TEST REPORT

Report Number: 102190713MIN-001
Project Number: G102190713

Testing performed on the
C12068
FCC ID: U4L2
Industry Canada ID: 8466A-2

to
47 CFR Part 15. 249:2015
RSS- 210, Issue 8, 2010
RSS-Gen, Issue 4, 2014

For
St. Jude Medical

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

Test Authorized by:
St. Jude Medical
5050 Nathan Lane North
Plymouth, MN 55442, USA

Prepared by: Richard Blonigen

Reviewed by: Uri Spector

Date of issue: August 9, 2016

TABLE OF CONTENTS

1.0 GENERAL DESCRIPTION

Model:	C12068
Type of EUT:	PressureWire™ Sensor Medical Device
Serial Number:	Batch # 5071228 21064C0C (sample with normal mode) 21064BE9 (sample operating at 2402MHz) 21064BE2 (sample operating at 2441MHz) 21064C14 (sample operating at 2480MHz)
Frequency Band of Operation:	2400 – 2483.5 MHz
FCC ID:	U4L2
Industry Canada ID:	8466A-2
Related Submittal(s) Grants:	Class II Permissive Changes
Company:	St. Jude Medical
Customer:	Mr. Quoc Dang
Address:	5050 Nathan Lane North Plymouth, MN 55442, USA
Phone:	651-756-6953
Email:	Qdang02@sjm.com
Test Standards:	☒ 47 CFR, Part 15:2015, §15.249 ☒ RSS–210, Issue 8, 2010 ☒ RSS-Gen, Issue 4, 2014 ☐ 47 CFR, Part 15:2015, §15.107 and §15.109, Class ☐ ICES-003, Issue 5:2012 ☐ Other
Type of radio:	☒ Stand -alone ☐ Module ☐ Hybrid
Date Sample Submitted:	July 16, 2015
Test Work Started:	July 16, 2015
Test Work Completed:	July 17, 2015
Test Sample Conditions:	☐ Damaged ☐Poor (Usable) ☒ Good

1.1 Product Description; Test Facility

Type of Radio Equipment:	Low Power Device (2400-2483.5MHz)
Operating Frequency	2402 - 2480 MHz
Modulation:	FHSS
Emission Designator:	1M48F1D
Antenna(s) Info:	Antenna Type: Integral, Gain 0.5 dBi
Antenna Installation:	☐ User ☐ Professional ☒ Factory
Transmitter Power Configuration:	☒ Internal battery ☐ External power source ☐ 120VAC ☐ 230VAC ☐ 400VAC ☒ 3.0 VDC ☐ Other: Amp. ☐ 50Hz ☐ 60Hz
Special Test Arrangement:	As a 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 C63.10-2013

1.2 EUT Configuration

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

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

Operating modes of the EUT:

No.	Description
1	Three units were programmed to transmit continuously at a given frequency 2402, 2441, 2480MHz.
2	A normal mode unit was used to determine the duty cycle to determine the correction factor.

Cables:

No.	Type	Length	Designation	Note
1	None			
2				

Support equipment/Services:

No.	Item	Description
1	None	
2		

General notes: The transmitter uC nRF51822 and ST Micro BALUN were changed from rev. 1 to rev. 3; therefore testing at fundamentals, harmonics, and spurious emissions measurements were performed in order to demonstrate RF device compliance.

1.3 Environmental conditions

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

☒ **Normal**

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 86-106 kPa

1.4 Measurement uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be: ±4 dB at 10m and ±5.4 dB at 3m

The expanded uncertainty (k = 2) for conducted emissions from 150 kHz to 30 MHz 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
15.249(a) / RSS-210 A2.9(a)	Field strength of fundamental	Pass
15.249(a) / RSS-210 A2.9(a)	Field strength of harmonics	Pass
15.249(d) / RSS-210 A2.9(b)	Field strength of spurious emissions	Pass

3.0 TEST CONDITIONS AND RESULTS

3.1 Field strength of fundamental

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 2402 – 2480MHz

Test result: **Pass**

Max. Emissions margin at fundamental: 15.2 dB below the limits

Notes: None

Date:	July 16, 2015	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC 15.249(a) / RSS-210 A2.9	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 43%(RH); 97kPa	
Note:	None	

