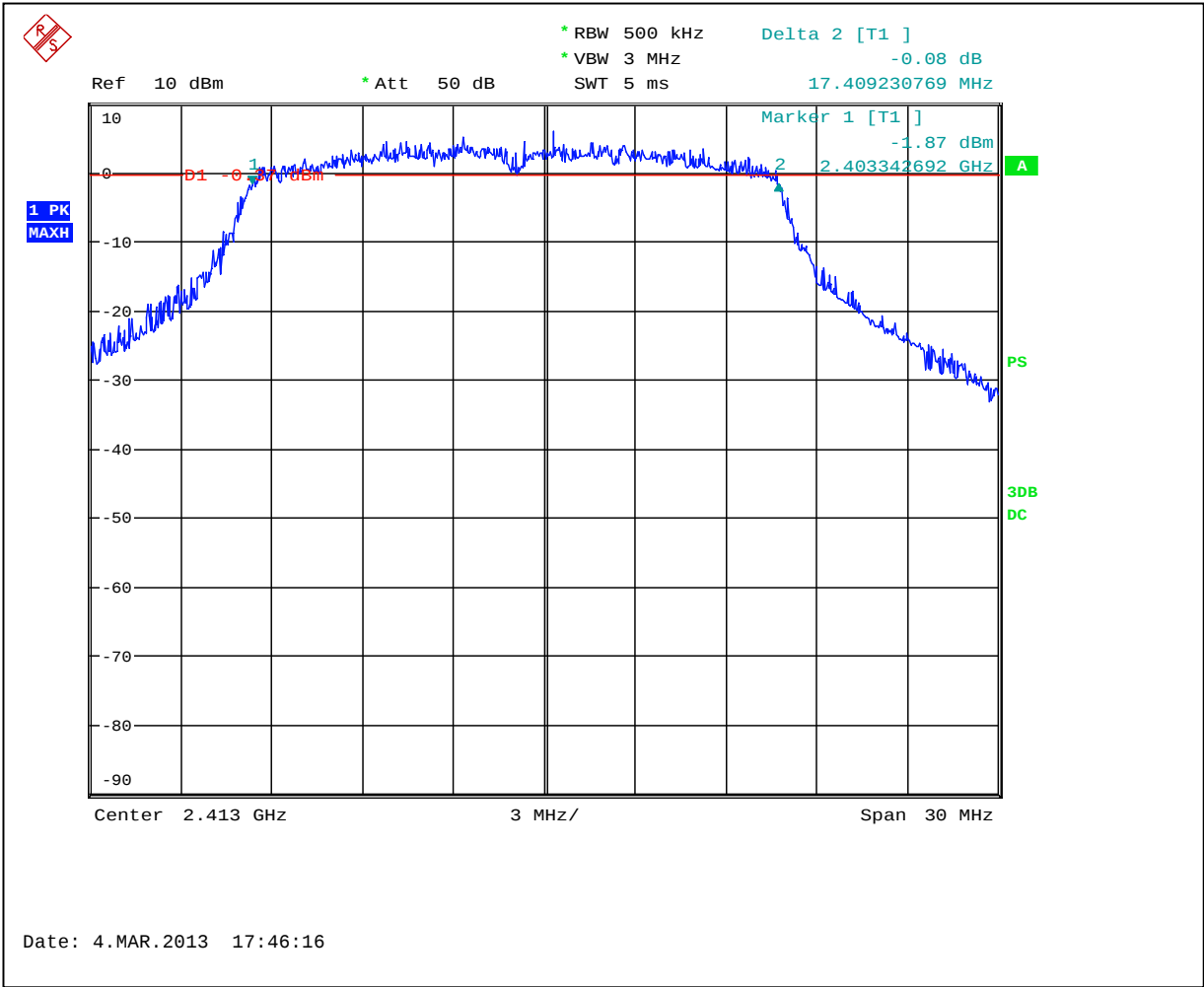
Graph 3.1.4



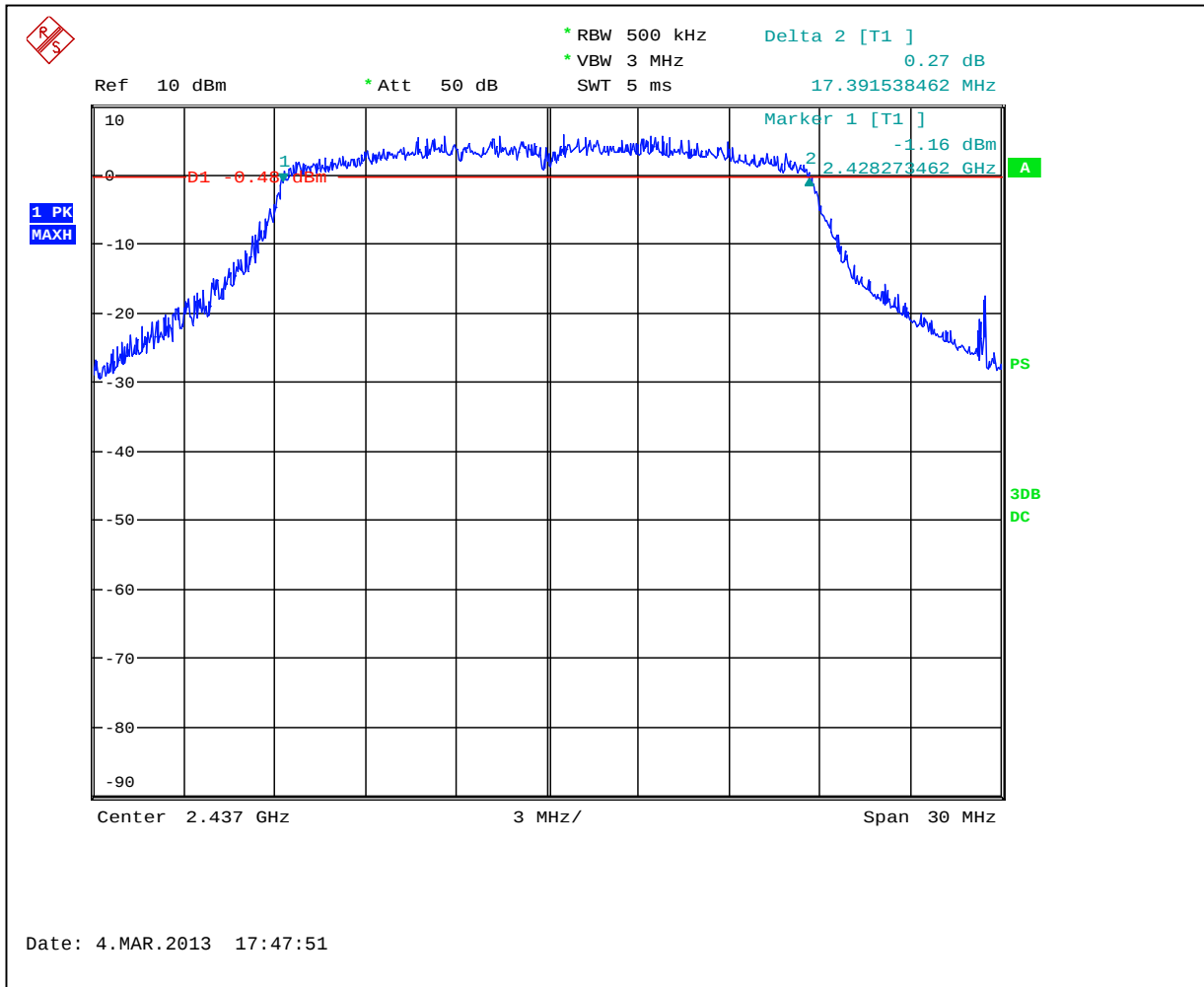
Graph 3.1.5



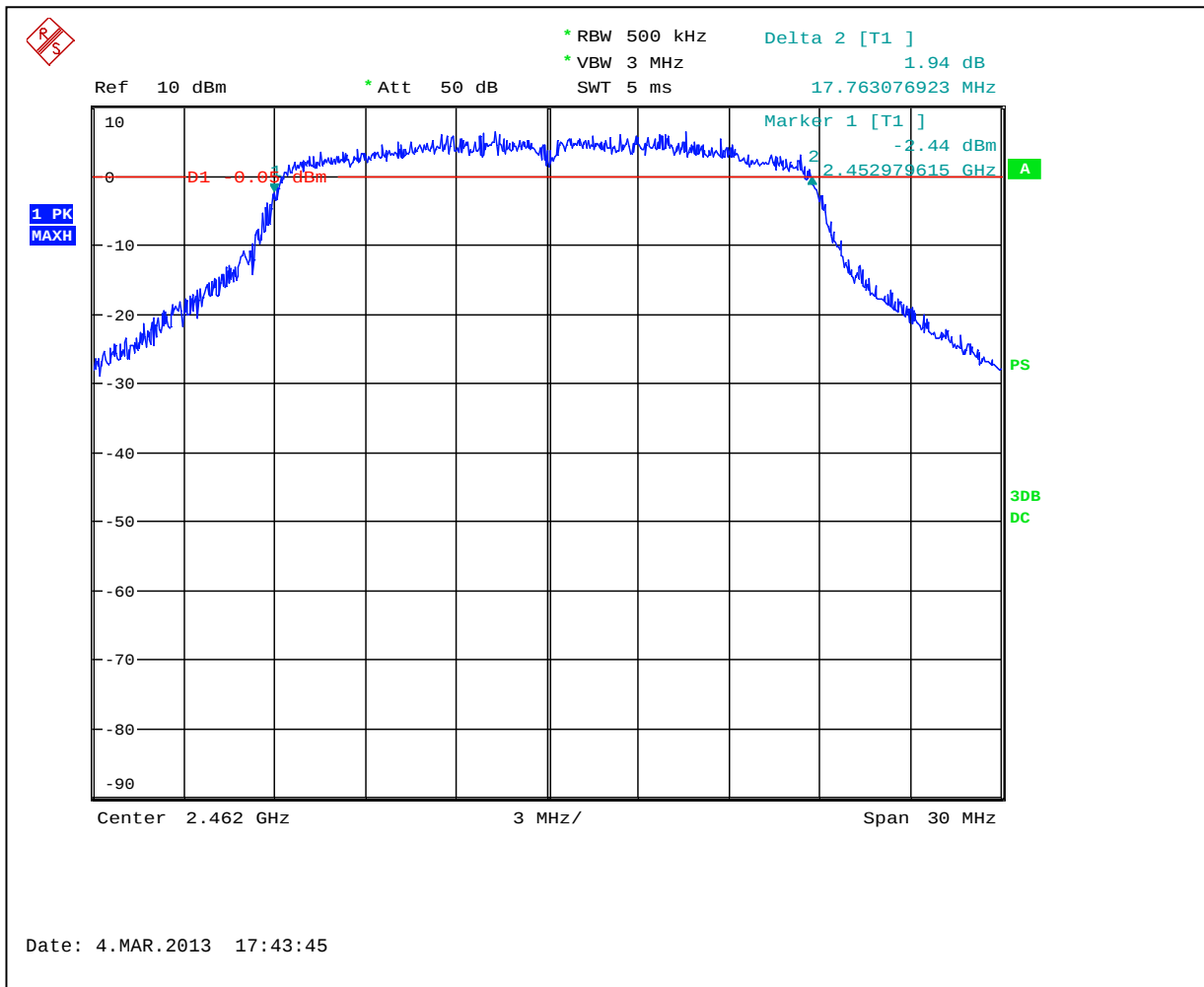
Graph 3.1.6



Graph 3.1.7



Graph 3.1.8



Graph 3.1.9



3.2 Maximum peak output power

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. Margin: 8.3dB below the limits

802.11b

Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz		☒ 2400-2483.5MHz		☐ 5725-5850MHz	
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2412.4	16.3	1.3	17.9	30	0	-12.1
Middle Frequency MHz						
2436.8	16.8	1.3	18.1	30	0	-11.9
Upper Frequency MHz						
2462.0	17.3	1.3	18.6	30	0	-11.4
RBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
VBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					



802.11g

Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz					
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2412.4	19.4	1.3	20.7	30	0	-9.3
Middle Frequency MHz						
2436.8	19.9	1.3	21.2	30	0	-8.8
Upper Frequency MHz						
2462.0	20.4	1.3	21.7	30	0	-8.3
RBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
VBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

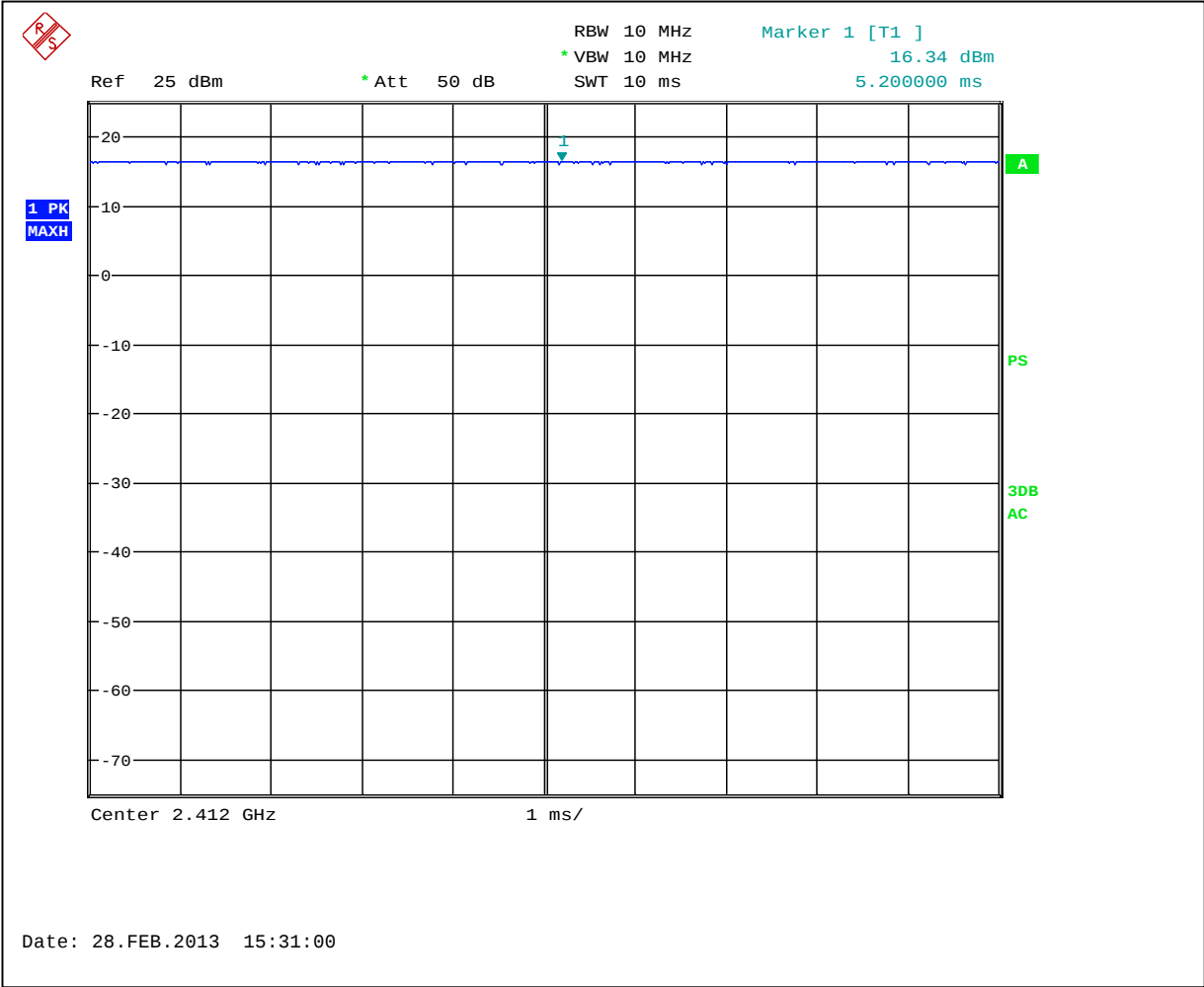


802.11n

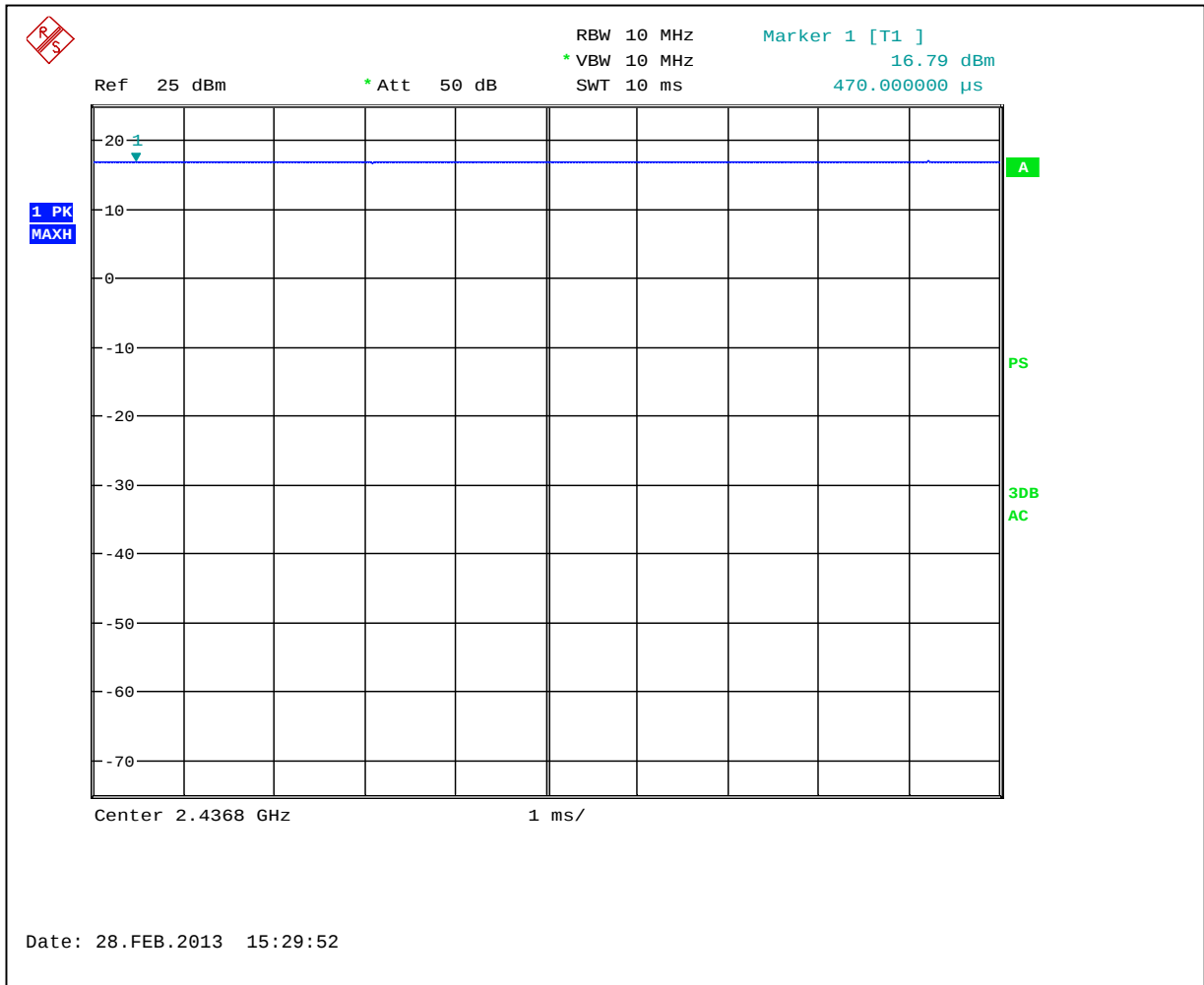
Power Output:	Conducted					
Frequency Range:	☐ 902-928MHz ☒ 2400-2483.5MHz ☐ 5725-5850MHz					
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
2412.4	17.7	1.3	19.0	30	0	-11.0
Middle Frequency MHz						
2436.8	18.2	1.3	19.5	30	0	-10.5
Upper Frequency MHz						
2462.0	18.5	1.3	19.8	30	0	-10.2
RBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
VBW:	☐ 1MHz ☐ 3MHz ☒ 10MHz					
Antenna Gain:	☒ < 6dBi ☐ >6dBi and = dBi, Output power reduction = dB					

Notes:

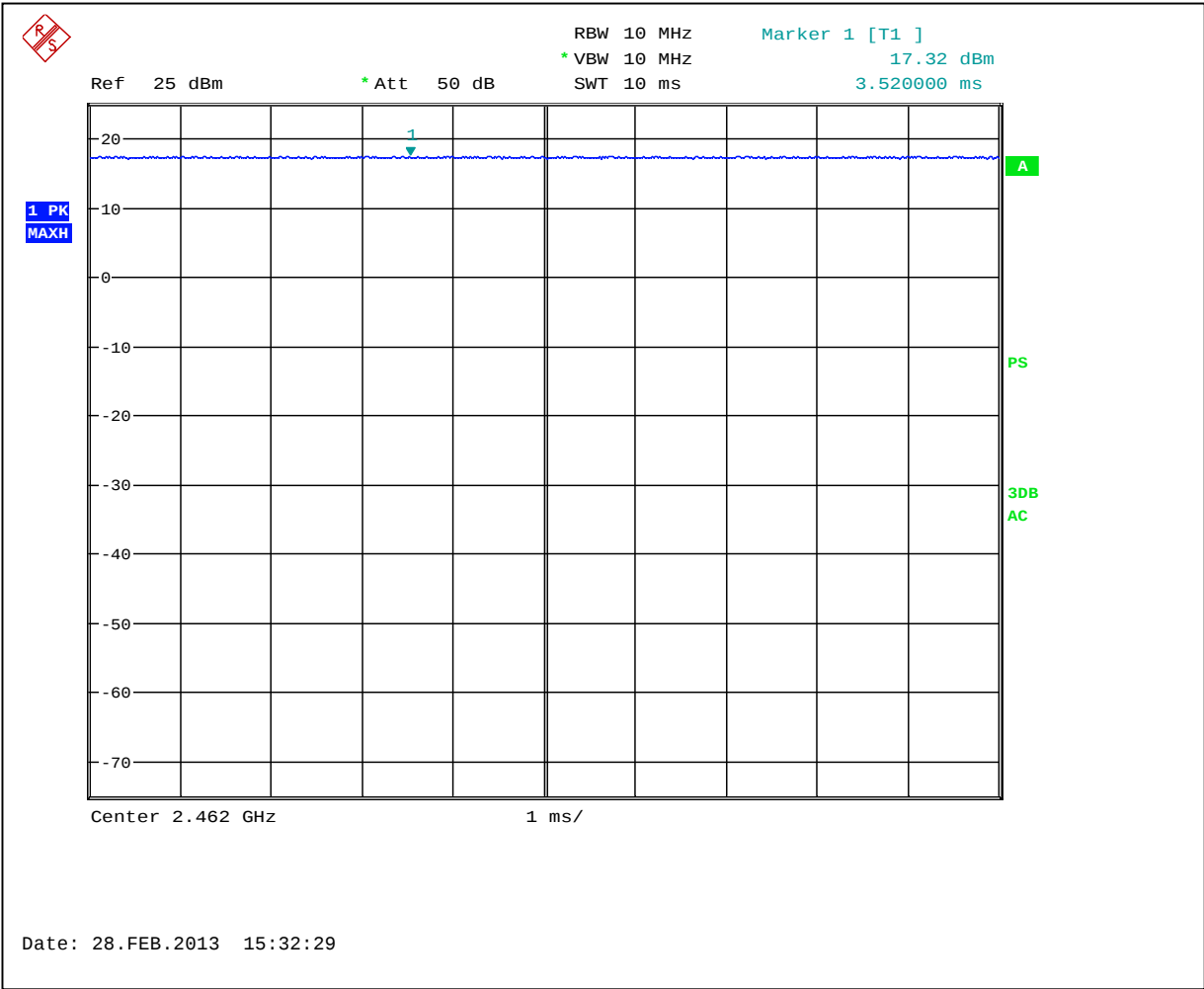
The maximum peak conducted output power limit is 1 W, or 30dBm
 Graphs 3.2.1, 3.2.2, 3.2.3 for 802.11b show the conducted output power
 Graphs 3.2.4, 3.2.5, 3.2.6 for 802.11g show the conducted output power
 Graphs 3.2.7, 3.2.8, 3.2.9 for 802.11n show the conducted output power



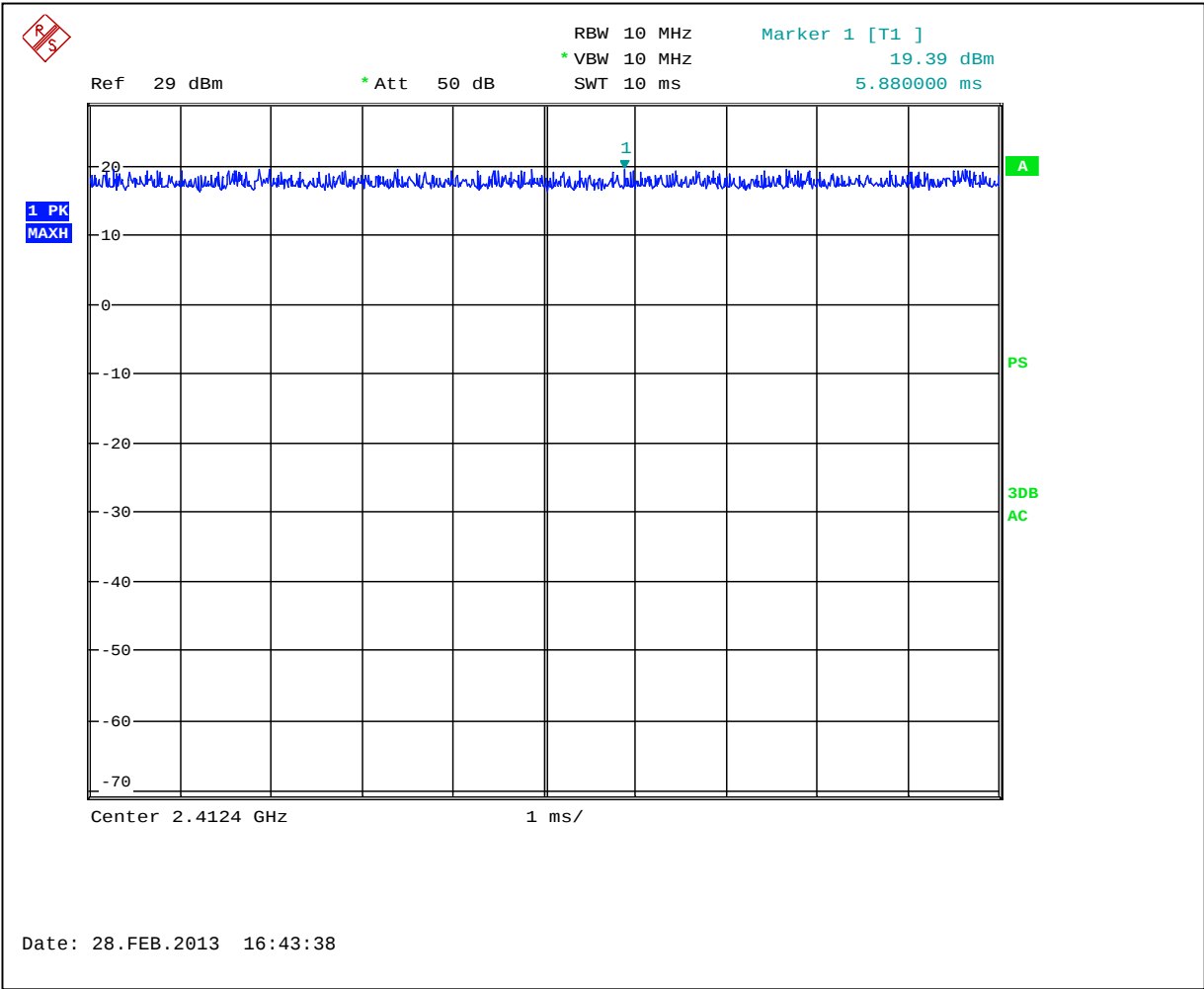
Graph 3.2.1



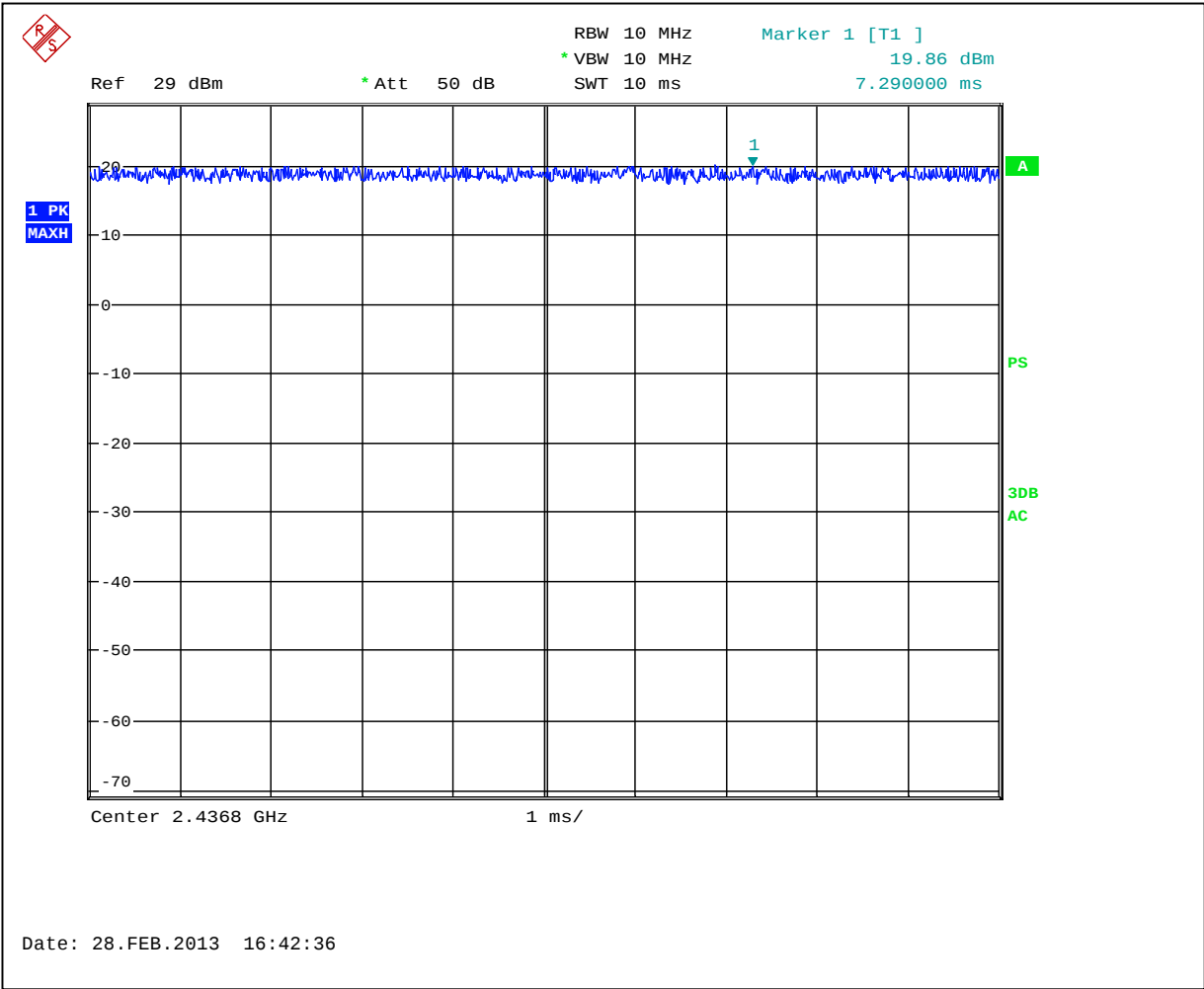
Graph 3.2.2



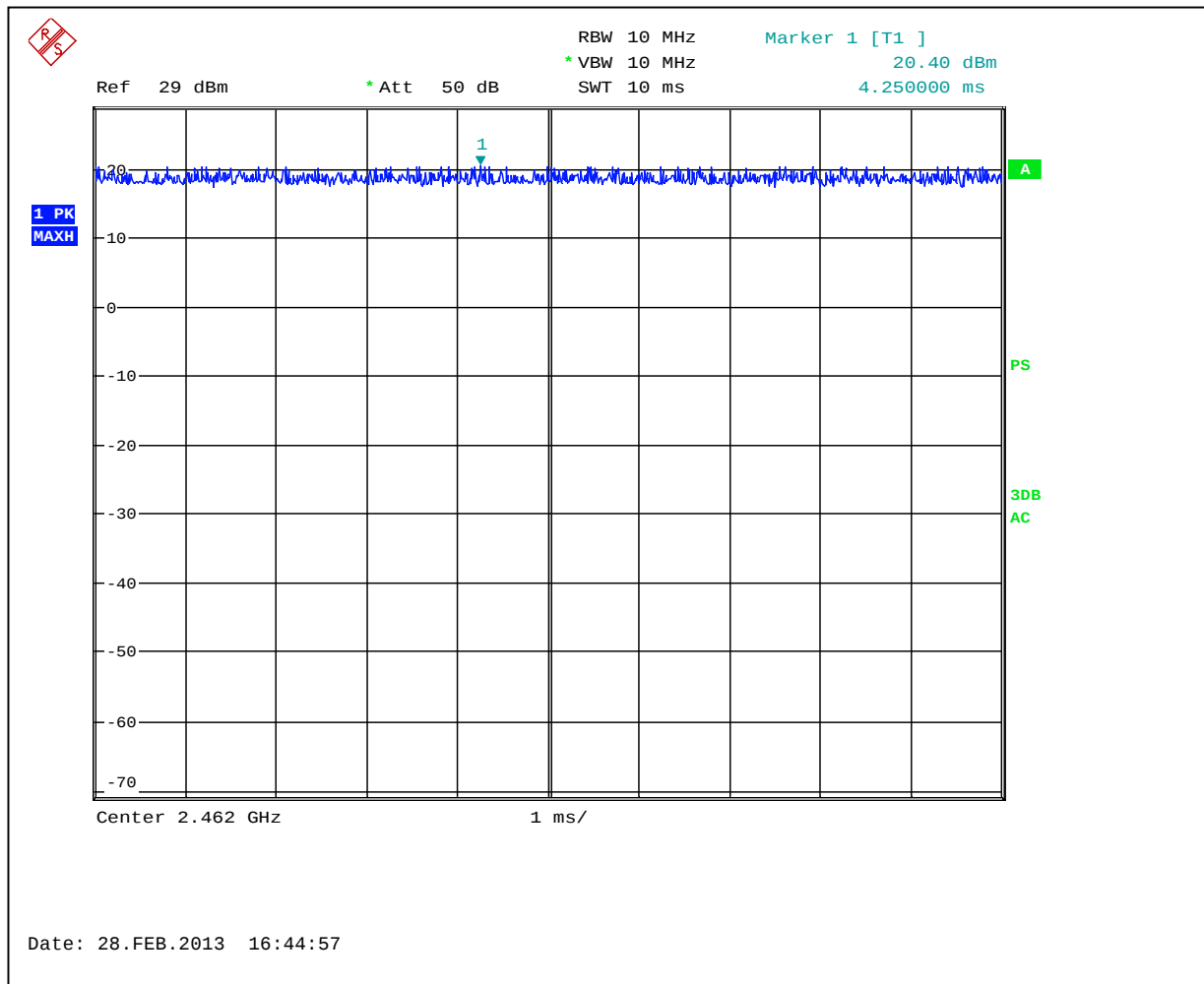
Graph 3.2.3



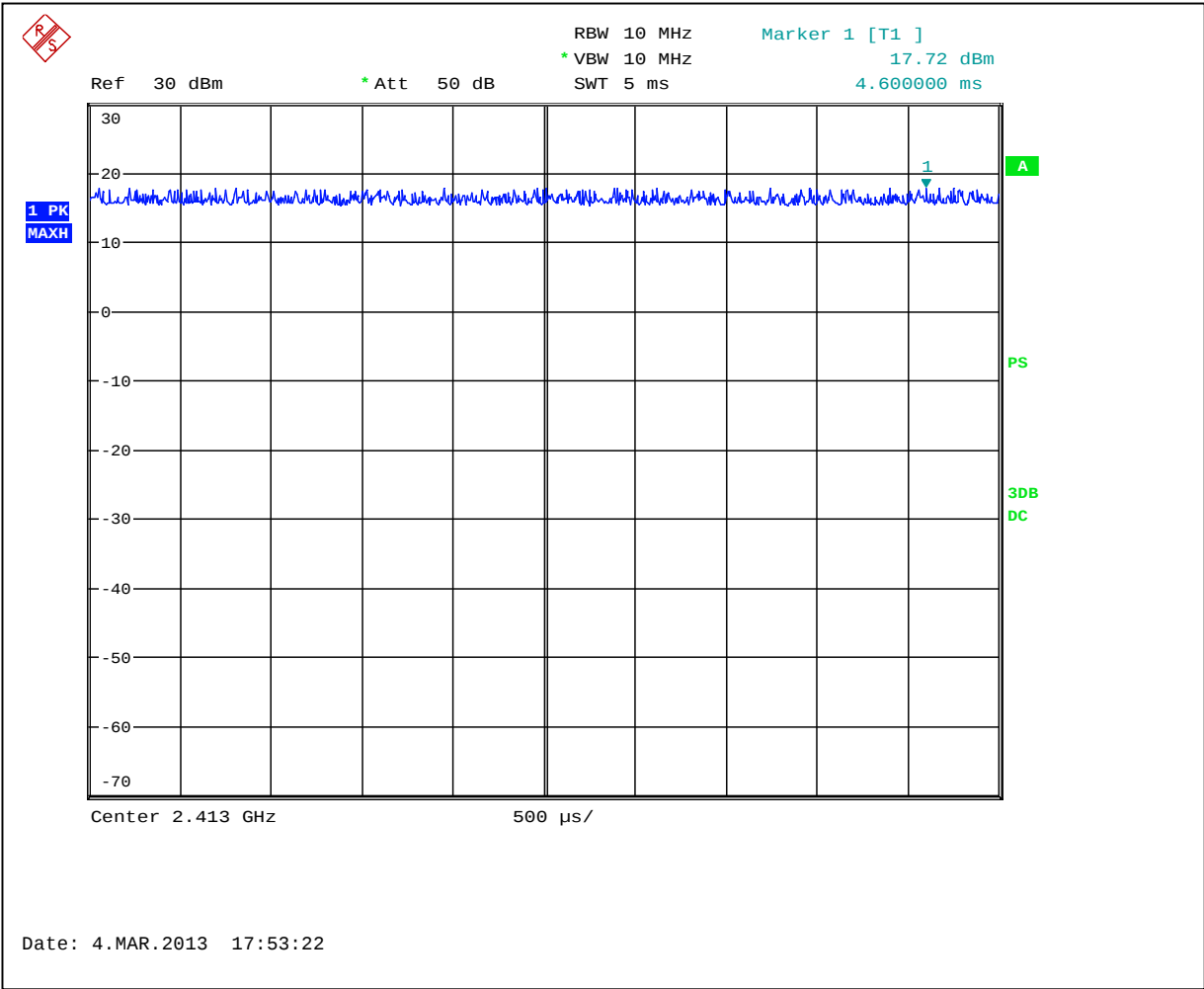
Graph 3.2.4



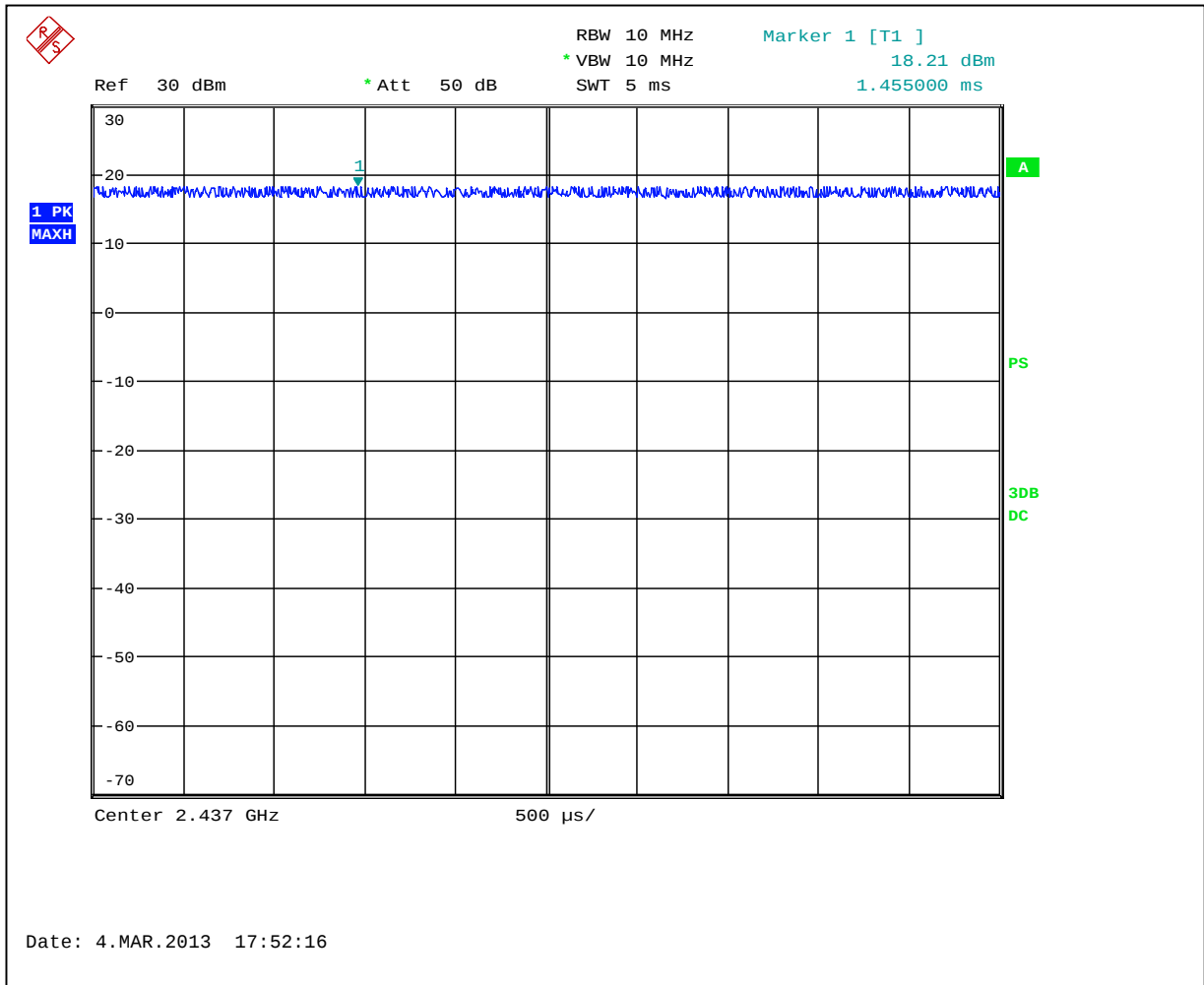
Graph 3.2.5



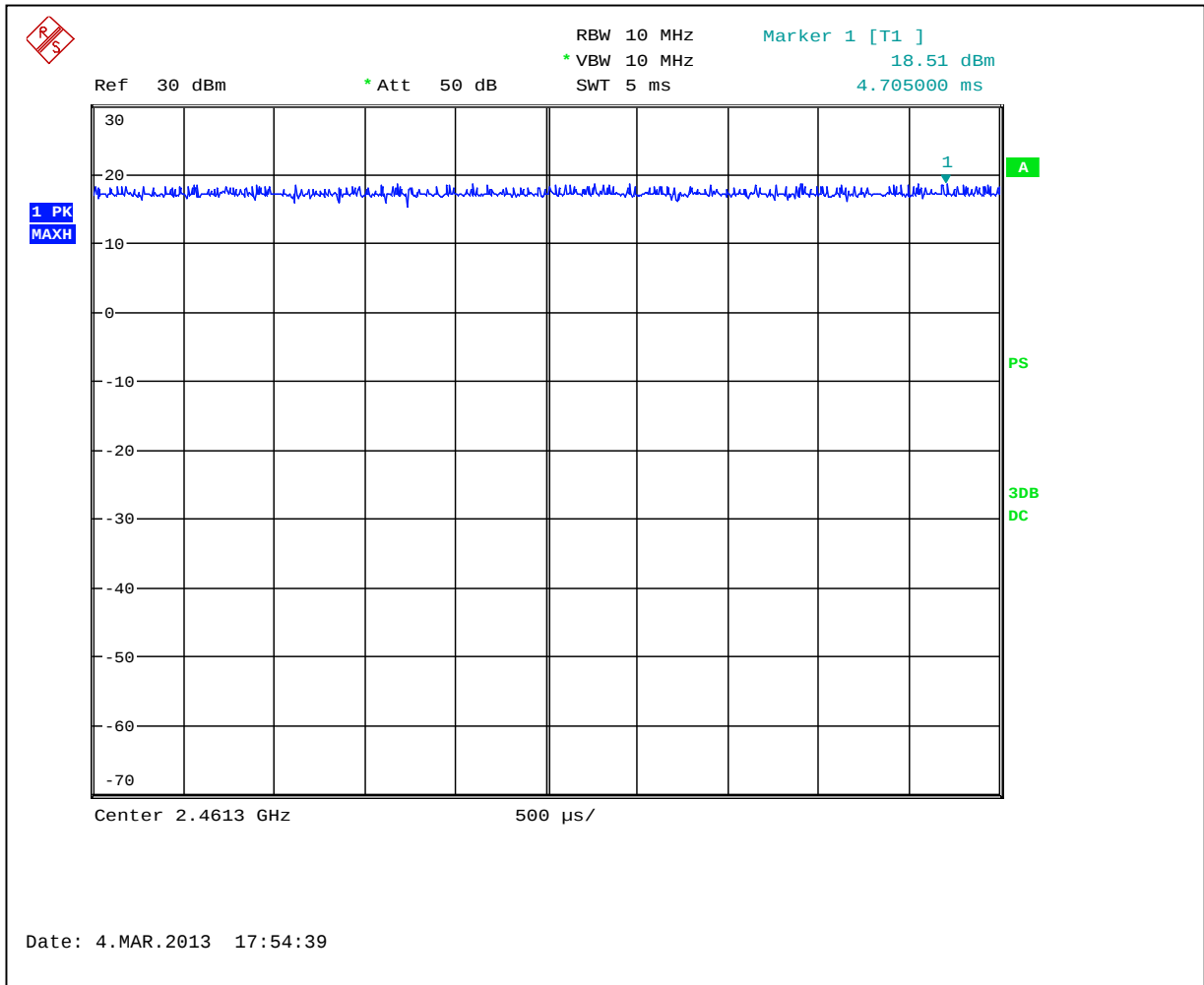
Graph 3.2.6



Graph 3.2.7



Graph 3.2.8



Graph 3.2.9



3.3 Power spectral density

802.11b

Power Output:	☒ Conducted ☐ Radiated				
	Measured Density dBm	Power Density at Antenna dBm	Calculated Power Spectral Density (dBm) at RBW 3kHz	Limit dBm	Margin dB
Low Frequency Channel	4.4	5.7	-9.3	8	-17.3
Middle Frequency Channel	5.0	6.3	-8.7	8	-16.7
Upper Frequency Channel	5.2	6.5	-8.5	8	-16.5
Analyzer Settings:	☒ RBW=100KHz ☒ VBW=300KHz ☒ Span=15MHz ☒ Sweep=Auto				
Antenna Gain:	☒ < 6dBi and = 2.5dBi ☐ >6dBi and = dBi, limit reduction = dB				

Notes: The Power Spectral Density at Antenna was calculated adding the cable loss and attenuator of 1.3dB from the measured density value.
The final value of the Power Spectral Density was calculated from the Power Density at Antenna by applying a bandwidth correction factor (BWCF)=-15.2dB

Graphs 3.3.1, 3.3.2, 3.3.3 for 802.11b

**802.11g**

Power Output:	☒ Conducted ☐ Radiated				
	Measured Density dBm	Power Density at Antenna dBm	Calculated Power Spectral Density (dBm) at RBW 3kHz	Limit dBm	Margin dB
Low Frequency Channel	0.3	1.6	-13.4	8	-21.4
Middle Frequency Channel	1.0	2.3	-12.9	8	-20.9
Upper Frequency Channel	1.3	2.6	-12.6	8	-20.6
Analyzer Settings:	☒ RBW=100KHz ☒ VBW=300KHz ☒ Span=20MHz ☒ Sweep=Auto				
Antenna Gain:	☒ < 6dBi and = 2.5dBi ☐ >6dBi and = dBi, limit reduction = dB				

Notes: The Power Spectral Density at Antenna was calculated adding the cable loss and attenuator of 1.3dB from the measured density value.
The final value of the Power Spectral Density was calculated from the Power Density at Antenna by applying a bandwidth correction factor (BWCF)=-15.2dB