Table 3.1.1

Frequency	Antenna		Ant. CF	Cable loss	Pre-amp	Reading	Total @ 3m	Corr Factor	Limit	Margin	Comments
MHz	Polarity	Hts(cm)	dB1/m	dB	Gain (dB)	dBµV	dBµV/m	dBµV/m	dBµV/m	dB	
Peak Readings											
2402.00	V	115	28.4	2.9	0.0	67.5	98.8	0.0	114.0	-15.2	
2402.00	H	115	28.4	2.9	0.0	61.3	92.5	0.0	114.0	-21.5	
2441.00	V	153	28.5	2.9	0.0	60.3	91.6	0.0	114.0	-22.4	
2441.00	H	100	28.5	2.9	0.0	64.4	95.8	0.0	114.0	-18.2	
2480.00	V	188	28.6	2.9	0.0	59.9	91.4	0.0	114.0	-22.6	
2480.00	H	100	28.6	2.9	0.0	63.8	95.3	0.0	114.0	-18.7	
Average Readings											
2402.00	V	115	28.4	2.9	0.0	67.5	98.8	20.0	94.0	-15.2	
2402.00	H	115	28.4	2.9	0.0	61.3	92.5	20.0	94.0	-21.5	
2441.00	V	153	28.5	2.9	0.0	60.3	91.6	20.0	94.0	-22.4	
2441.00	H	100	28.5	2.9	0.0	64.4	95.8	20.0	94.0	-18.2	
2480.00	V	188	28.6	2.9	0.0	59.9	91.4	20.0	94.0	-22.6	
2480.00	H	100	28.6	2.9	0.0	63.8	95.3	20.0	94.0	-18.7	

3.2 Field strength of harmonics and spurious emissions

Test location: ☐ OATS ☒ Anechoic Chamber ☐ Other

Test distance: ☐ 10 meters ☒ 3 meters

Frequency range of measurements: 30MHz-26000MHz

Test result: **Pass**

Max. margin of harmonics and spurious emissions: 9.4 dB below the limits

Notes: No harmonics and spurious emissions above ambient were detected other than those shown in Table 3.2.1.

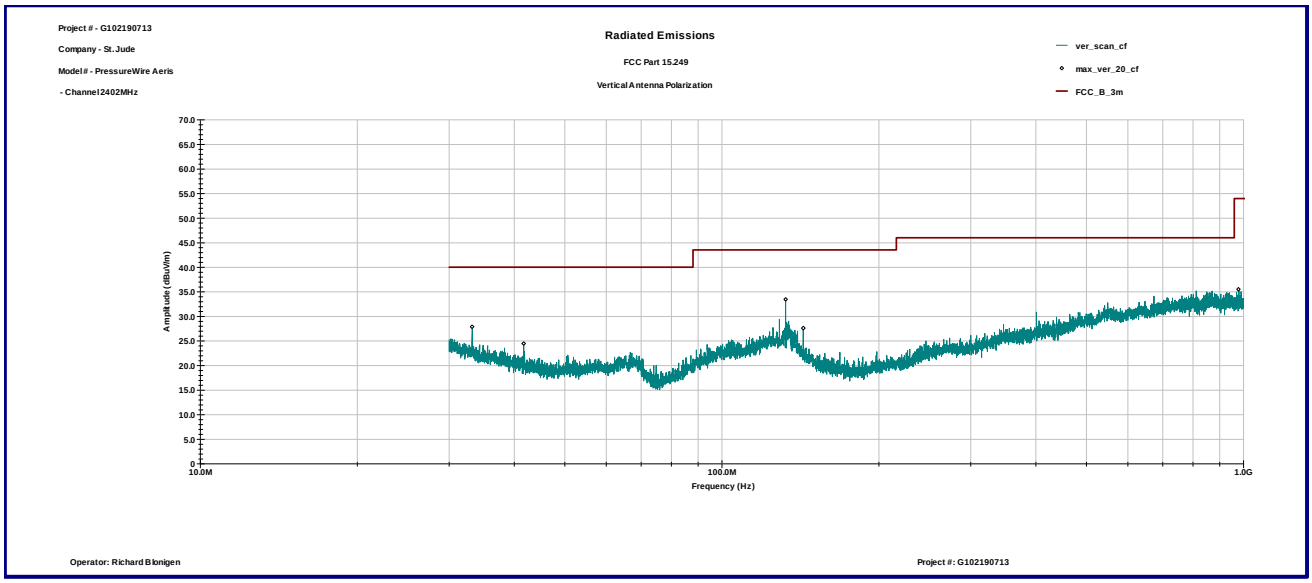
Date:	July 16-17, 2015	**Result: Pass**
Tested by:	Richard Blonigen	
Standard:	FCC 15.249(a) and (d) / RSS-210 A2.9	
Test Point:	Enclosure with antenna	
Operation mode:	See page 5	
Environmental Conditions:	23°C; 43%(RH); 97kPa	
Note:	None	

Table 3.2.1

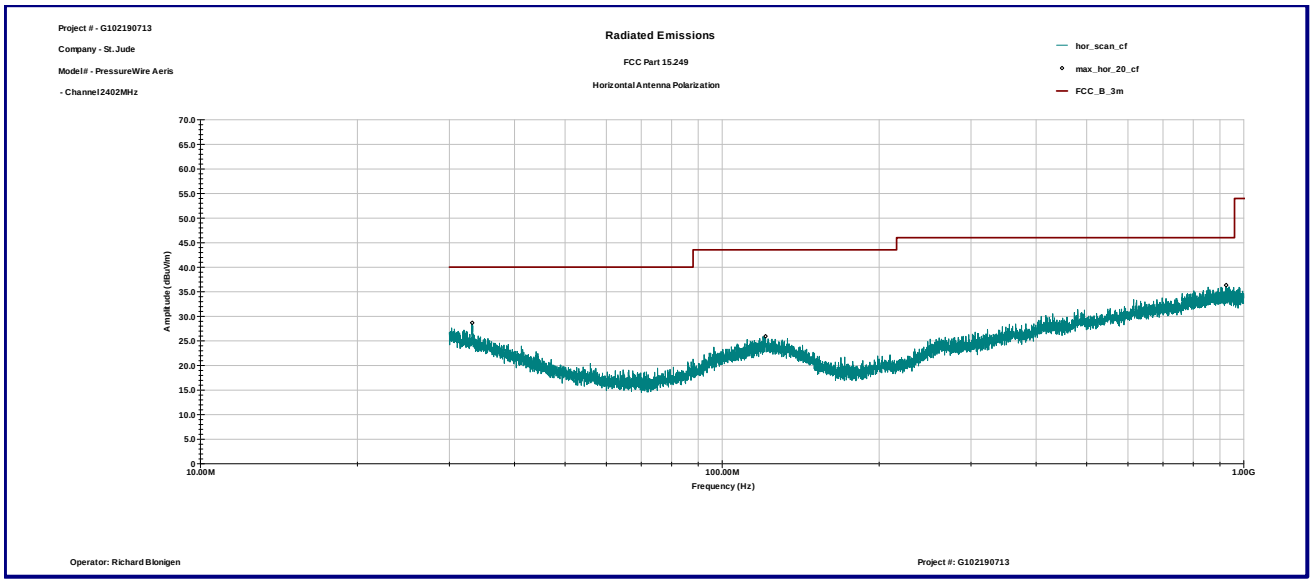
Frequency	Ant. Polarity	Peak Reading dBµV	Total C.F. dB1/m	Total at 3m dBµV/m	Limit dBµV/m	Margin dB
Channel 2402MHz						
33.194 MHz	V	11.5	16.4	27.9	40.0	-12.1
41.669 MHz	V	12.0	12.5	24.5	40.0	-15.5
132.5 MHz	V	19.3	14.2	33.5	43.5	-10.1
143.25 MHz	V	15.0	12.7	27.6	43.5	-15.9
978.07 MHz	V	11.6	23.9	35.5	54.0	-18.5
33.194 MHz	H	10.4	18.3	28.7	40.0	-11.3
121.18 MHz	H	12.0	13.9	25.9	43.5	-17.6
925.08 MHz	H	12.0	24.3	36.3	46.0	-9.7
Channel 2441MHz						
33.211 MHz	V	10.6	16.4	27.0	40.0	-13.0
68.571 MHz	V	16.2	6.4	22.6	40.0	-17.4
128.93 MHz	V	15.3	14.3	29.7	43.5	-13.8
132.5 MHz	V	17.5	14.2	31.6	43.5	-11.9
143.25 MHz	V	14.1	12.7	26.7	43.5	-16.8
995.07 MHz	V	11.3	24.1	35.3	54.0	-18.6
33.194 MHz	H	10.4	18.3	28.7	40.0	-11.3
111.98 MHz	H	13.2	13.2	26.4	43.5	-17.1
913.26 MHz	H	12.3	24.4	36.6	46.0	-9.4
Channel 2480MHz						
33.211 MHz	V	11.4	16.4	27.8	40.0	-12.2
128.93 MHz	V	16.0	14.3	30.3	43.5	-13.2
132.43 MHz	V	19.0	14.2	33.2	43.5	-10.4
872.1 MHz	V	12.7	23.2	35.9	46.0	-10.2
33.229 MHz	H	11.3	18.3	29.6	40.0	-10.4
137.59 MHz	H	13.2	13.1	26.3	43.5	-17.2
919.42 MHz	H	11.9	24.3	36.2	46.0	-9.8