Graphs 3.3.4, 3.3.5, 3.3.6 for 802.11g

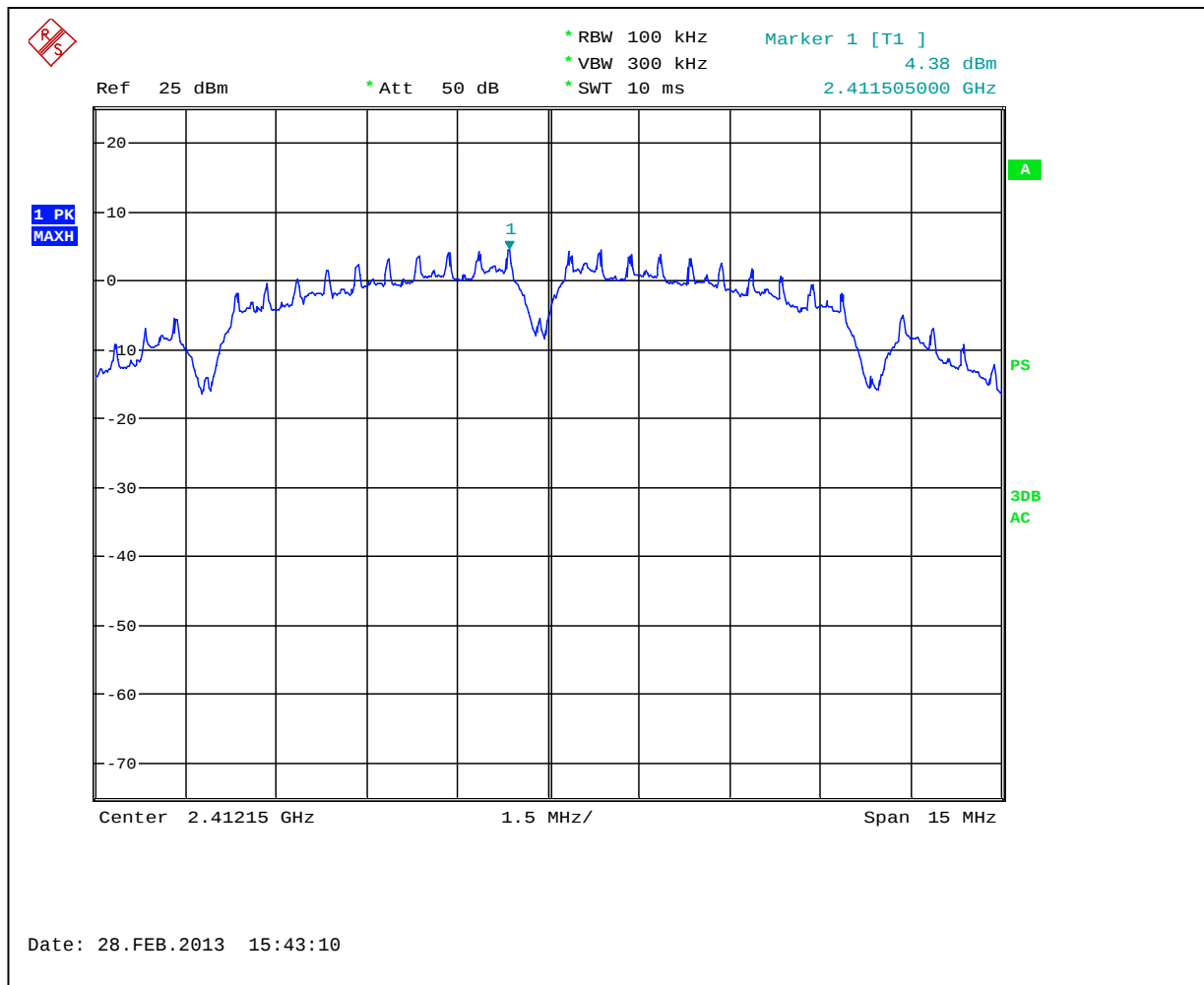


802.11n

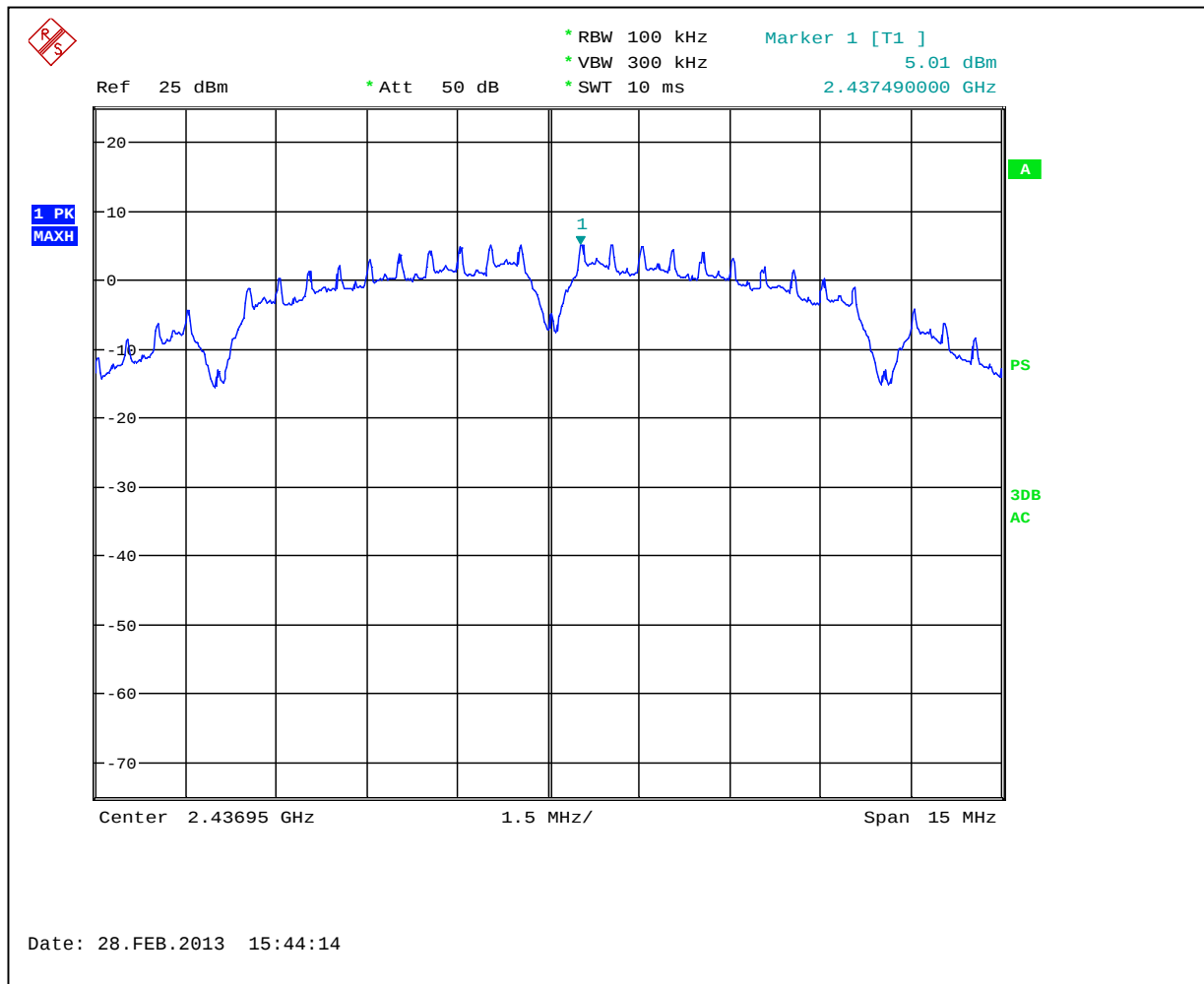
Power Output:	☒ Conducted ☐ Radiated				
	Measured Density dBm	Power Density at Antenna dBm	Calculated Power Spectral Density (dBm) at RBW 3kHz	Limit dBm	Margin dB
Low Frequency Channel	0.0	1.3	-13.9	8	-21.9
Middle Frequency Channel	1.0	2.3	-12.9	8	-20.9
Upper Frequency Channel	0.9	2.2	-13.0	8	-21.0
Analyzer Settings:	☒ RBW=100KHz ☒ VBW=300KHz ☒ Span=25MHz ☒ Sweep=Auto				
Antenna Gain:	☒ < 6dBi and = 2.5dBi ☐ >6dBi and = dBi, limit reduction = dB				

Notes: The Power Spectral Density at Antenna was calculated adding the cable loss and attenuator of 1.3dB from the measured density value.
 The final value of the Power Spectral Density was calculated from the Power Density at Antenna by applying a bandwidth correction factor (BWCF)=-15.2dB

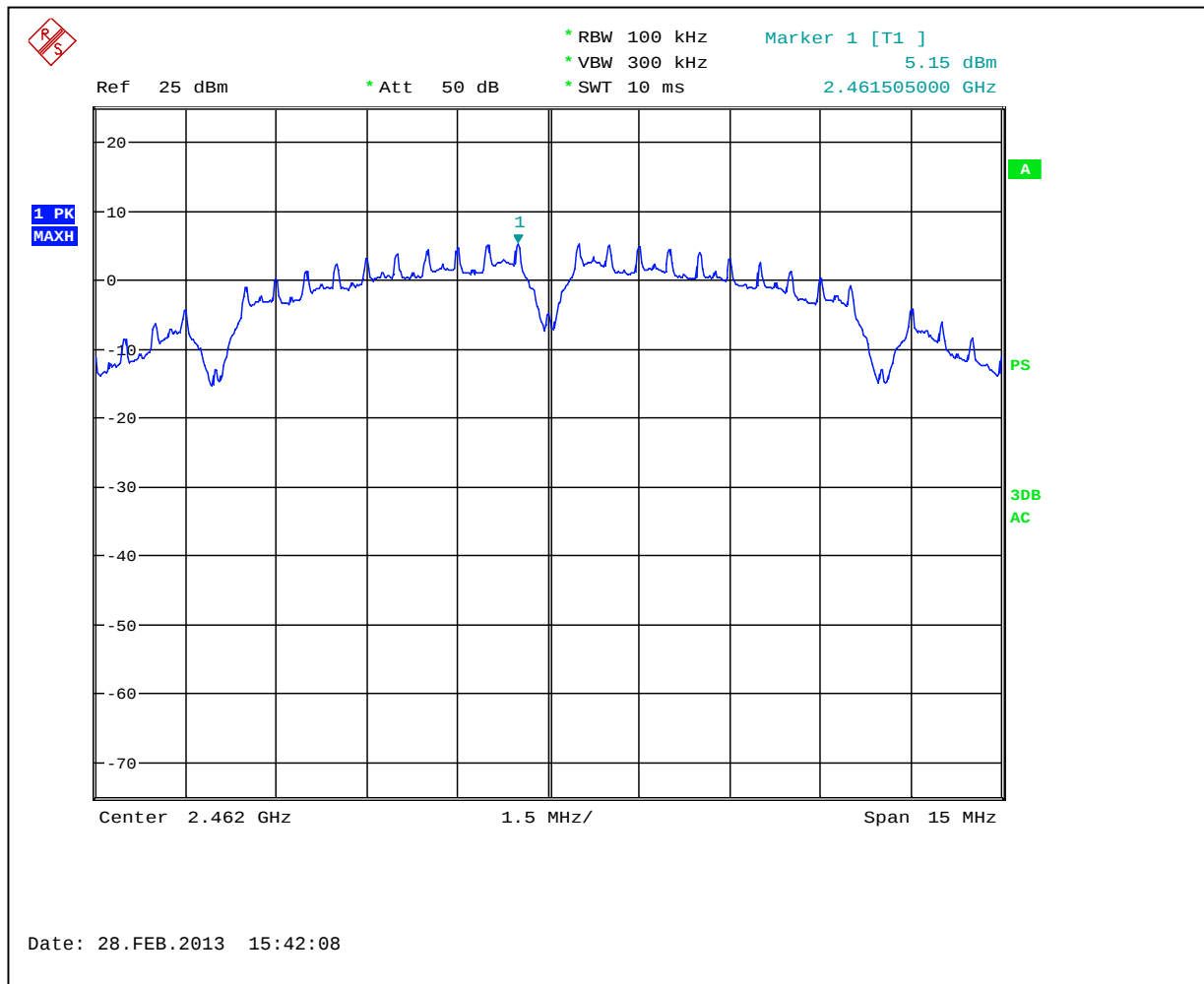
Graphs 3.3.7, 3.3.8, 3.3.9 for 802.11n



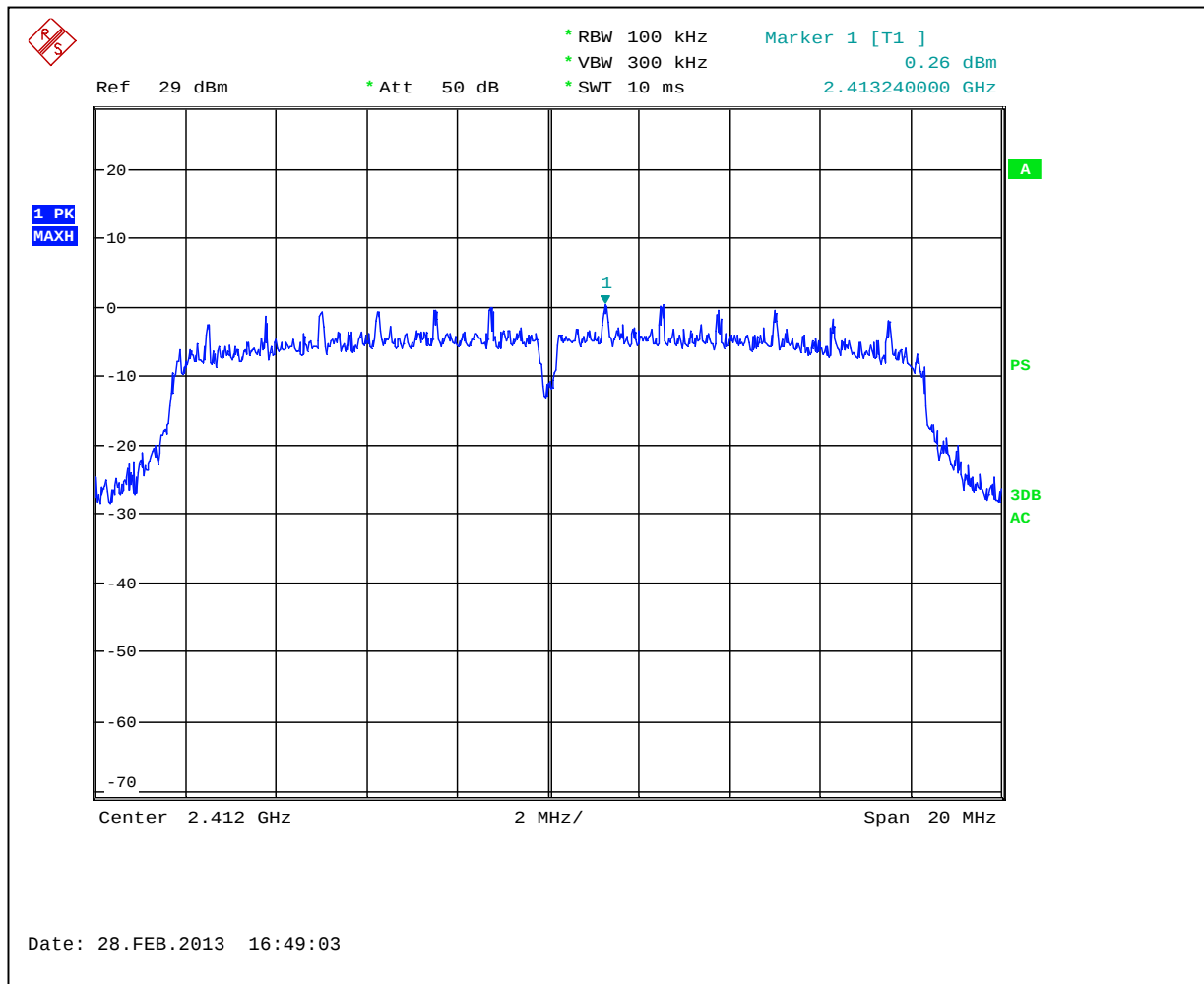
Graph 3.3.1



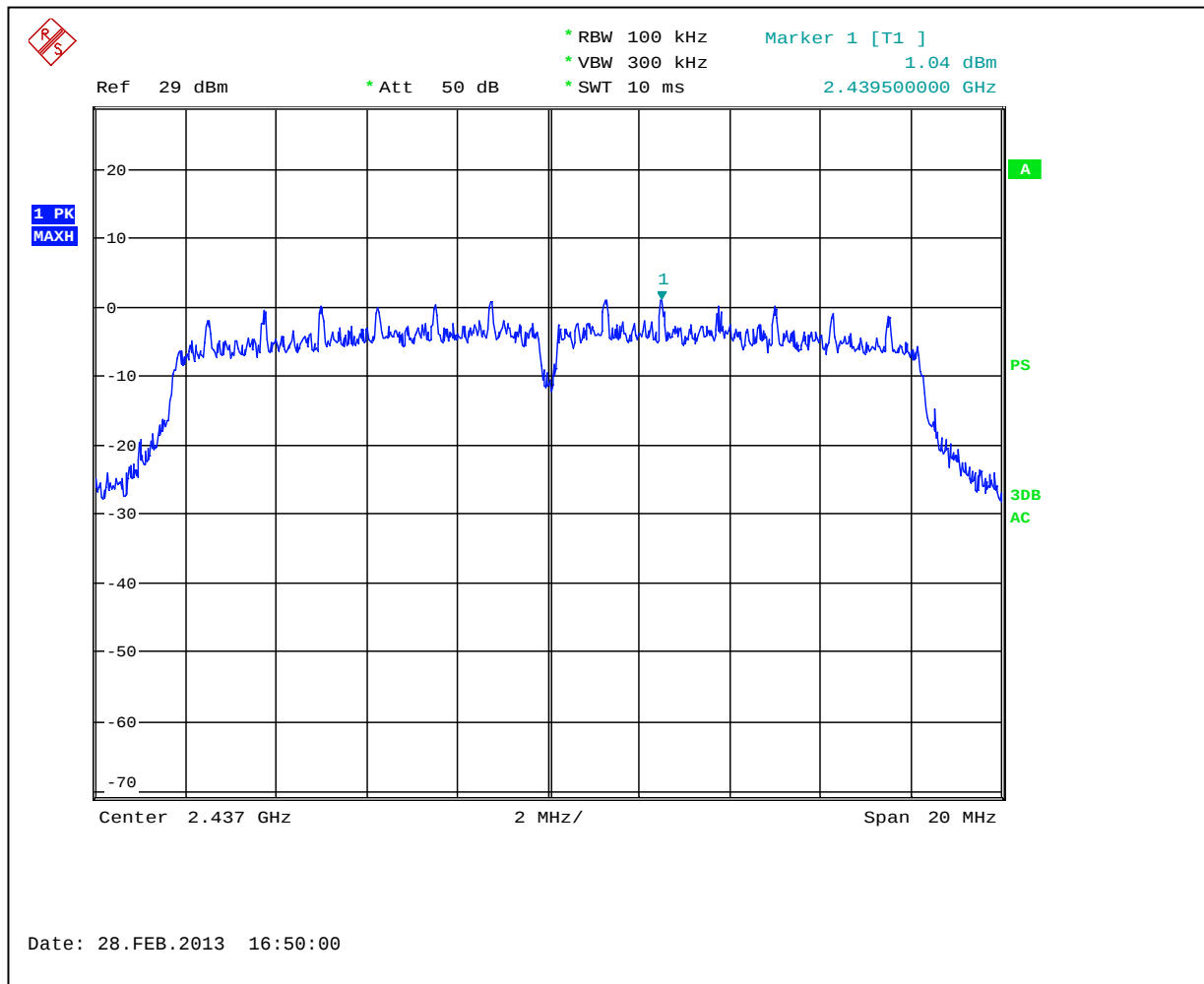
Graph 3.3.2



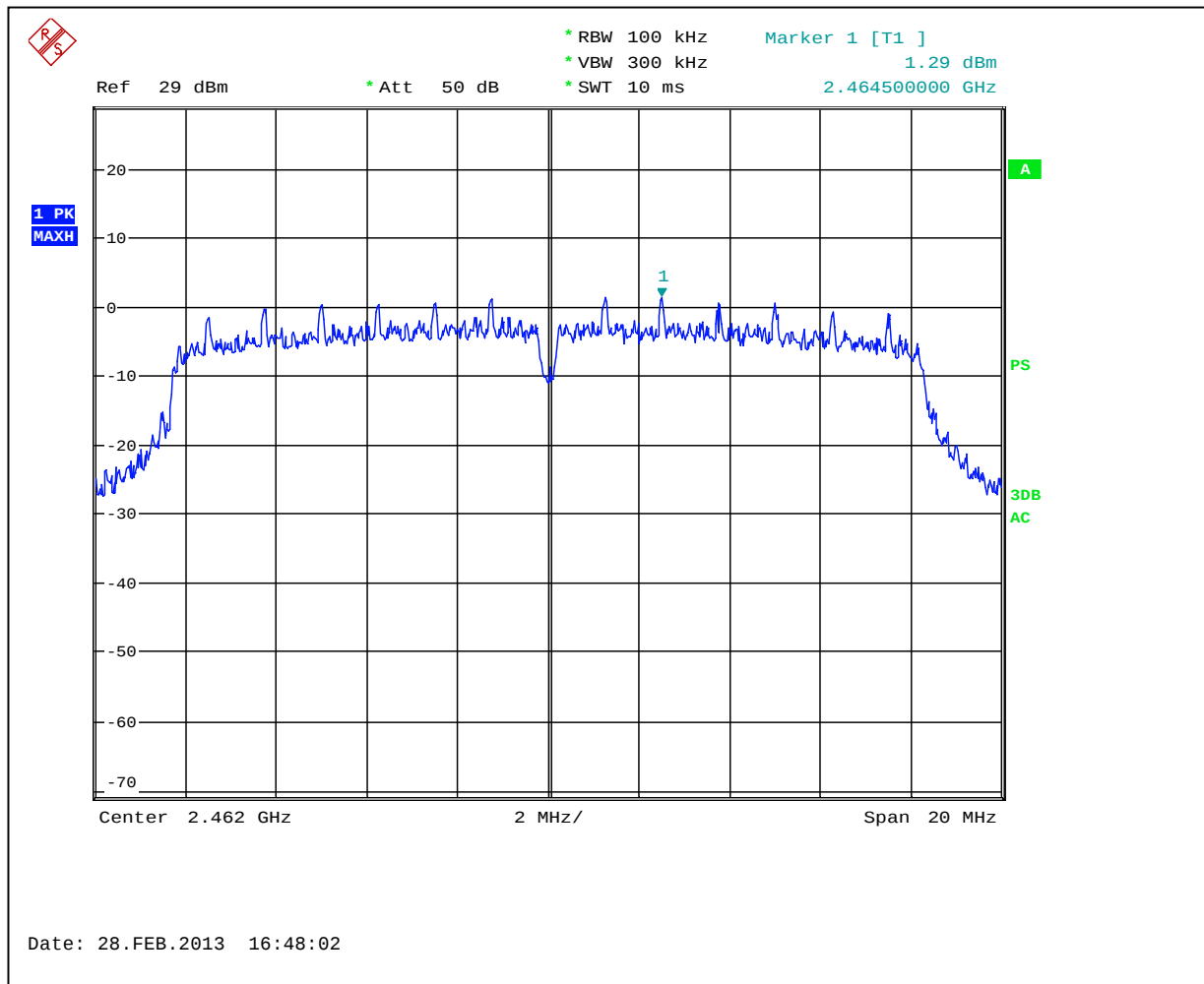
Graph 3.3.3



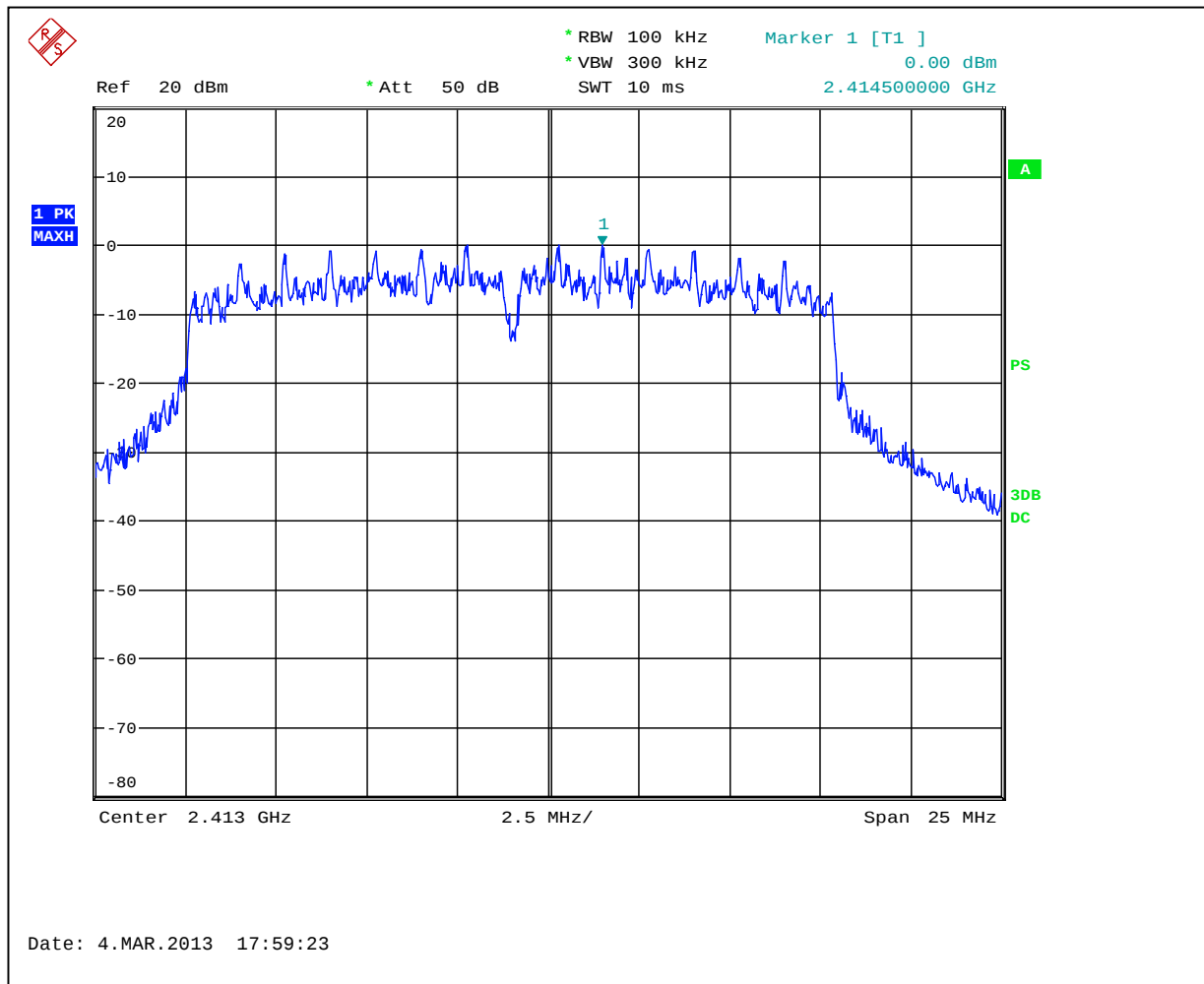
Graph 3.3.4



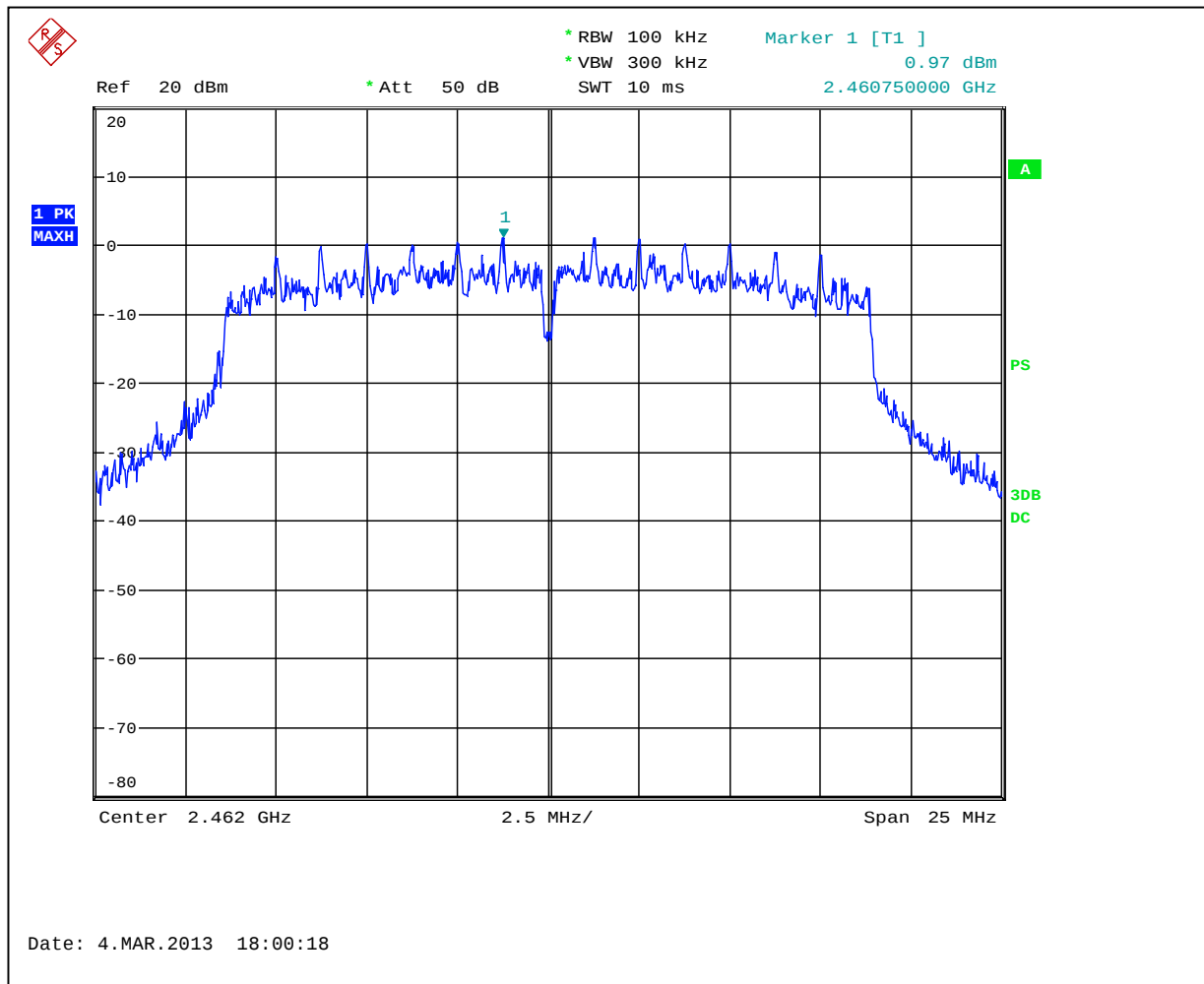
Graph 3.3.5



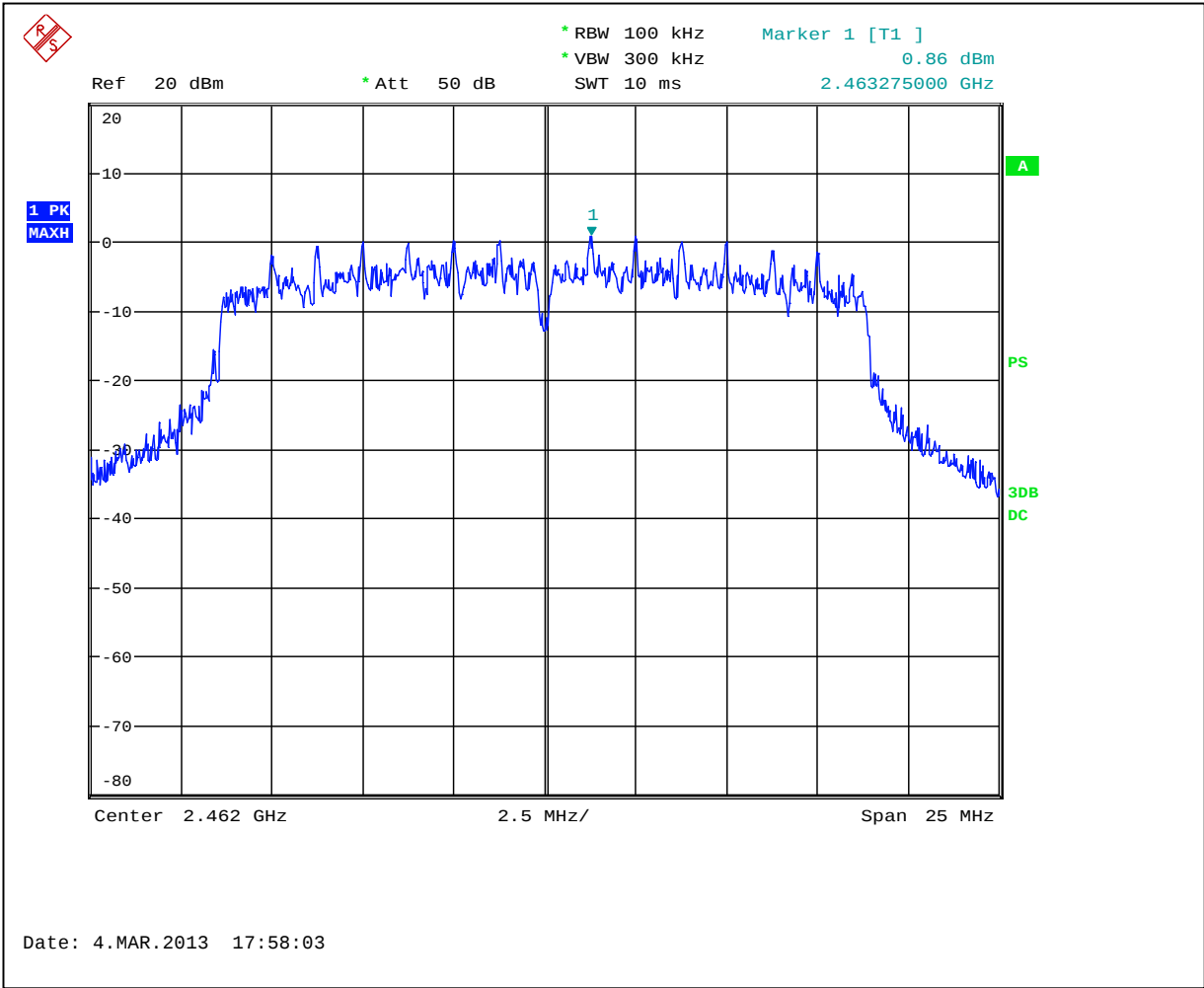
Graph 3.3.6



Graph 3.3.7



Graph 3.3.8



Graph 3.3.9



3.4 Antenna conducted spurious emissions

802.11b

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	48.0	20	-28.0
Middle Frequency Channel	47.4	20	-27.4
Upper Frequency Channel	47.1	20	-27.1
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

802.11g

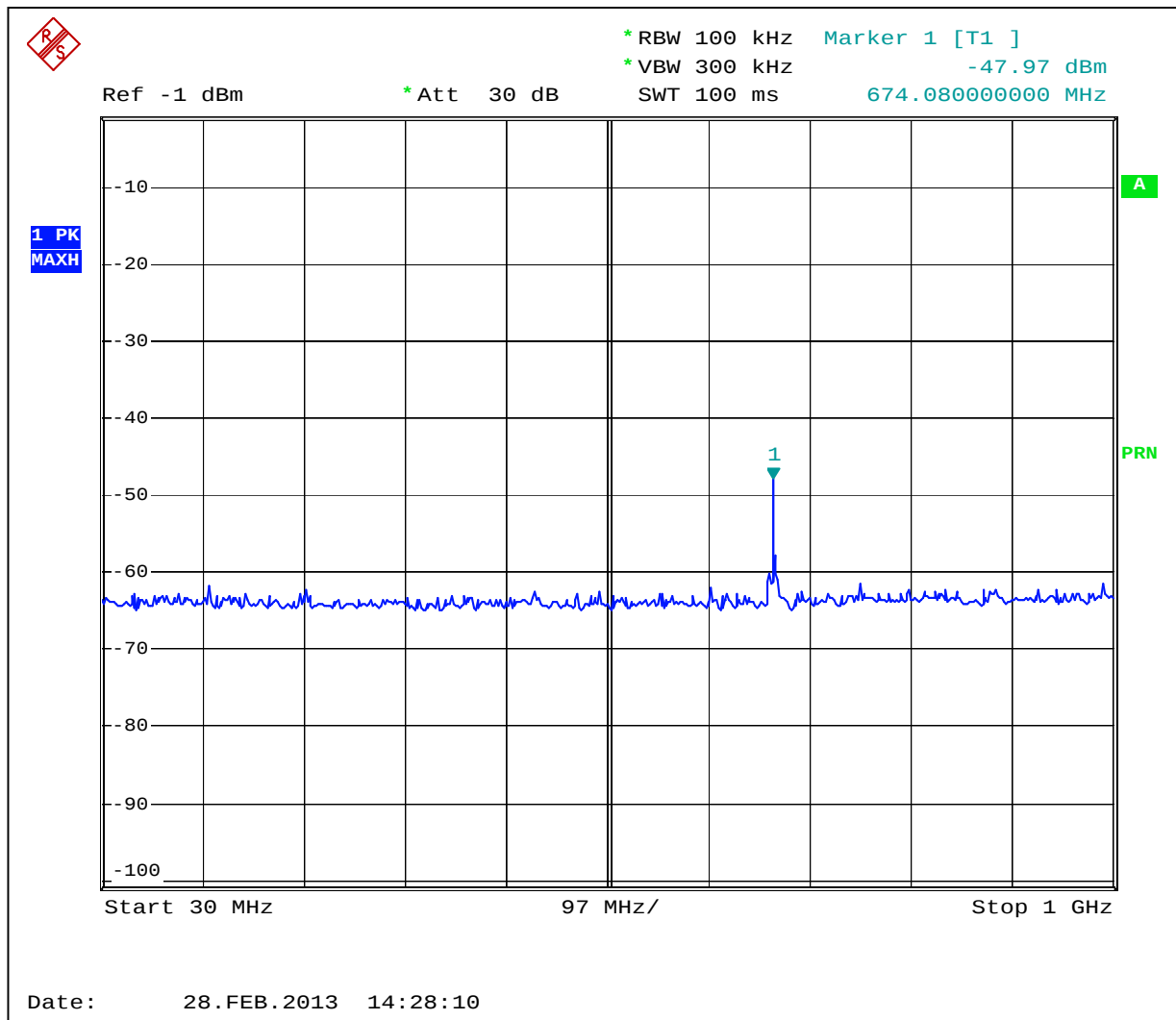
	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	53.0	20	-33.0
Middle Frequency Channel	53.8	20	-33.8
Upper Frequency Channel	54.7	20	-34.7
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

802.11n

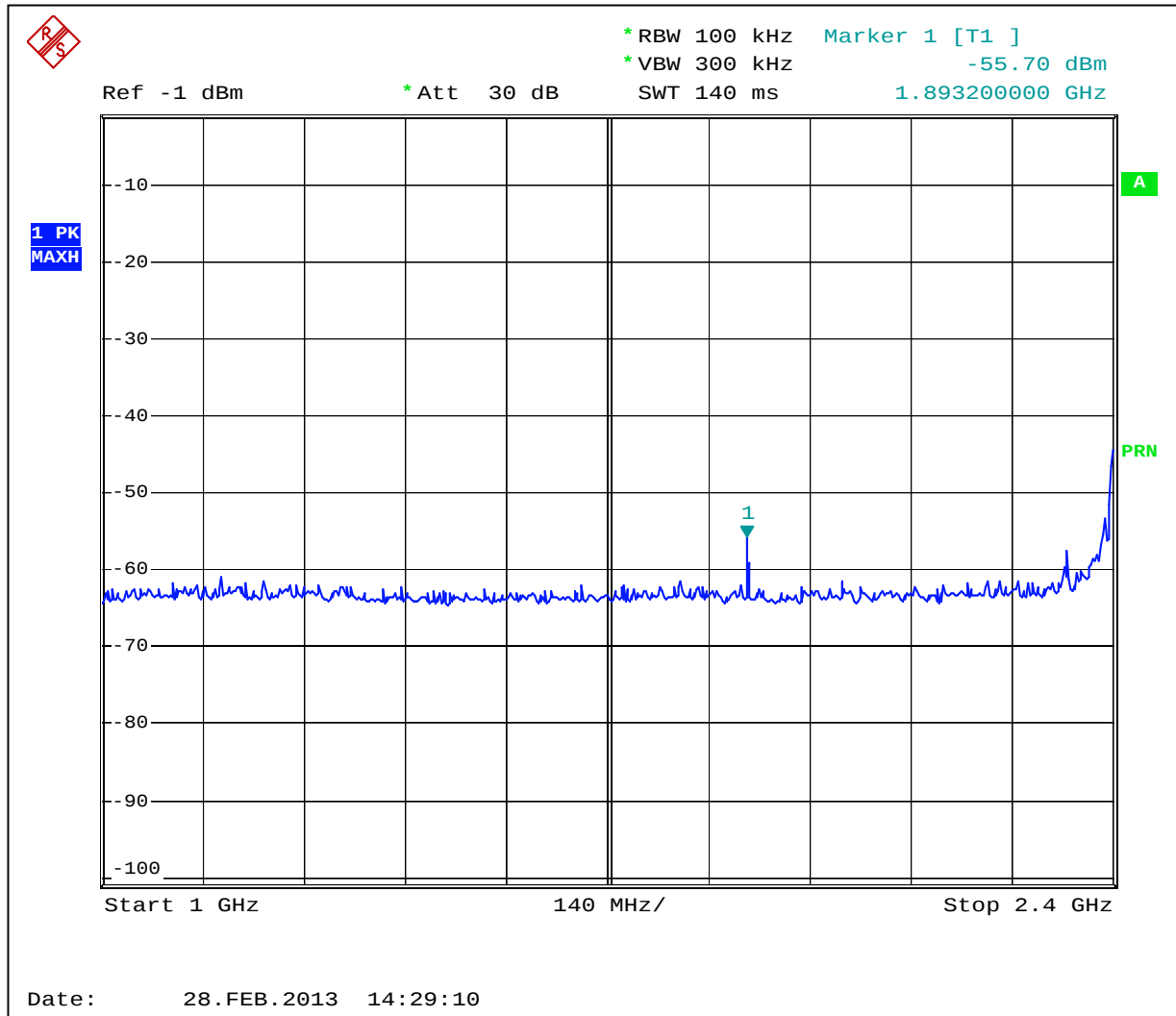
	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	53.9	20	-33.9
Middle Frequency Channel	53.1	20	-33.1
Upper Frequency Channel	52.7	20	-32.7
Analyzer Settings:	☒ RBW=100KHz		
Minimum Allowed Attenuation:	☒ 20dB ☐ 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

Notes:

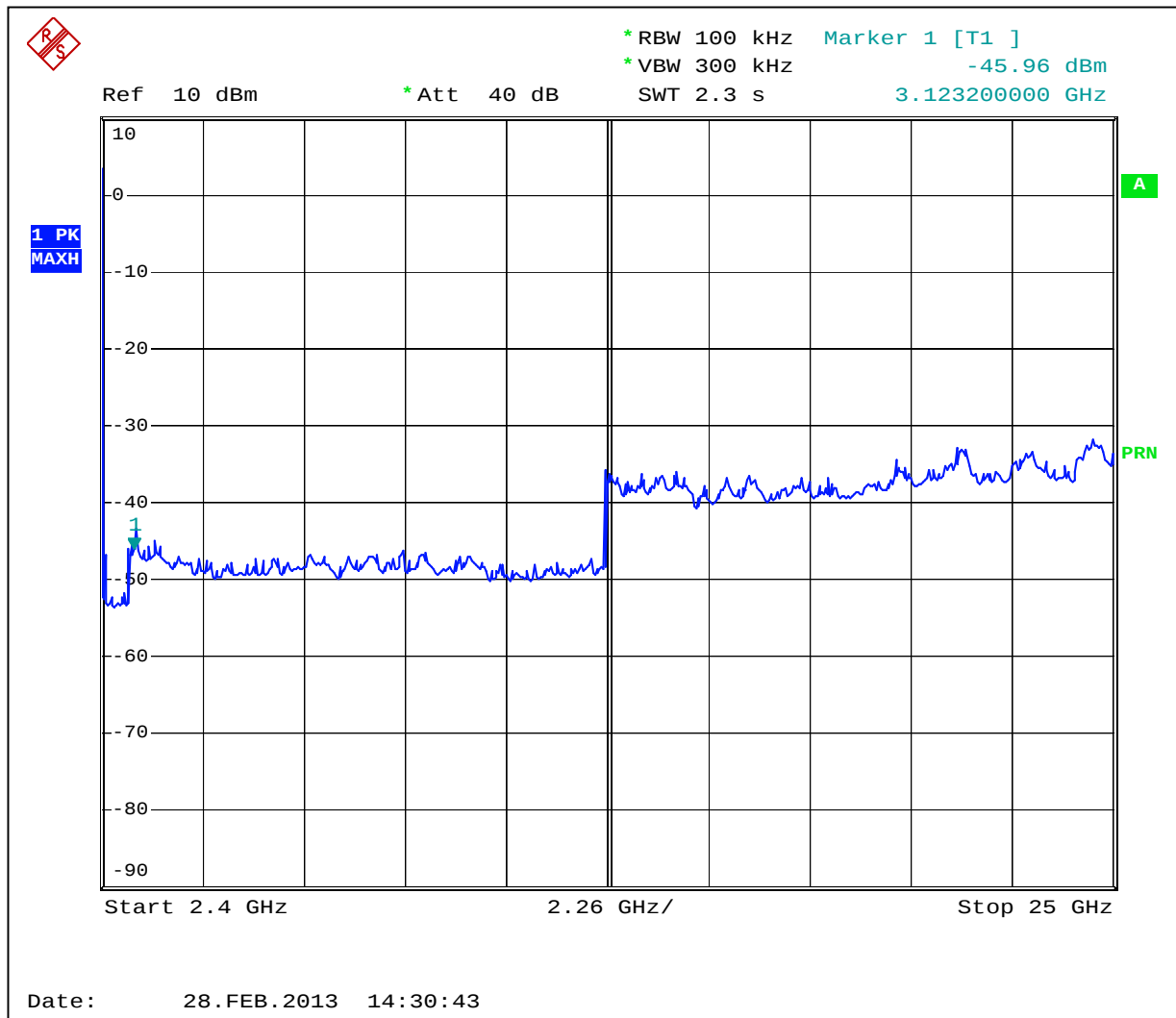
Graphs 3.4.1- 3.4.9 for 802.11b show antenna conducted spurious emissions
 Graphs 3.4.10- 3.4.18 for 802.11g show antenna conducted spurious emissions
 Graphs 3.4.19-3.4.27 for 802.11n show antenna conducted spurious emissions
 Graph 3.4.28, and 3.4.29 show band edge compliance for 802.11b
 Graph 3.4.30, and 3.4.31 show band edge compliance for 802.11g
 Graph 3.4.32, and 3.4.33 show band edge compliance for 802.11n



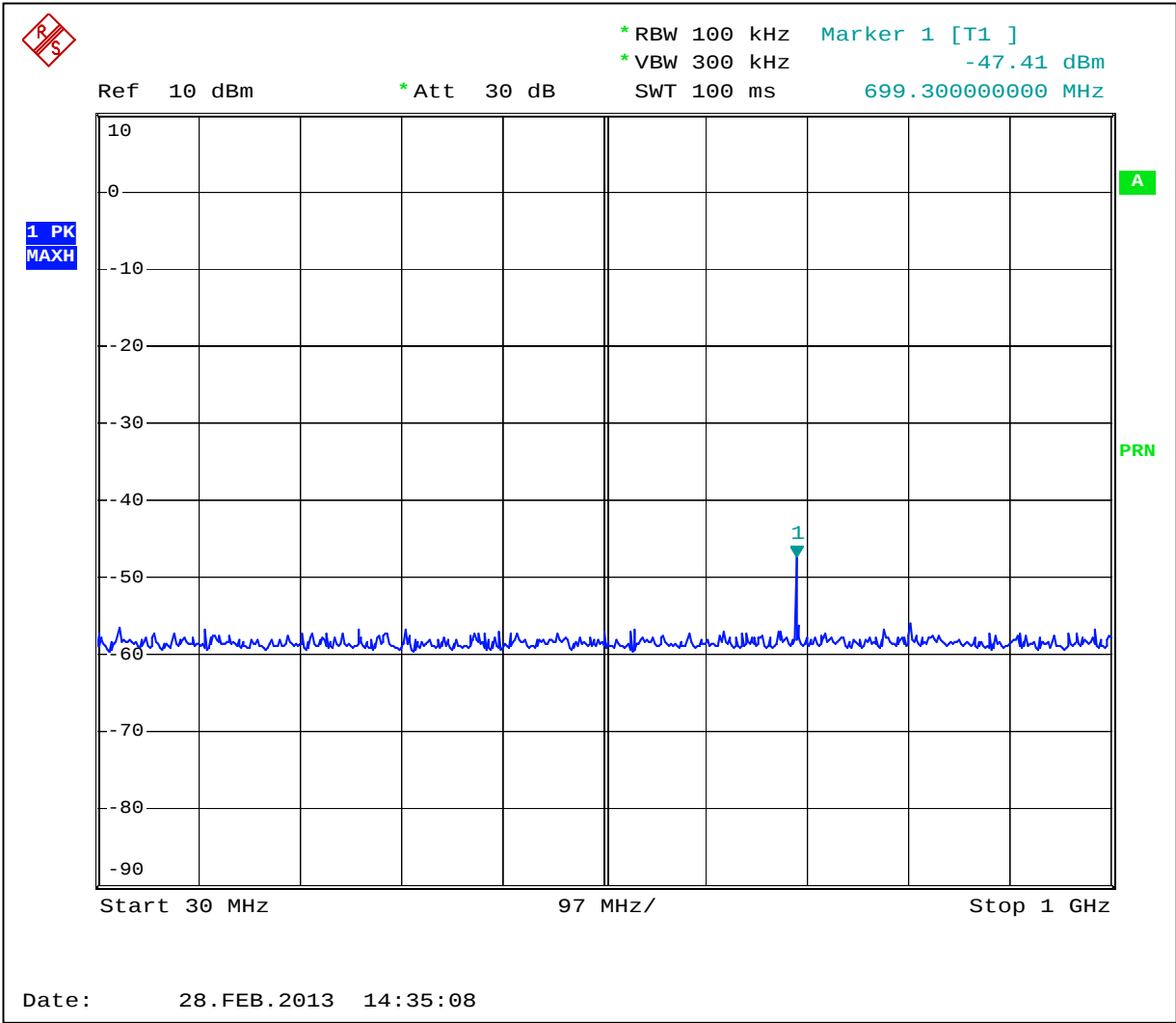
Graph 3.4.1



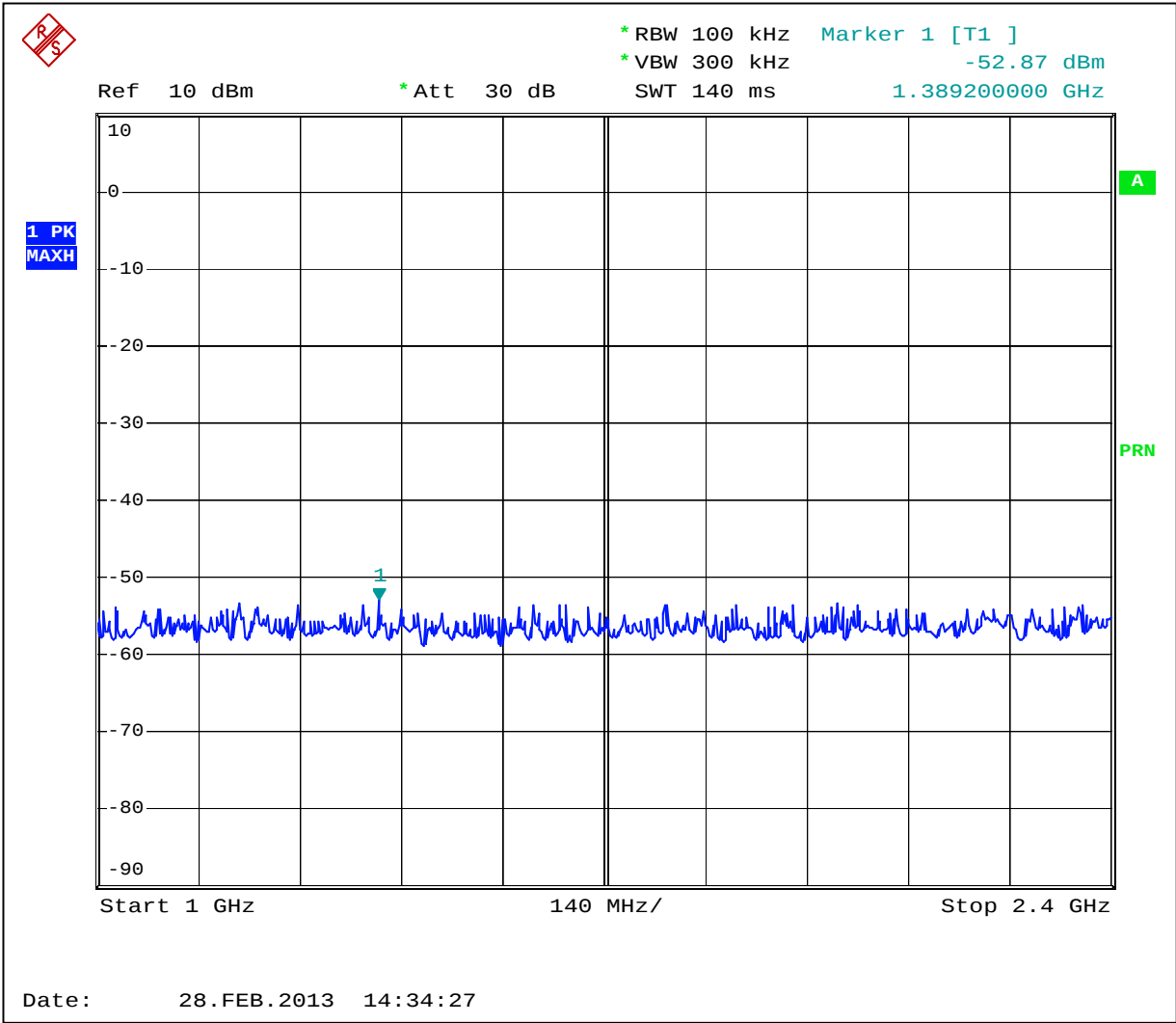
Graph 3.4.2



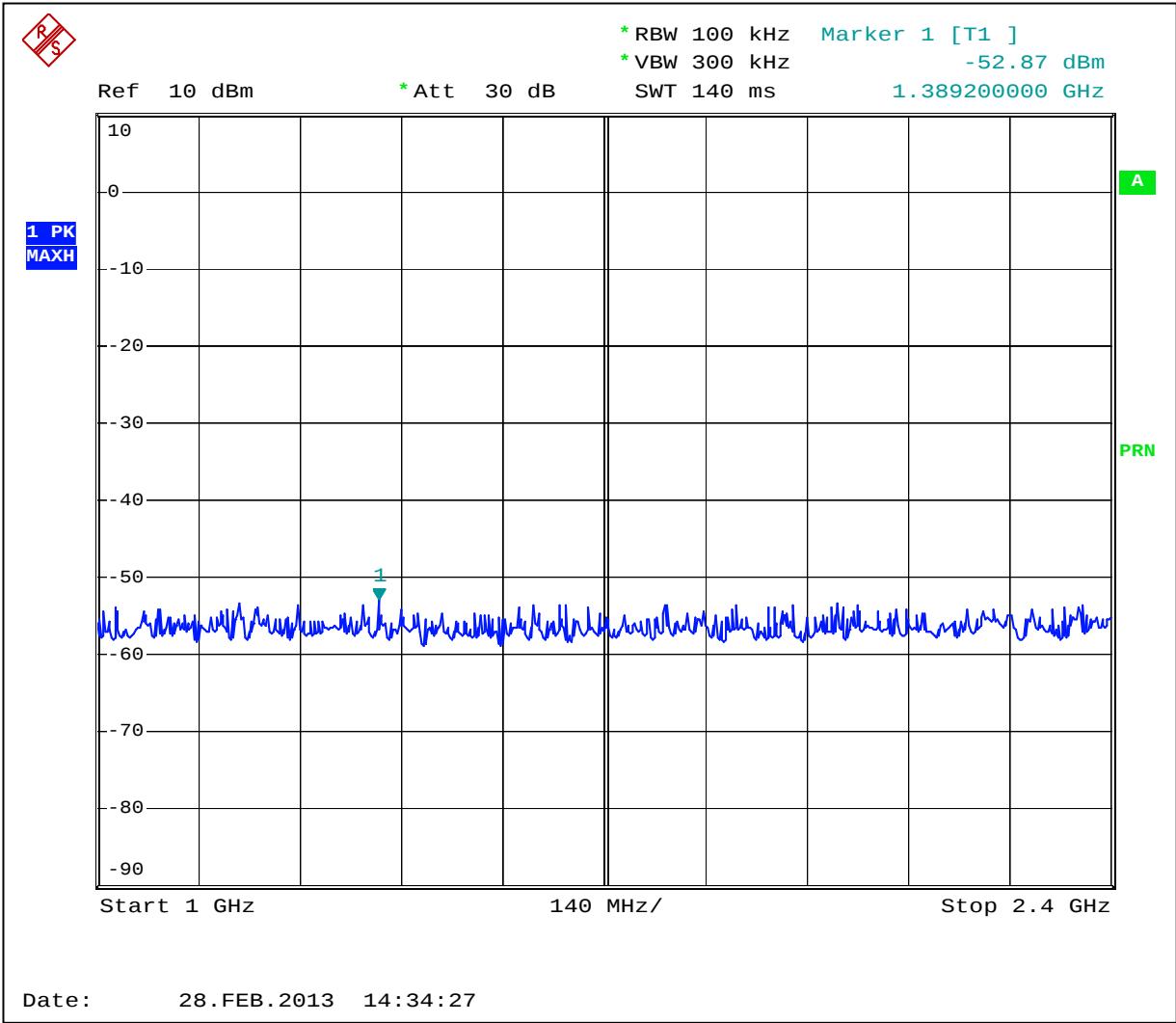
Graph 3.4.3



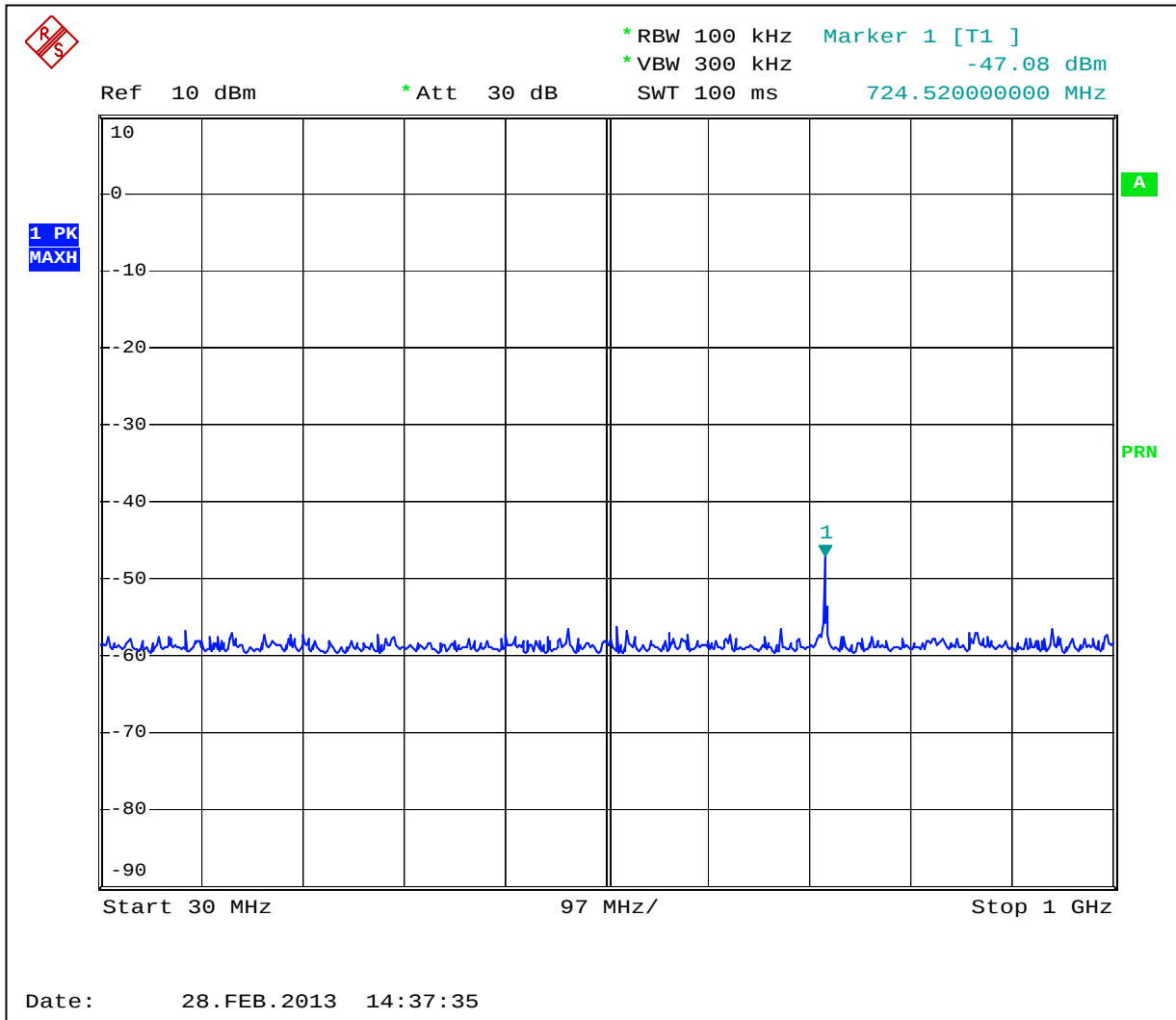
Graph 3.4.4



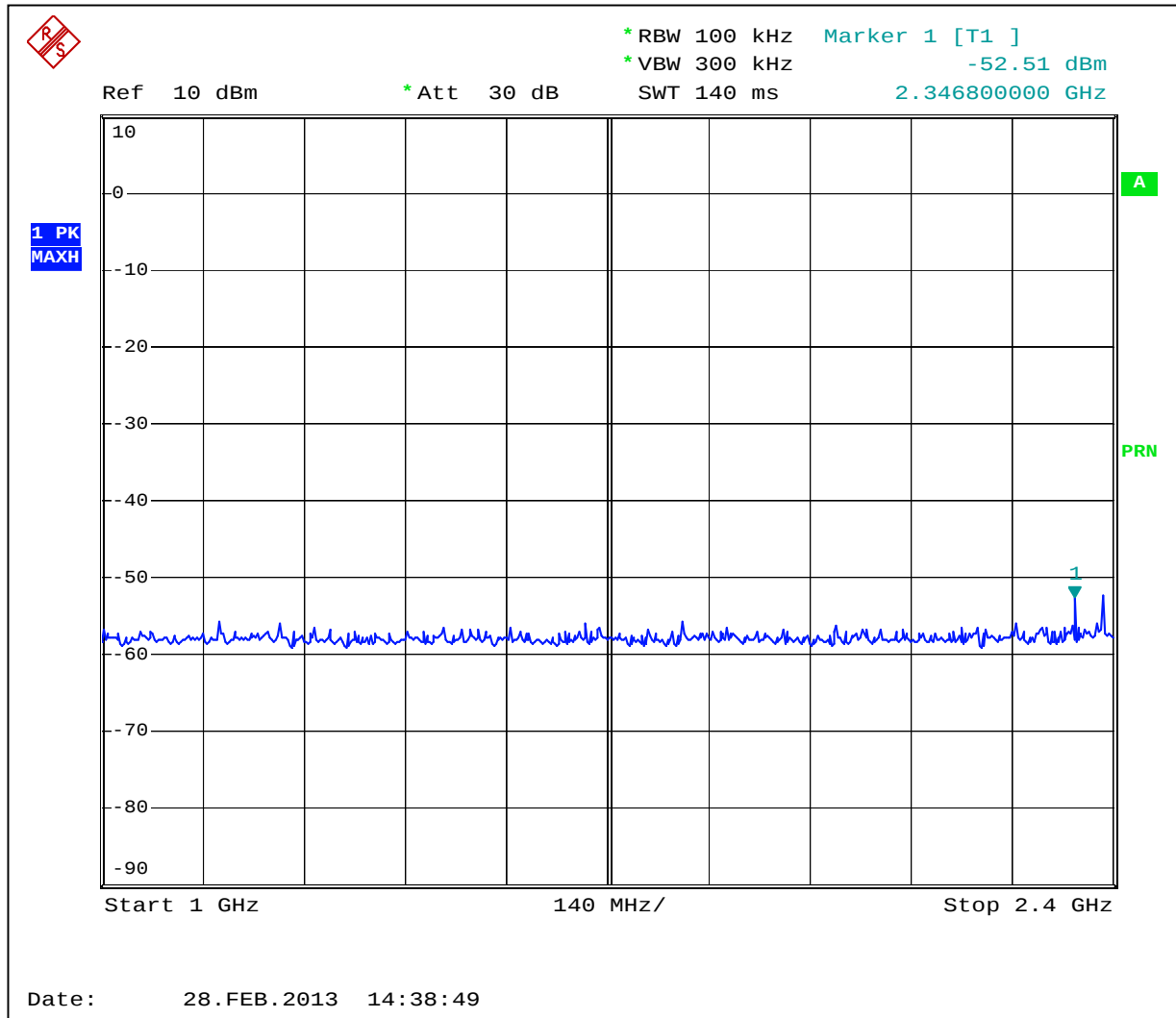
Graph 3.4.5



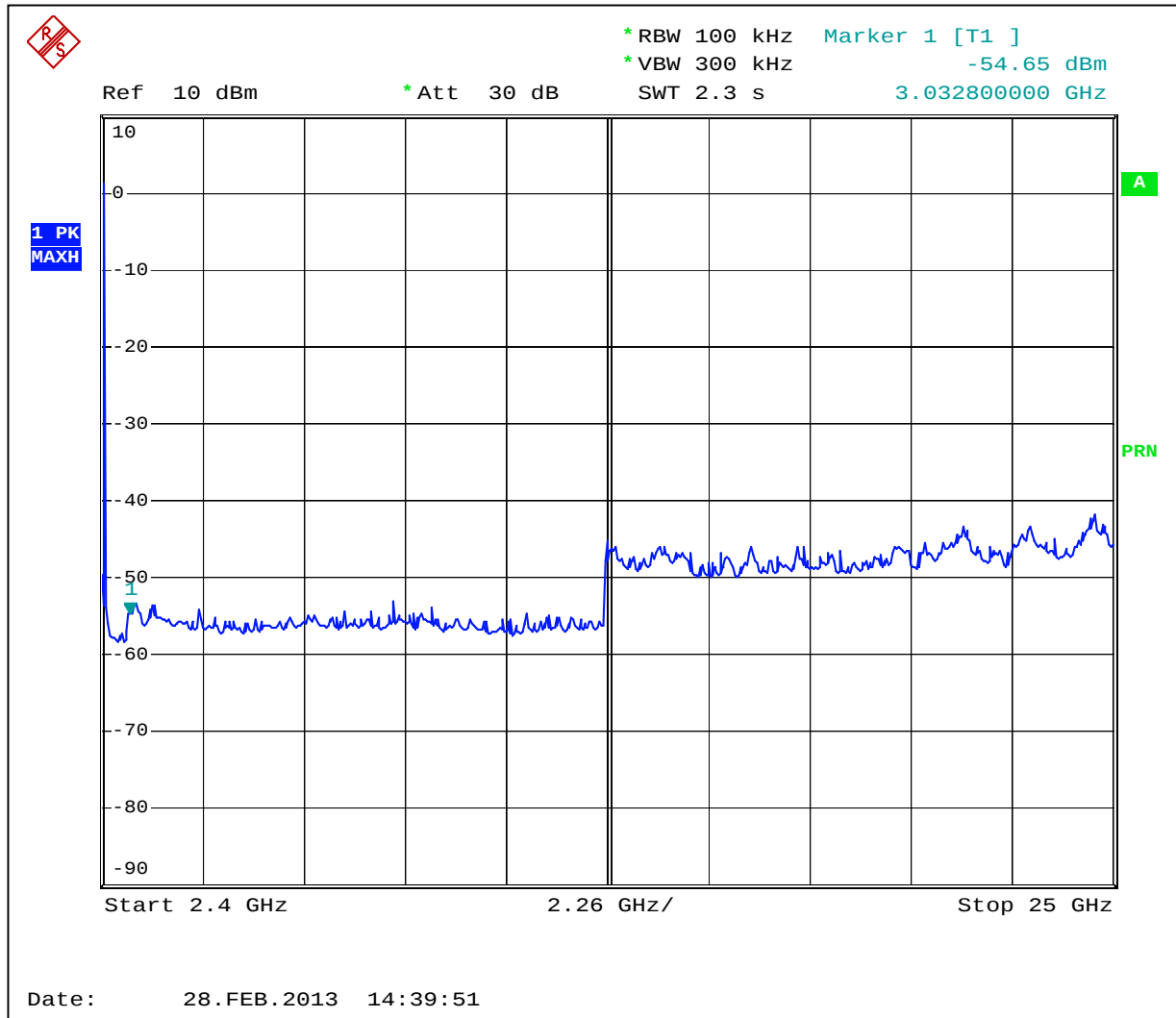
Graph 3.4.6



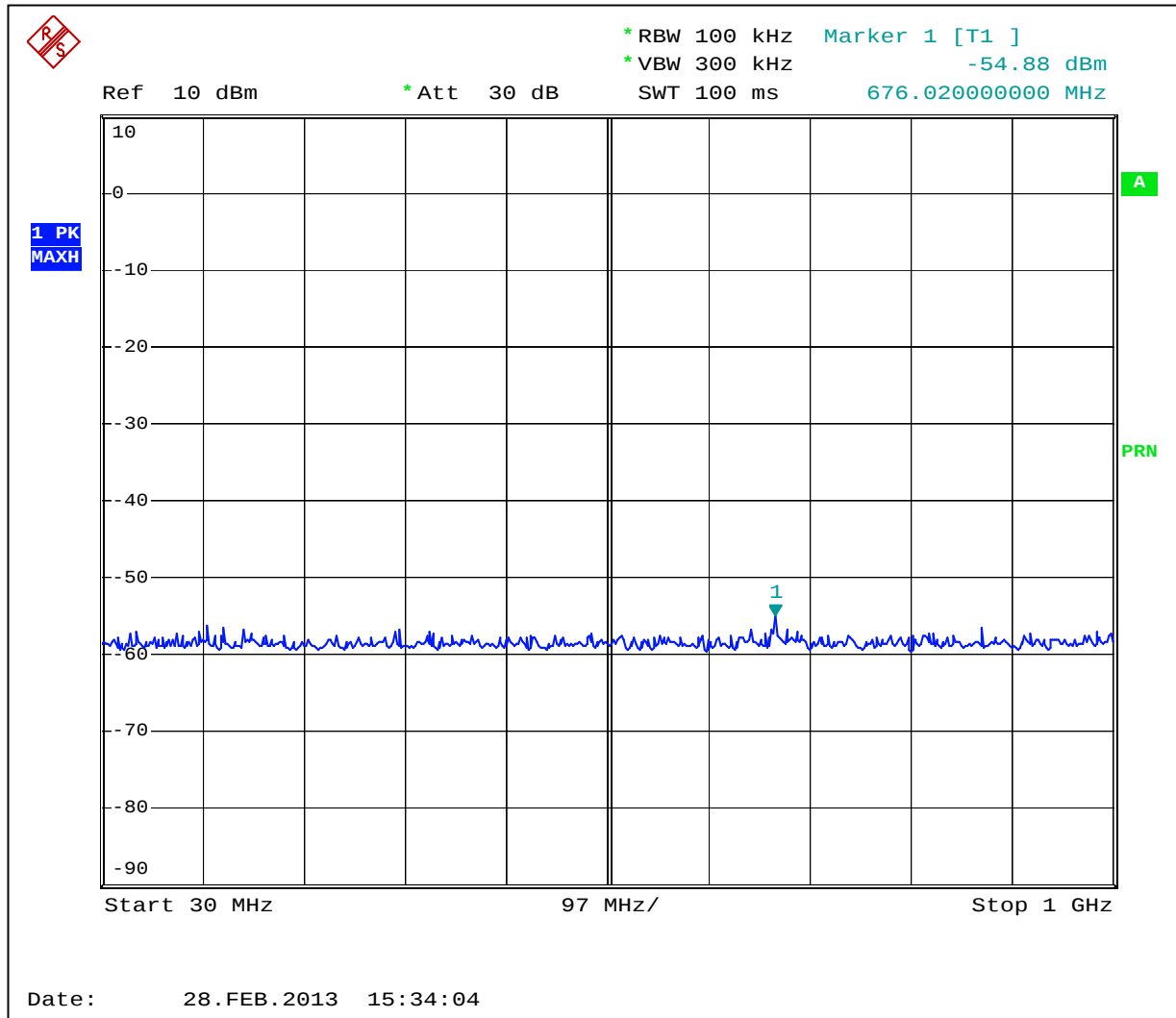
Graph 3.4.7



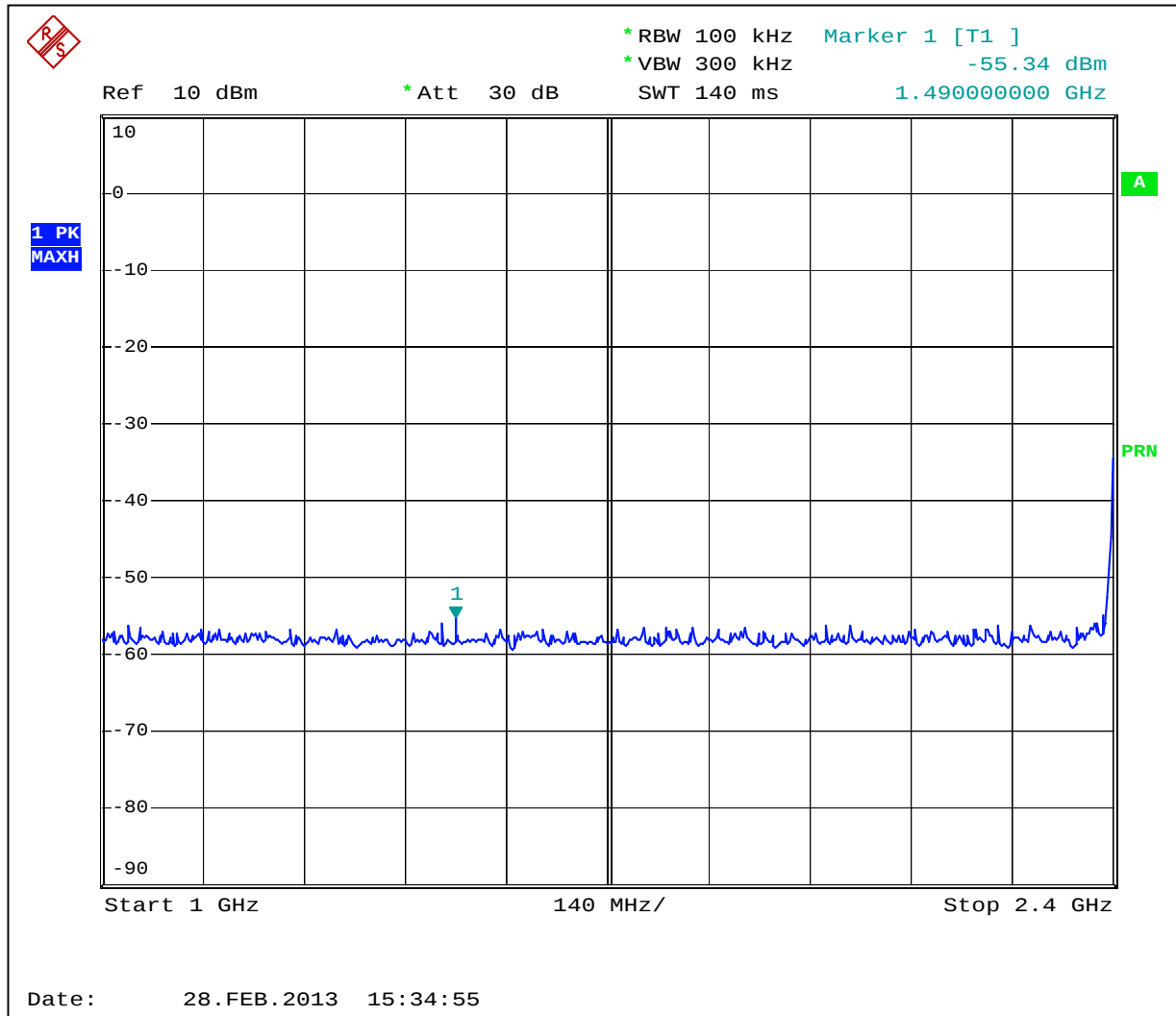
Graph 3.4.8



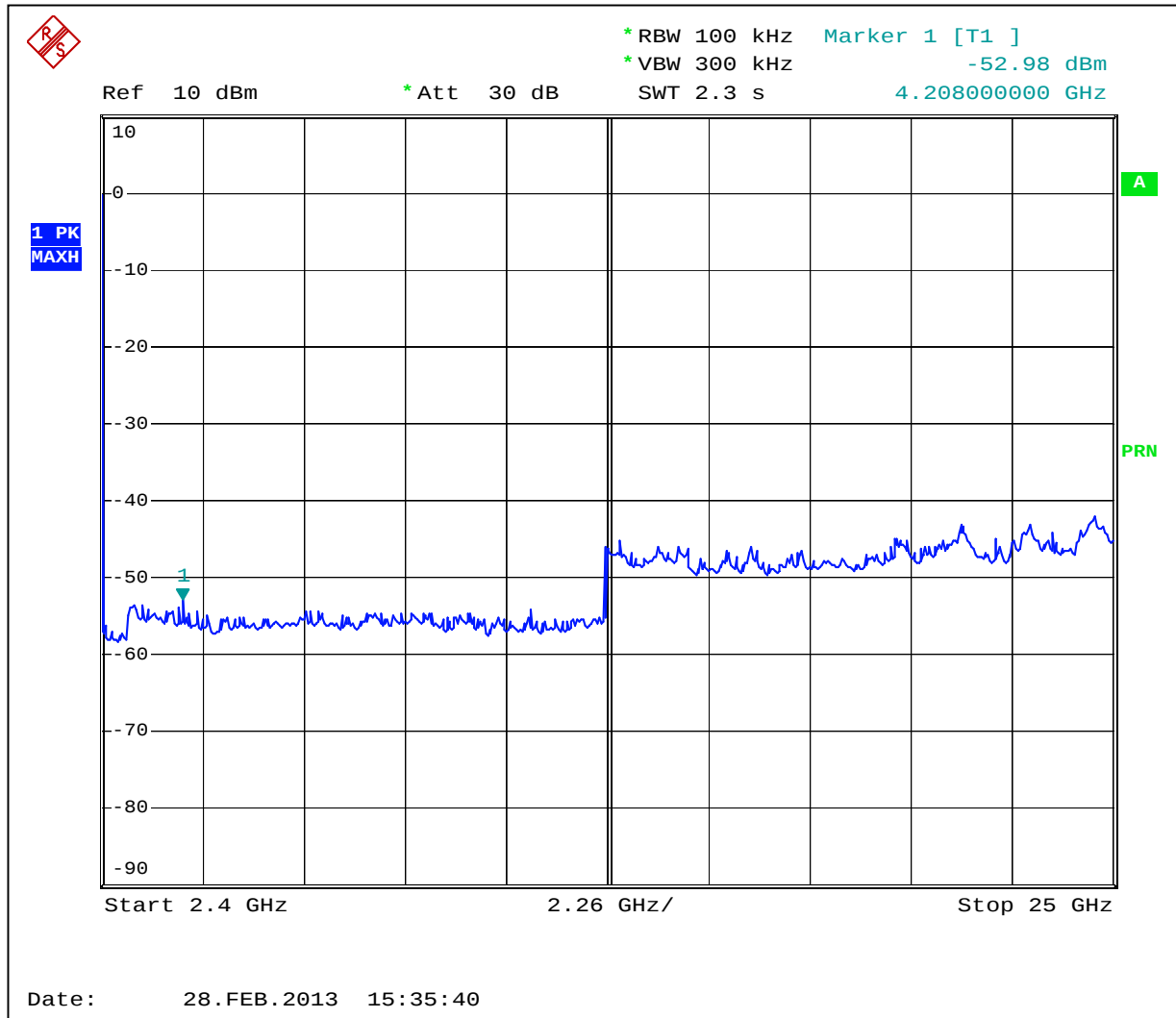
Graph 3.4.9



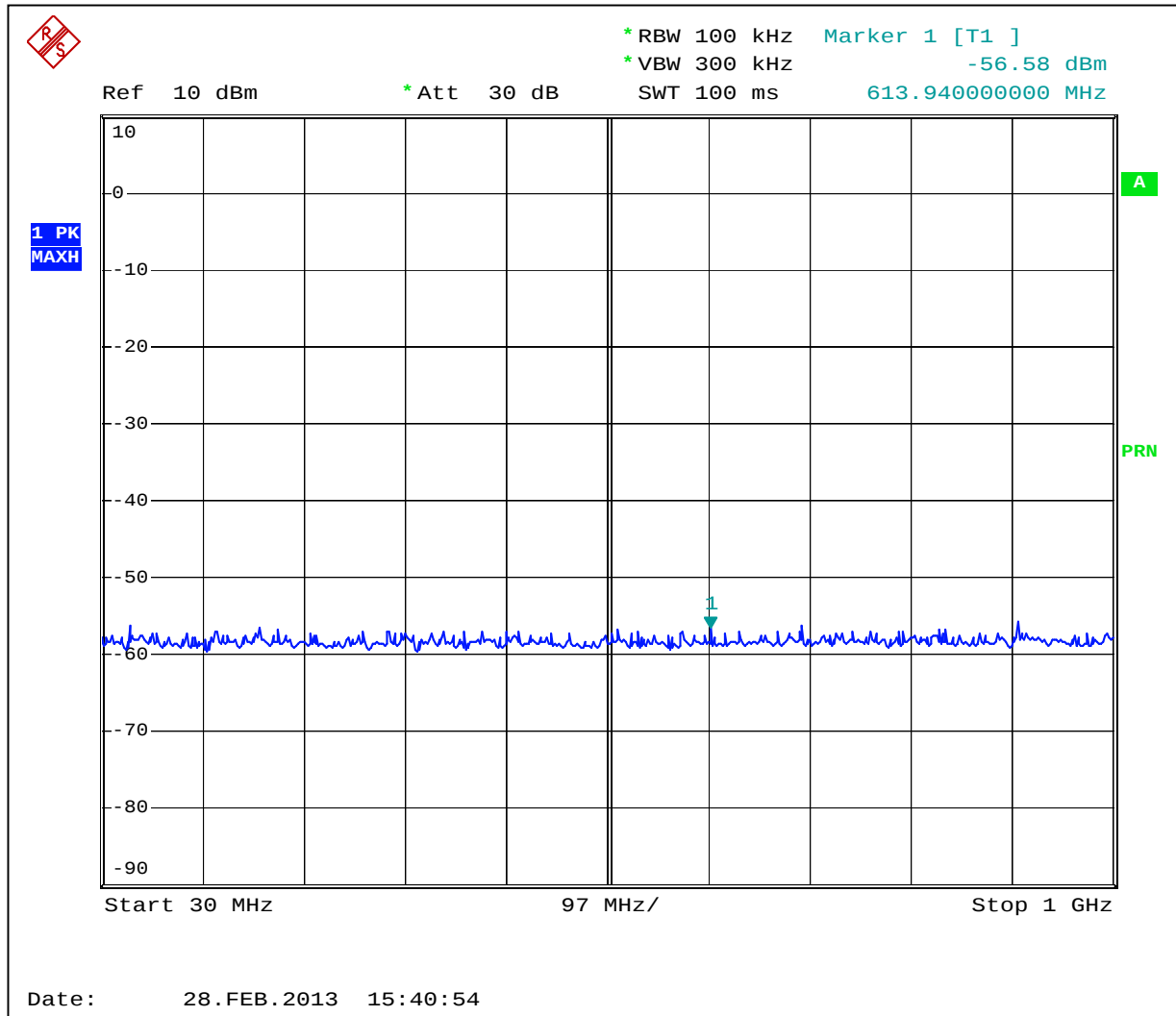
Graph 3.4.10



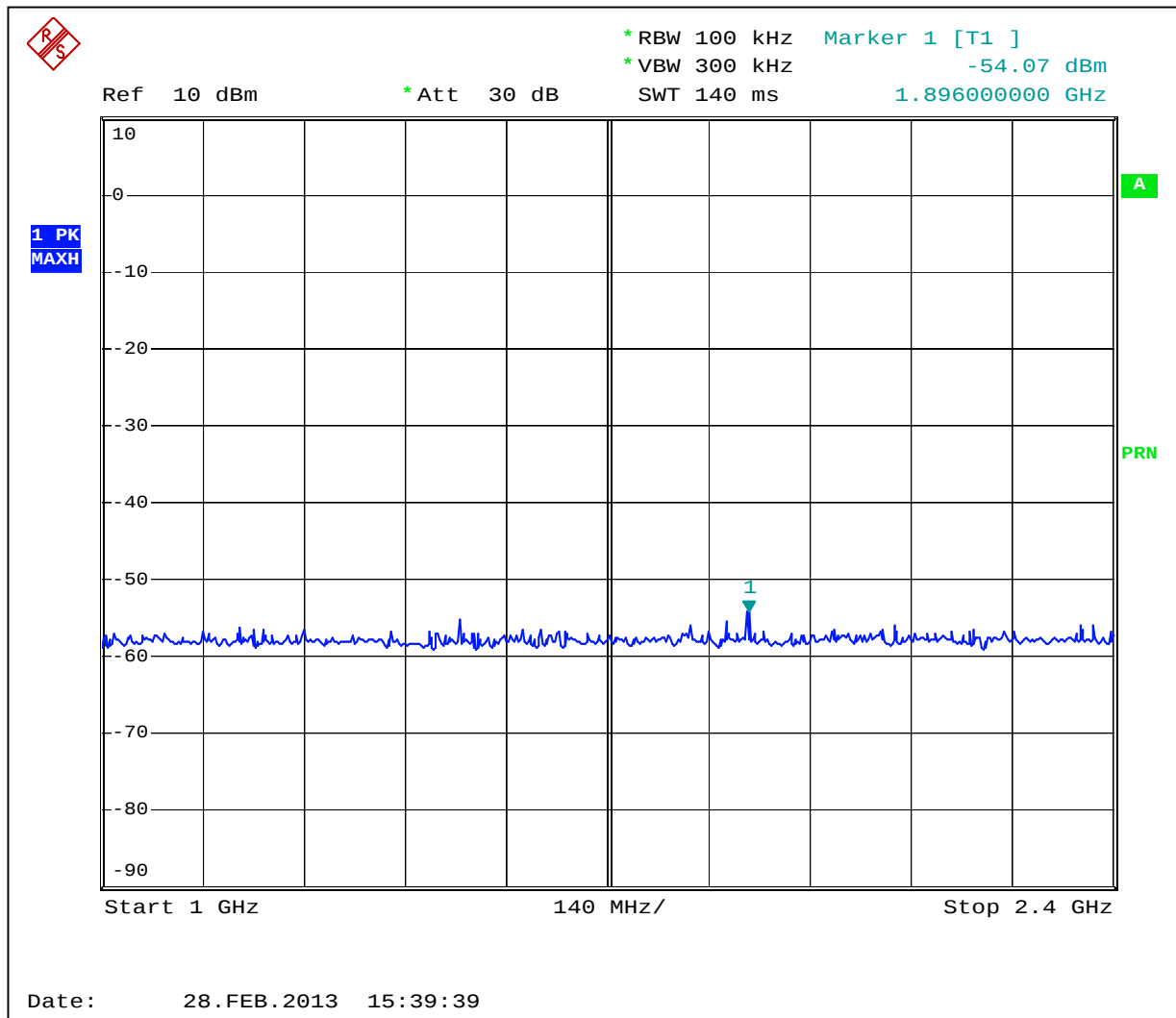
Graph 3.4.11



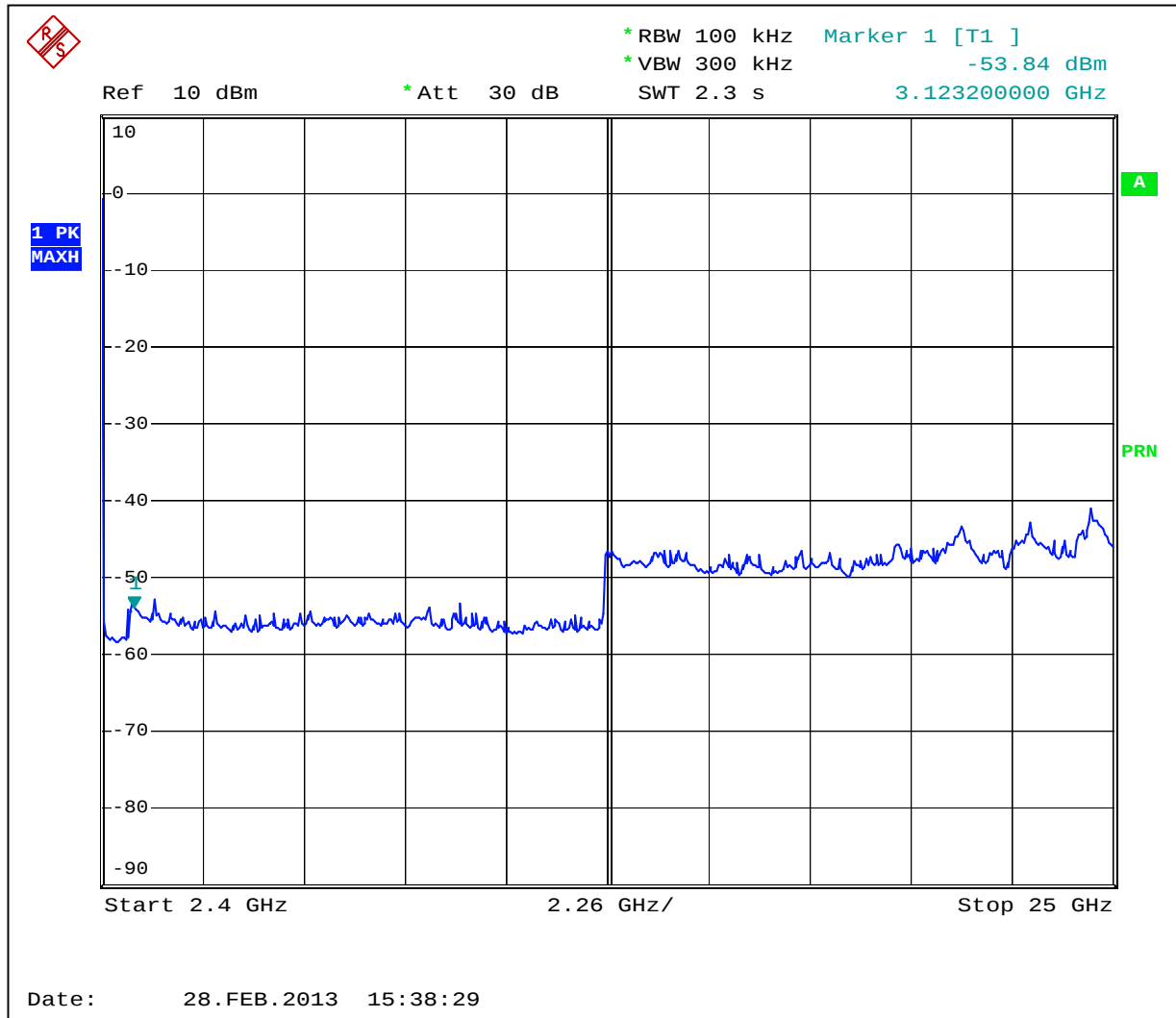
Graph 3.4.12



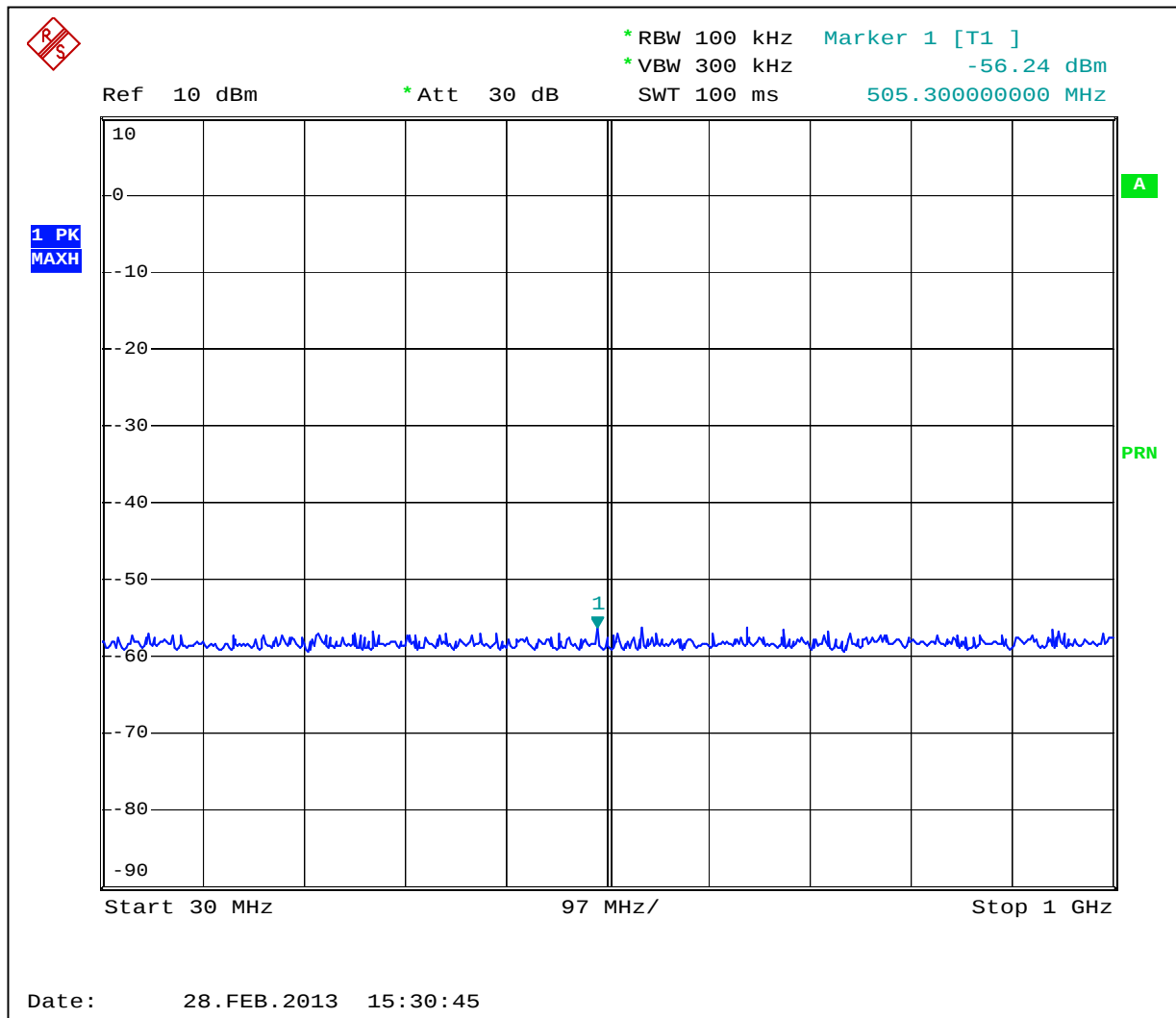
Graph 3.4.13



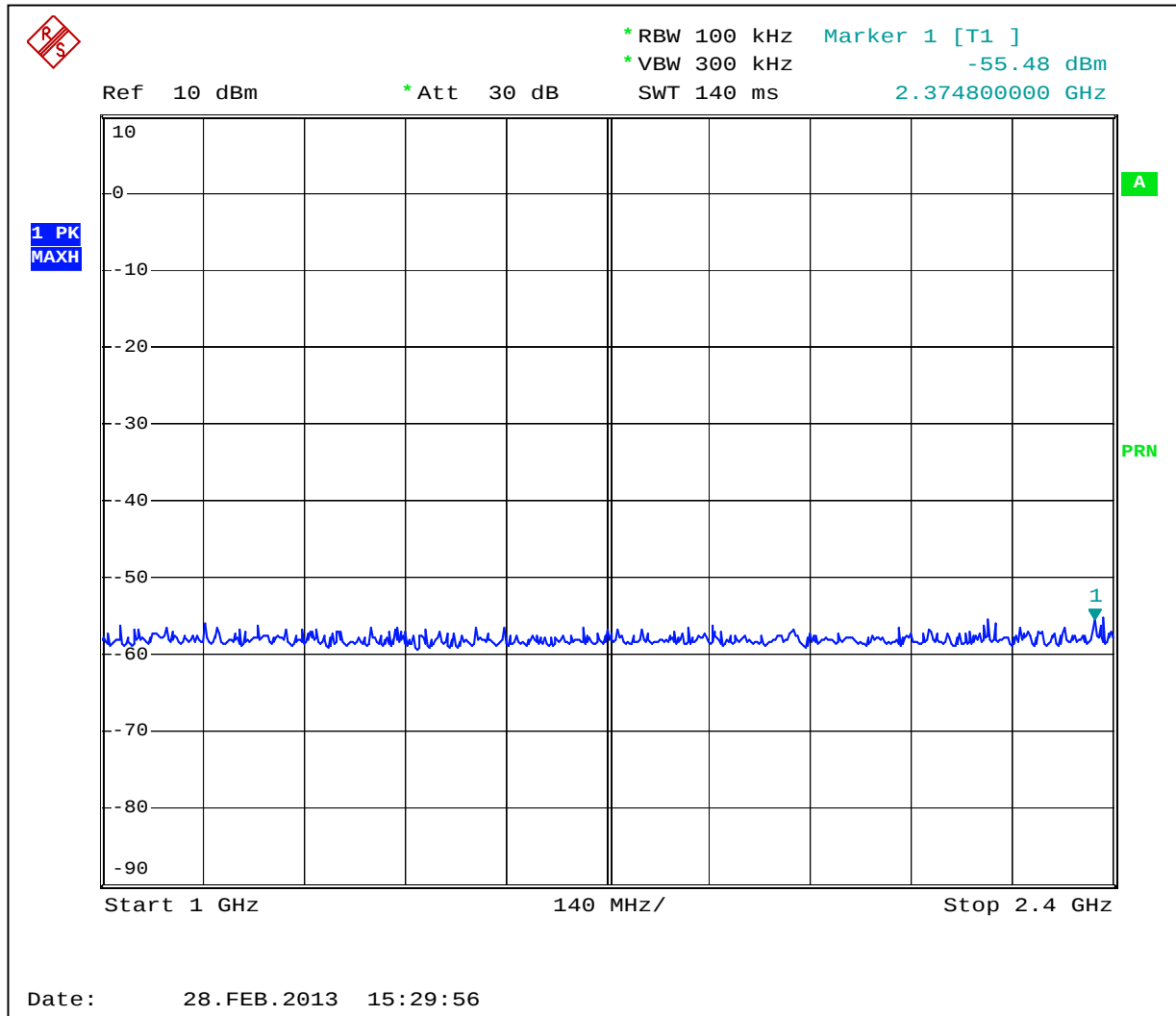
Graph 3.4.14



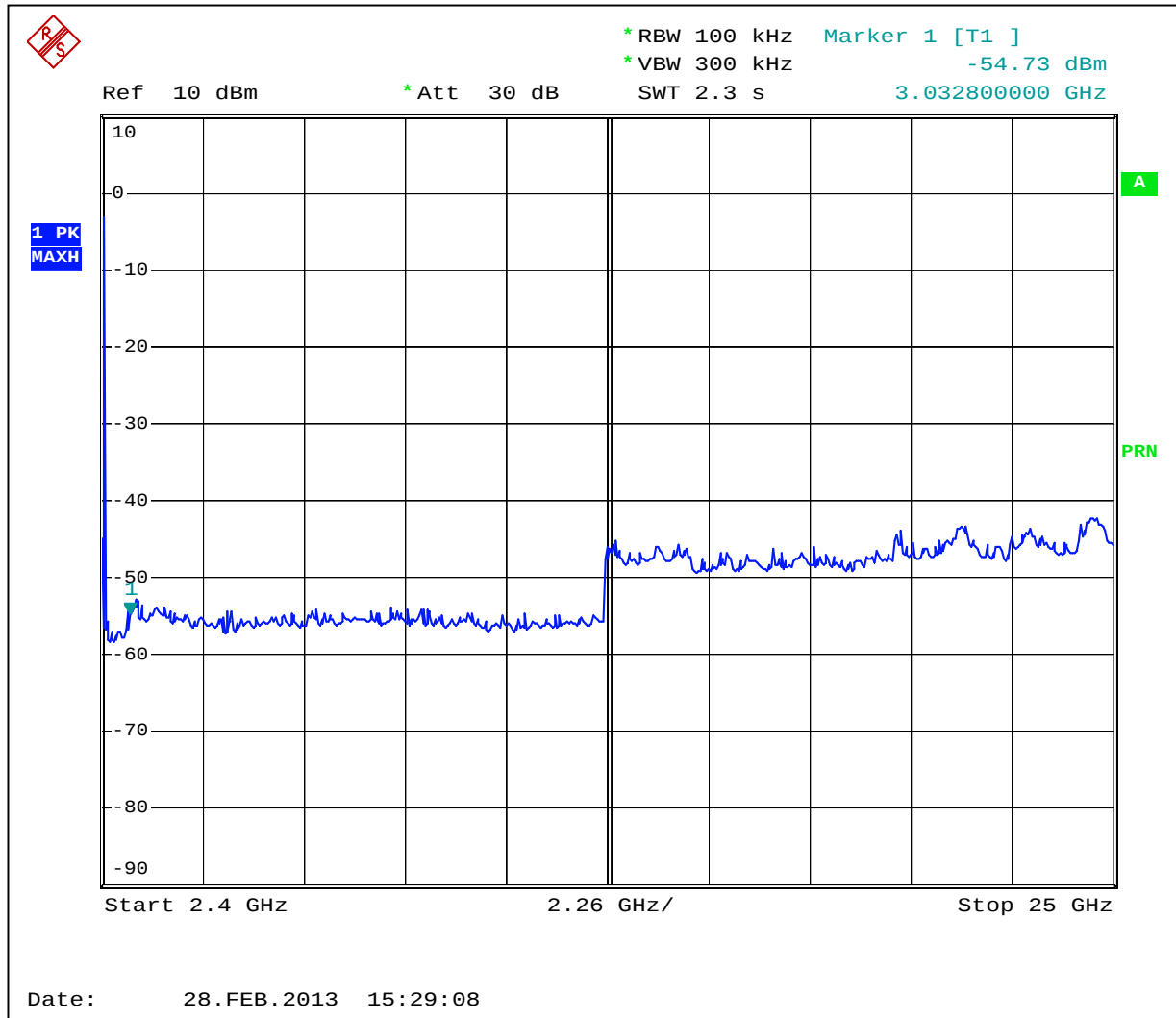
Graph 3.4.15



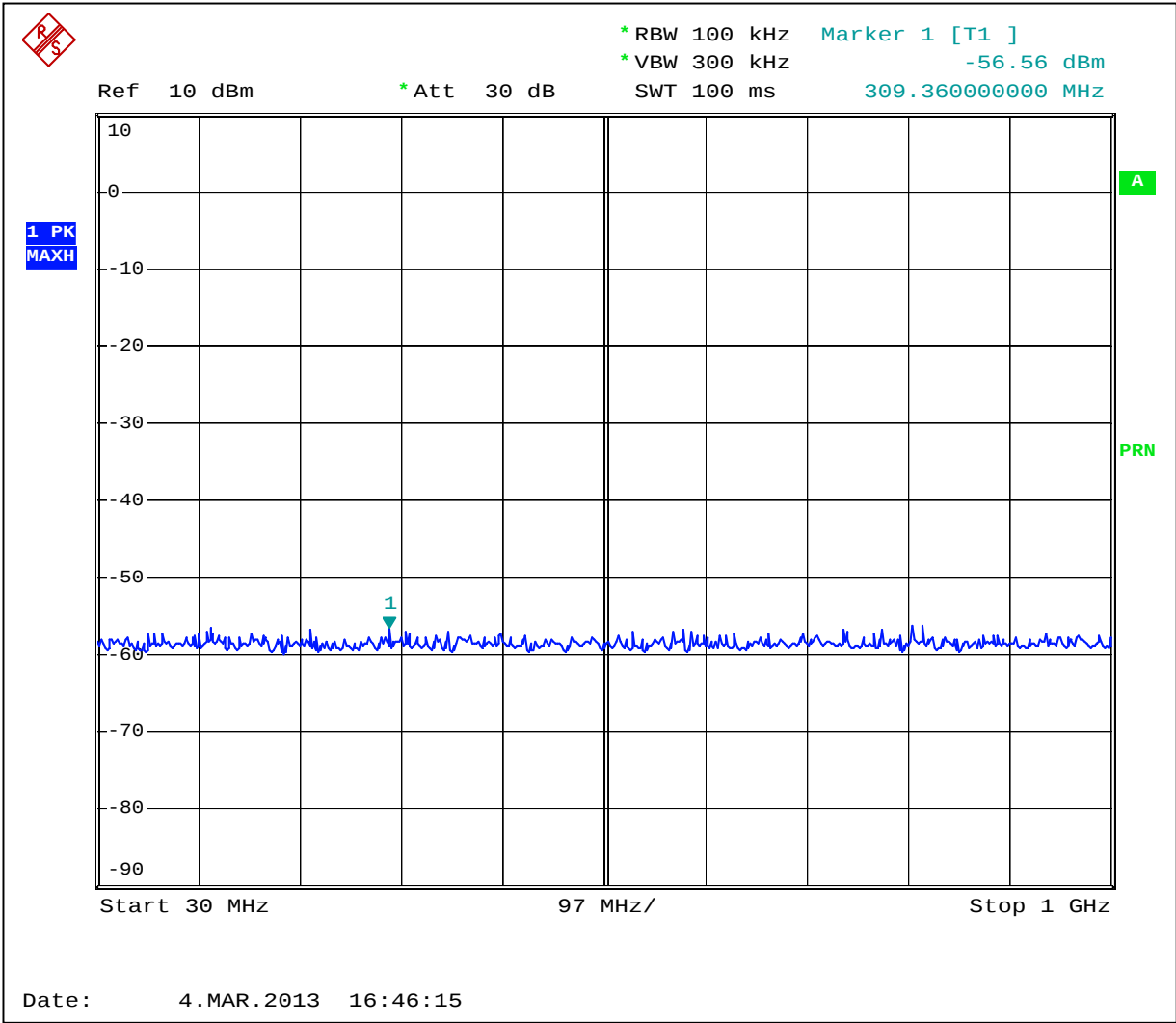
Graph 3.4.16



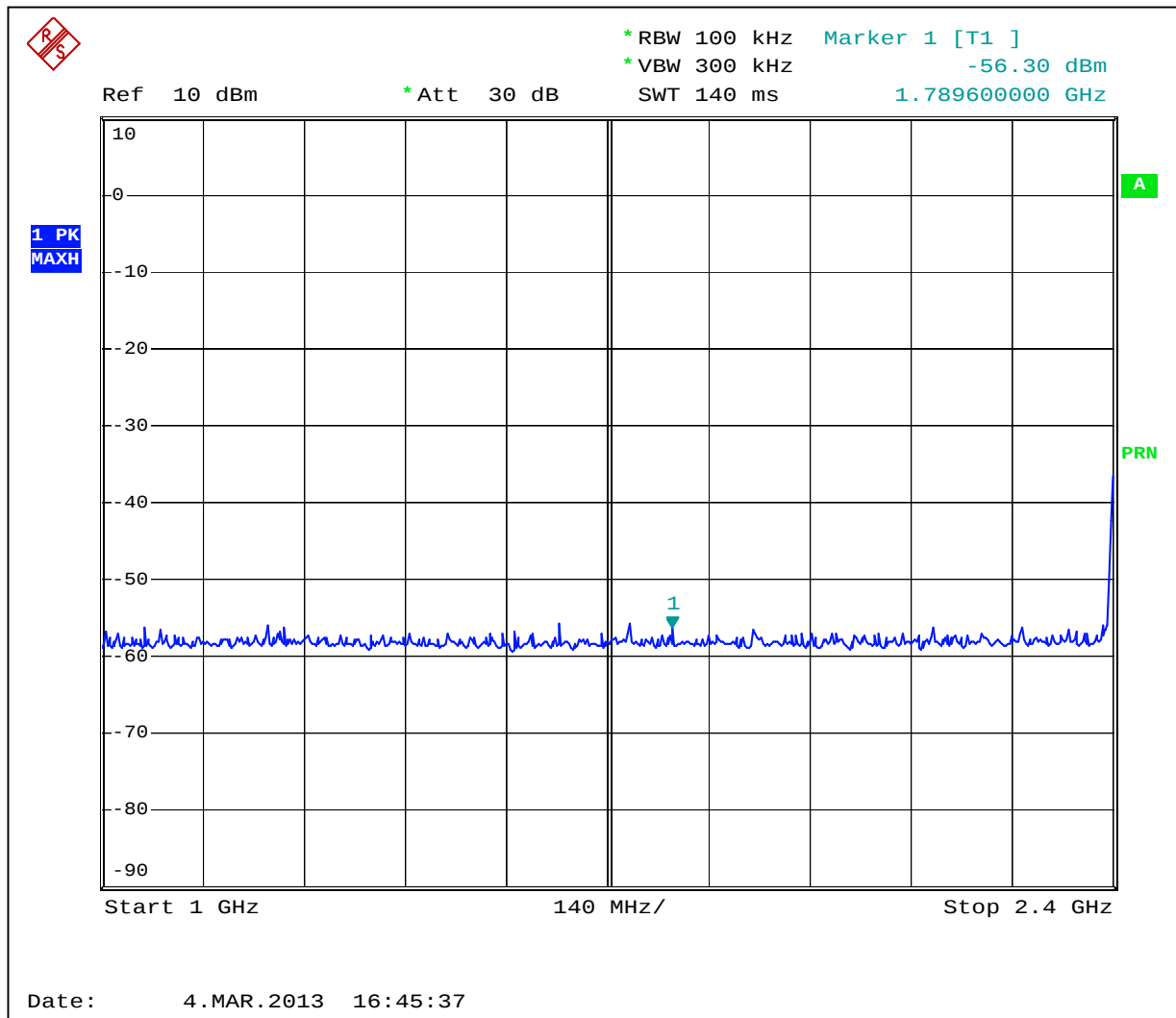
Graph 3.4.17



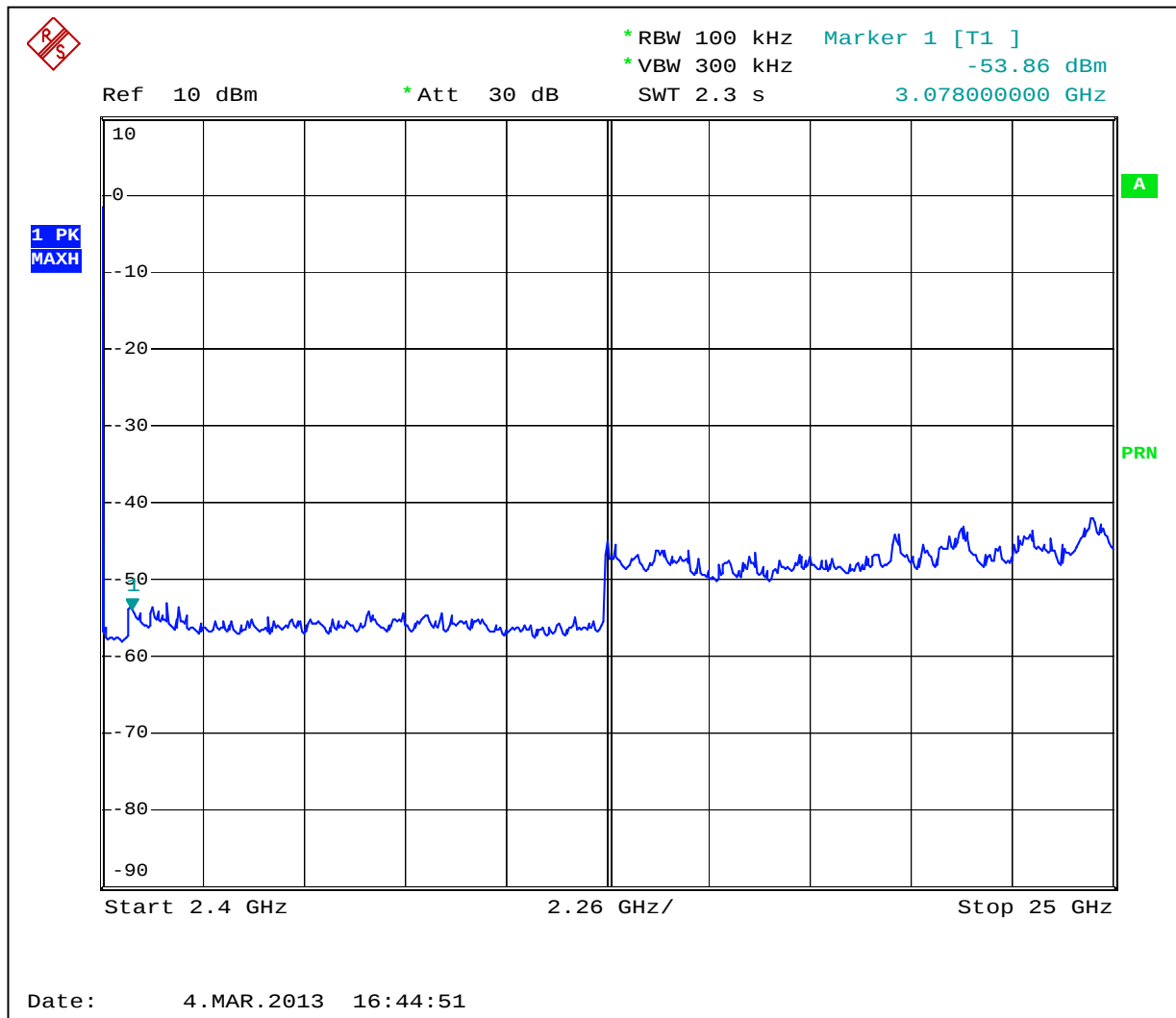
Graph 3.4.18



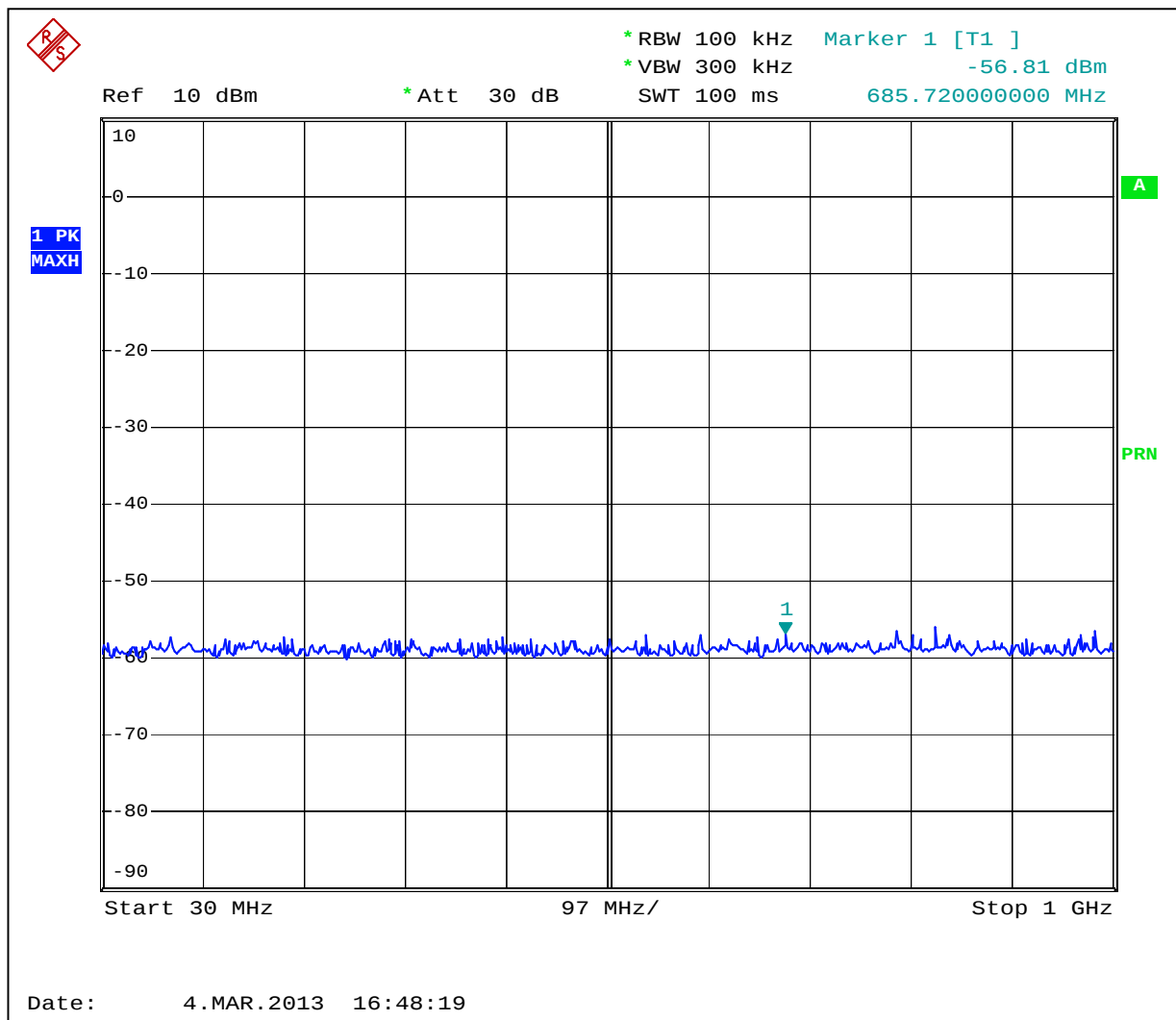
Graph 3.4.19



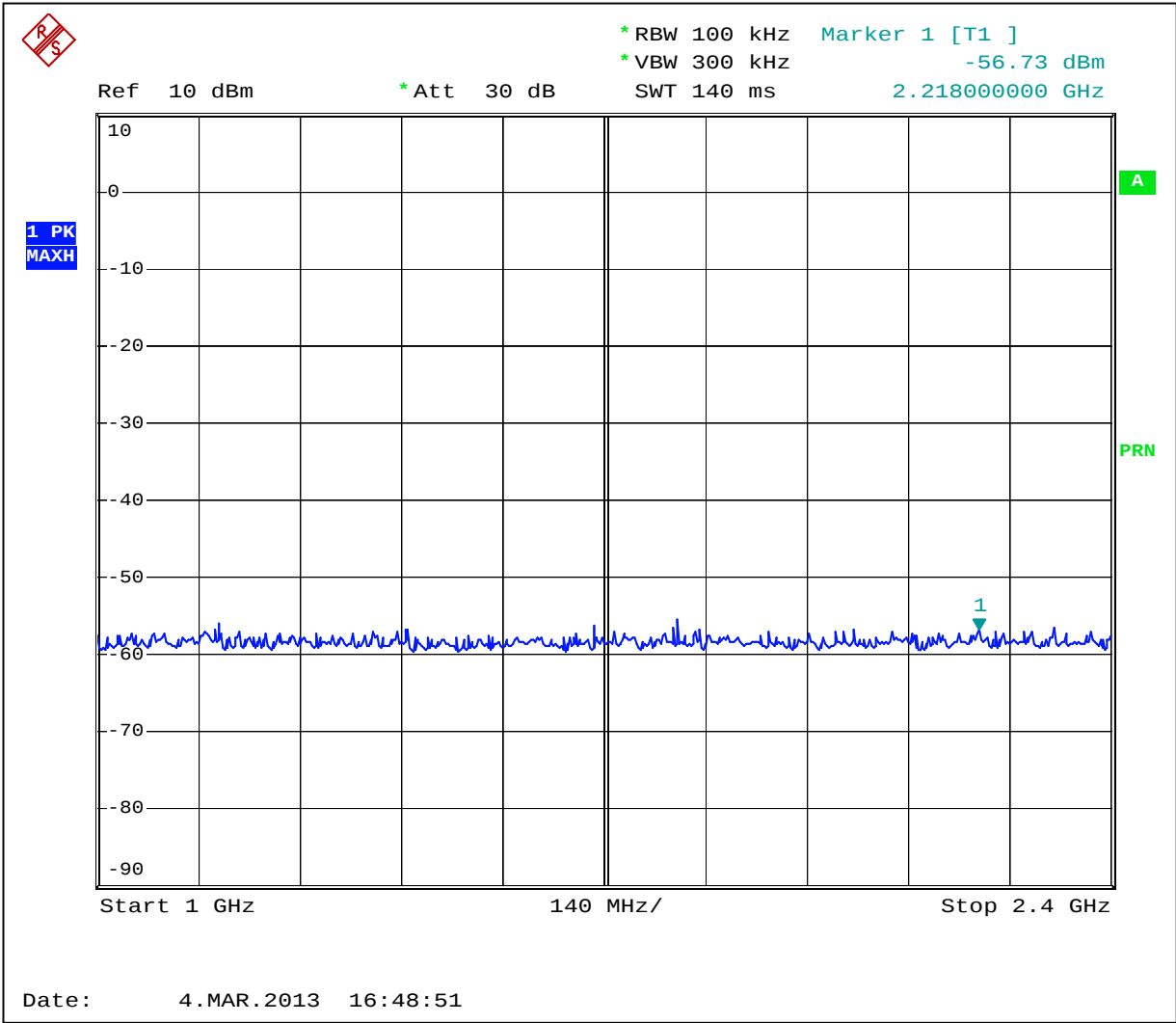
Graph 3.4.20



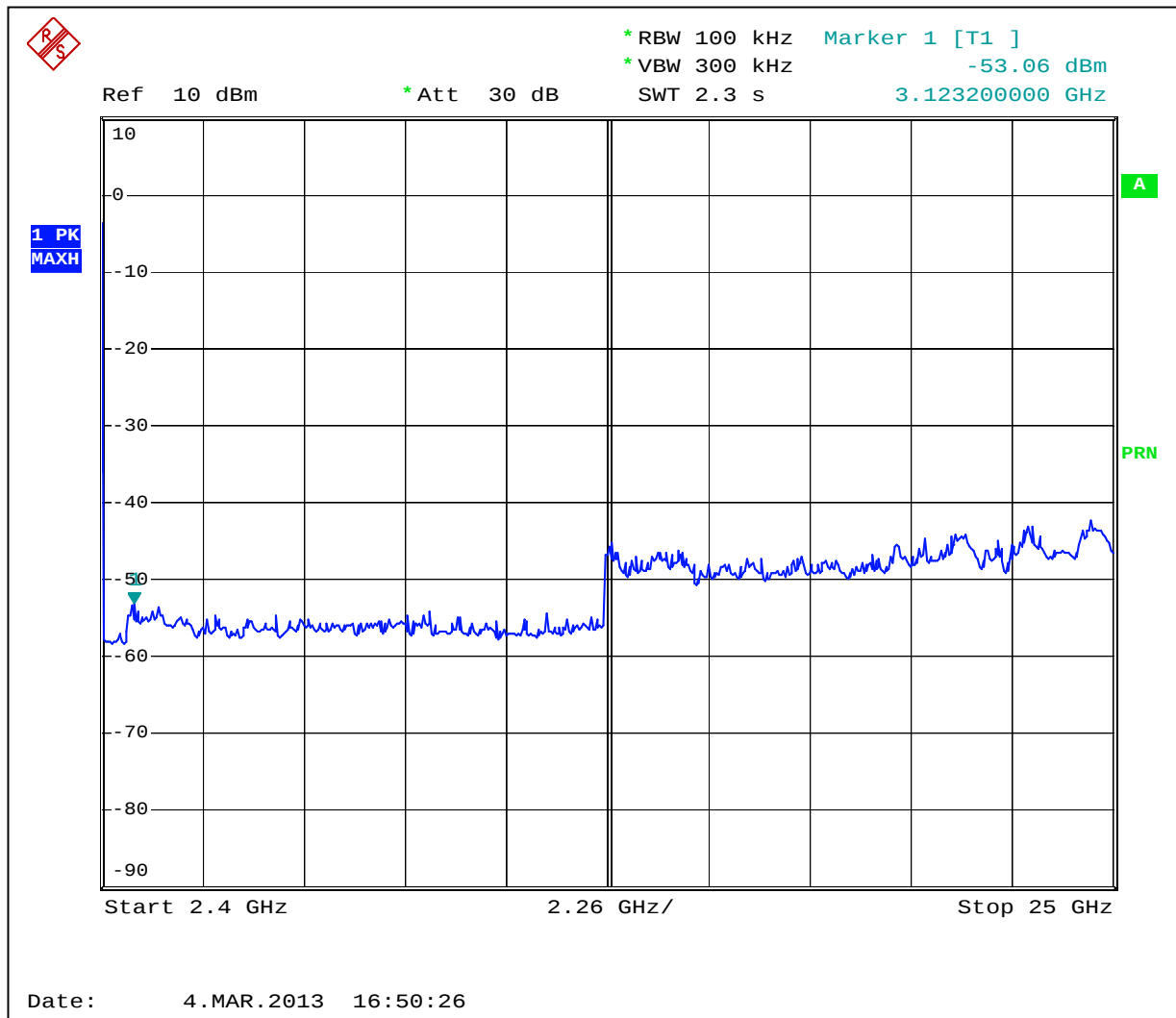
Graph 3.4.21



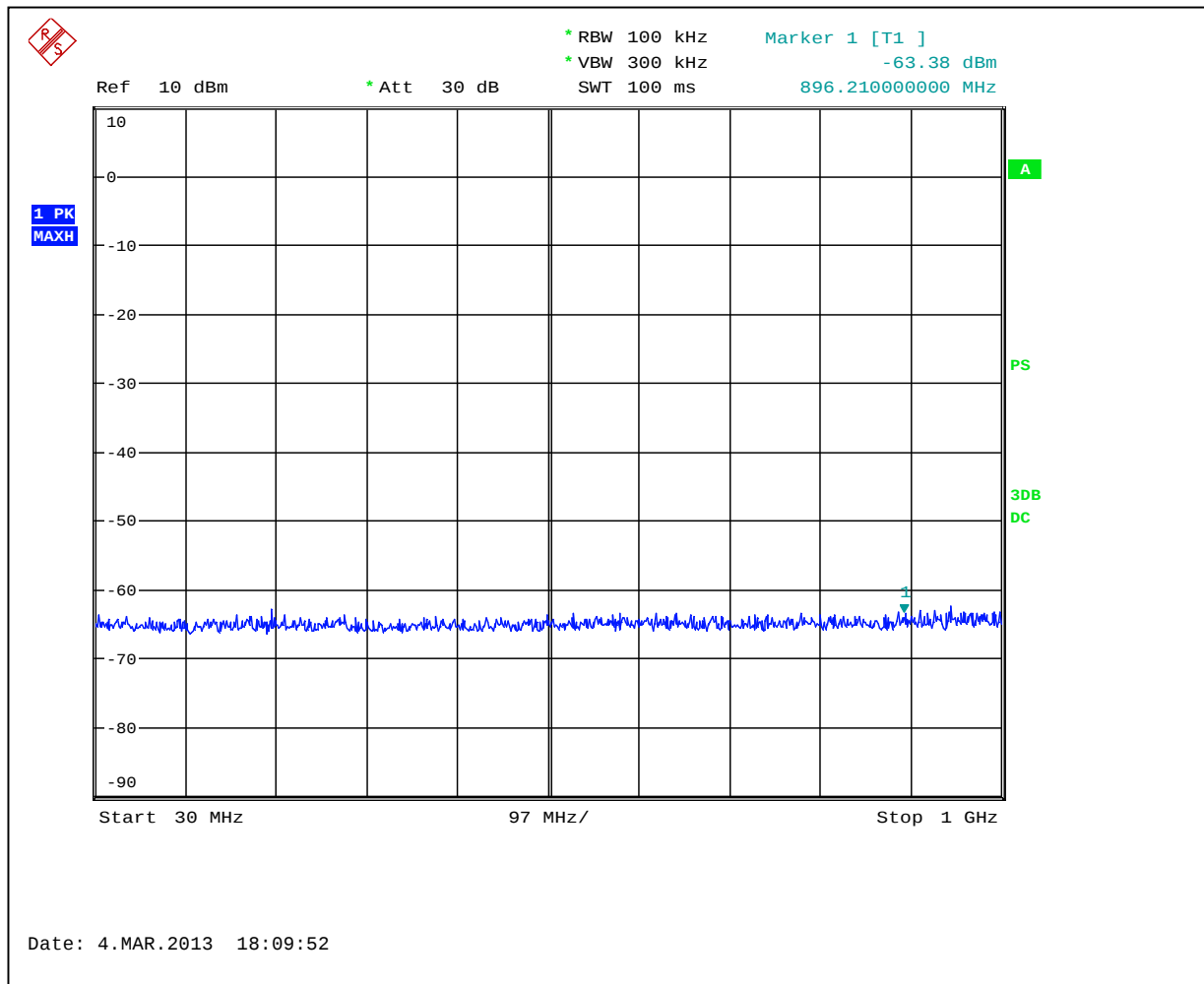
Graph 3.4.22



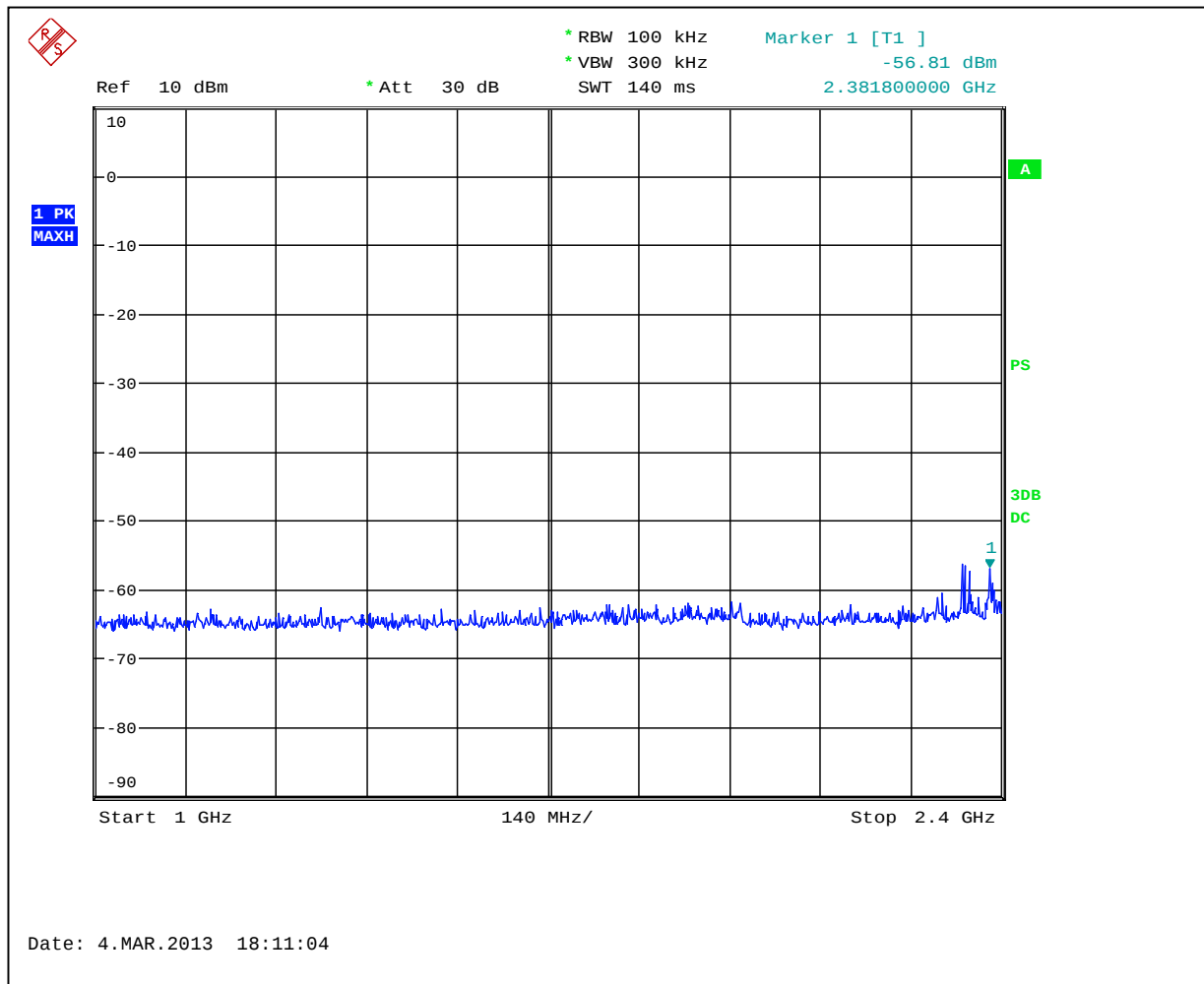
Graph 3.4.23



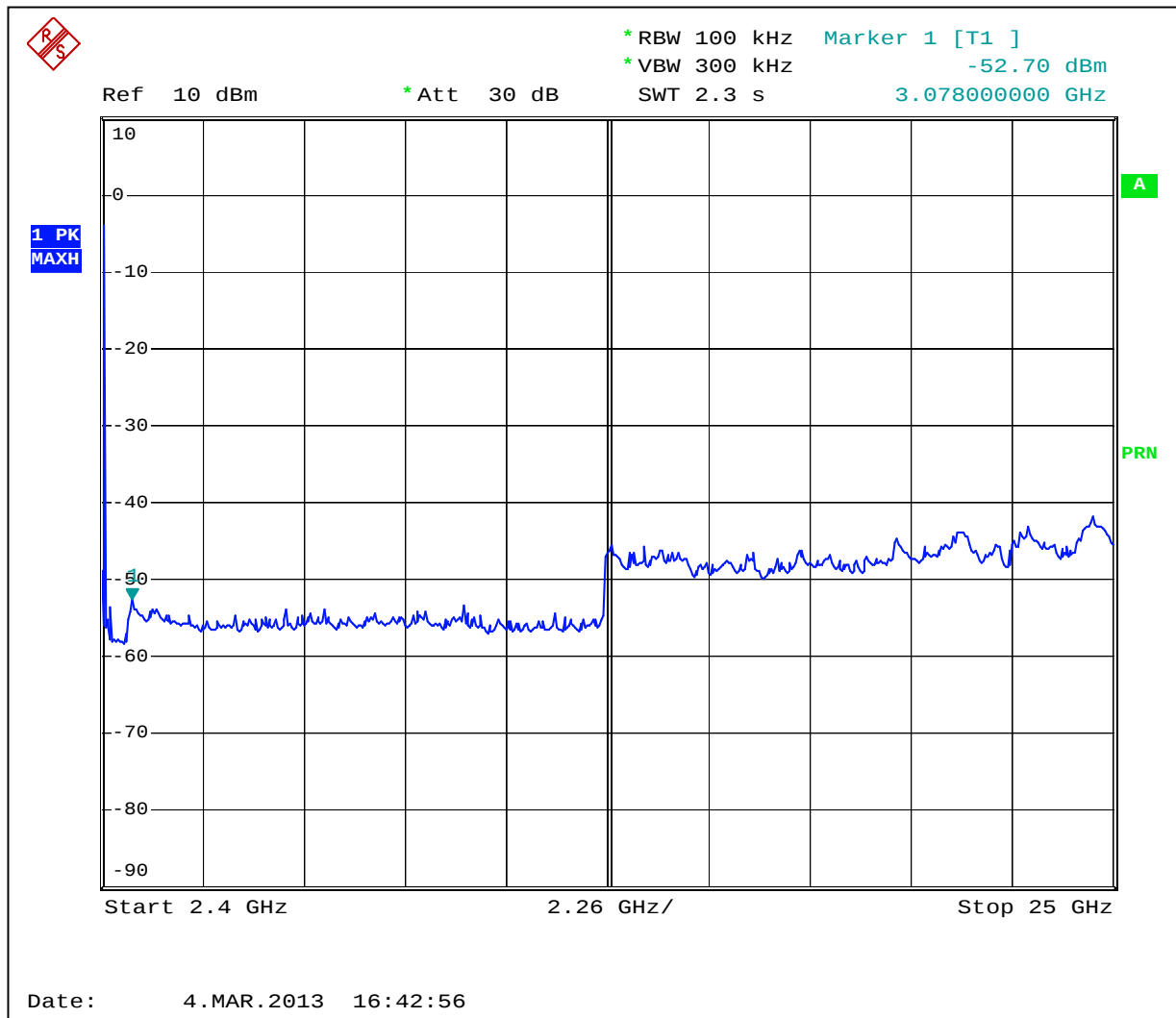
Graph 3.4.24



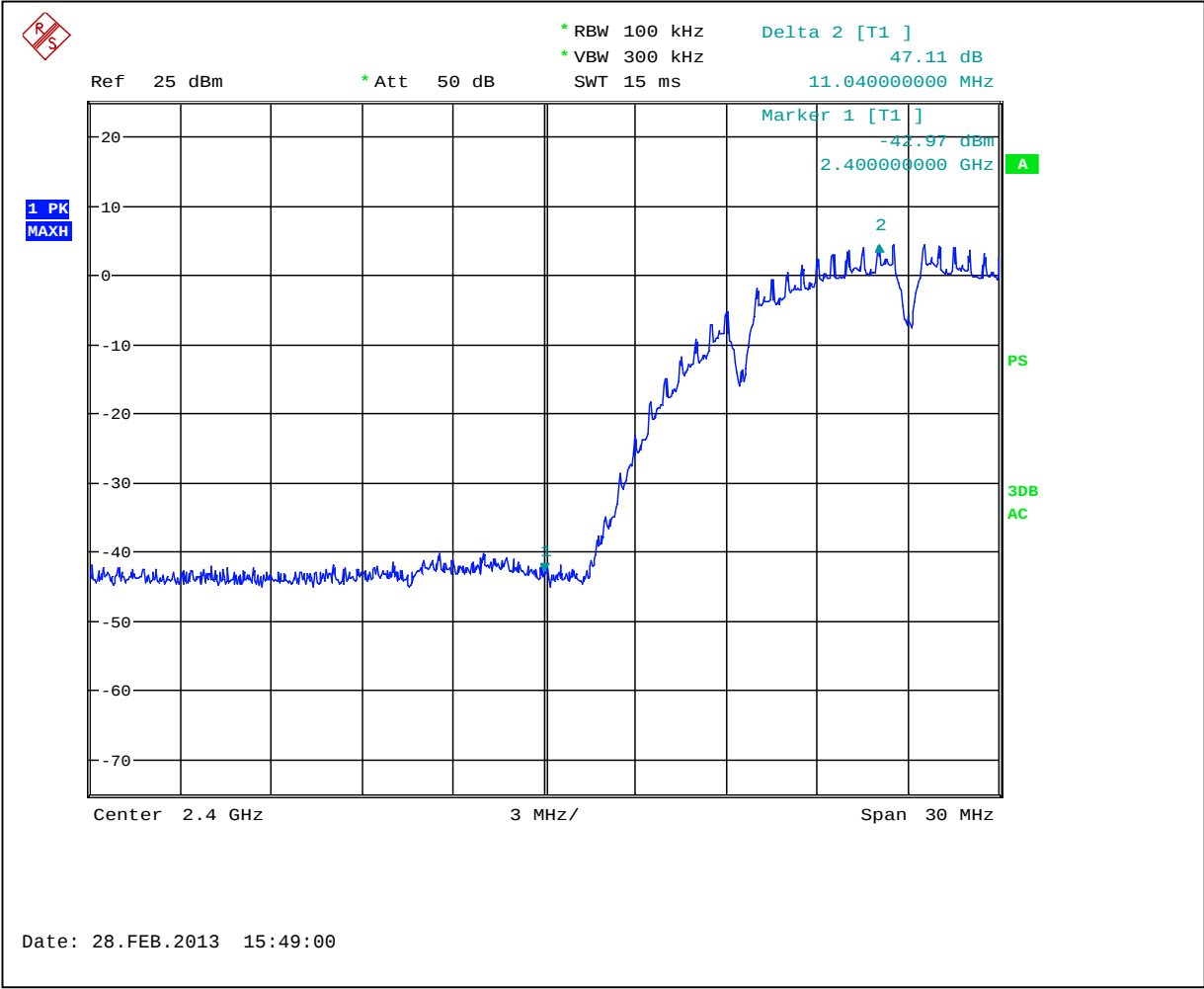
Graph 3.4.25



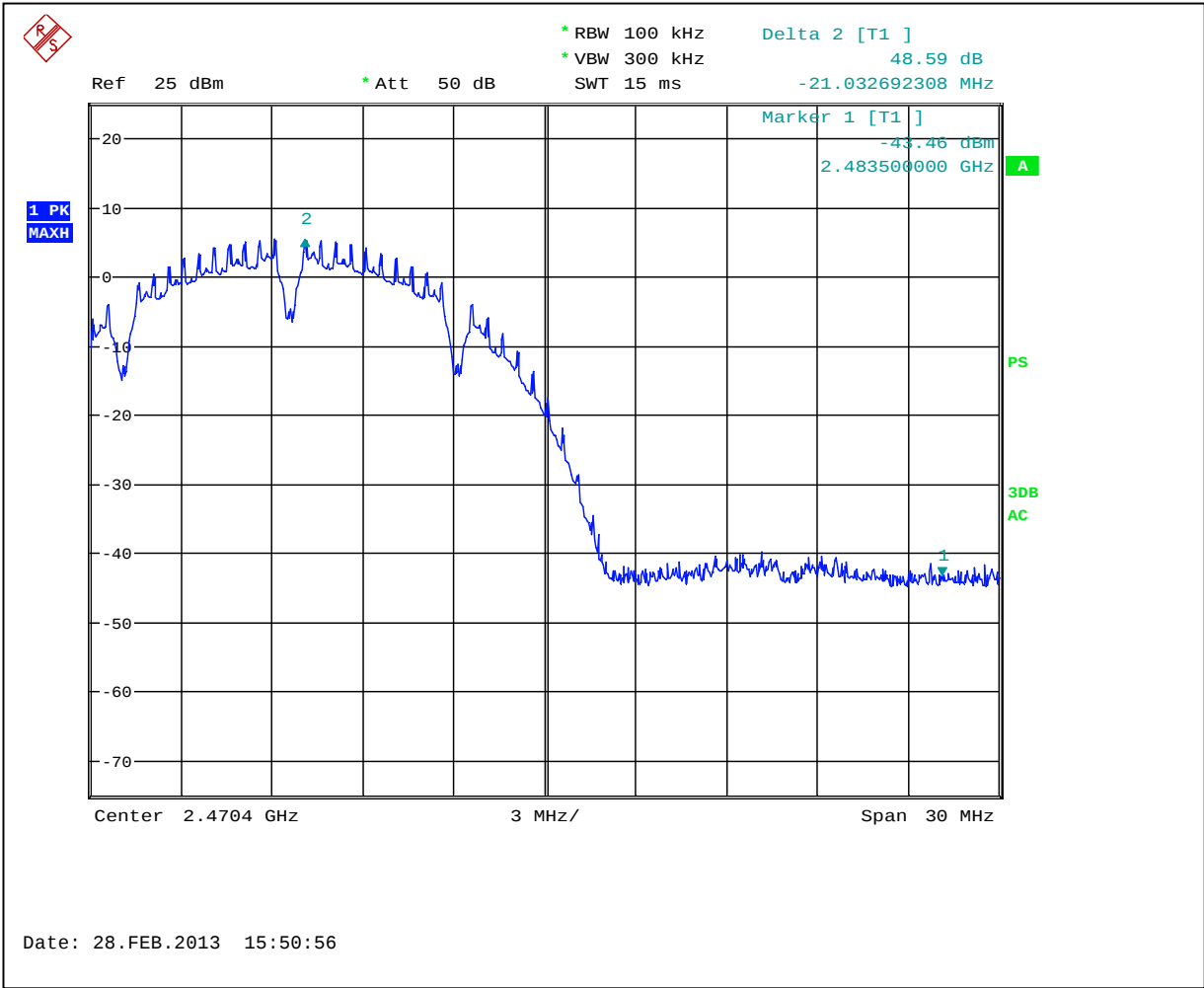
Graph 3.4.26



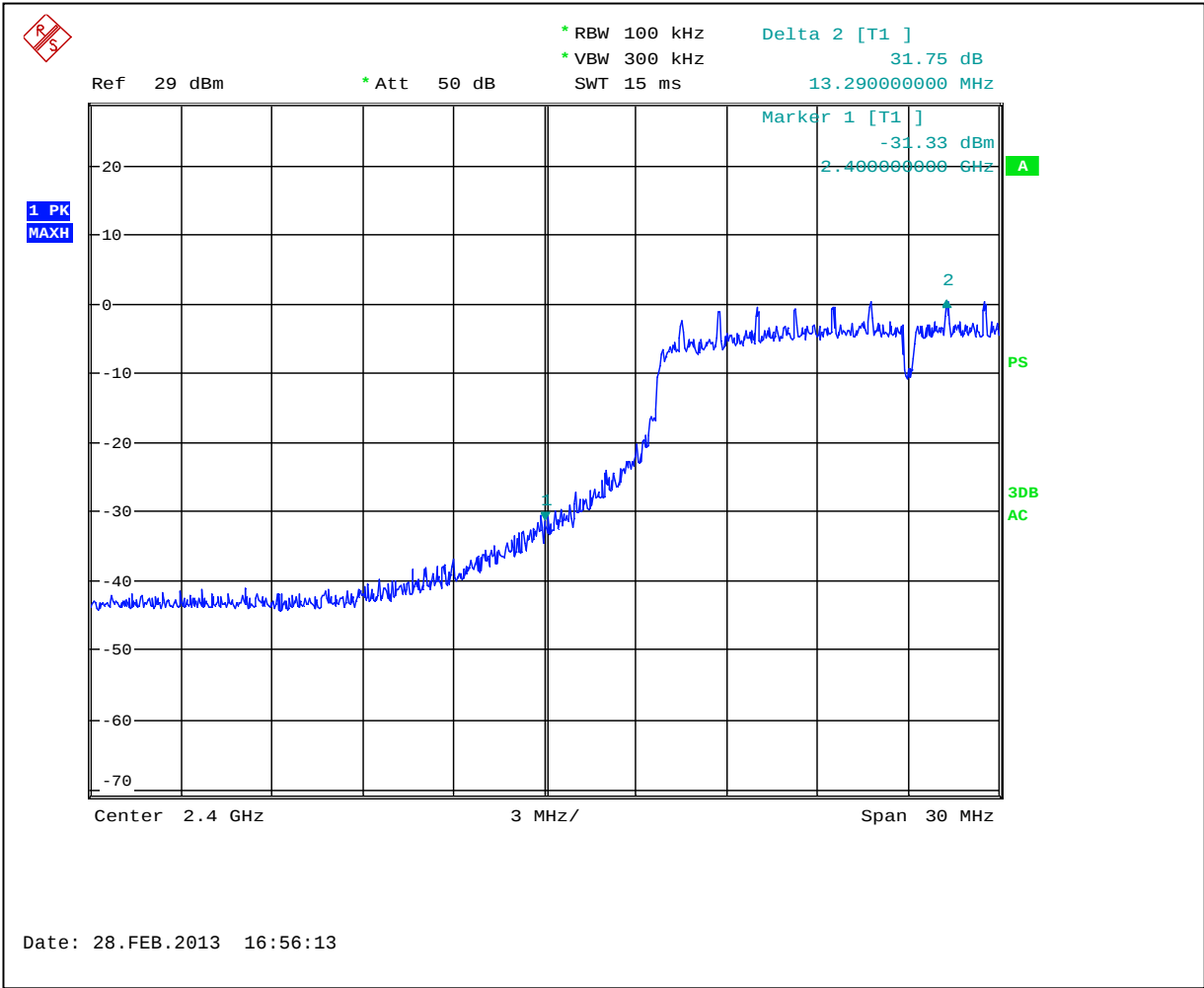
Graph 3.4.27