Graph 3.2.1

Vertical antenna polarization

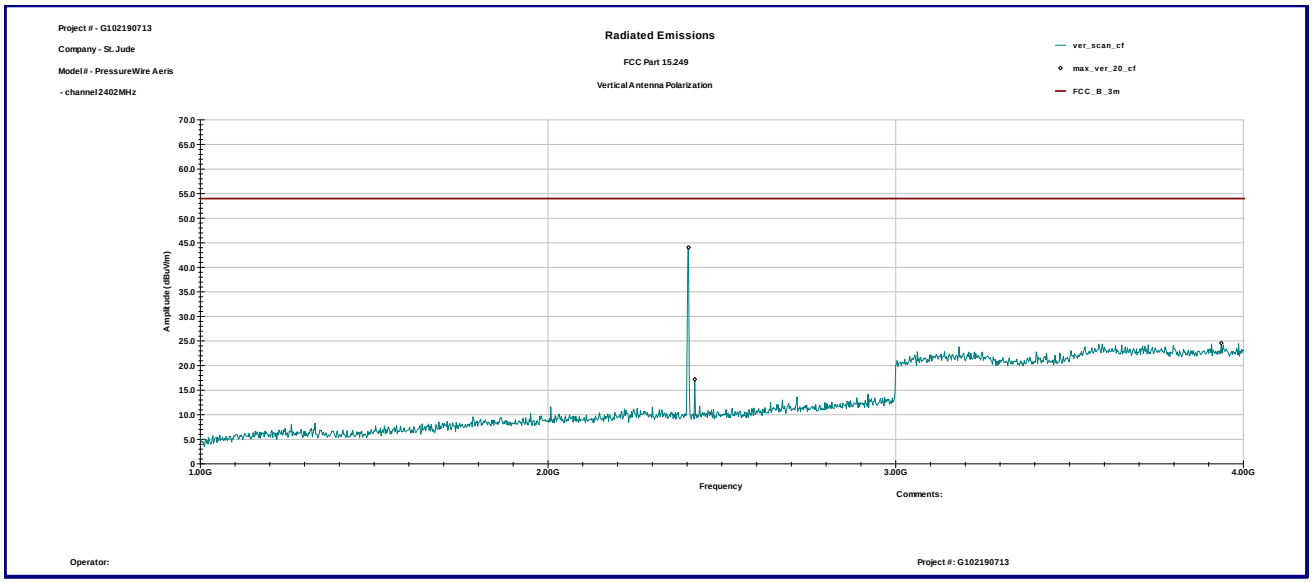


Horizontal antenna polarization

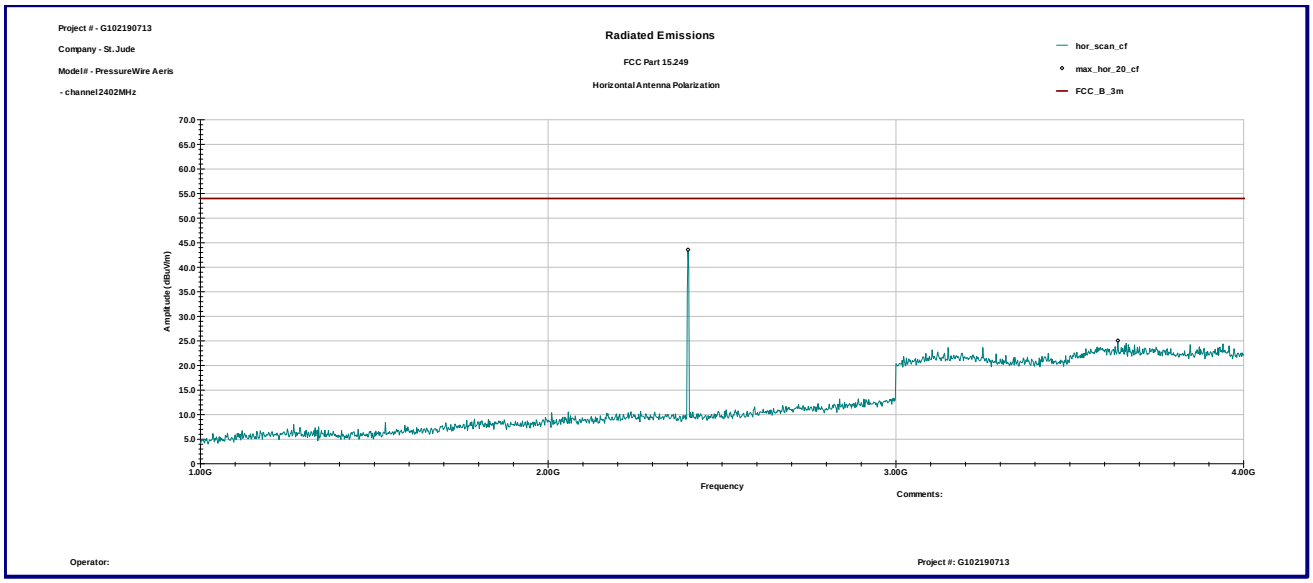


Graph 3.2.2