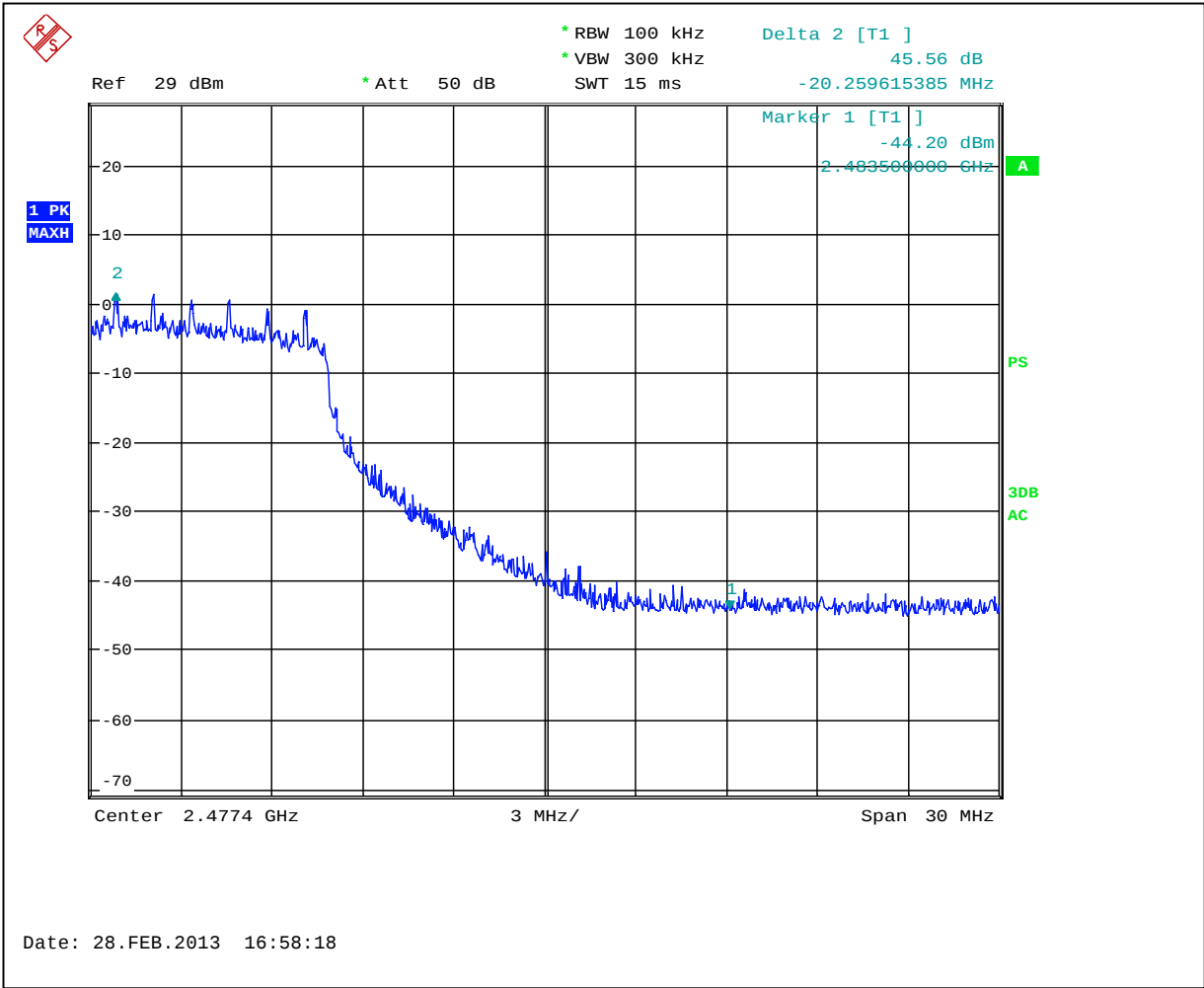
Graph 3.4.28



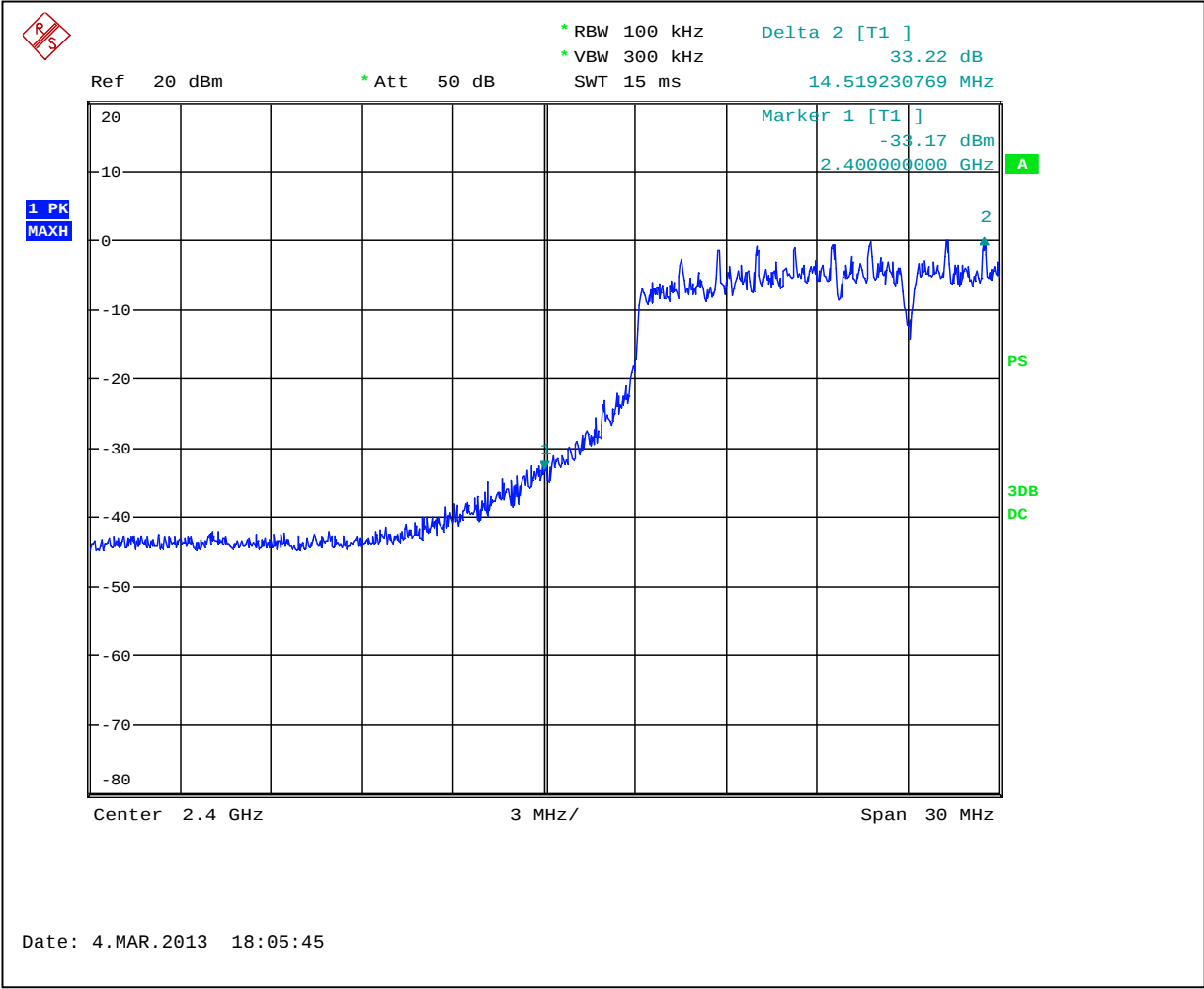
Graph 3.4.29



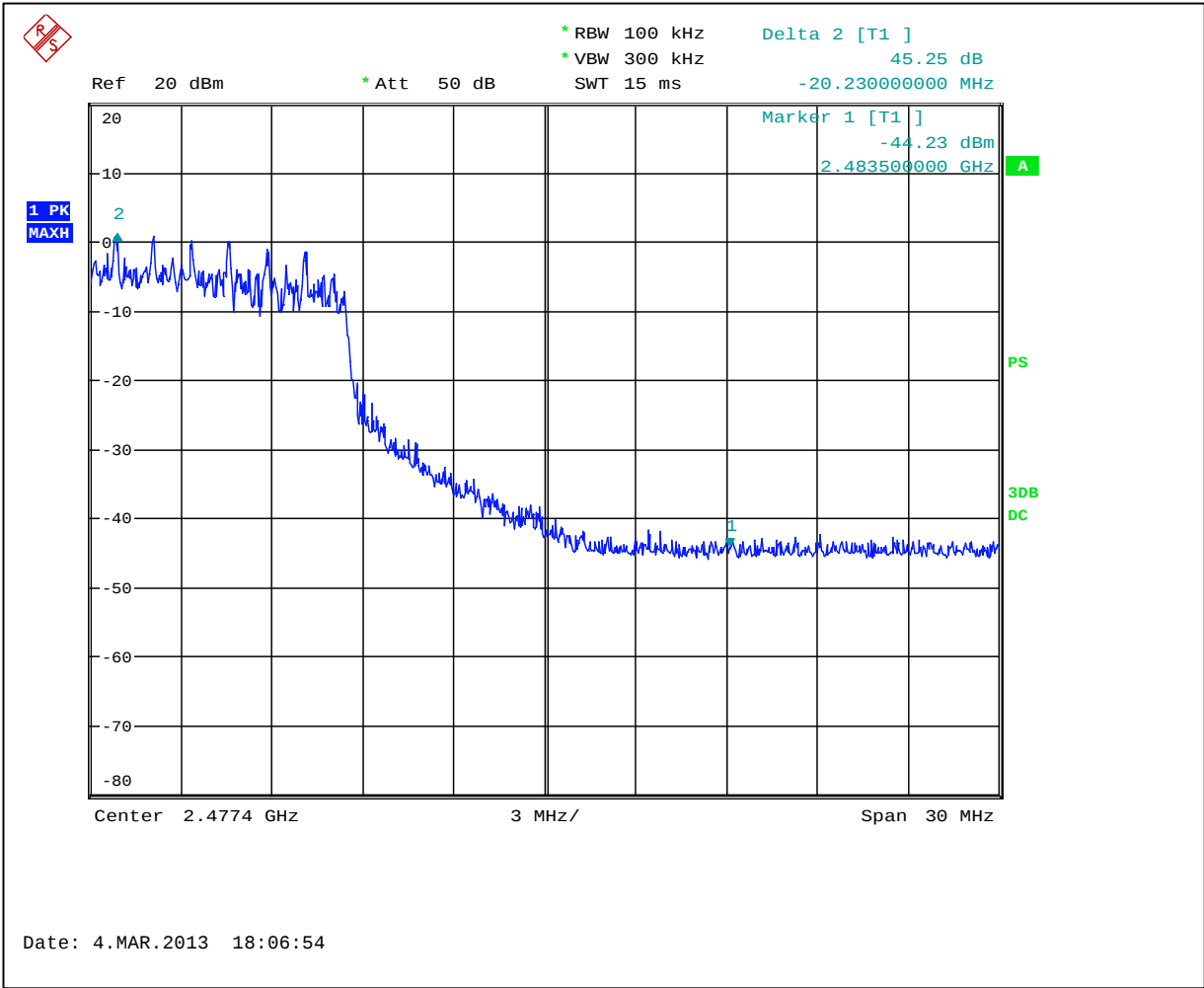
Graph 3.4.30



Graph 3.4.31



Graph 3.4.32



Graph 3.4.33



3.5 Radiated spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Max. Margin: 5.7dB below the limits

Date:	March 18-April 22, 2013	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	802.11b. Spurious Radiated Emissions not related with transmitter operation and fundamental frequencies were excluded from the table.	

Table 3.5.1

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
Low							
9.648 GHz	H	40.1	43.8	37.1	46.8	54.0	-7.2
Middle							
9.752 GHz	H	39.1	44.0	37.1	46.0	54.0	-8.0

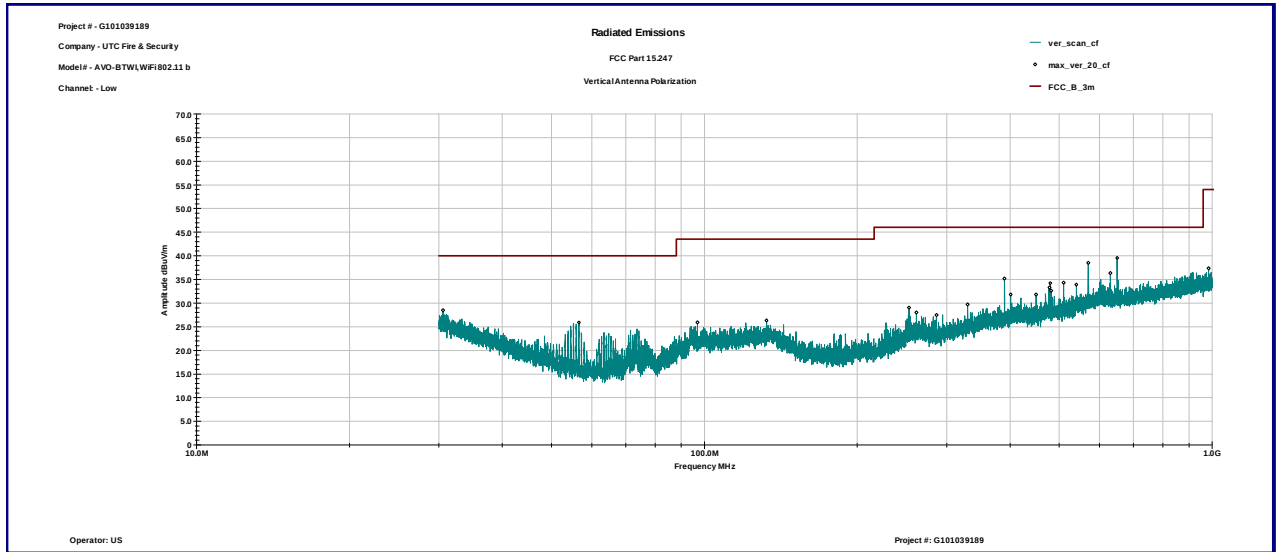
Date:	March 18-April 22, 2013	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	802.11g. Spurious Radiated Emissions not related with transmitter operation and fundamental frequencies were excluded from the table. No Spurious Radiated Emissions related with transmitter operation were detected.	



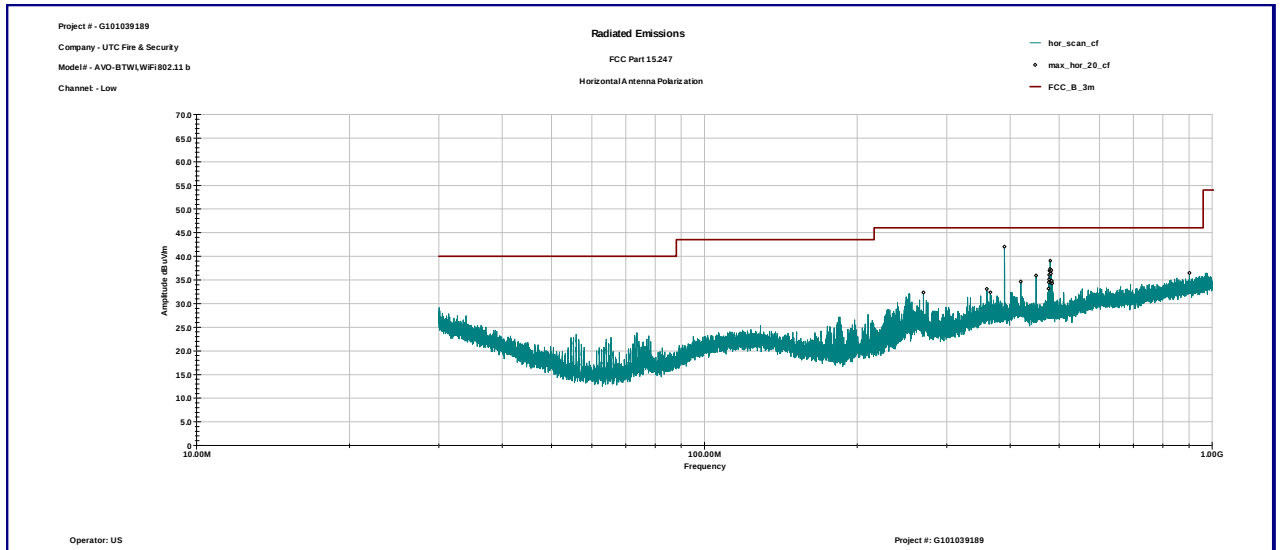
Date:	March 18-April 22, 2013	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	802.11n. Spurious Radiated Emissions not related with transmitter operation and fundamental frequencies were excluded from the table.	

Table 3.5.2

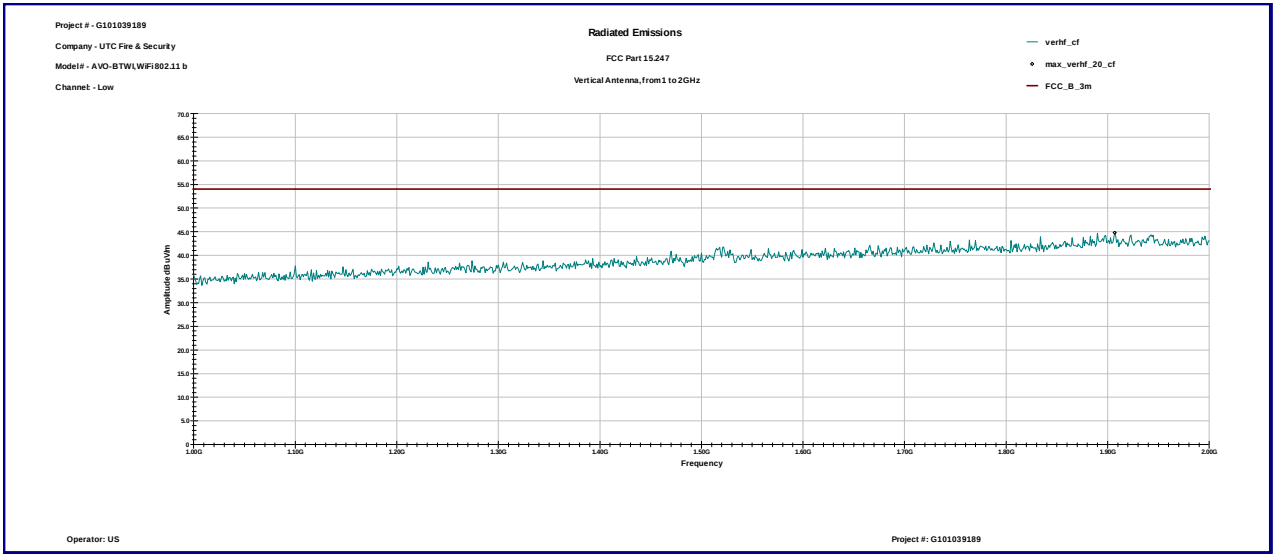
Frequency MHz	Antenna Polarity	Peak Reading dBμV	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dBμV/m	Limit dBμV/m	Margin dB
Middle							
9.752 GHz	H	41.4	44.0	37.1	48.3	54.0	-5.7



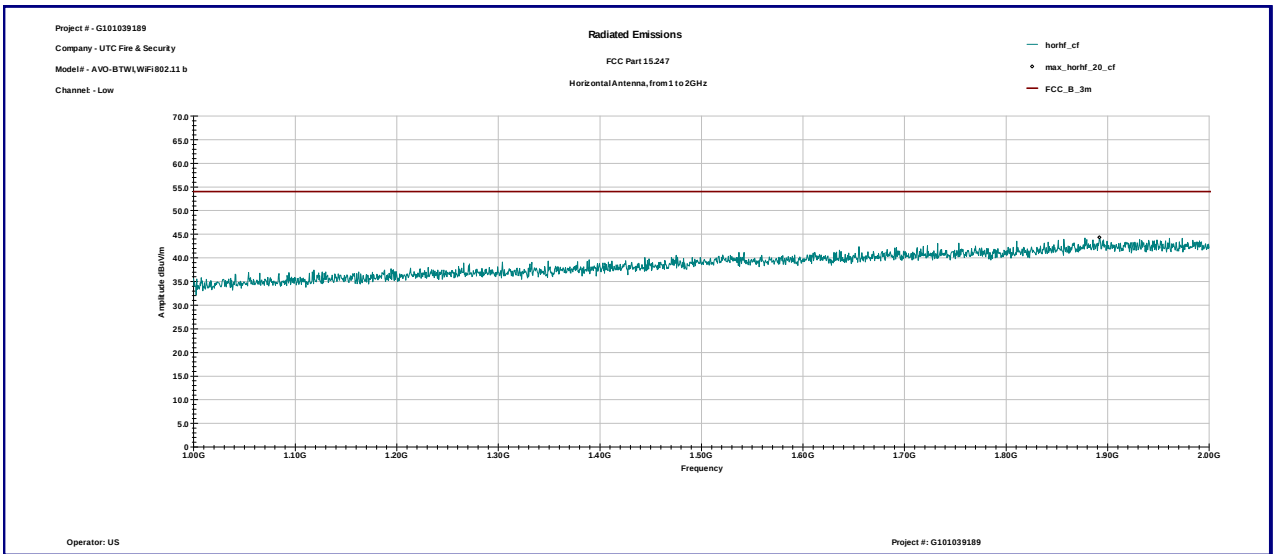
Graph 3.5.1



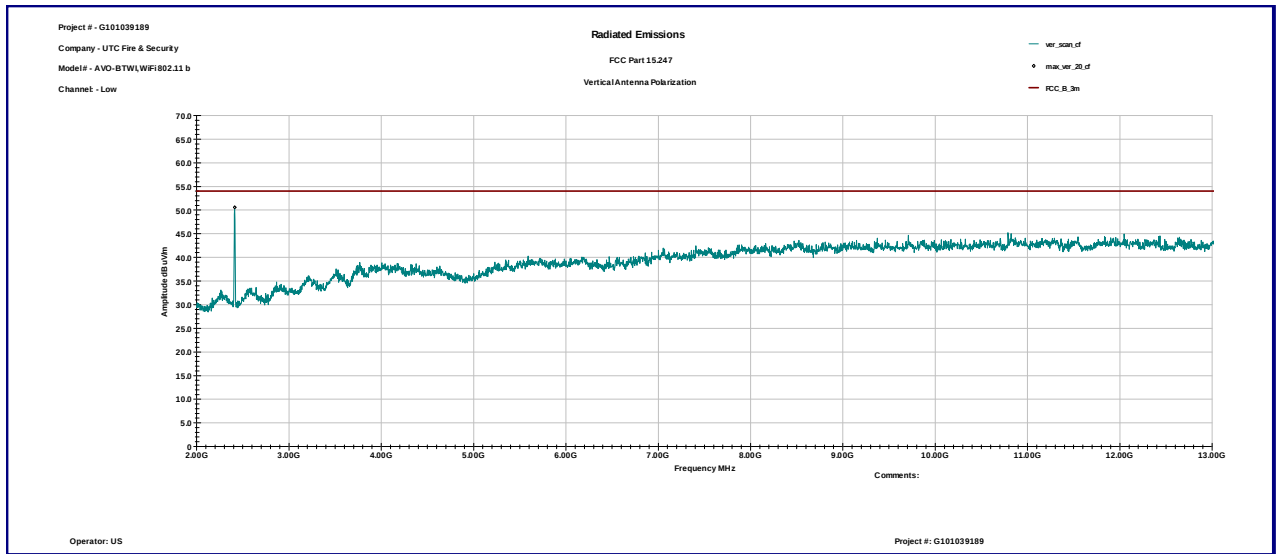
Graph 3.5.2



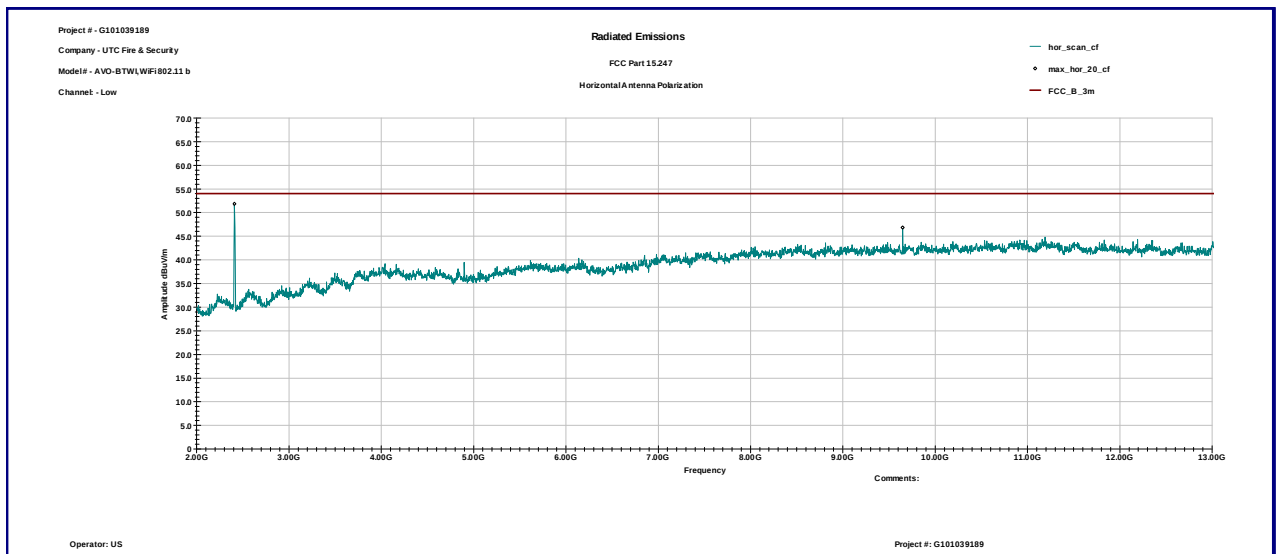
Graph 3.5.3



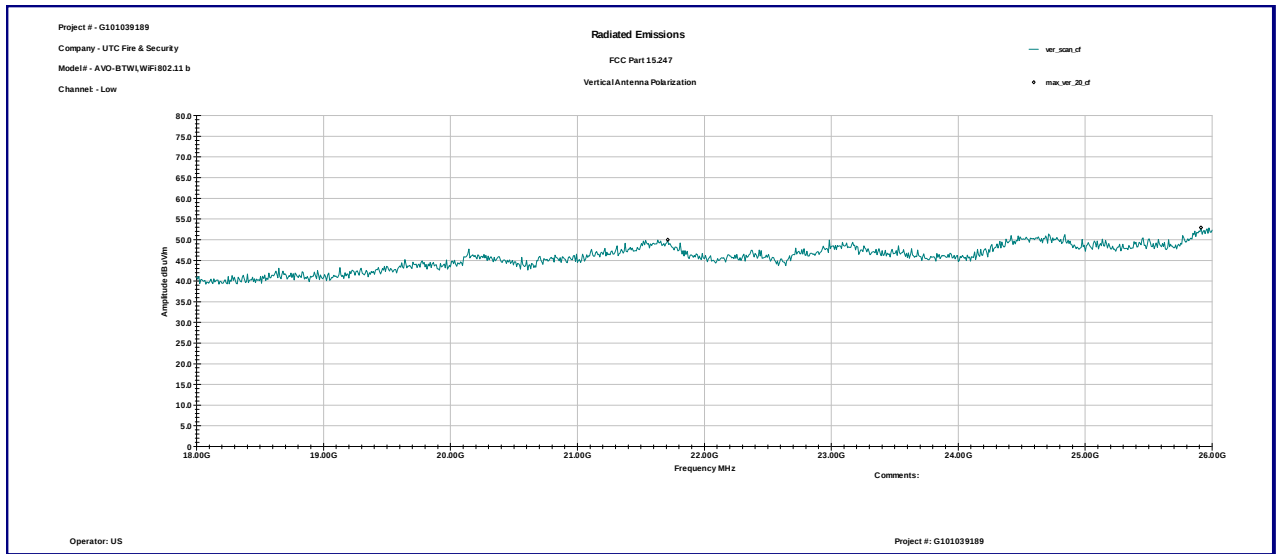
Graph 3.5.4



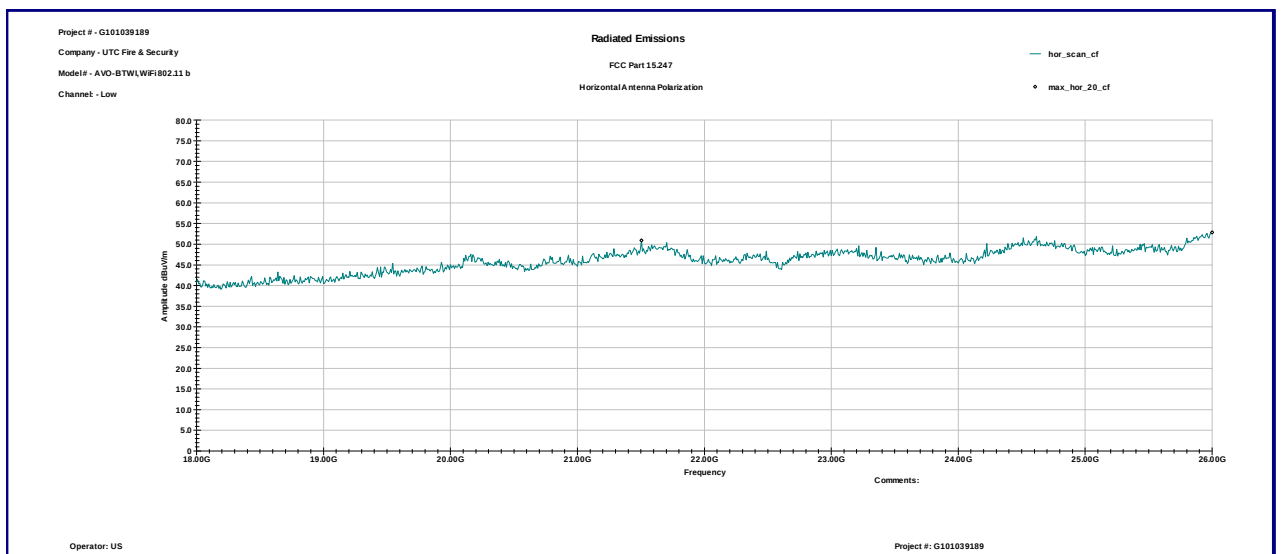
Graph 3.5.5



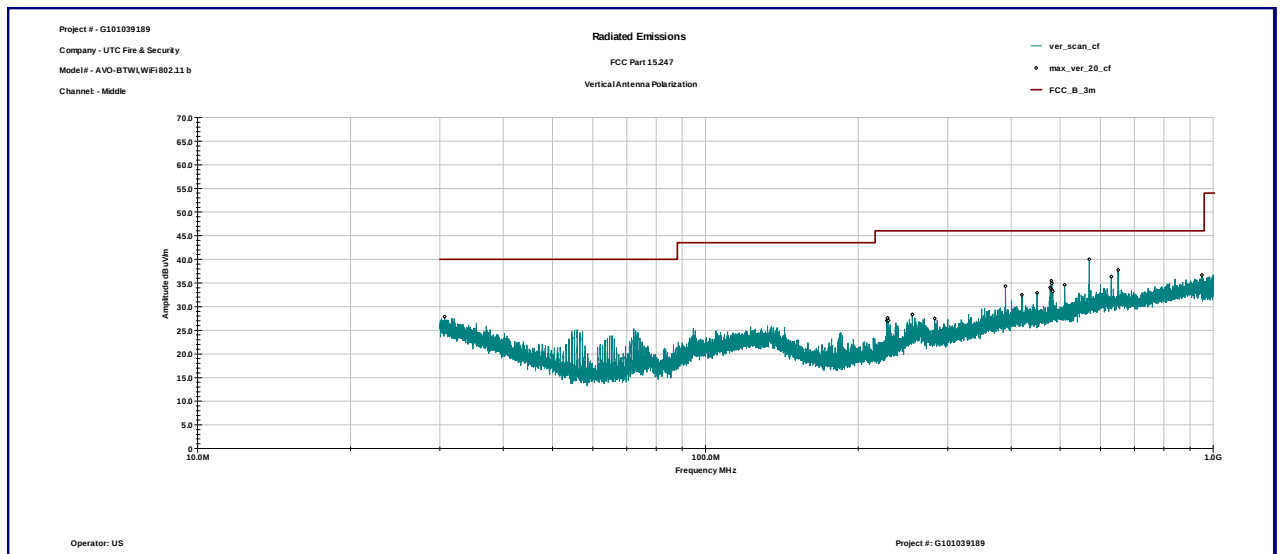
Graph 3.5.6



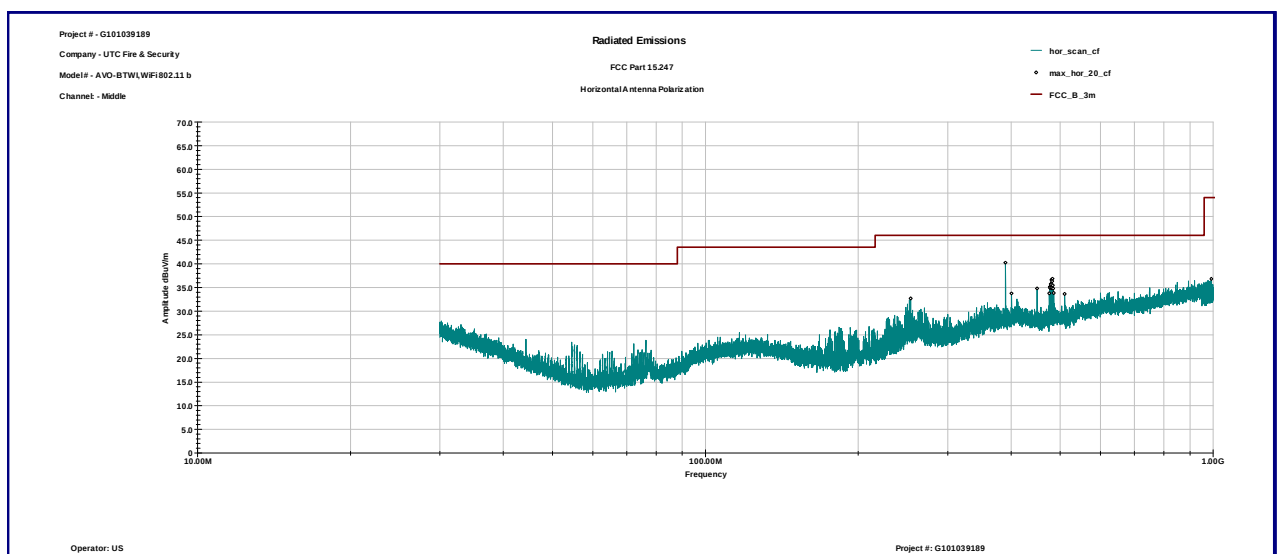
Graph 3.5.7



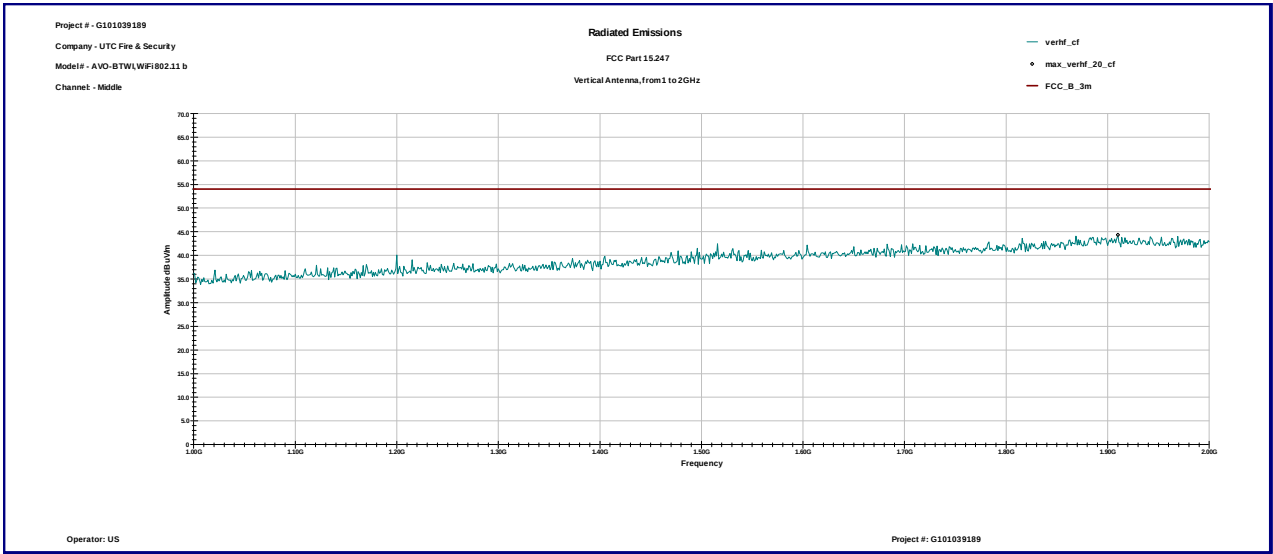
Graph 3.5.8



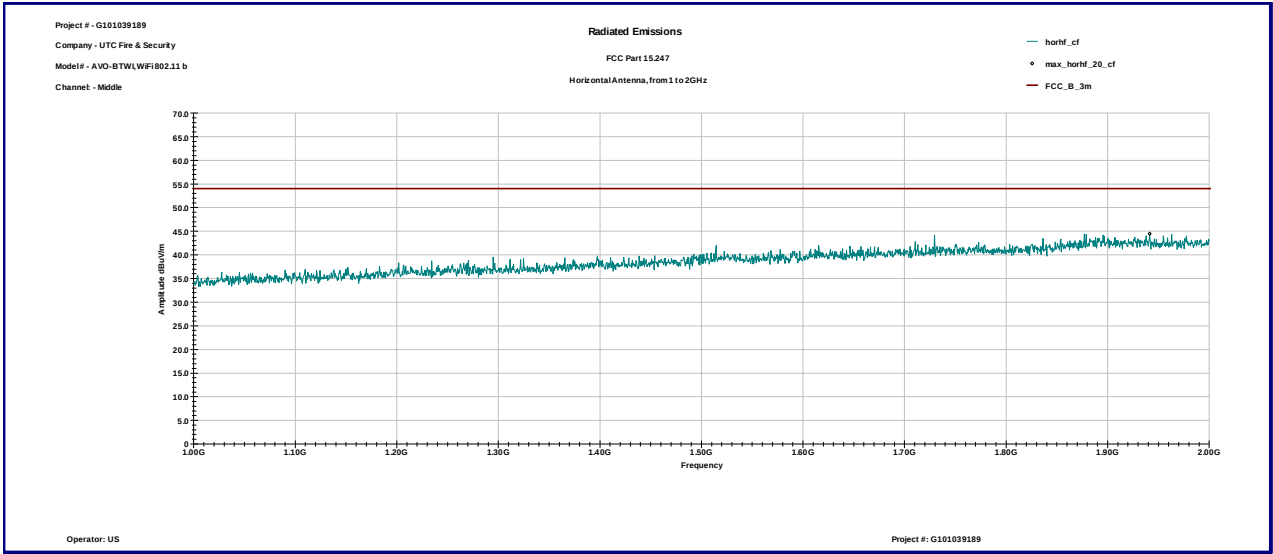
Graph 3.5.9



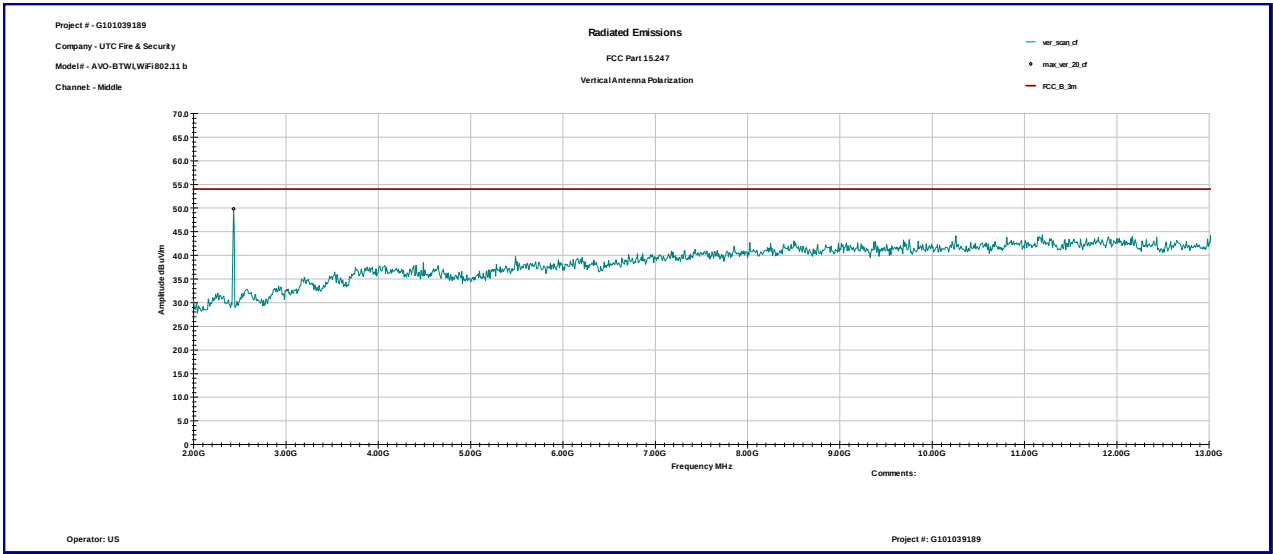
Graph 3.5.10



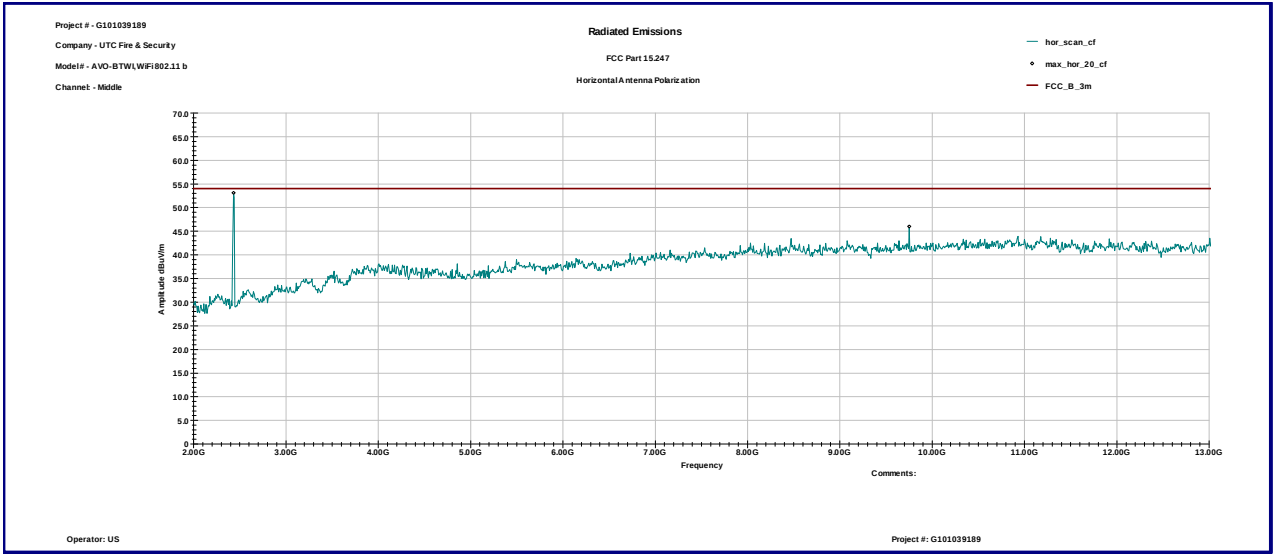
Graph 3.5.11



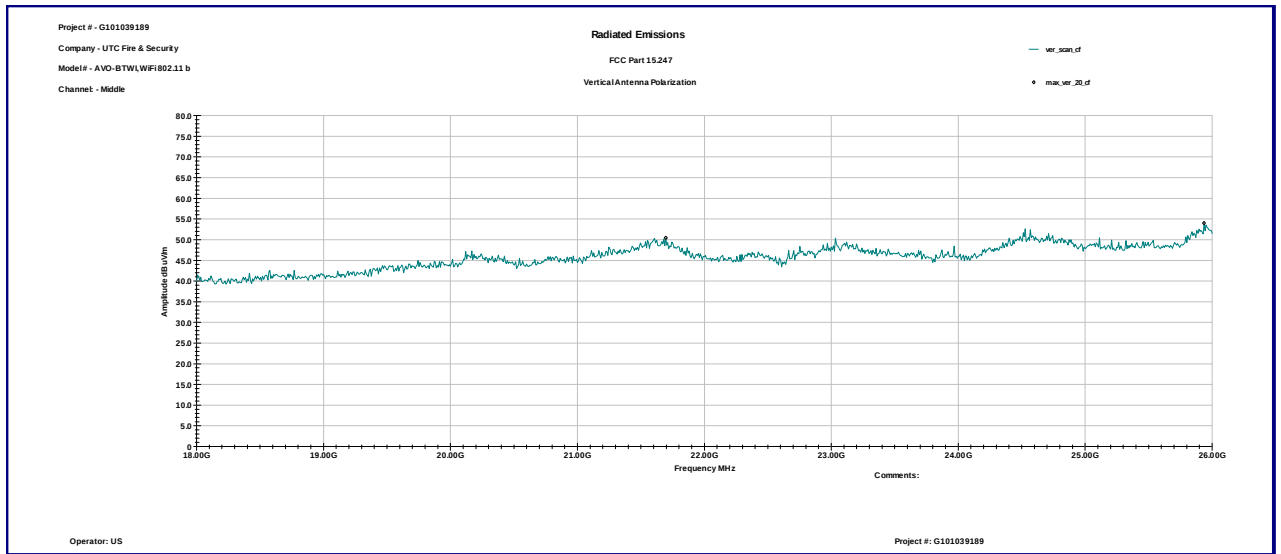
Graph 3.5.12



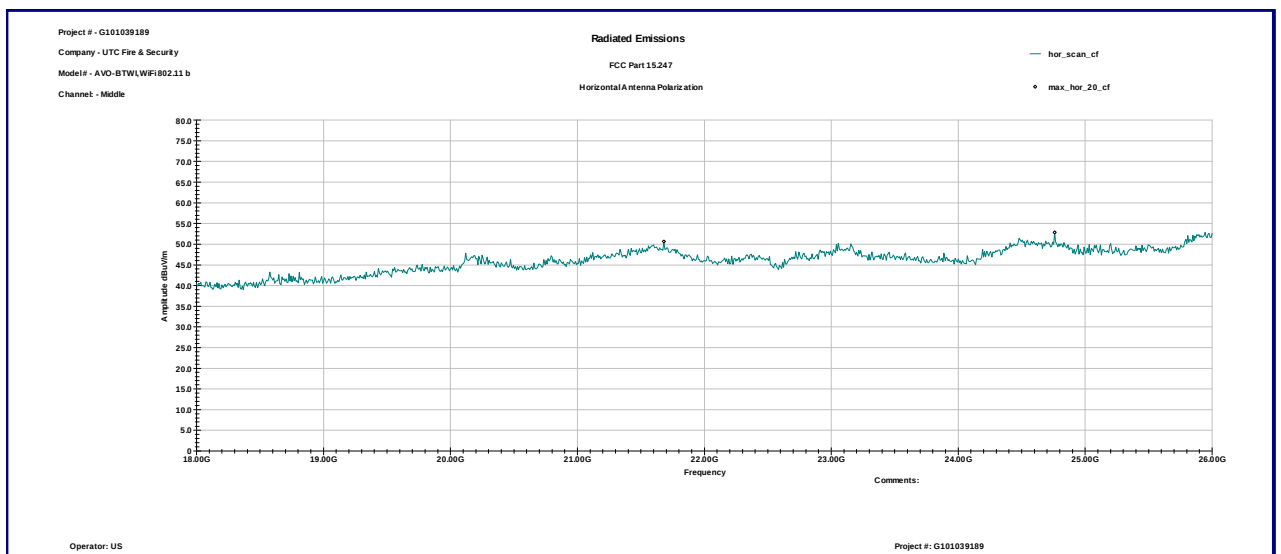
Graph 3.5.13



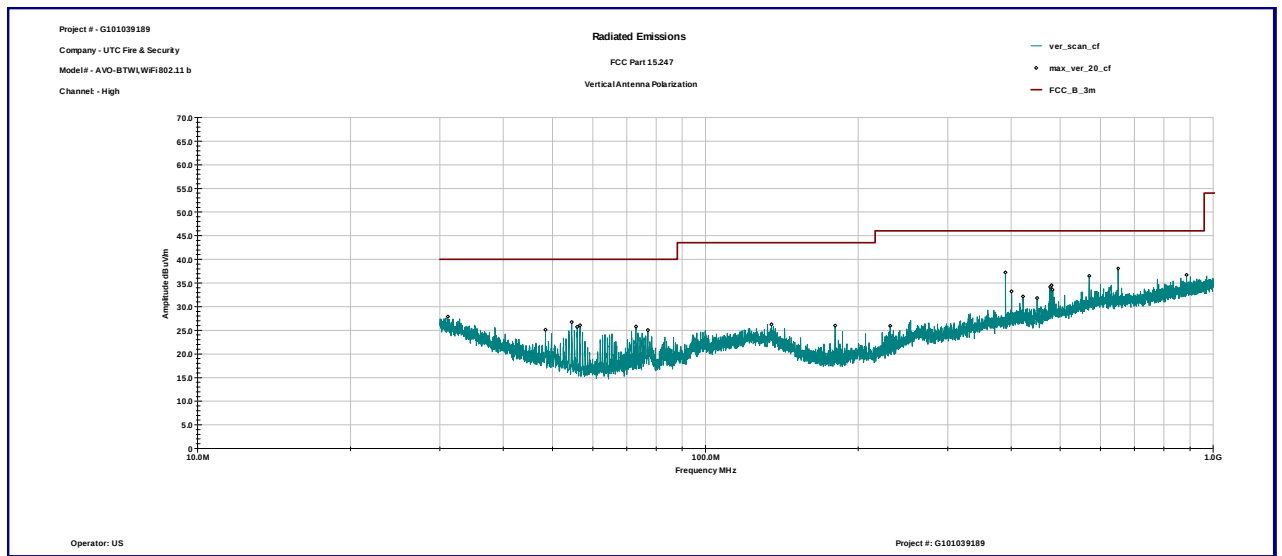
Graph 3.5.14



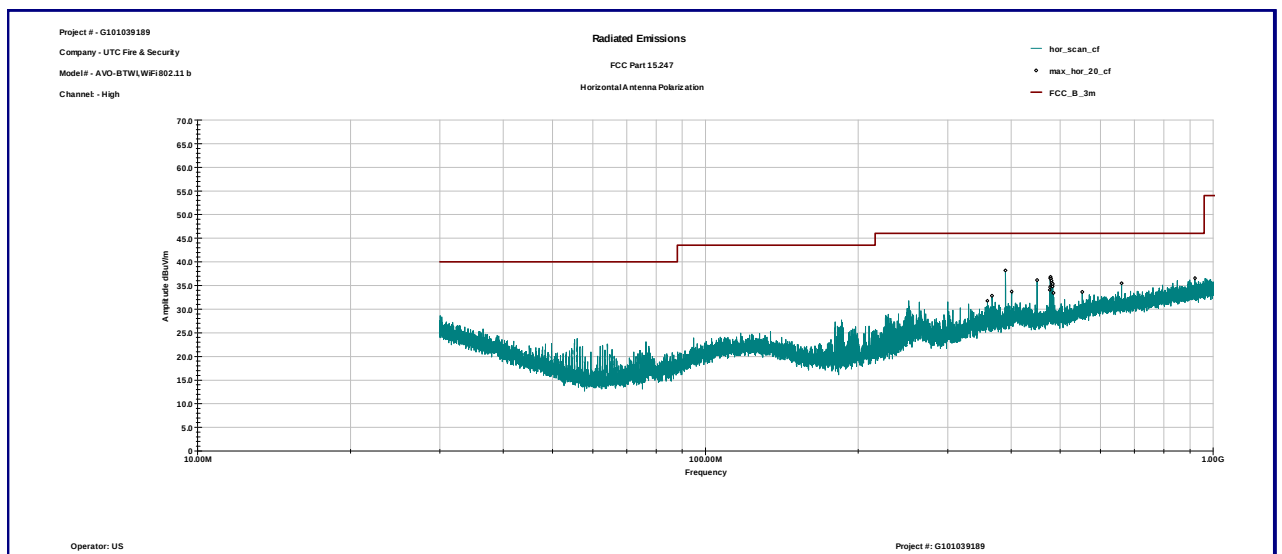
Graph 3.5.15



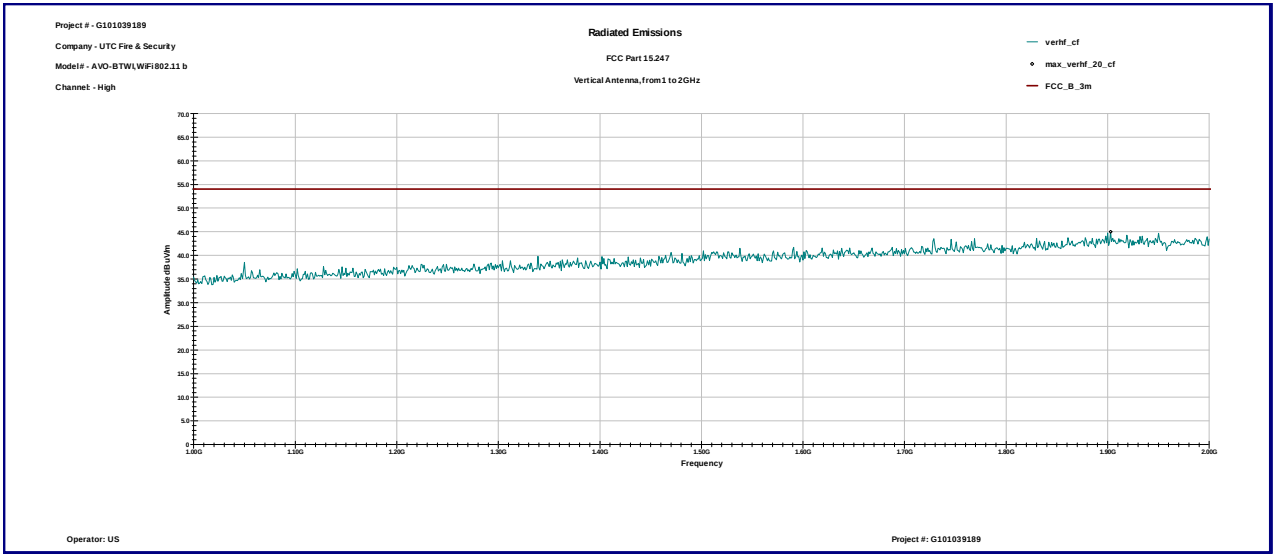
Graph 3.5.16



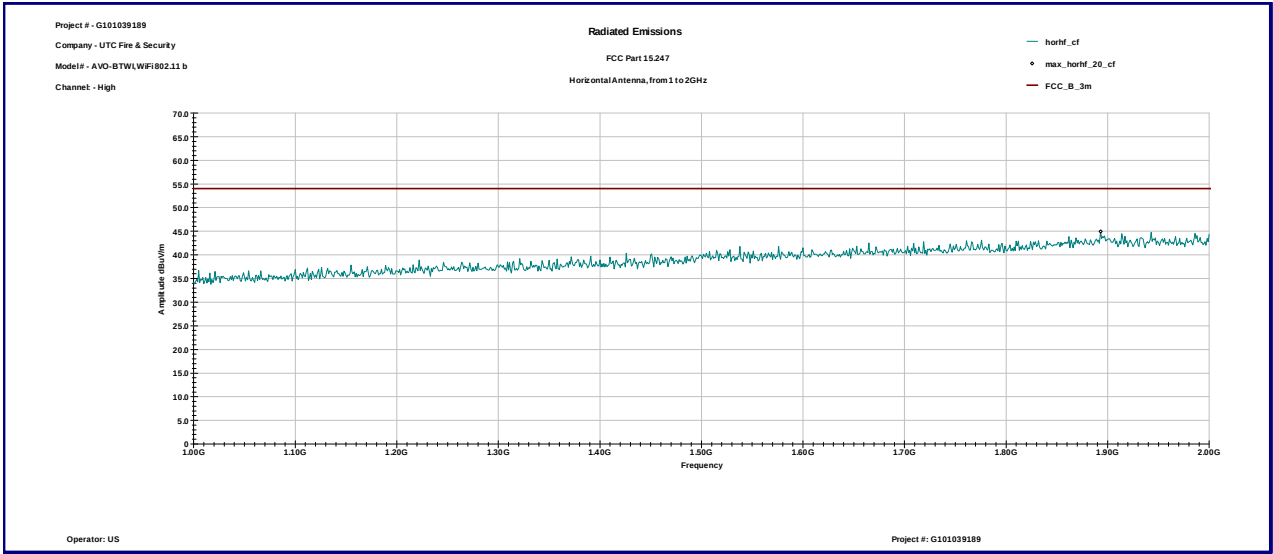
Graph 3.5.17



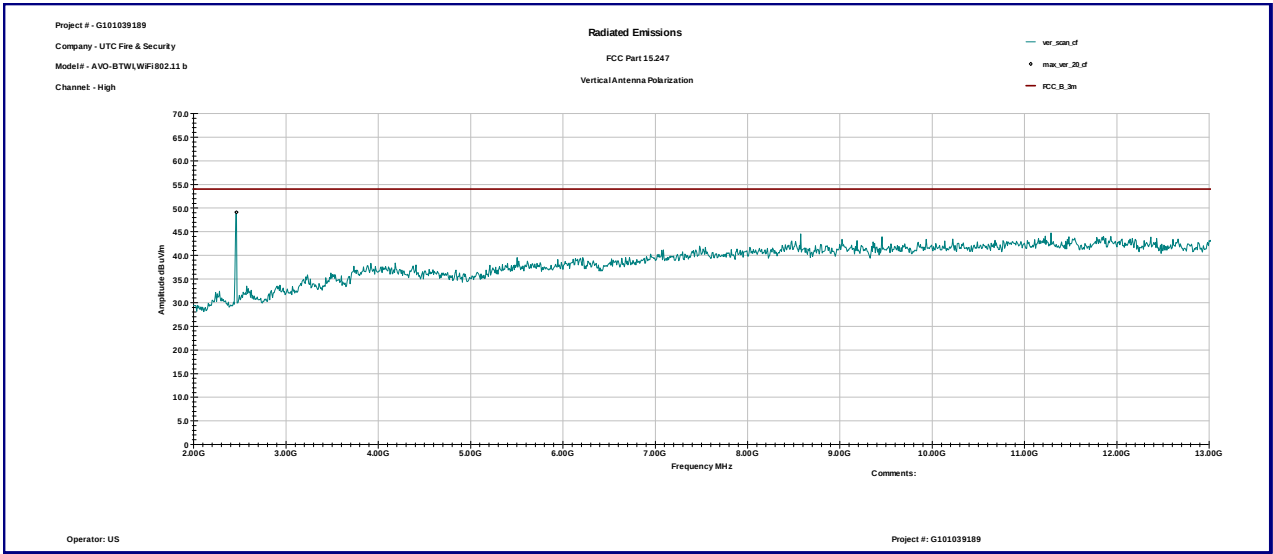
Graph 3.5.18



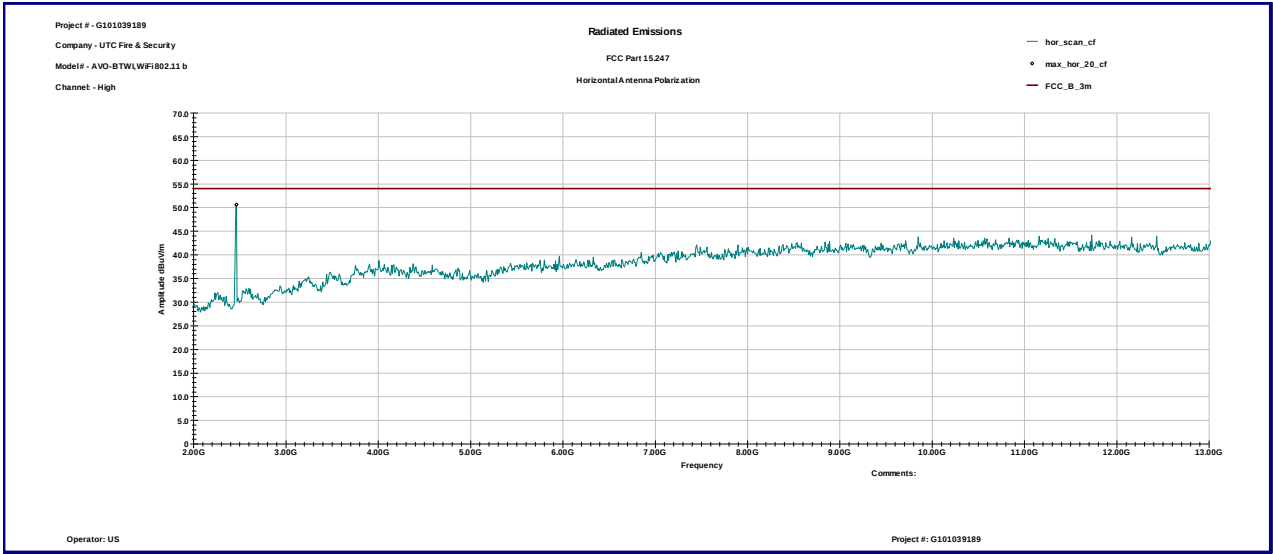
Graph 3.5.19



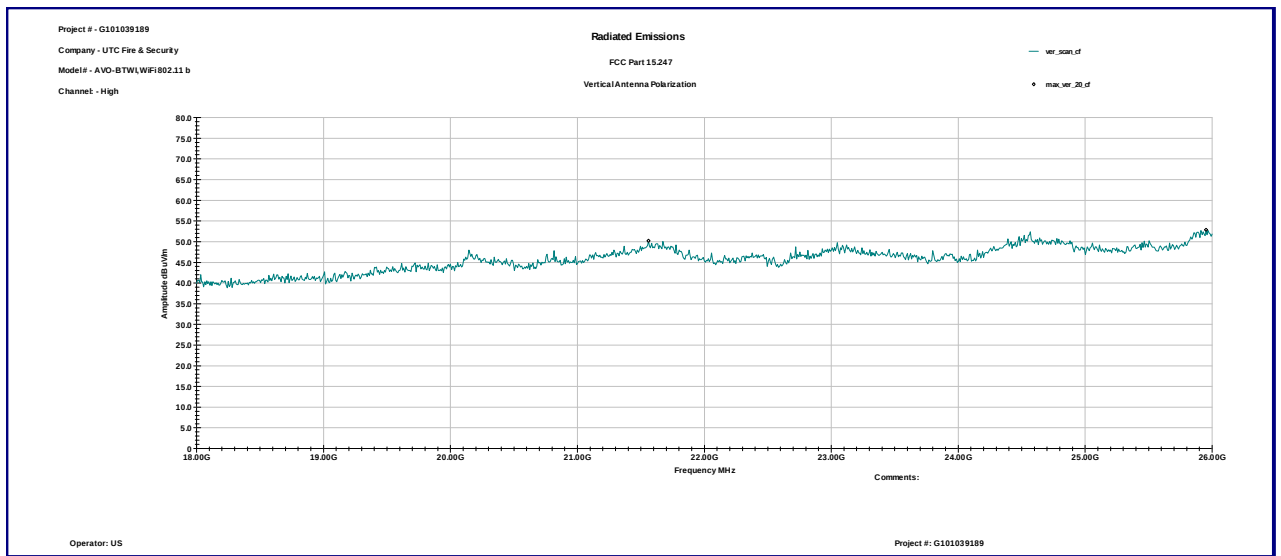
Graph 3.5.20



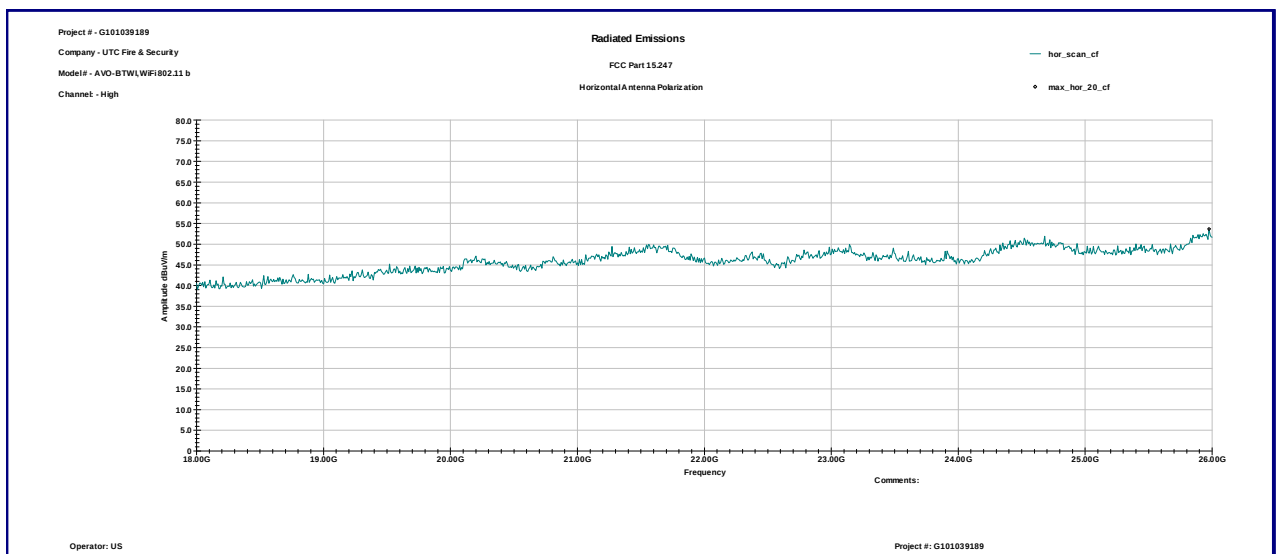
Graph 3.5.21



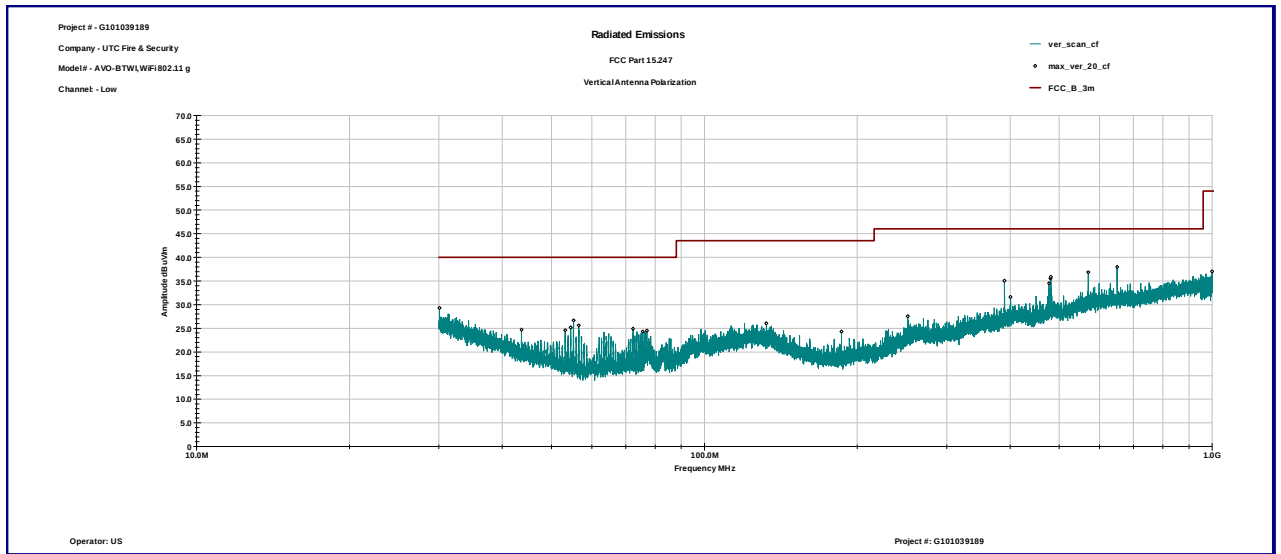
Graph 3.5.22



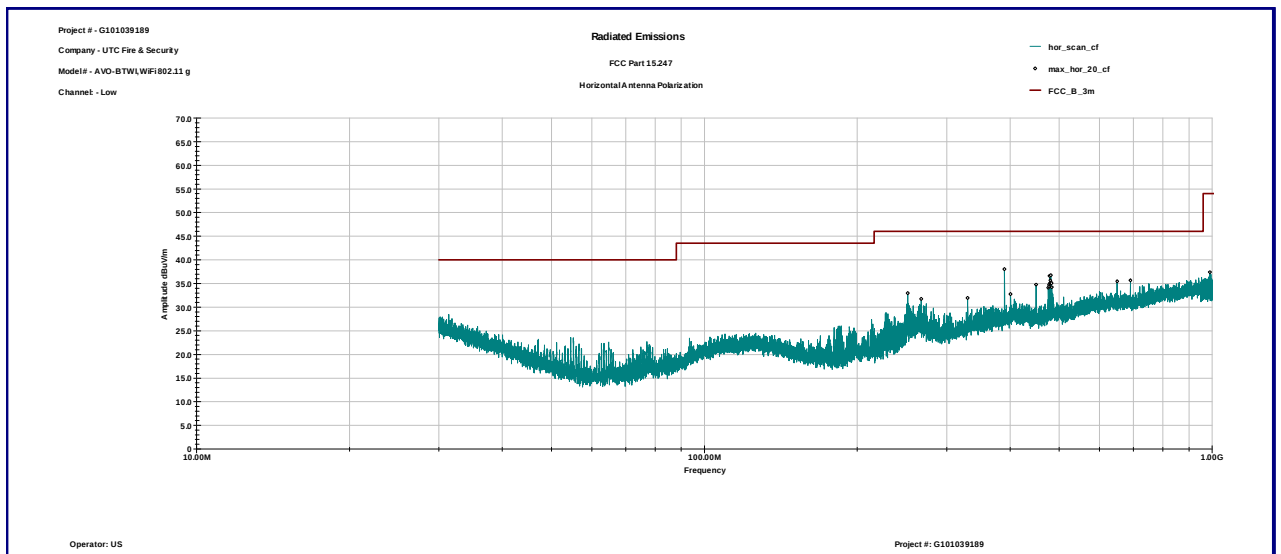
Graph 3.5.23



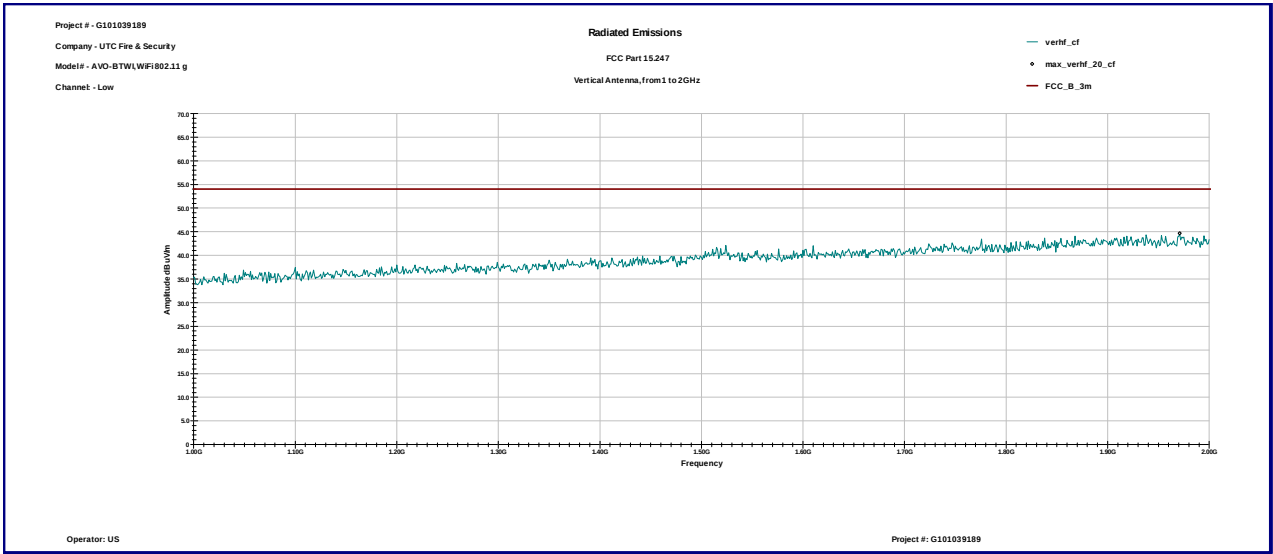
Graph 3.5.24



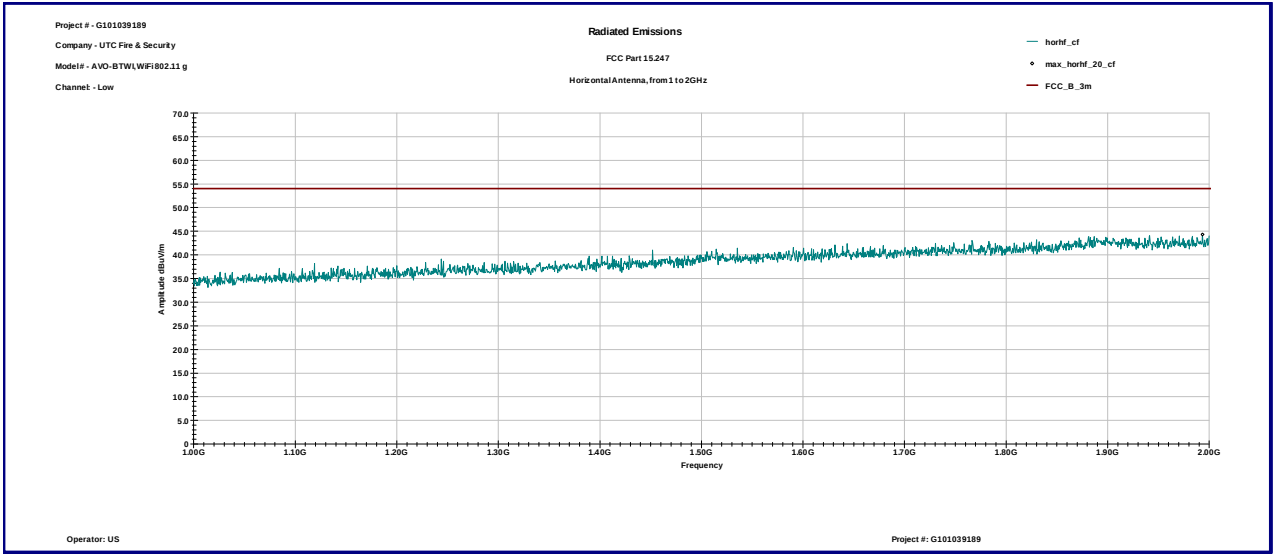
Graph 3.5.25



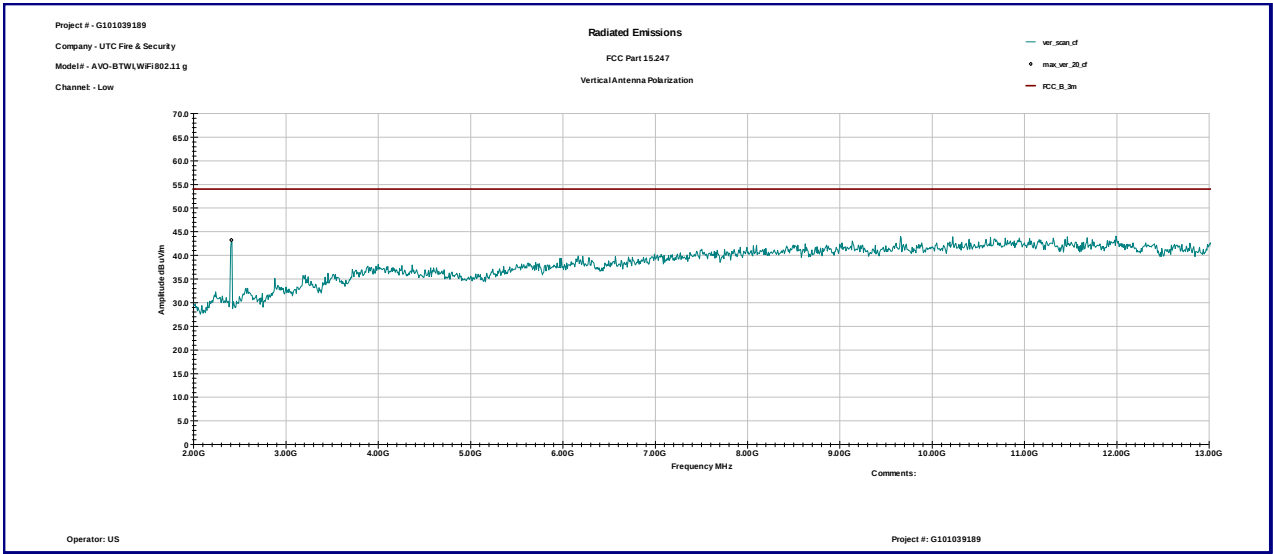
Graph 3.5.26



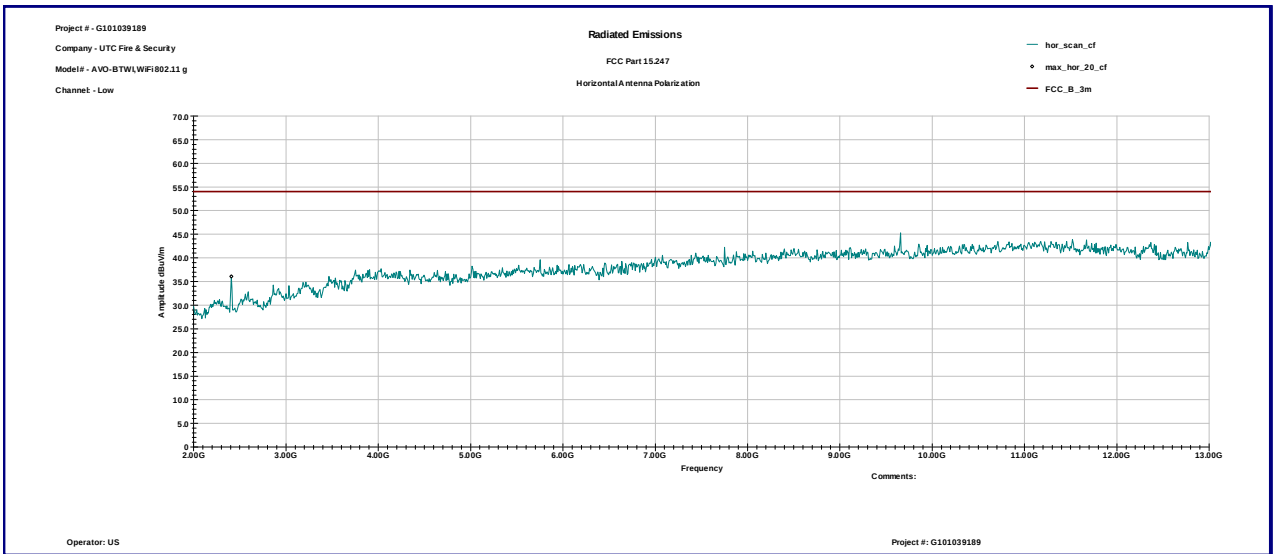
Graph 3.5.27



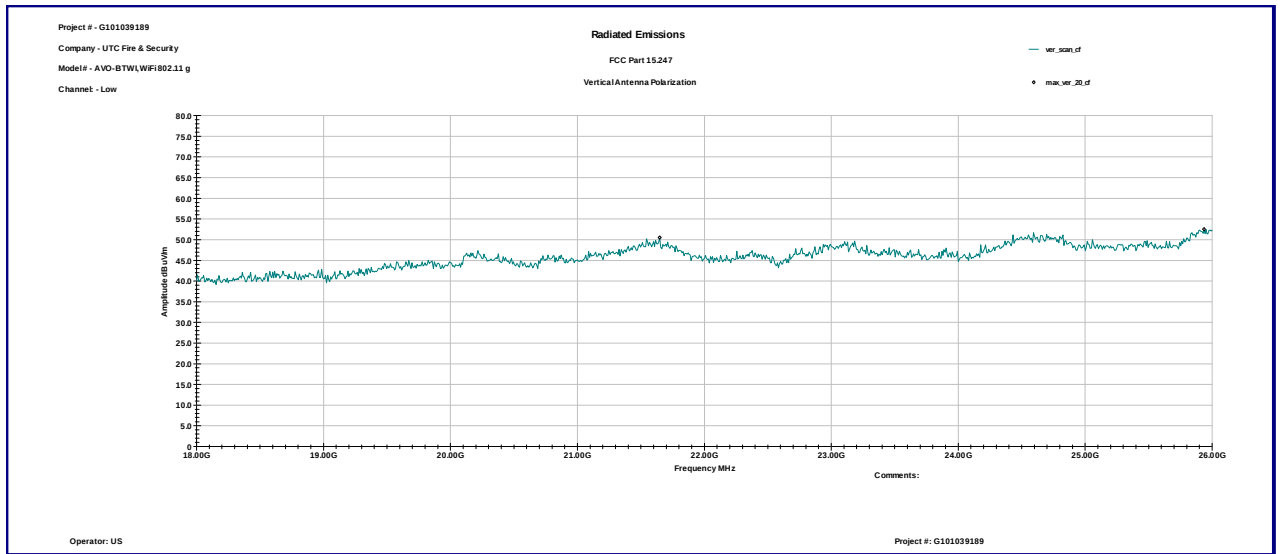
Graph 3.5.28



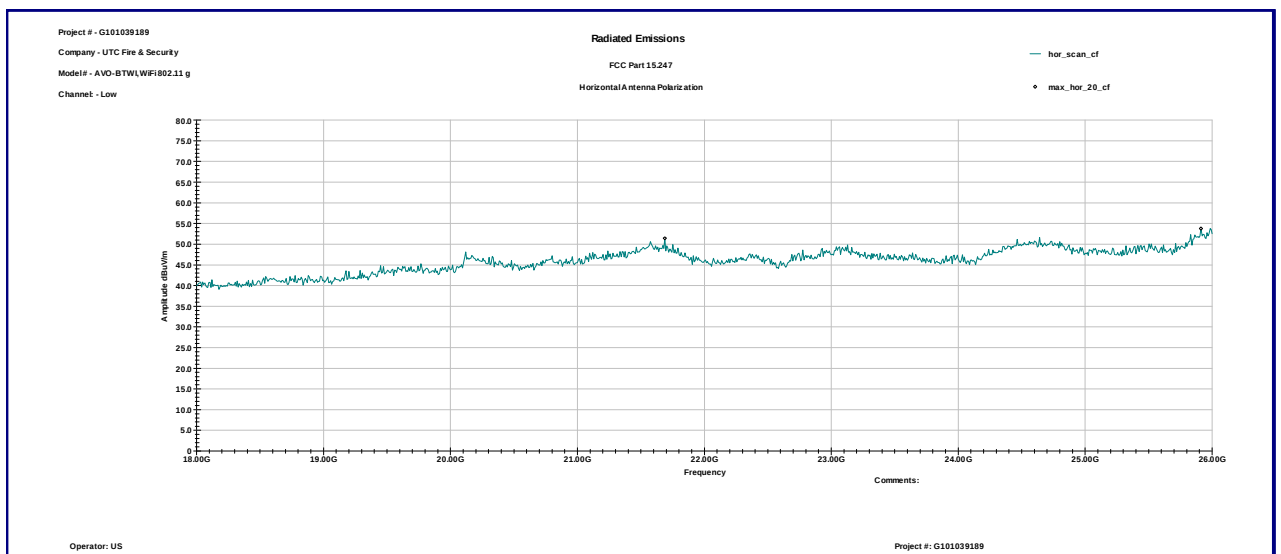
Graph 3.5.29



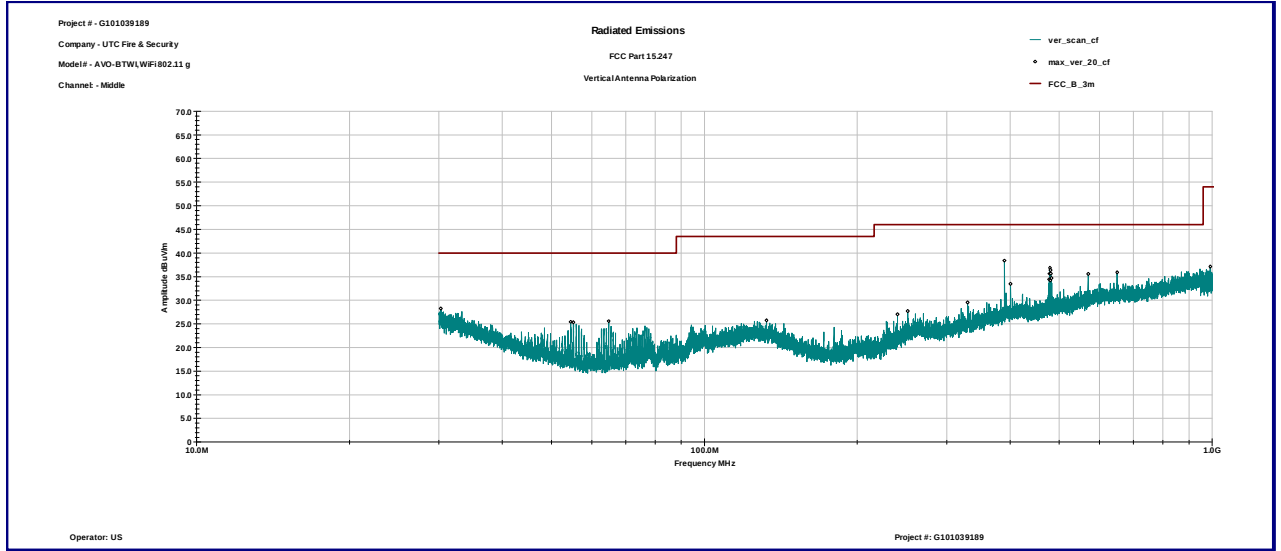
Graph 3.5.30



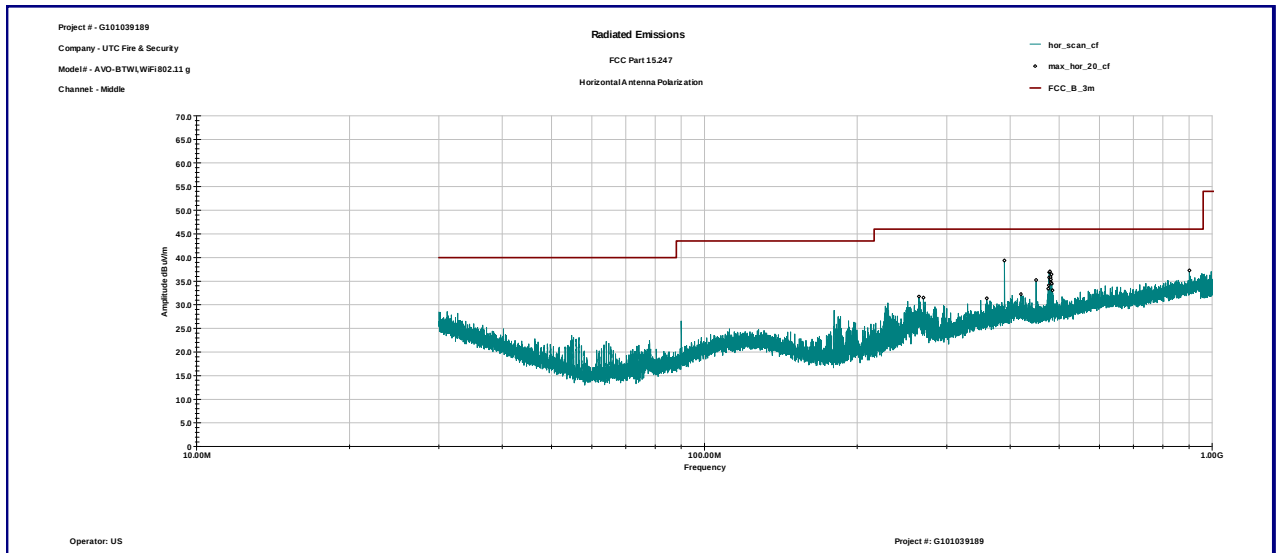
Graph 3.5.31



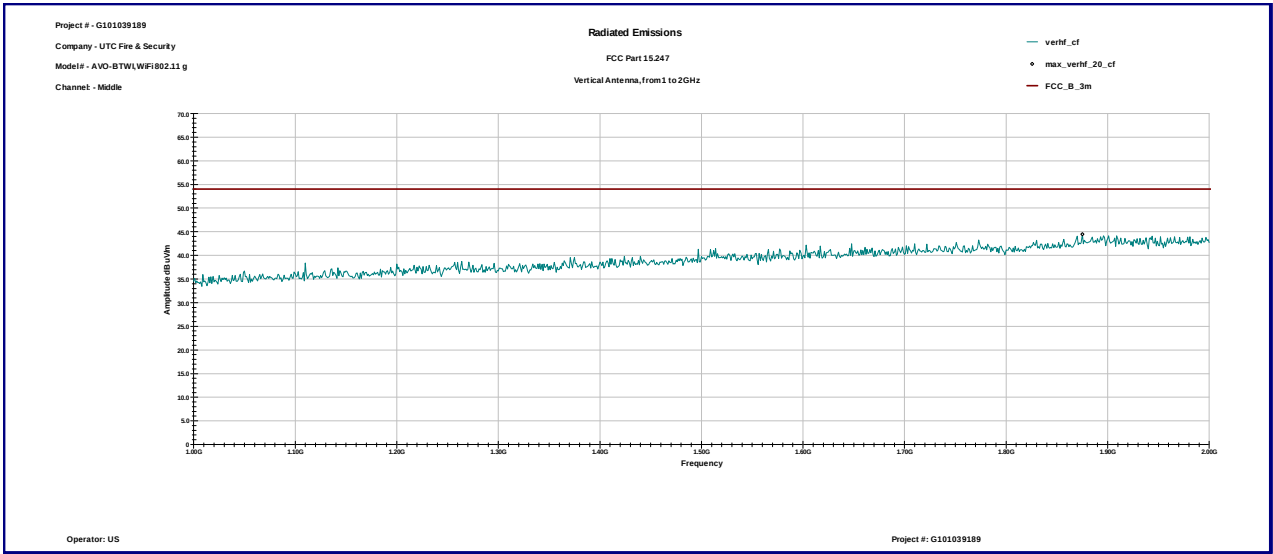
Graph 3.5.32



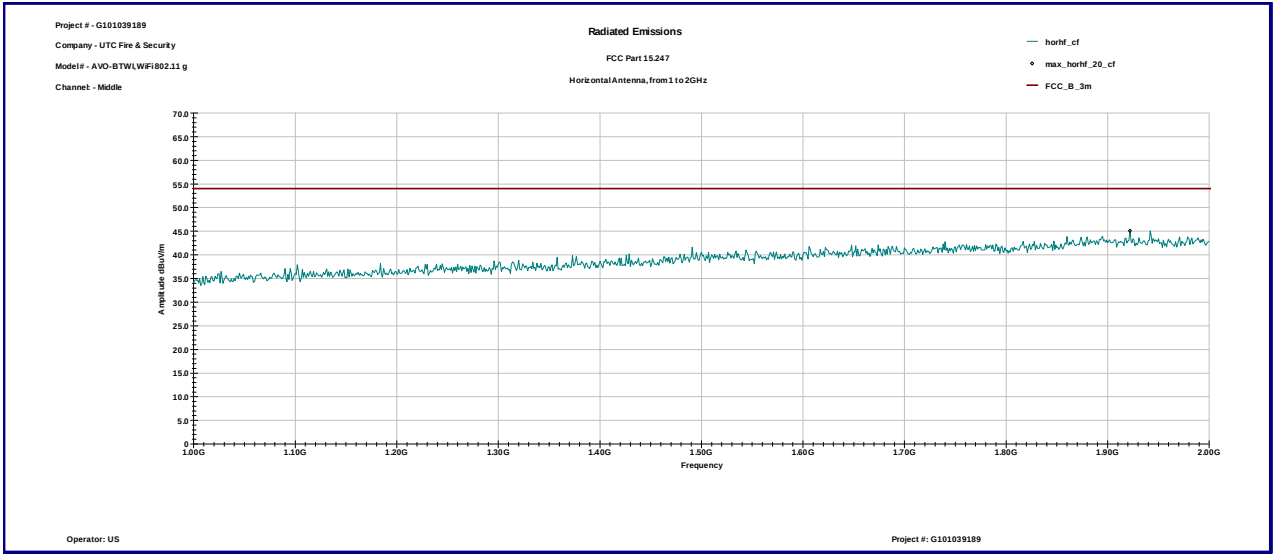
Graph 3.5.33



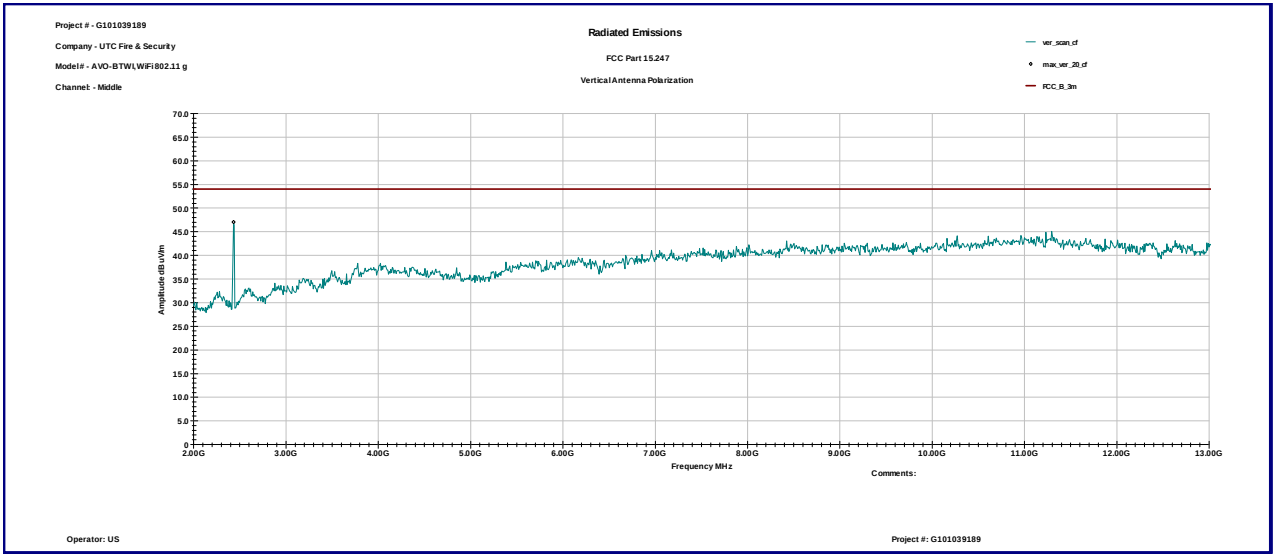
Graph 3.5.34



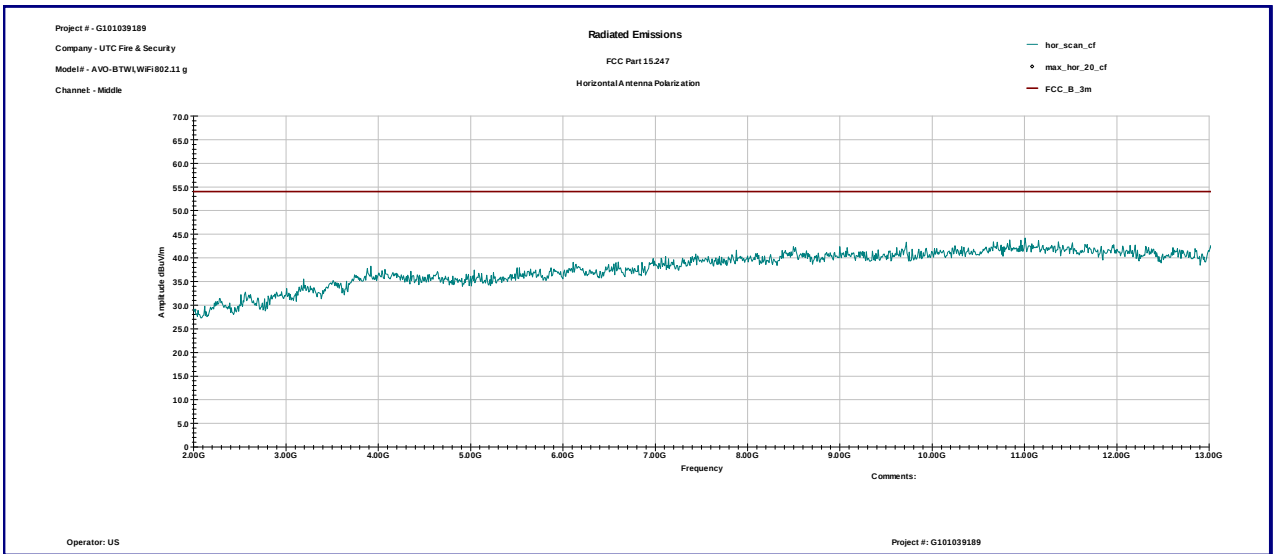
Graph 3.5.35



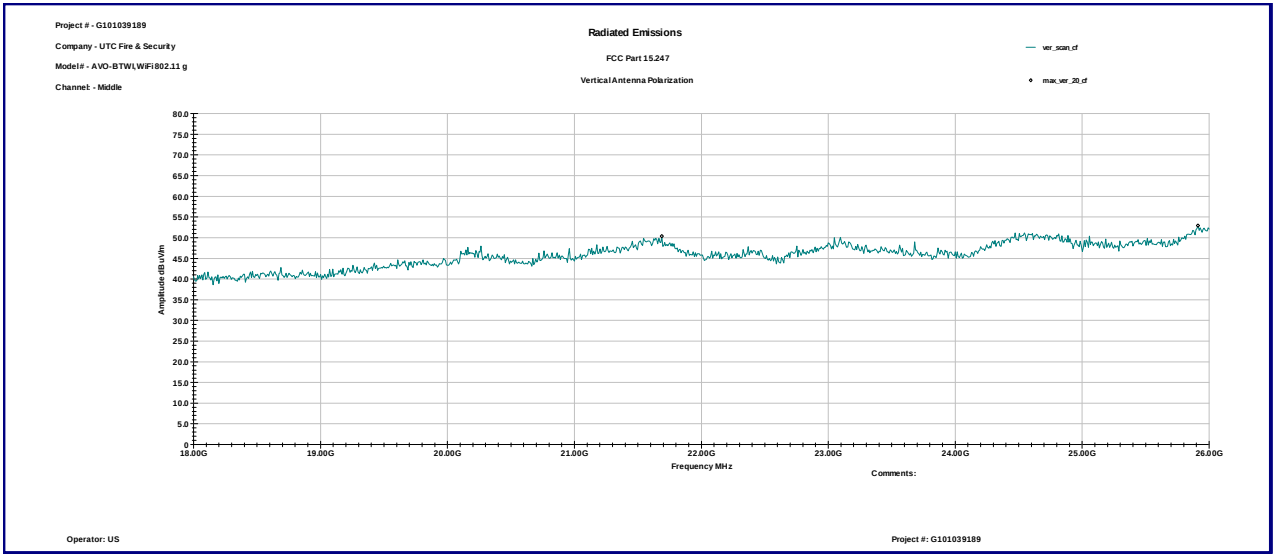
Graph 3.5.36



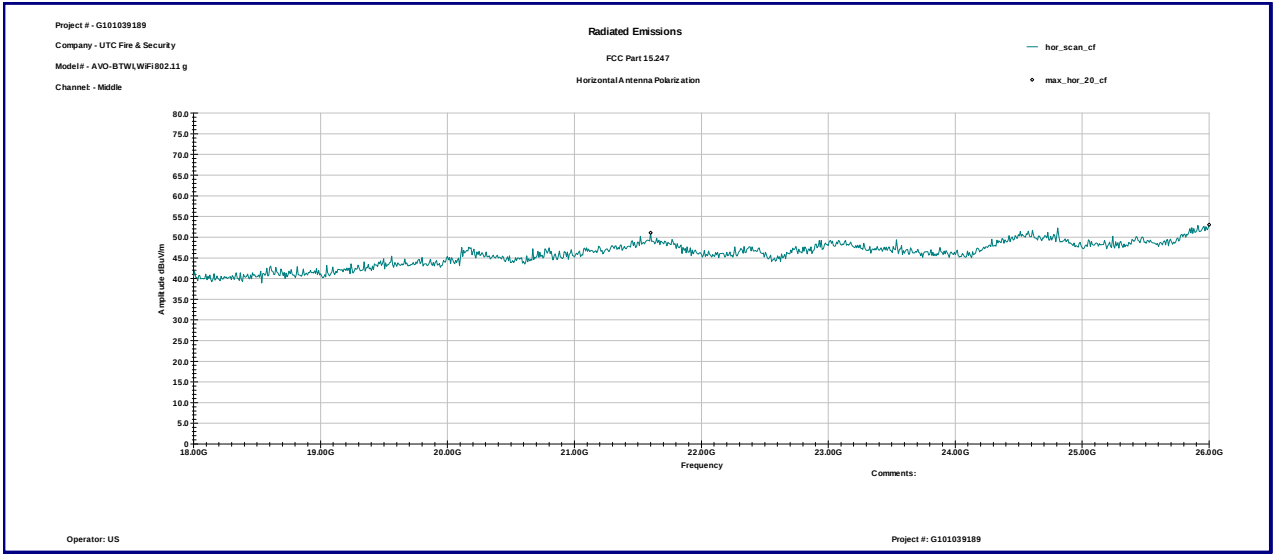
Graph 3.5.37



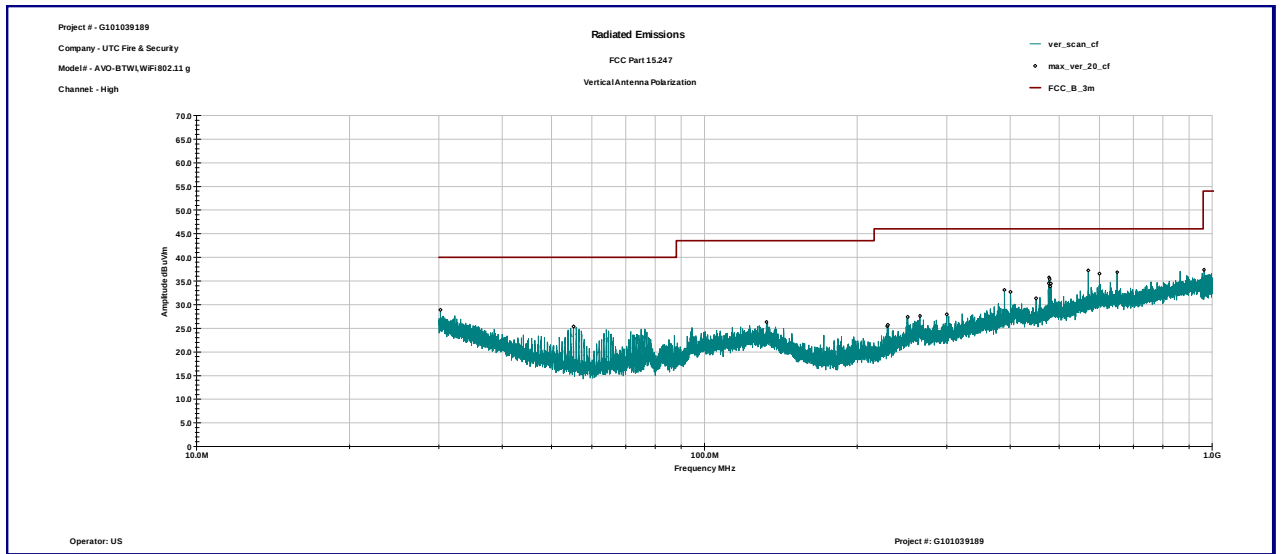
Graph 3.5.38



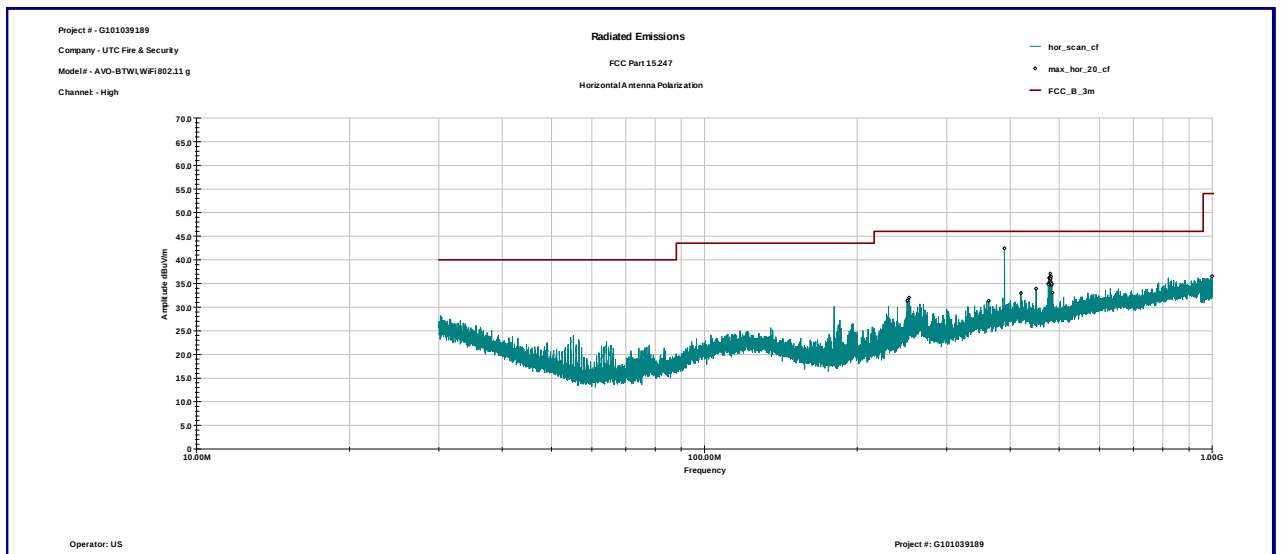
Graph 3.5.39