Vertical antenna polarization

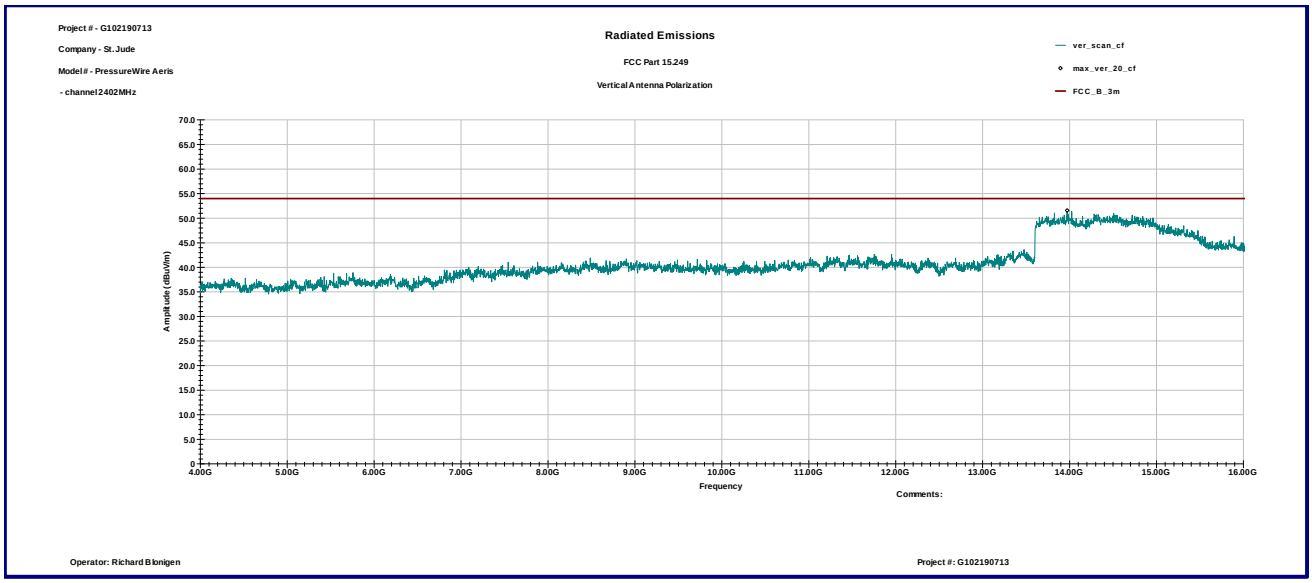


Horizontal antenna polarization

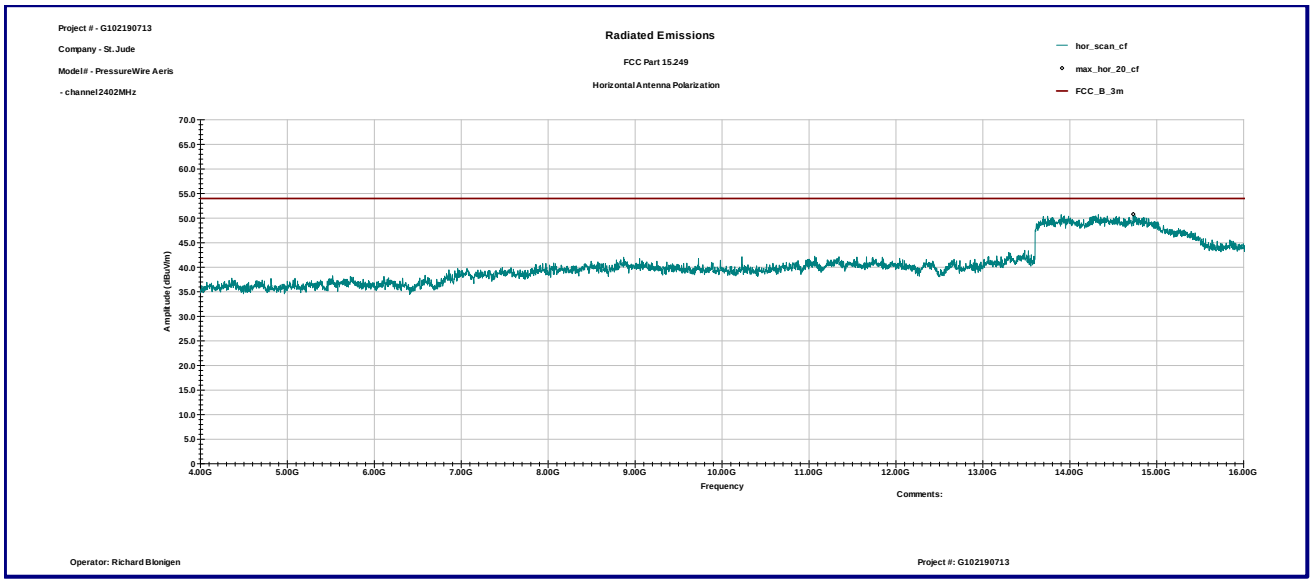


Graph 3.2.3

Vertical antenna polarization