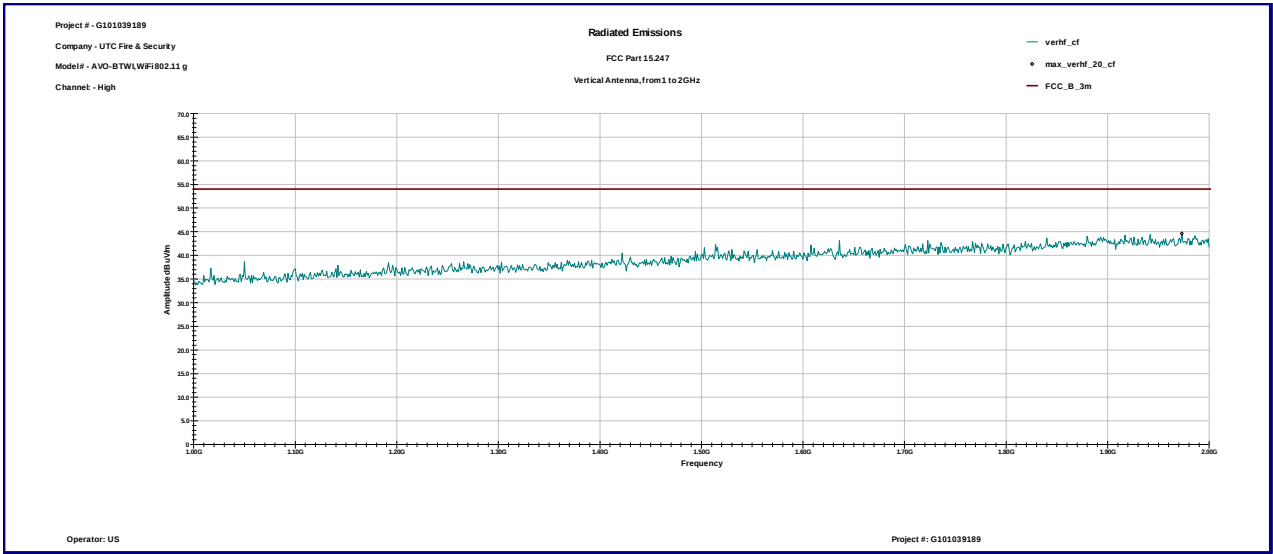
Graph 3.5.40



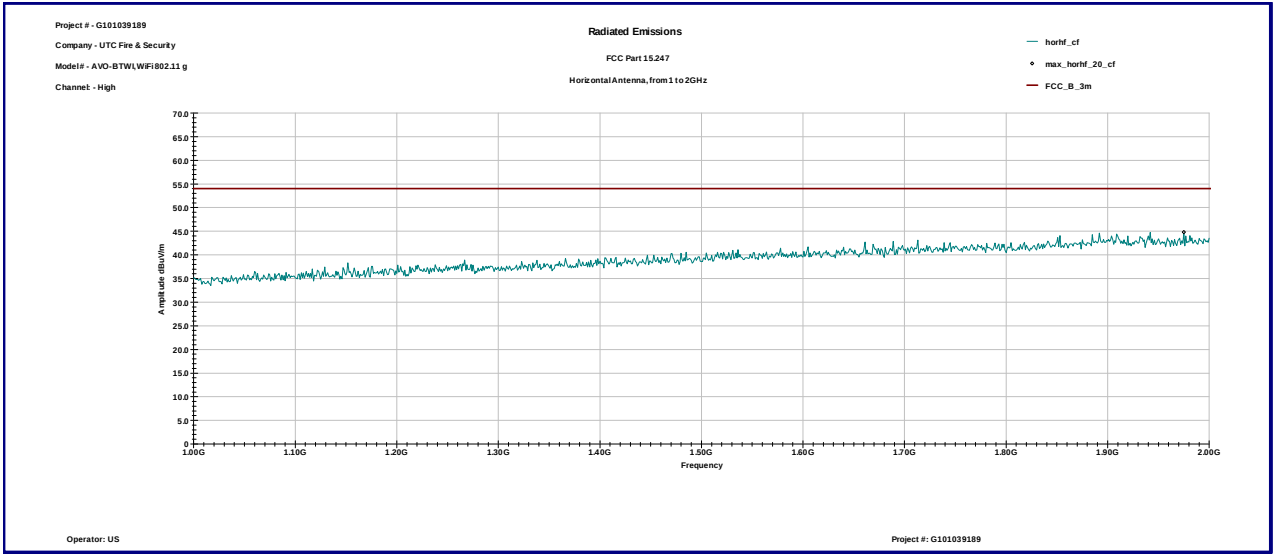
Graph 3.5.41



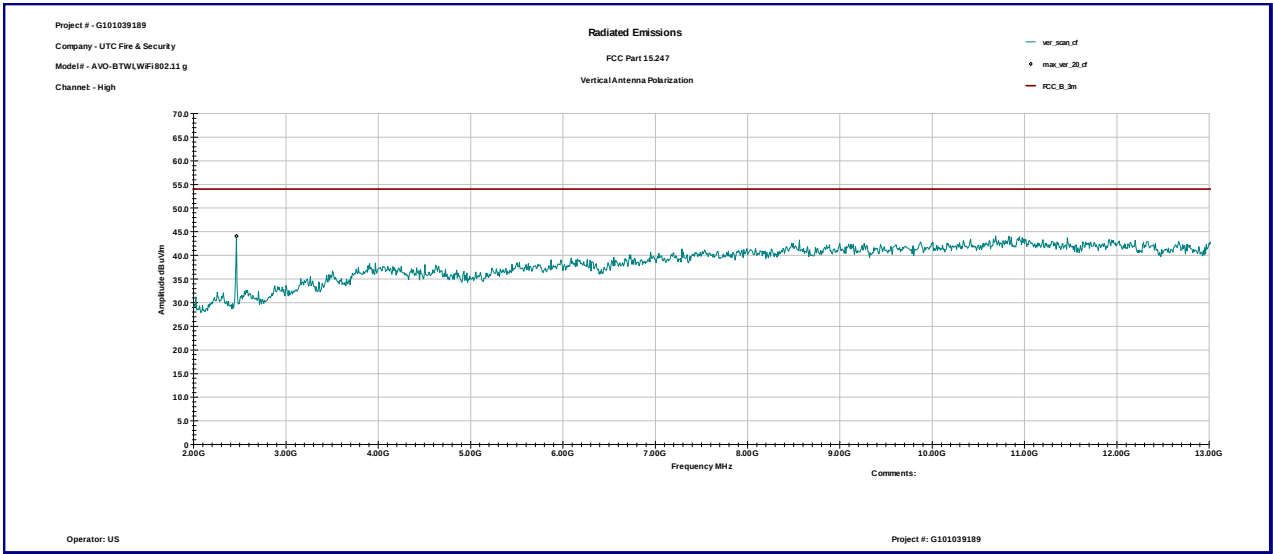
Graph 3.5.42



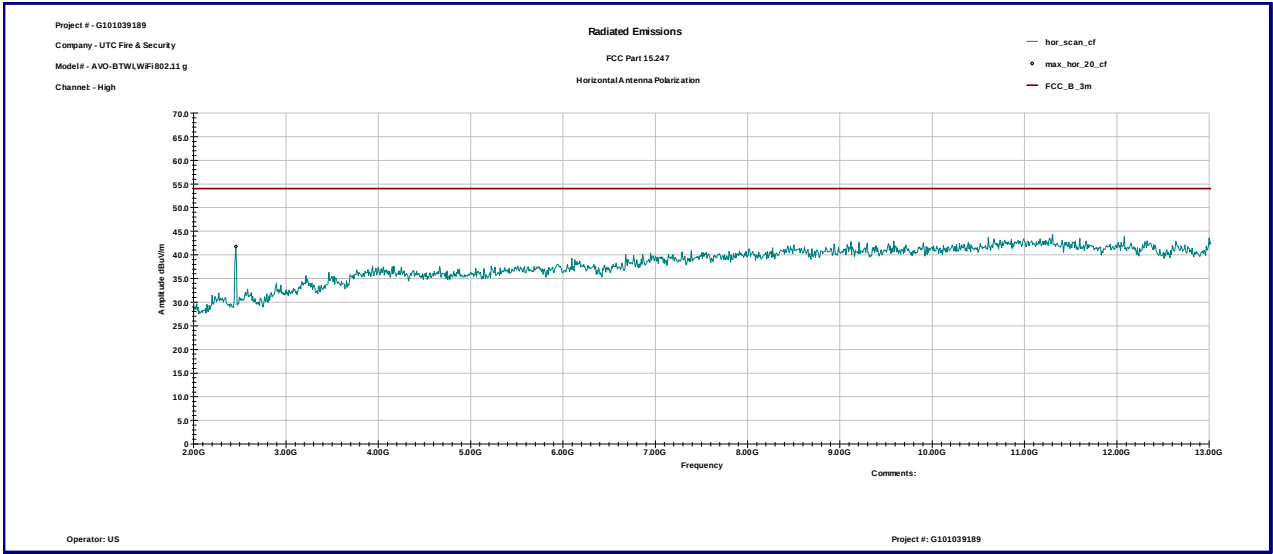
Graph 3.5.43



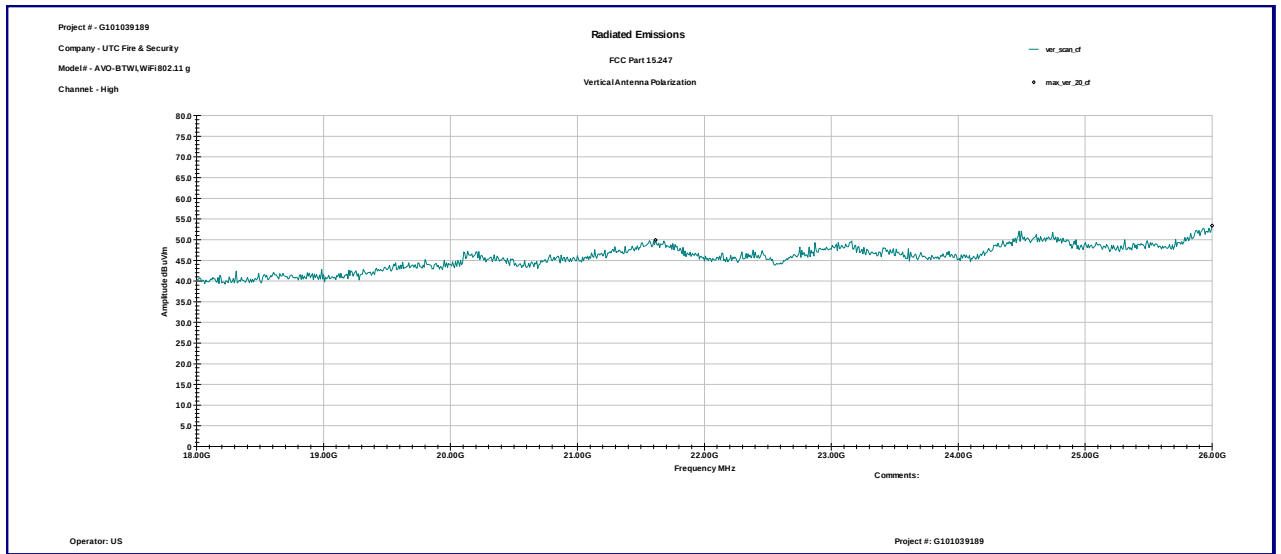
Graph 3.5.44



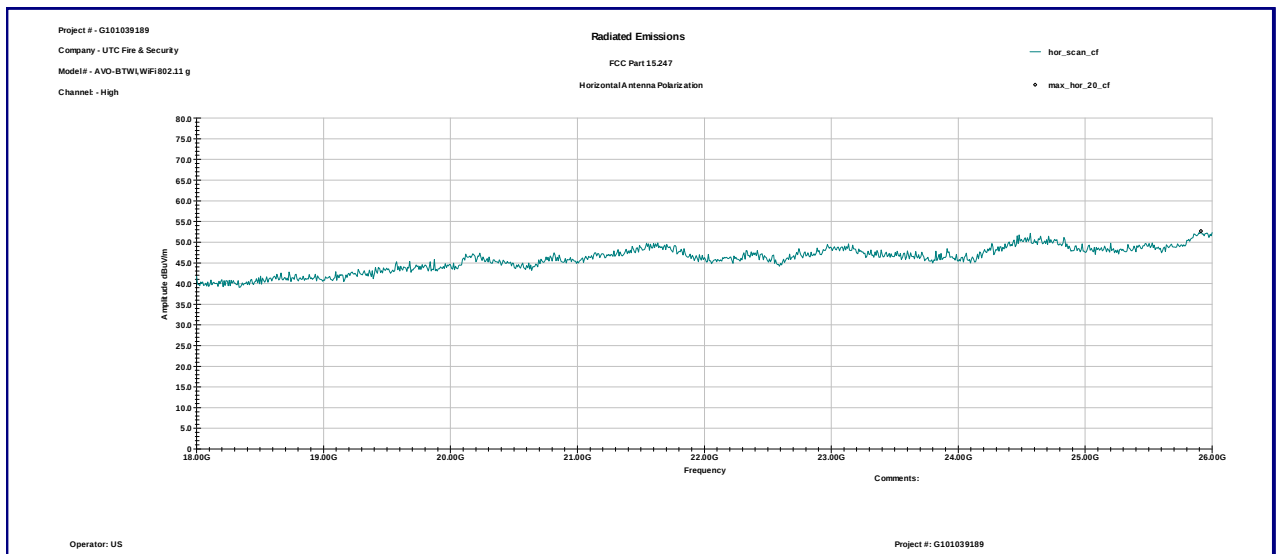
Graph 3.5.45



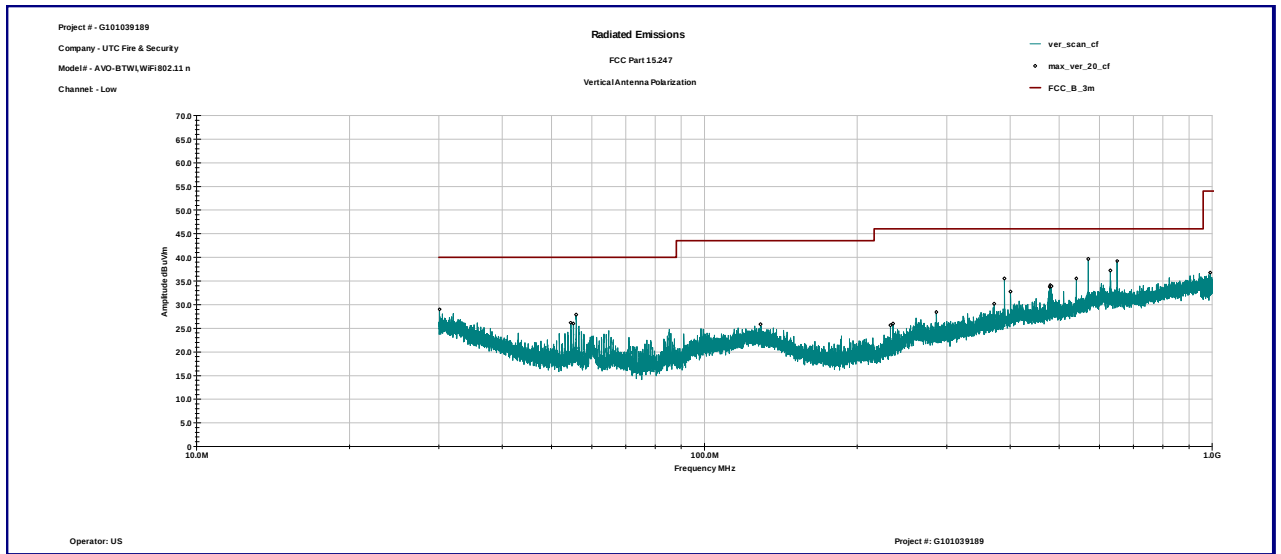
Graph 3.5.46



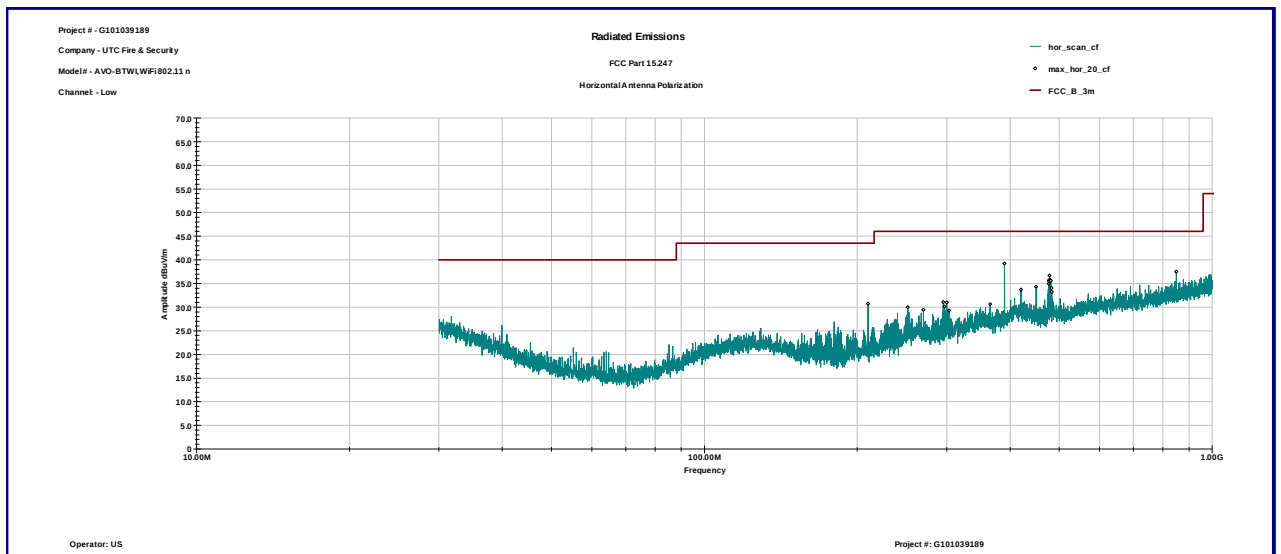
Graph 3.5.47



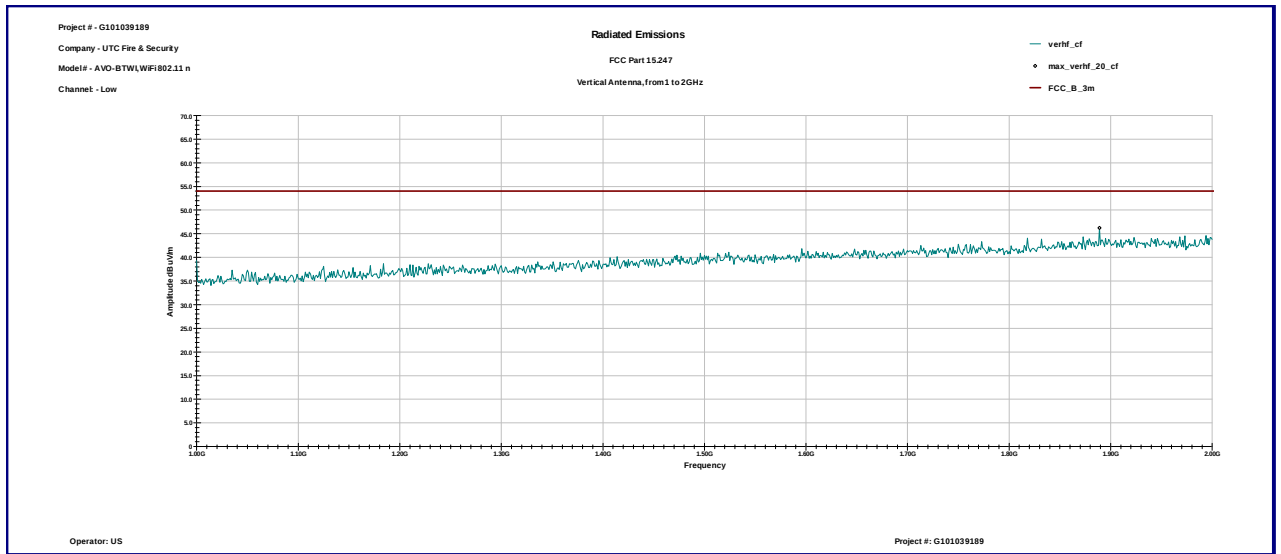
Graph 3.5.48



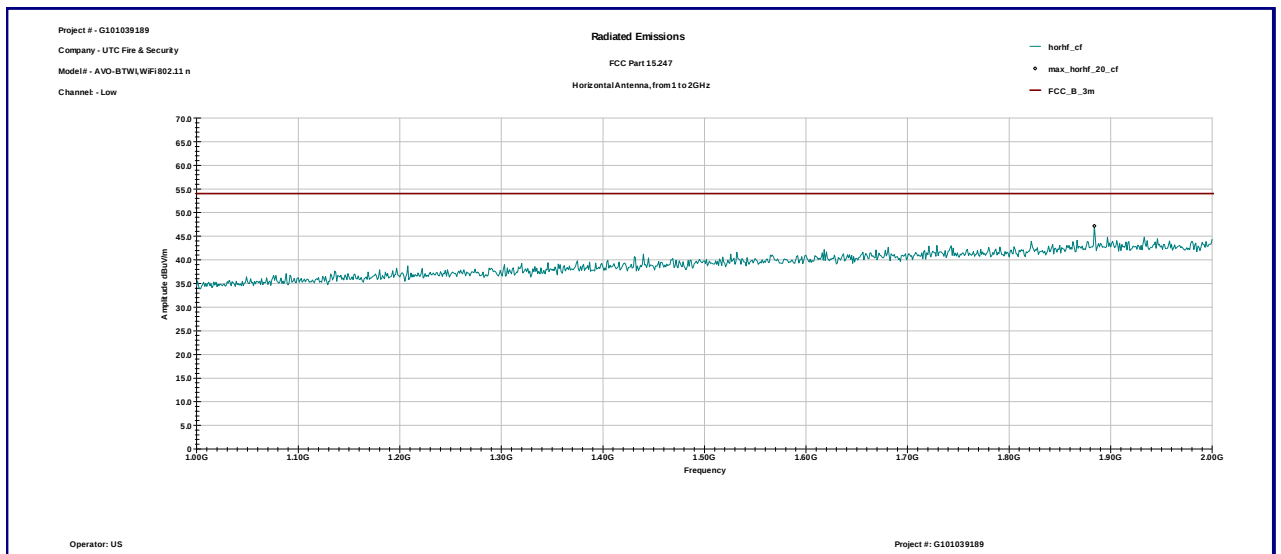
Graph 3.5.49



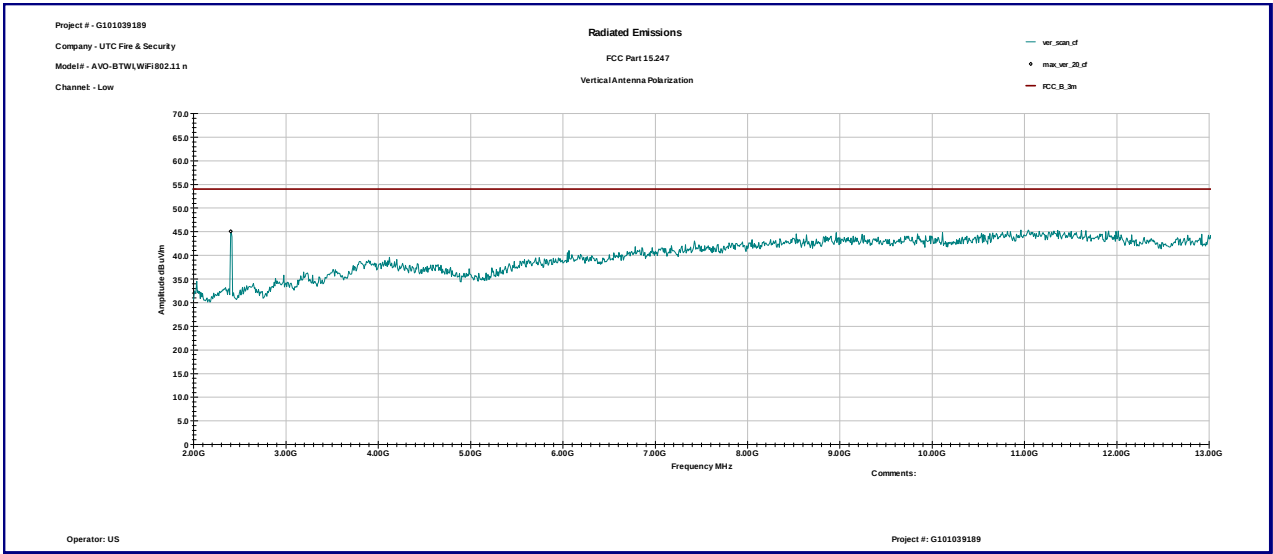
Graph 3.5.50



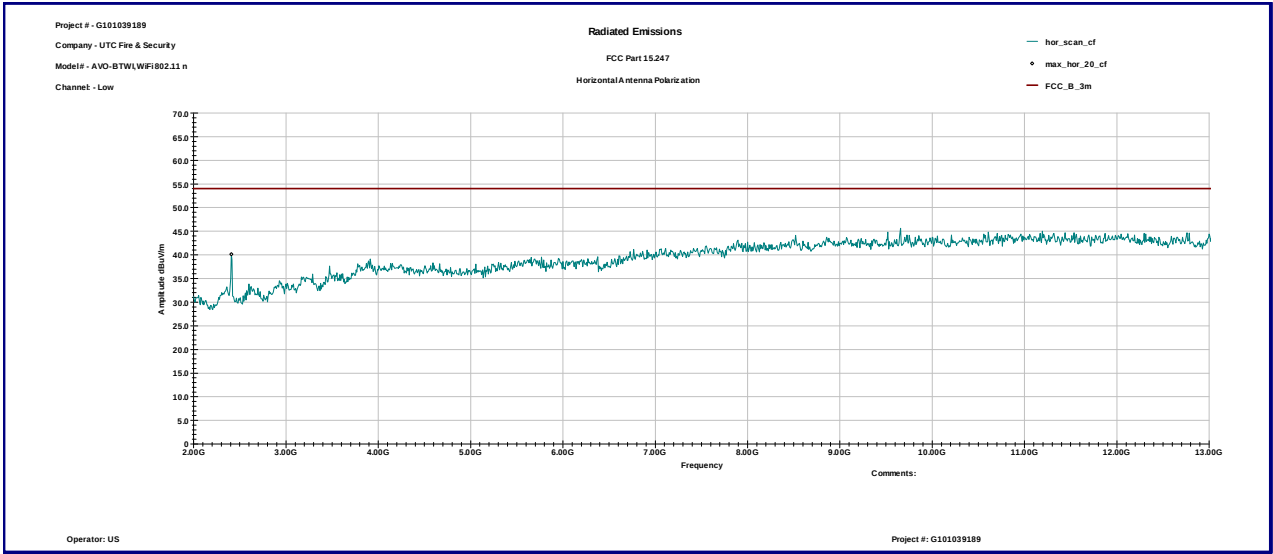
Graph 3.5.51



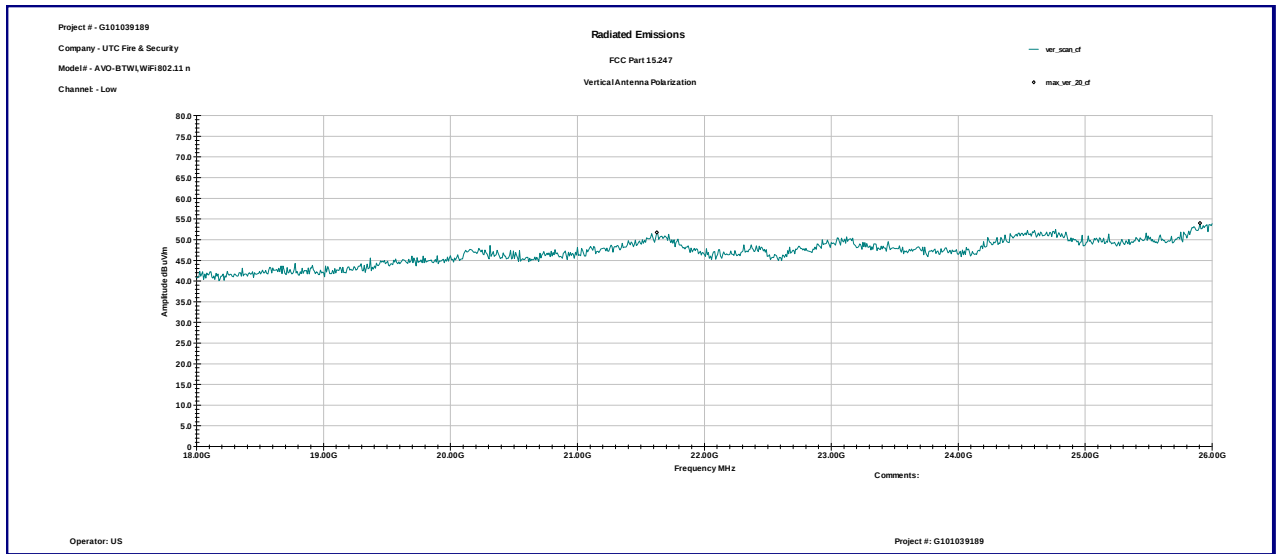
Graph 3.5.52



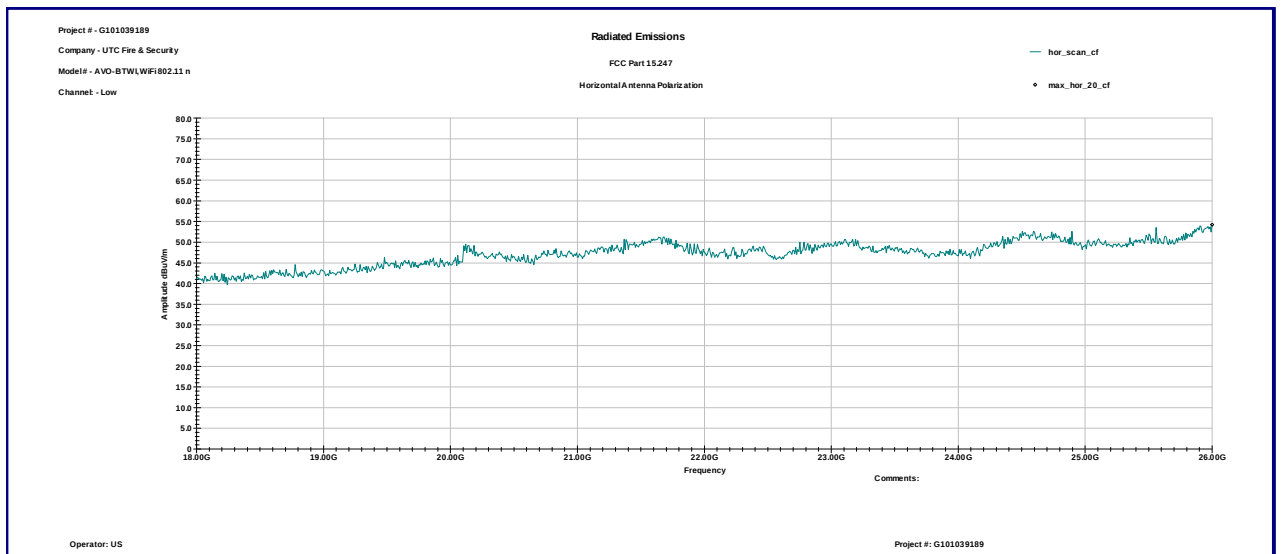
Graph 3.5.53



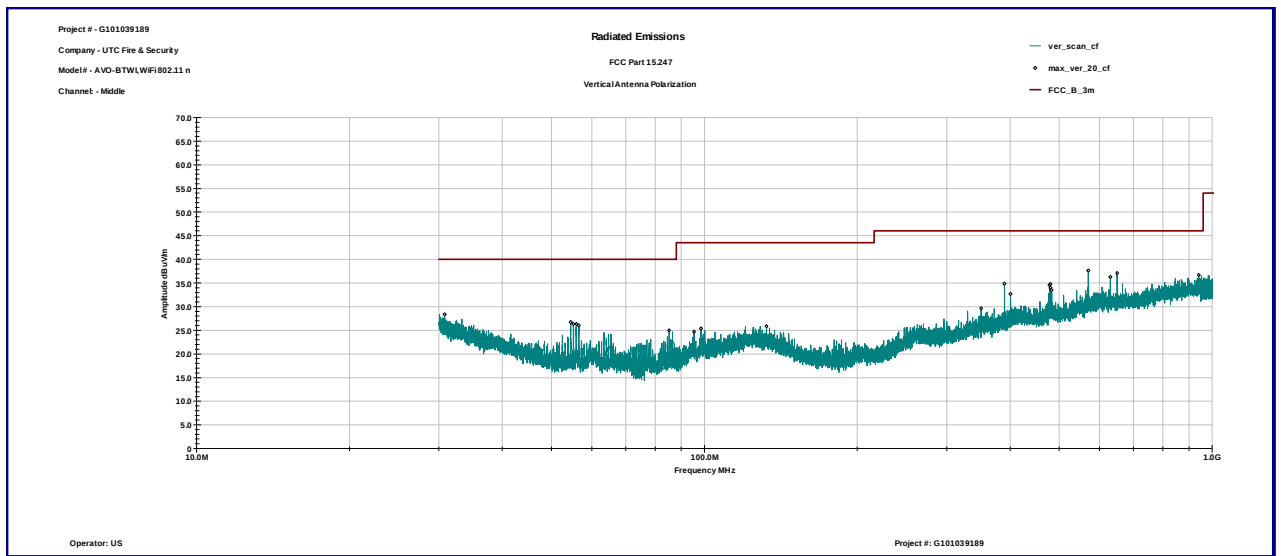
Graph 3.5.54



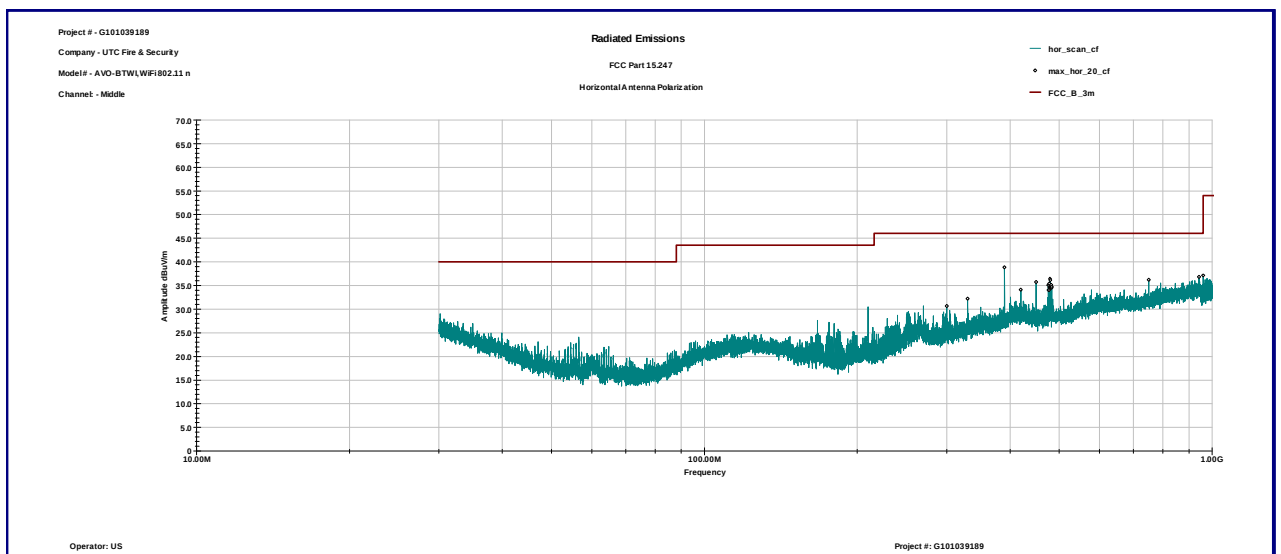
Graph 3.5.55



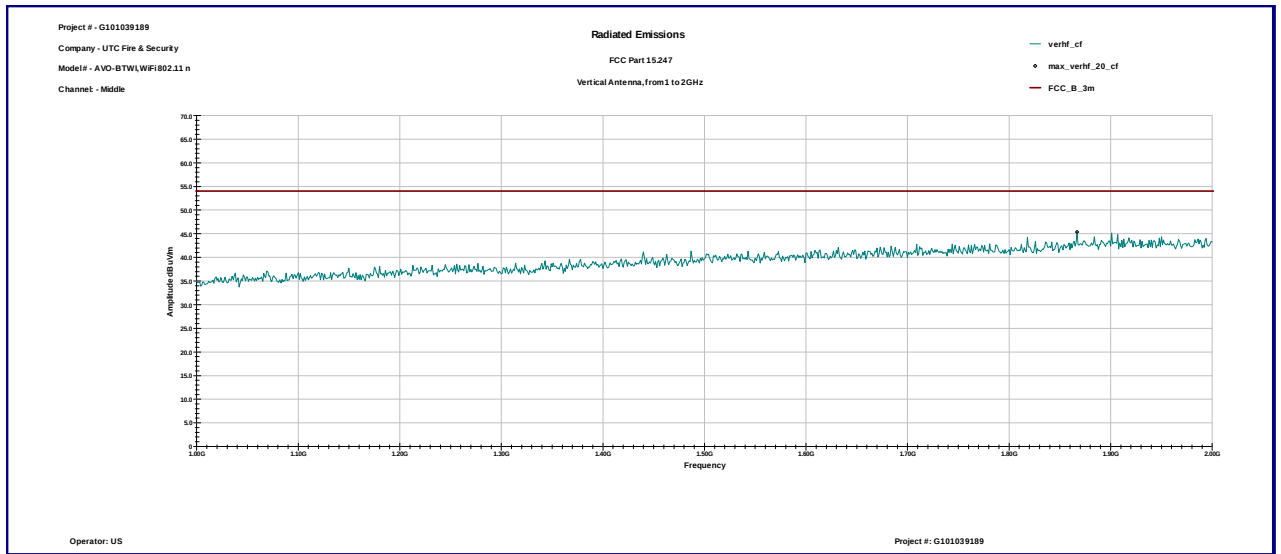
Graph 3.5.56



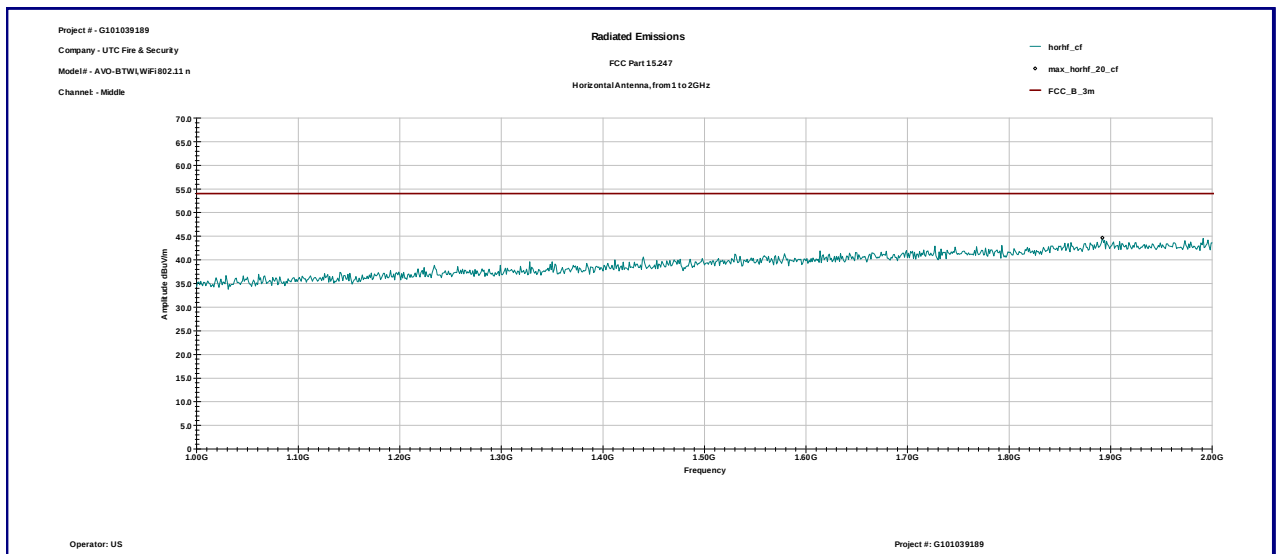
Graph 3.5.57



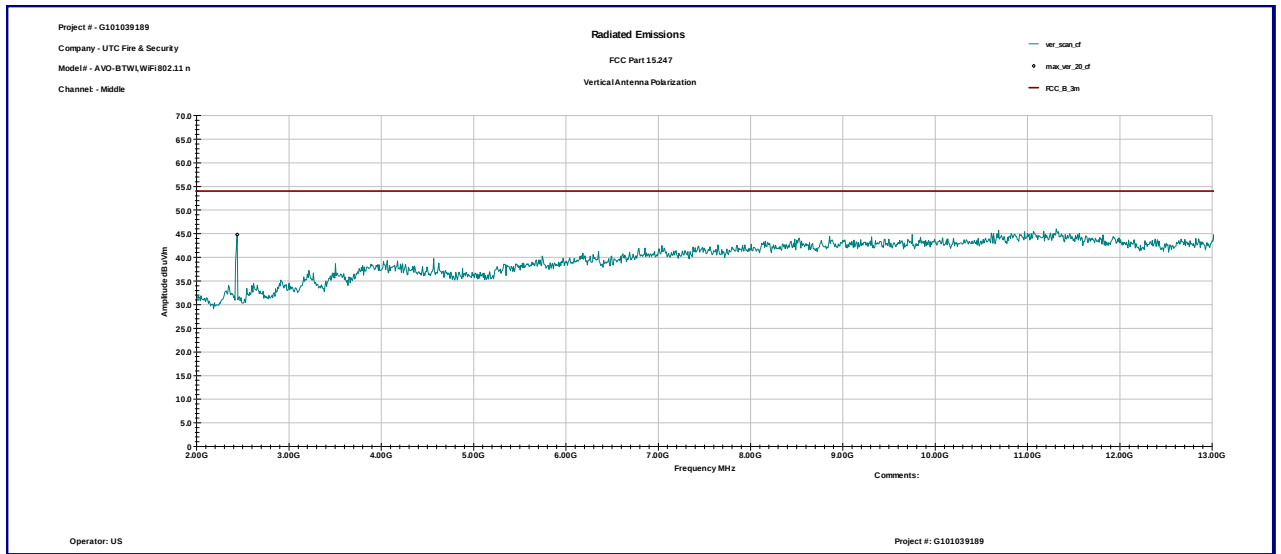
Graph 3.5.58



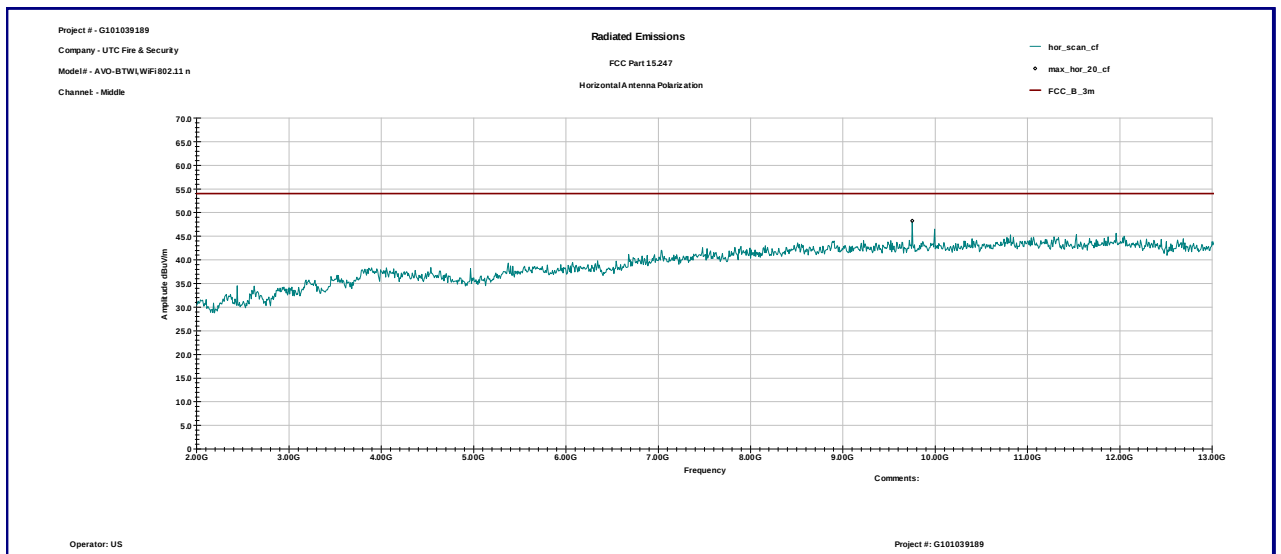
Graph 3.5.59



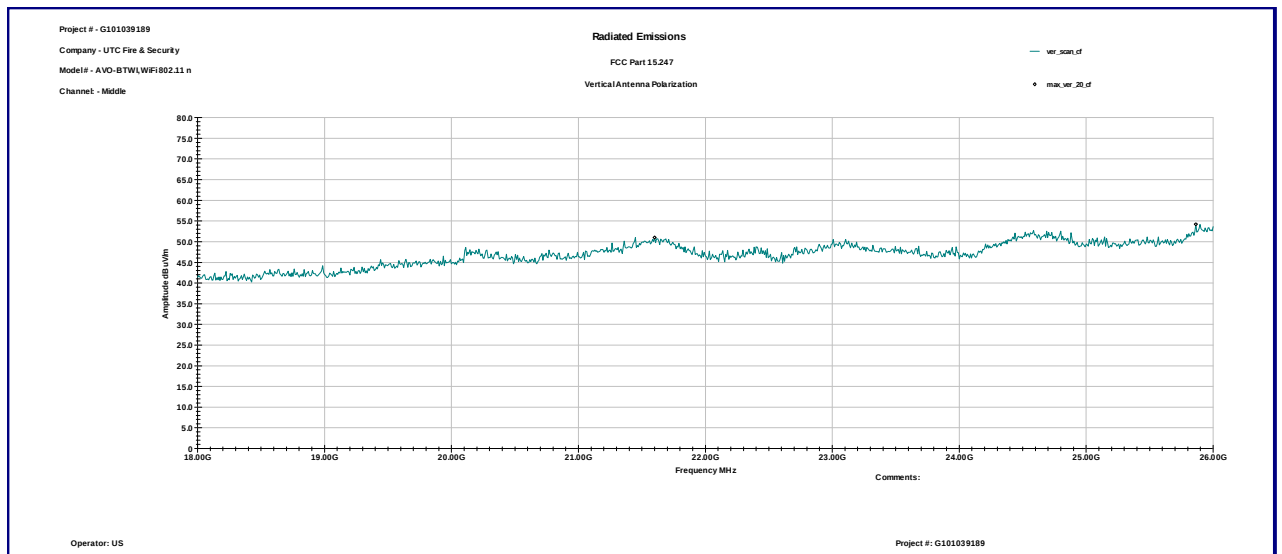
Graph 3.5.60



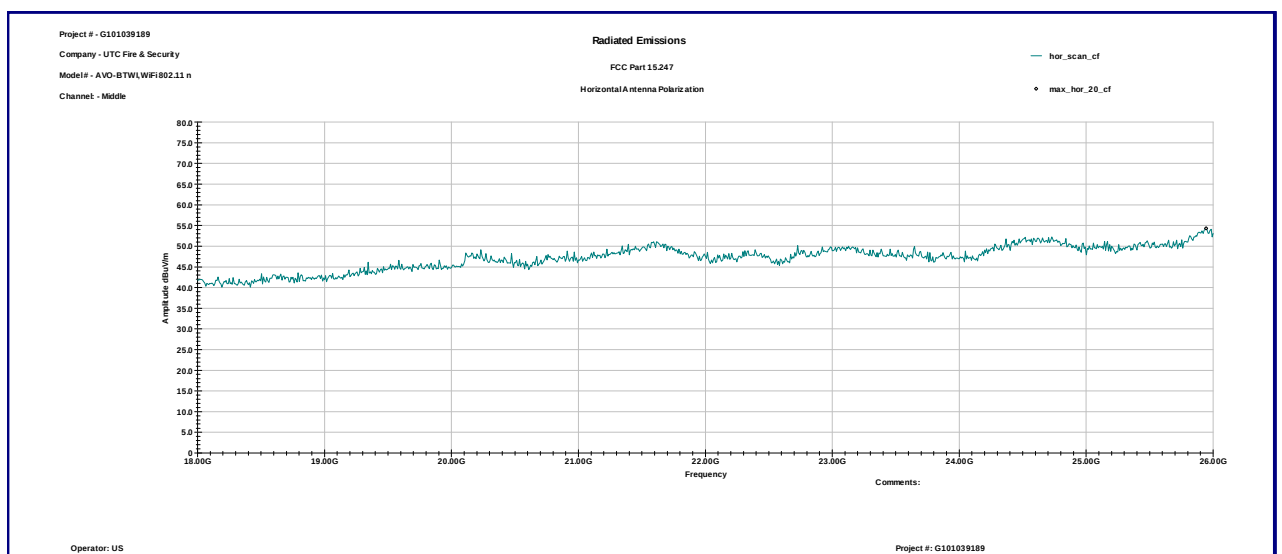
Graph 3.5.61



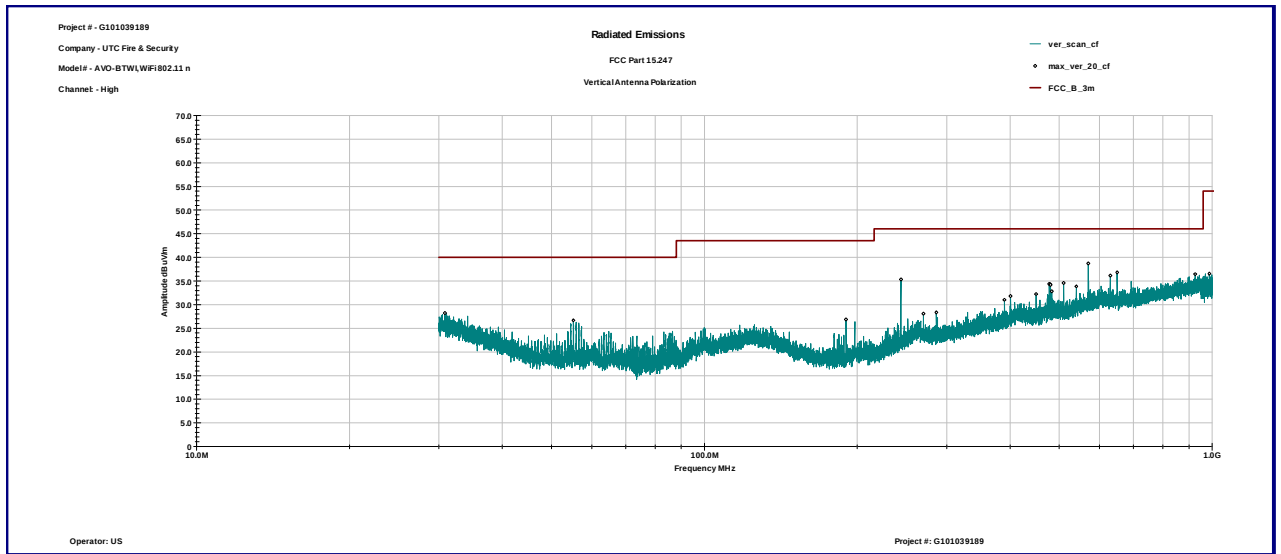
Graph 3.5.62



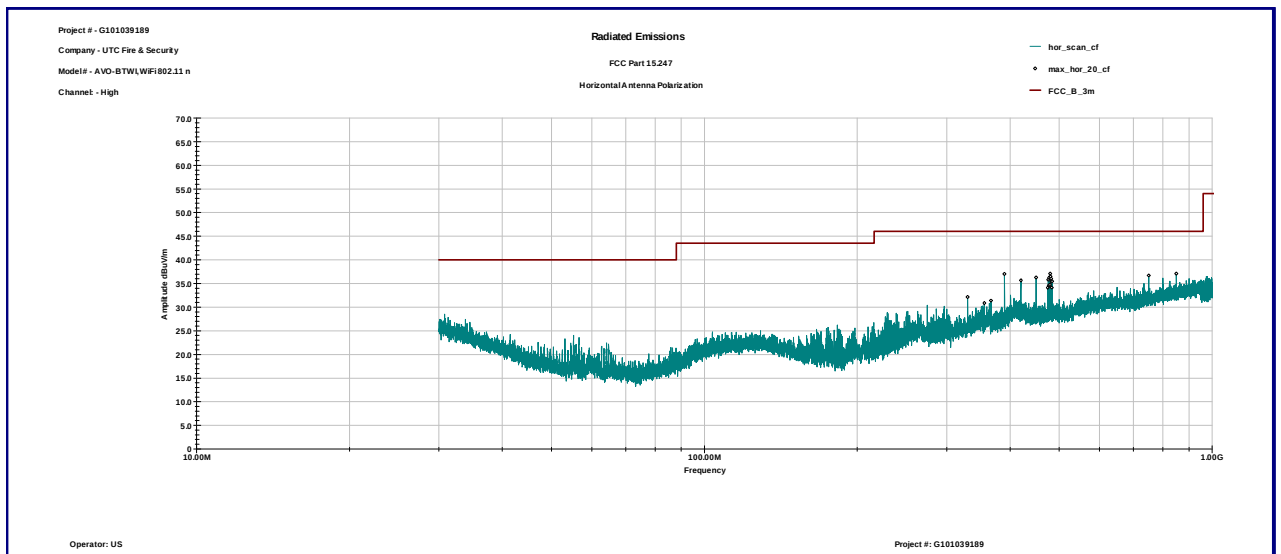
Graph 3.5.63



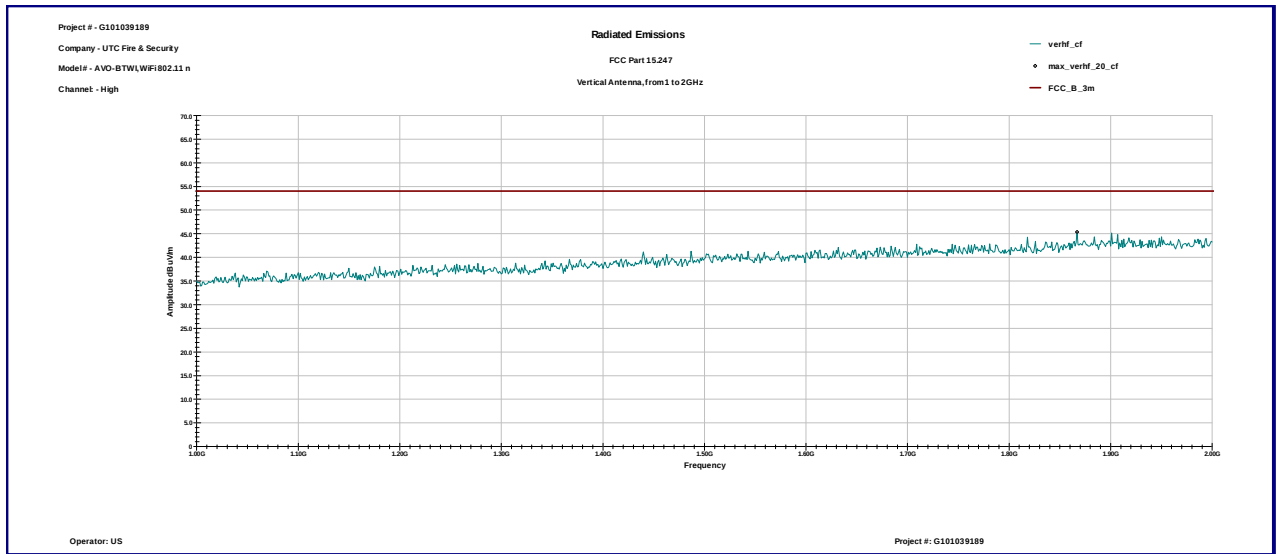
Graph 3.5.64



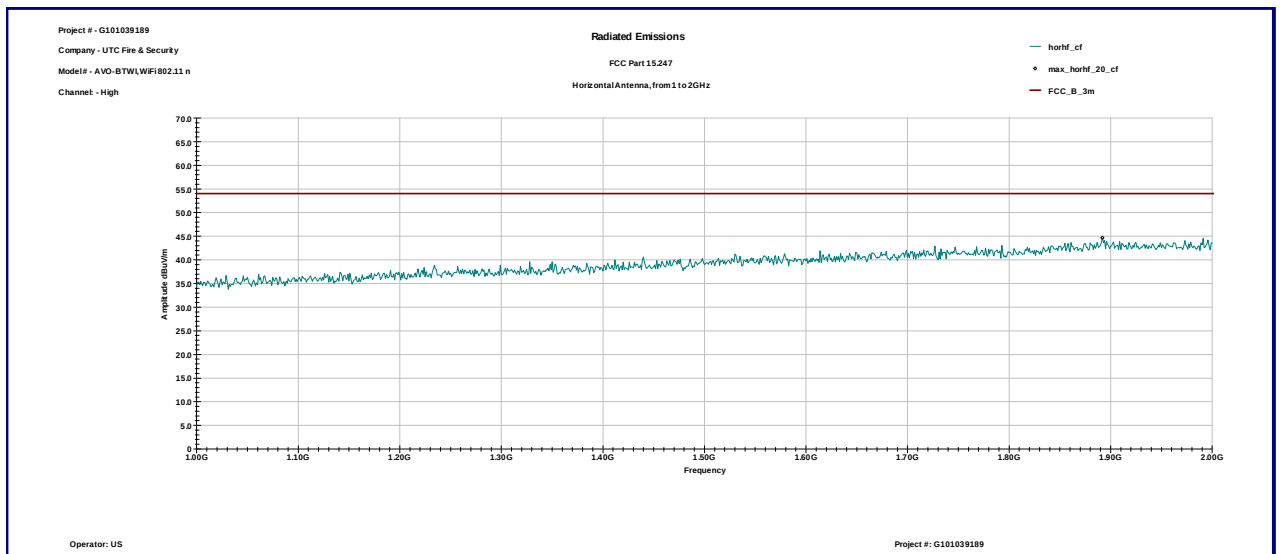
Graph 3.5.65



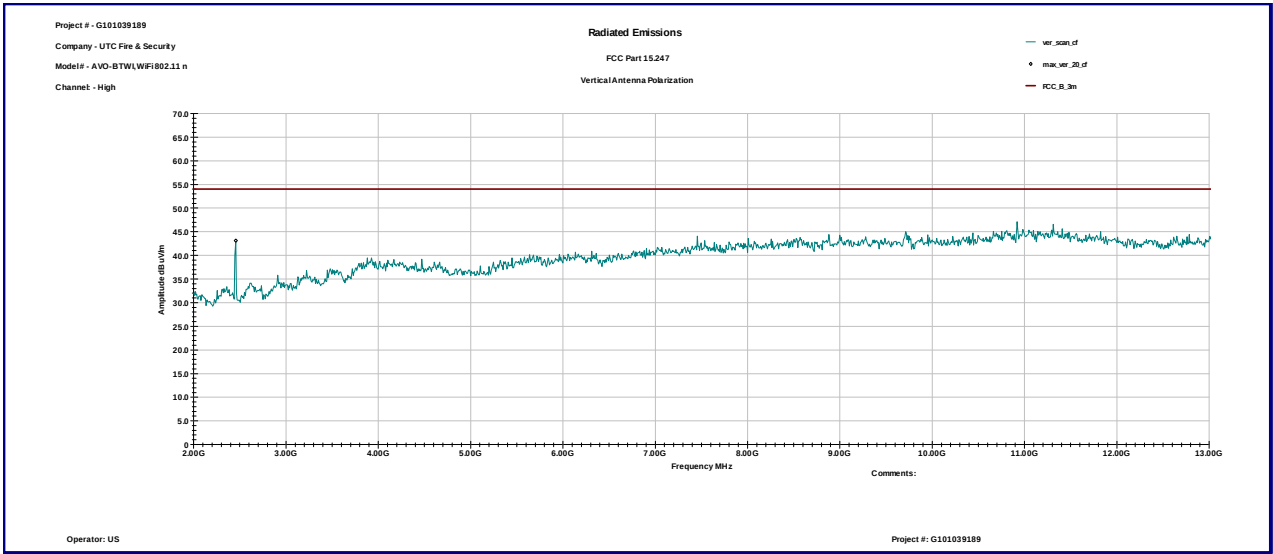
Graph 3.5.66



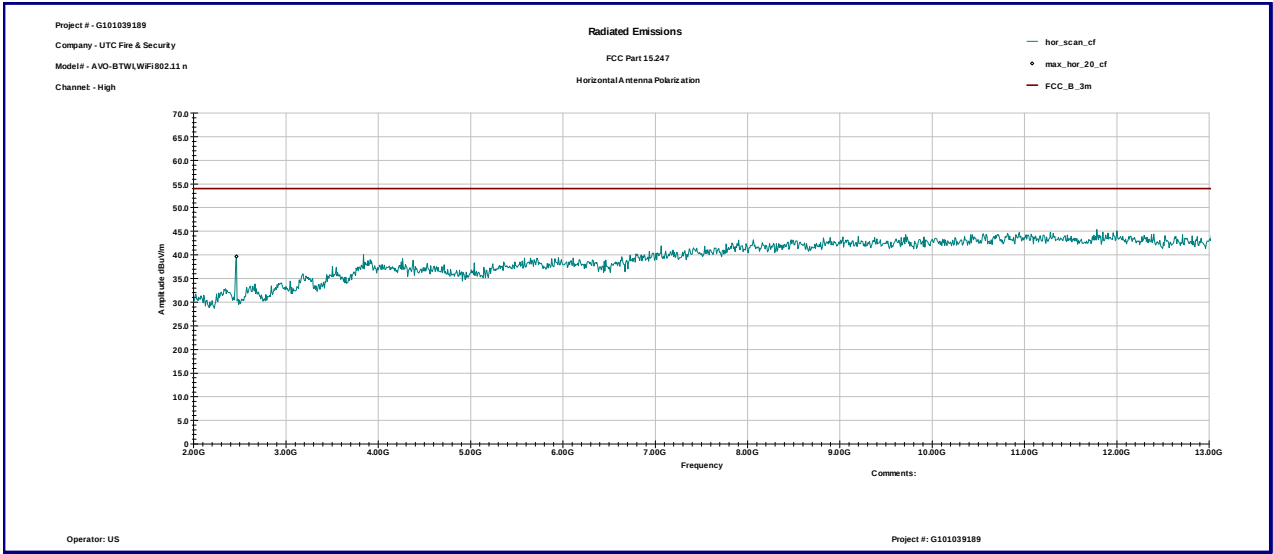
Graph 3.5.67



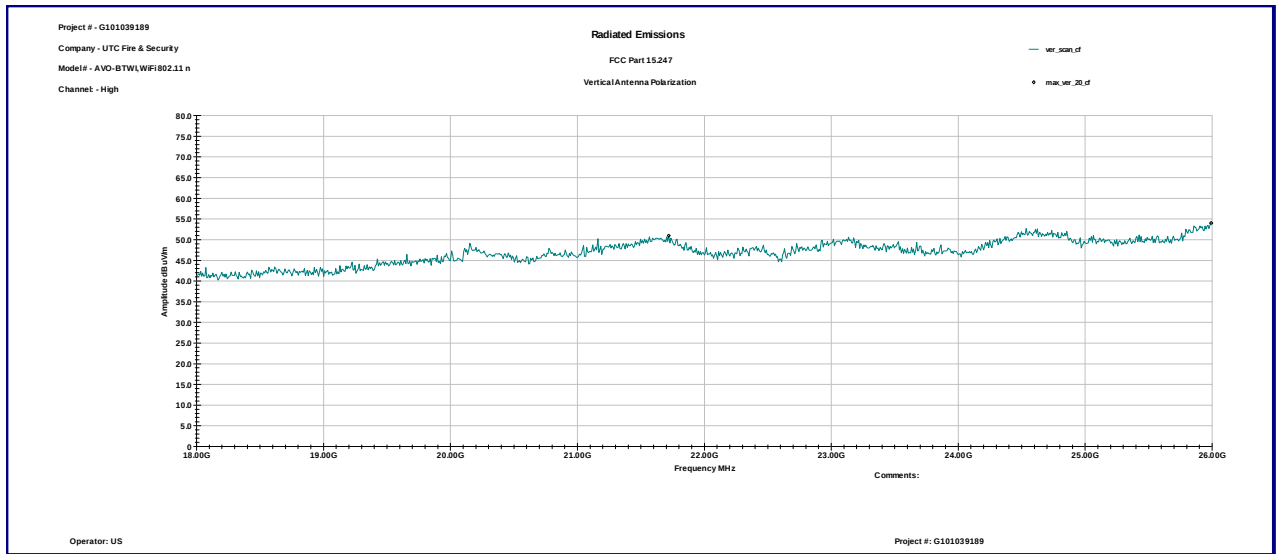
Graph 3.5.68



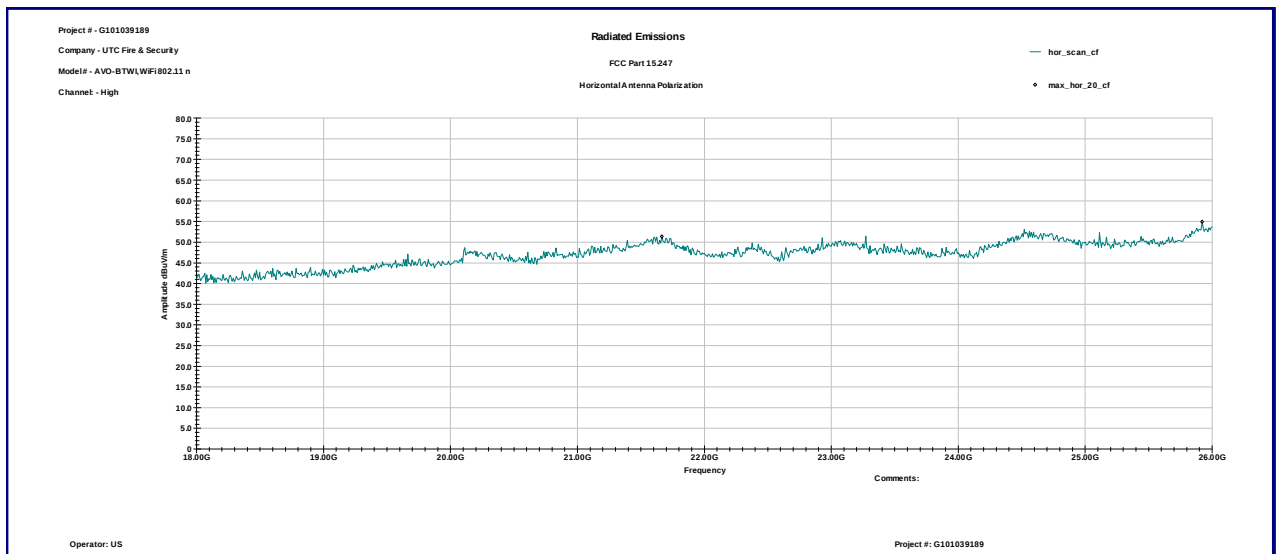
Graph 3.5.69



Graph 3.5.70



Graph 3.5.71



Graph 3.5.72



3.6 RF Exposure Compliance

The maximum measured antenna conducted power, P is 21.7dBm

The antenna gain, G is 2.5dBi

The maximum EIRP power = P + G

ERP = 21.7+ 2.5 = 24.2dBm, or 263mW

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

D = distance of 20cm

$S(\text{mW}/\text{cm}^2) = \text{EIRP}(\text{mW}) / 4\pi D^2$, or $S = 263 / (4\pi \times 400) = 0.052\text{mW}/\text{cm}^2$, that is $< 1.0 \text{mW}/\text{cm}^2$