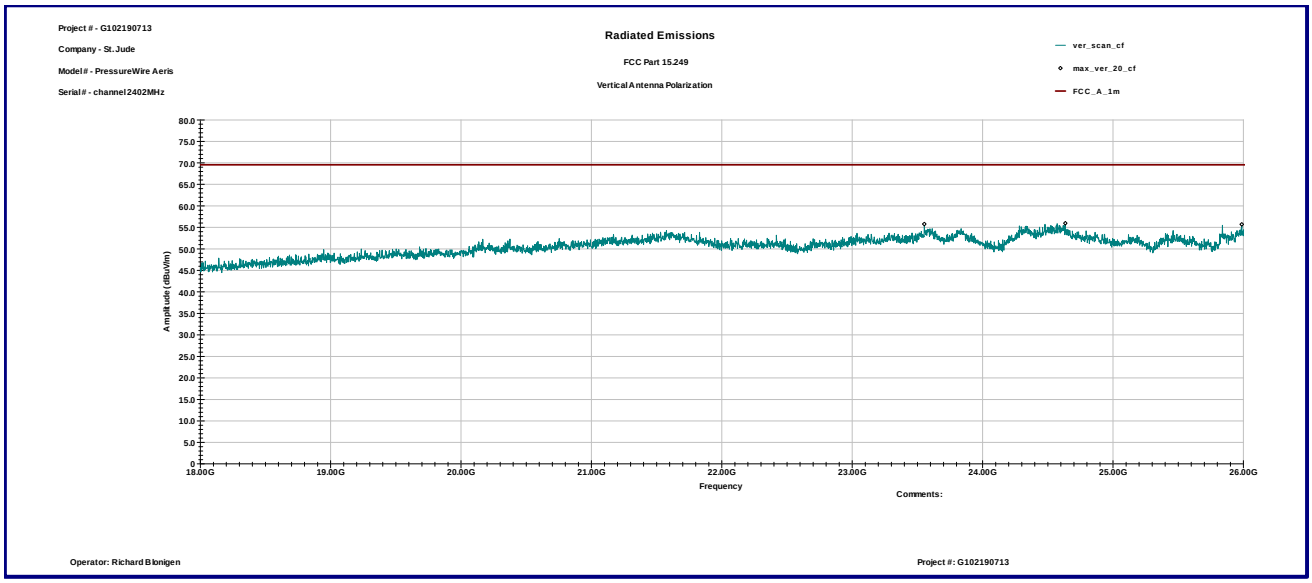


Horizontal antenna polarization

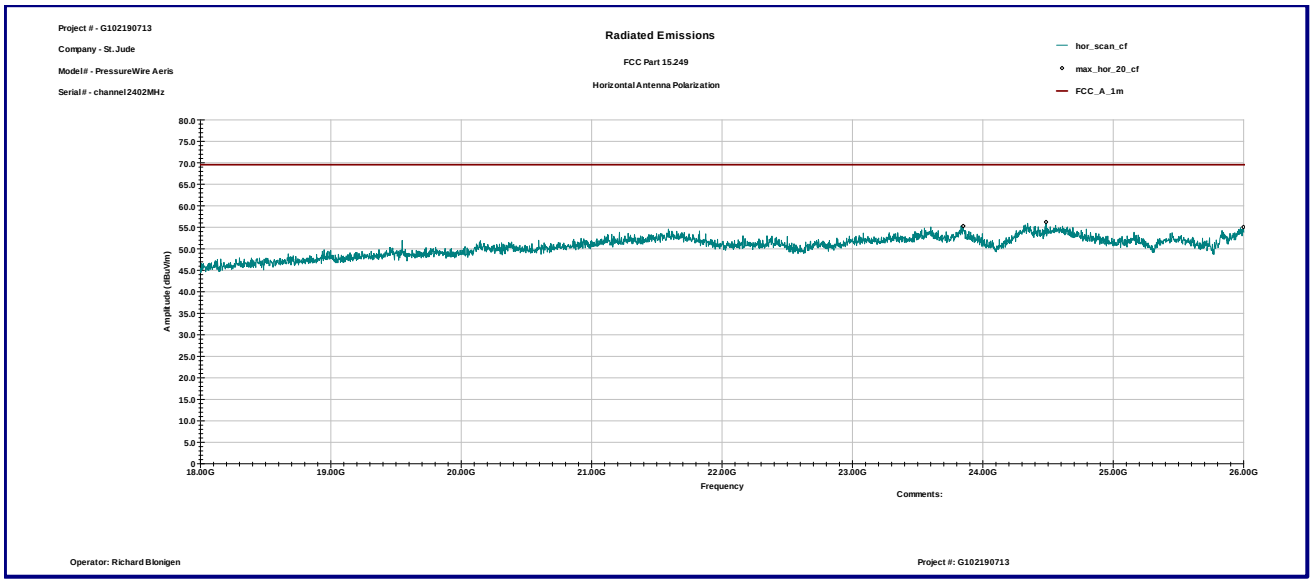


Graph 3.2.4

Vertical antenna polarization

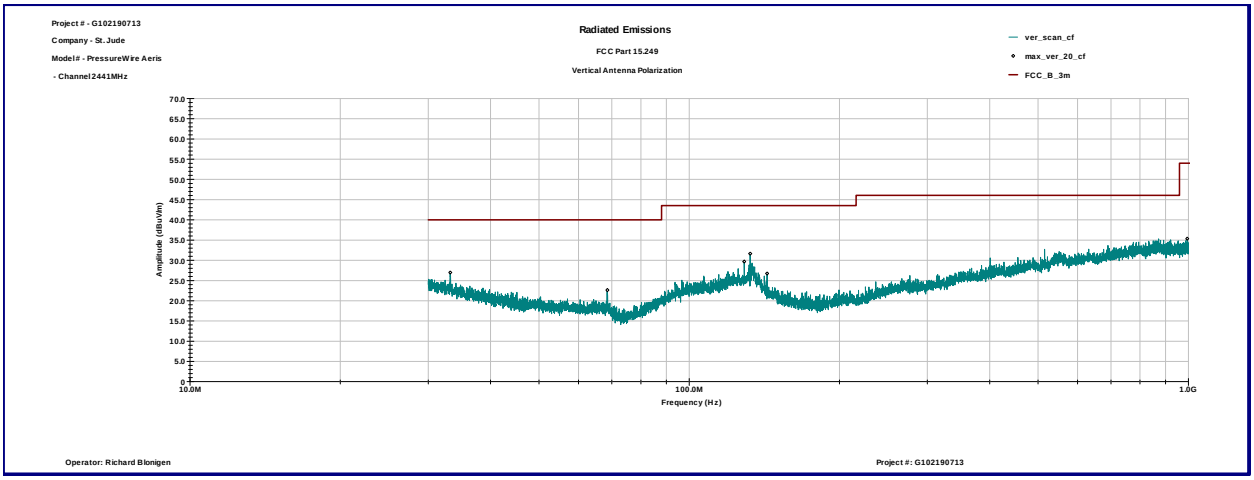


Horizontal antenna polarization

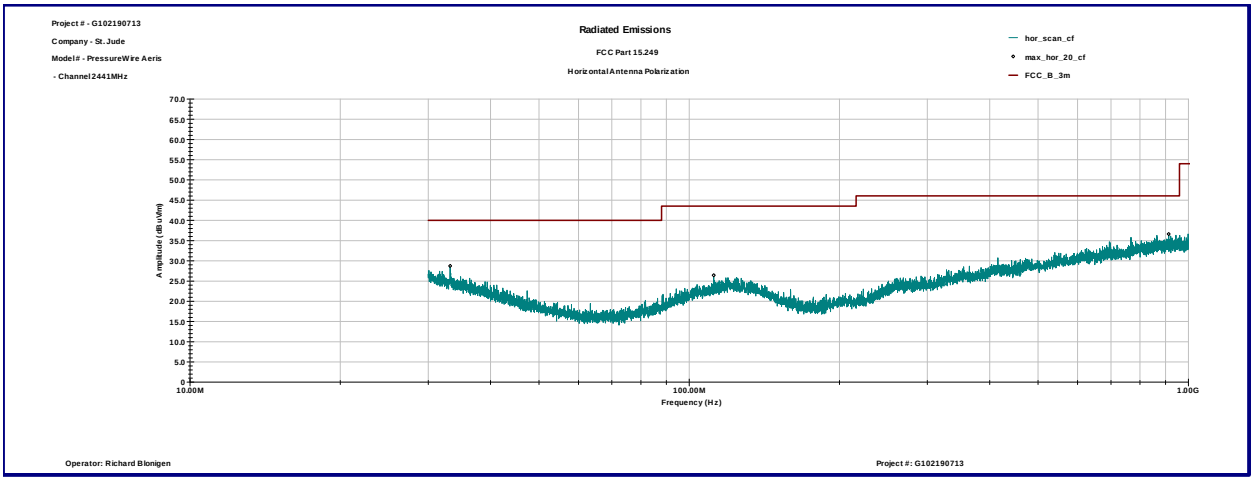


Graph 3.2.5

Vertical antenna polarization

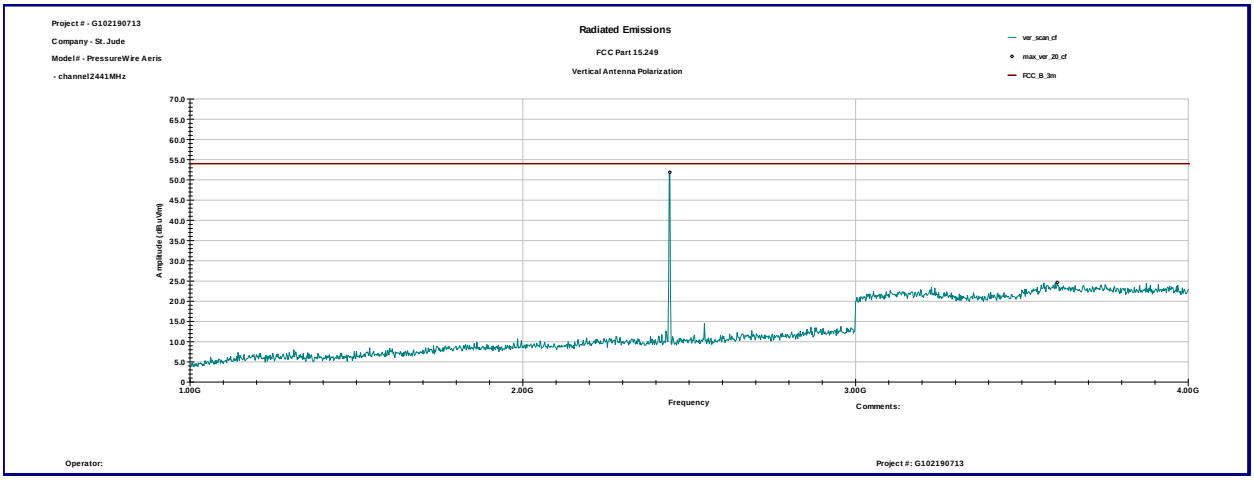