3.7 Transmitter power line conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 2.9dB below the limits

Notes: None



Date:	April 30, 2013	Result: Pass
Standard:	FCC 15.207	
Tested by:	Uri Spector	
Test Point:	Power Line	
Operation mode:	See Page 5	
Note:	None	

Table 3.7.1

Line 1

Frequency	Peak dBμV	QP Limit dBμV	AVG Limit dBμV	QP Margin dB	AVG Margin dB
179.52 KHz	50.3	64.5	54.5	-14.2	-4.2
182.82 KHz	51.0	64.4	54.4	-13.4	-3.4
184.18 KHz	51.3	64.3	54.3	-13.0	-3.0
230.79 KHz	47.1	62.4	52.4	-15.3	-5.3
368.72 KHz	44.2	58.6	48.6	-14.4	-4.4
1.797 MHz	36.5	56.0	46.0	-19.5	-9.5

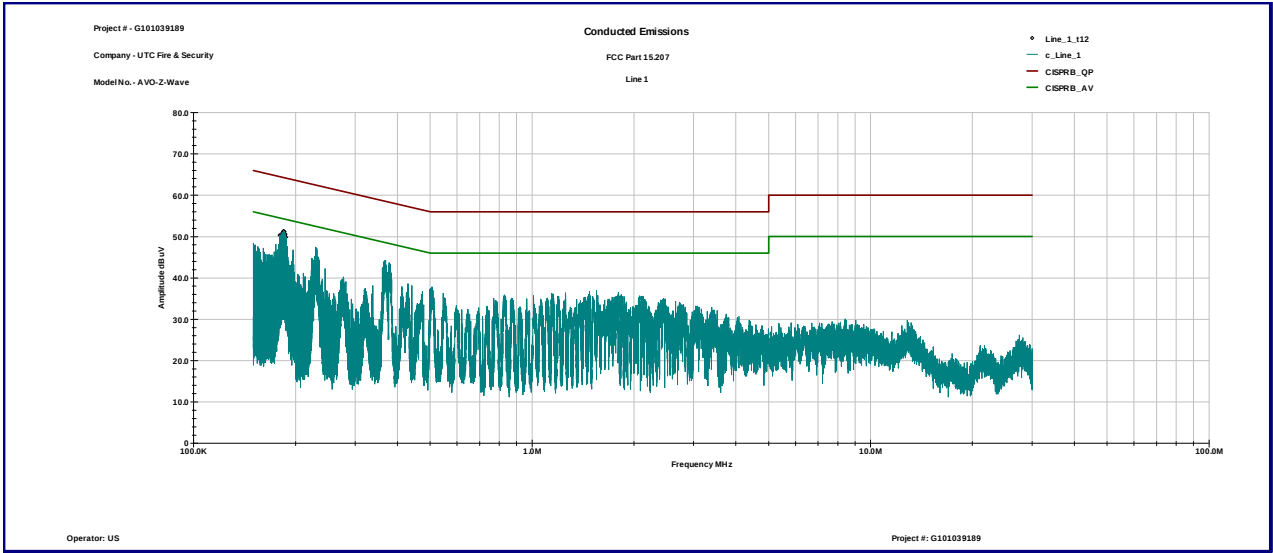
Line 2

Frequency	Peak dBμV	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
180.95 KHz	50.5	64.4	54.4	-14.0	-4.0
184.92 KHz	51.4	64.3	54.3	-12.9	-2.9
229.90 KHz	47.4	62.4	52.4	-15.0	-5.0
370.3 KHz	43.9	58.3	48.3	-14.4	-4.4
504.40 KHz	36.2	56.0	46.0	-19.8	-9.8
1.301 MHz	35.2	56.0	46.0	-20.8	-10.8

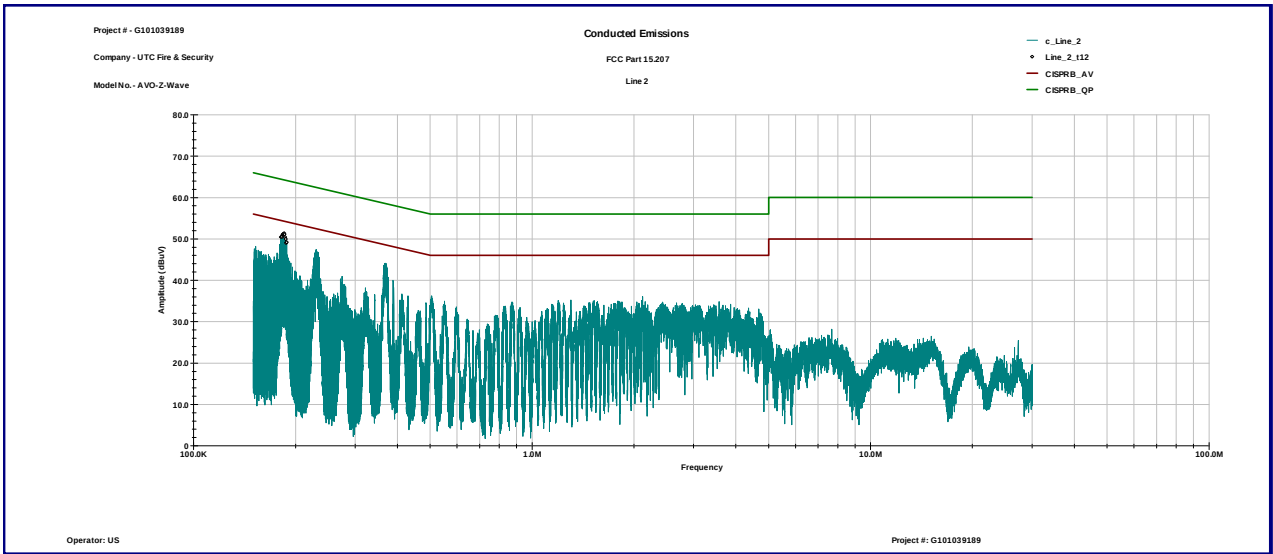


Graph 3.7.1

Line 1



Line 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-13000MHz

Max. Emissions margin: 7.3dB below the limits

Notes: The Radiated Emissions test was performed in the Anechoic chamber at 3m measurement distance (see Table 3.8.1 and Graphs 3.8.1and 3.8.2)



Date:	April 22, 2013	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See page 5	
Note:	30MHz-5000MHz	

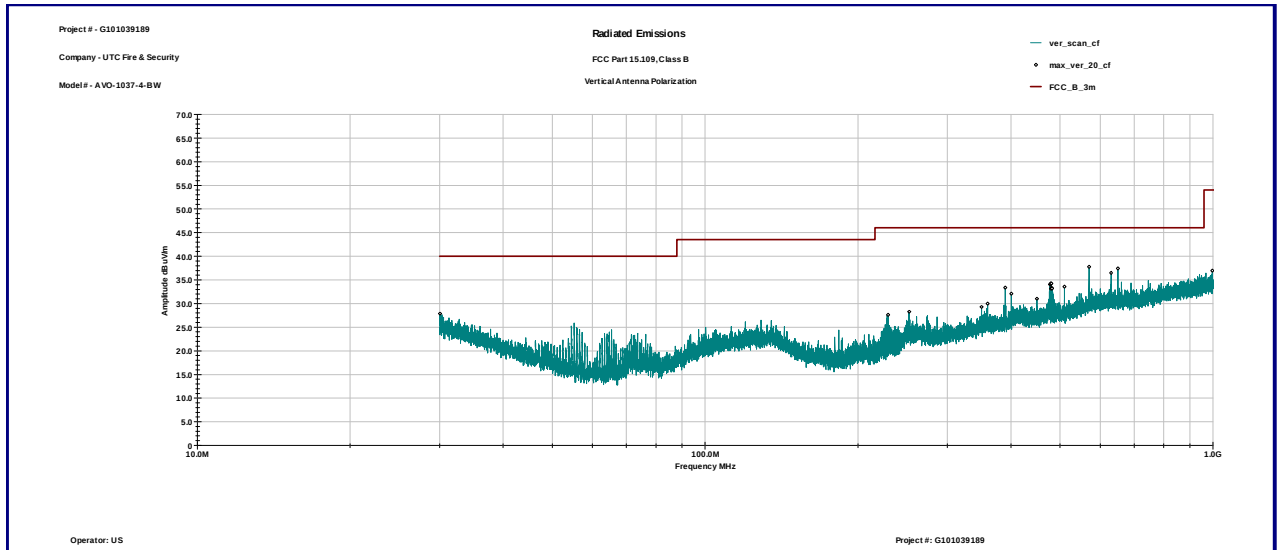
Table 3.8.1

Frequency	Ant. Polarity	Peak Reading dB μ V	Total C.F. dB1/m	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
30.056 MHz	V	7.7	20.2	27.8	40.0	-12.2
229.09 MHz	V	14.8	12.8	27.6	46.0	-18.4
252.23 MHz	V	13.4	14.9	28.3	46.0	-17.8
350.09 MHz	V	11.8	17.5	29.3	46.0	-16.8
359.93 MHz	V	12.1	17.9	30.0	46.0	-16.0
390.01 MHz	V	15.0	18.4	33.4	46.0	-12.6
400.86 MHz	V	13.1	18.9	32.1	46.0	-14.0
450.03 MHz	V	11.5	19.5	31.0	46.0	-15.0
477.95 MHz	V	13.9	20.1	34.0	46.0	-12.0
478.59 MHz	V	13.9	20.1	34.0	46.0	-12.0
479.33 MHz	V	14.1	20.1	34.3	46.0	-11.8
510.01 MHz	V	13.2	20.4	33.6	46.0	-12.5
570.0 MHz	V	16.1	21.7	37.7	46.0	-8.3
629.95 MHz	V	14.0	22.5	36.5	46.0	-9.6
650.11 MHz	V	14.7	22.7	37.4	46.0	-8.6
390.01 MHz	H	18.2	18.4	36.6	46.0	-9.4
420.06 MHz	H	14.5	19.6	34.1	46.0	-11.9
477.31 MHz	H	18.6	20.1	38.7	46.0	-7.3
479.33 MHz	H	17.5	20.1	37.6	46.0	-8.5
480.71 MHz	H	18.2	20.1	38.3	46.0	-7.7
481.35 MHz	H	17.8	20.2	37.9	46.0	-8.1
482.73 MHz	H	18.2	20.2	38.4	46.0	-7.6
483.37 MHz	H	16.9	20.2	37.1	46.0	-8.9

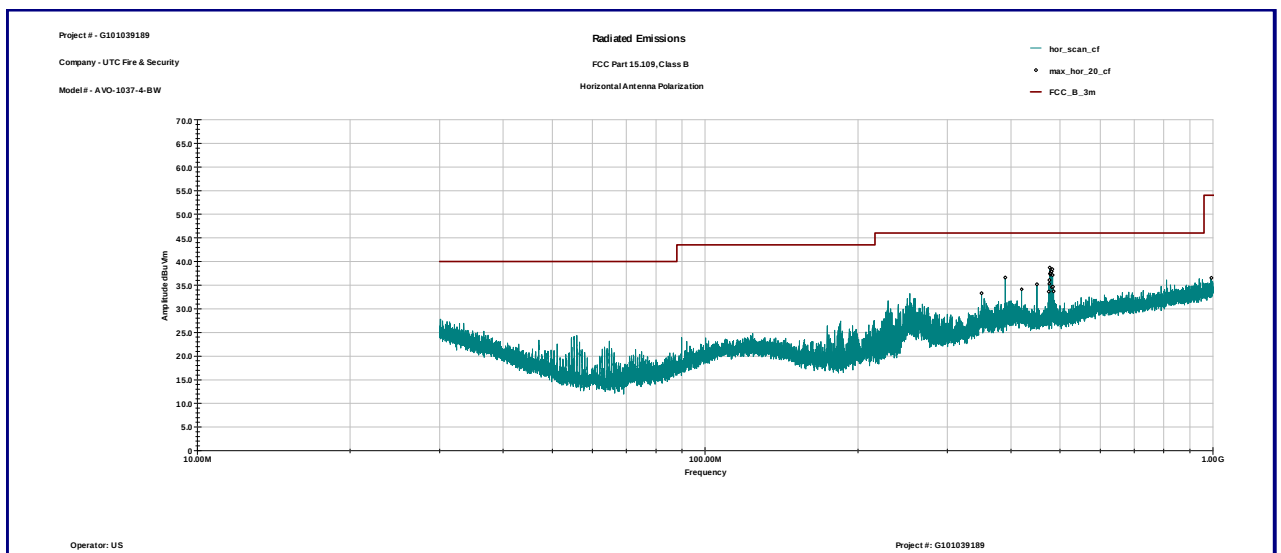


Graph 3.8.1

Vertical antenna polarization

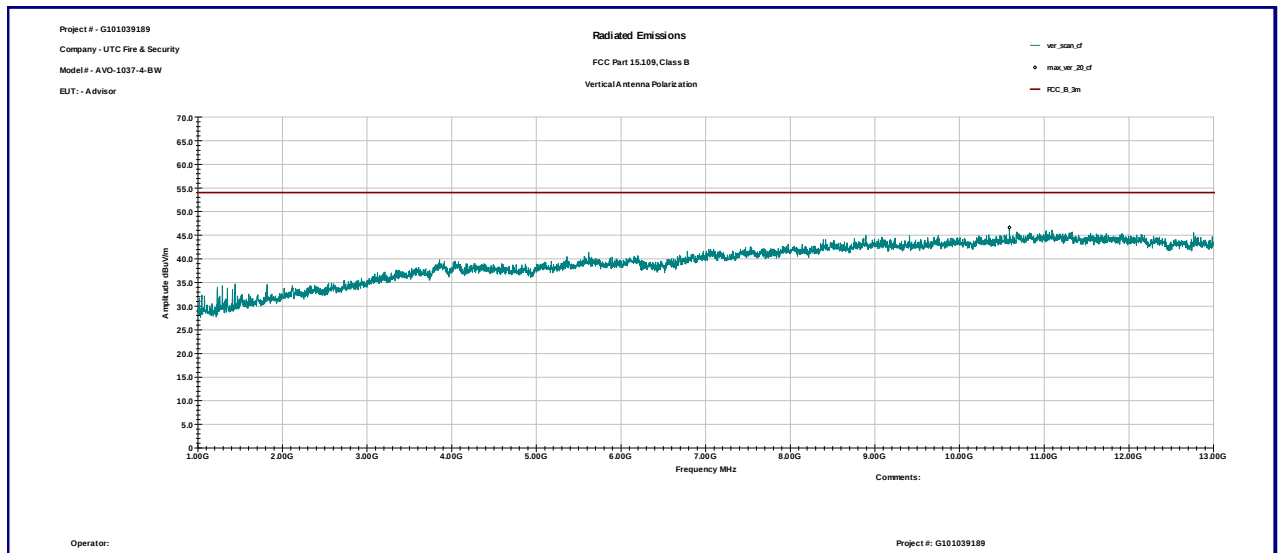


Horizontal antenna polarization

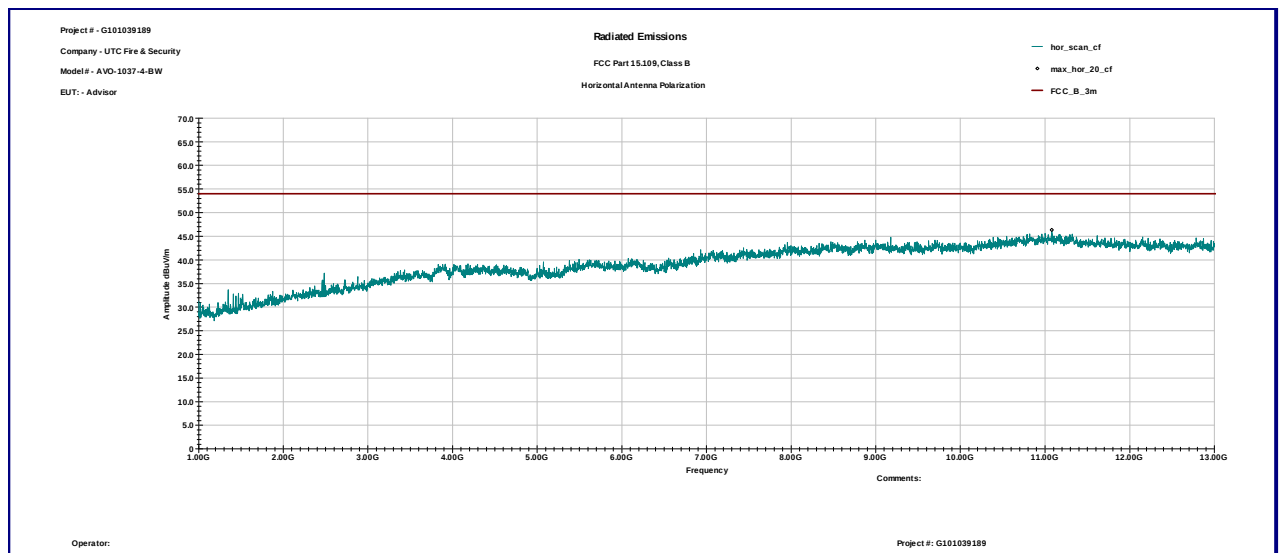


Intertek
Graph 3.8.2

Vertical antenna polarization



Horizontal antenna polarization





3.9 Digital device conducted emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 3.3dB below the limits

Notes: None

Date:	April 22, 2013	Result: Pass
Standard:	FCC 15.107, Class B	
Tested by:	Uri Spector	
Test Point:	Power Line	
Operation mode:	See page 5	
Note:	None	

Table 3.9.1

Line 1

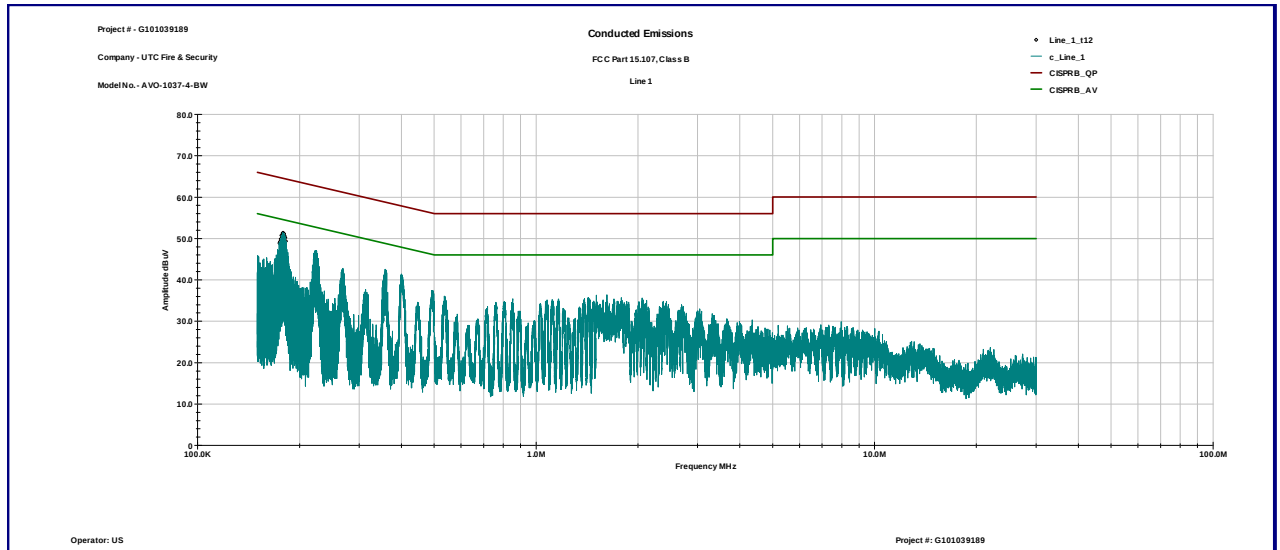
Frequency MHz	QP dBμV	AVG dBμV	Cable Loss dB	QP Lim dBμV	AVG Lim dBμV	QP Margin dB	AVG Margin dB
0.180	49.0	35.5	0.1	64.5	54.5	-15.4	-18.9
0.222	45.1	34.6	0.1	62.7	52.7	-17.5	-18.0
0.267	39.9	32.8	0.1	61.2	51.2	-21.2	-18.3
0.358	40.2	34.3	0.1	58.8	48.8	-18.4	-14.3
0.400	39.9	36.7	0.1	57.9	47.9	-17.8	-11.0
0.491	35.6	32.7	0.2	56.2	46.2	-20.4	-13.3

Line 2

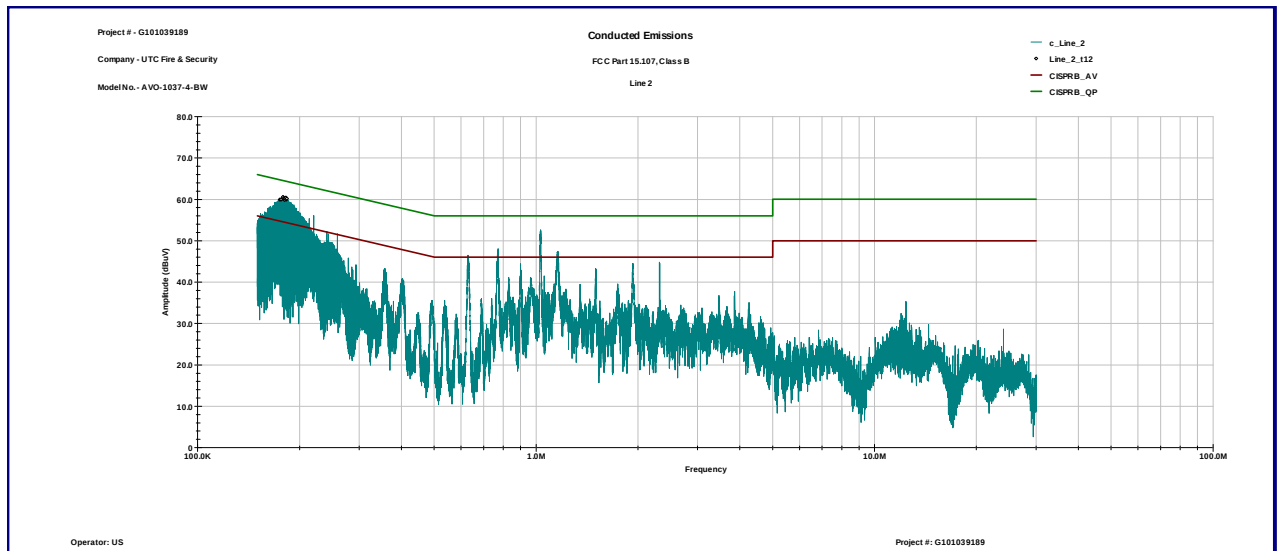
Frequency MHz	QP dBμV	AVG dBμV	Cable Loss dB	QP Lim dBμV	AVG Lim dBμV	QP Margin dB	AVG Margin dB
0.182	54.4	38.2	0.1	64.4	54.4	-9.9	-16.1
0.630	45.5	41.4	0.2	56.0	46.0	-10.3	-4.4
0.770	46.2	42.5	0.2	56.0	46.0	-9.6	-3.3
1.030	43.3	39.8	0.2	56.0	46.0	-12.5	-6.0
1.158	38.6	34.0	0.2	56.0	46.0	-17.2	-11.8
2.314	31.7	23.2	0.4	56.0	46.0	-23.9	-22.4

Graph 3.9.1

Line 1



Line 2





4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	ESU	100398	25283	12/19/2013	☒
Spectrum Analyzer	R & S	FSP 40	100024	12559	11/29/2013	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	08/09/2013	☒
Horn Antenna	EMCO	3115	9507-4513	9936	05/16/2013	☒
LISN	Fischer Custom Communications	FCC-LISN-2 MOD.SD	316	9945	07/17/2013	☒
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	11/07/2013	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/01/2013	☒
High Pass Filter	Reactel Inc.	7HS-4G-S12	0223	15274	VBU	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	11/01/2013	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