Horizontal antenna polarization

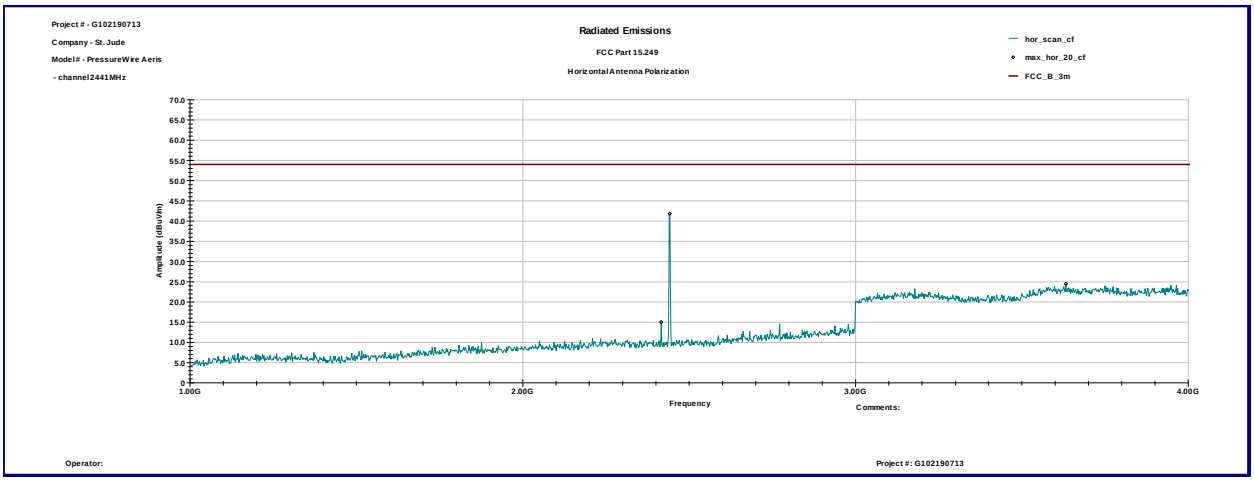


Graph 3.2.6

Vertical antenna polarization

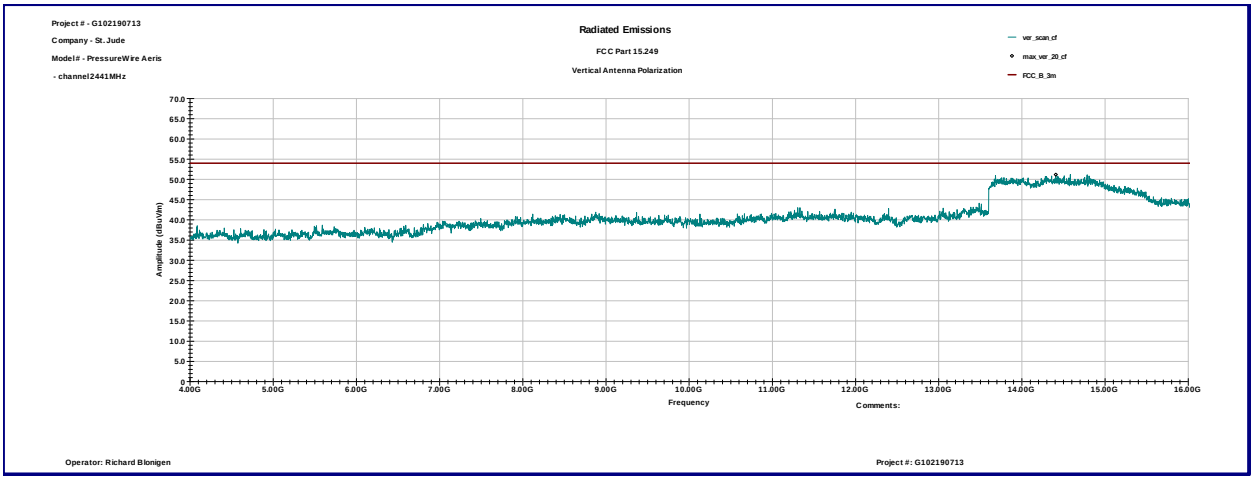


Horizontal antenna polarization

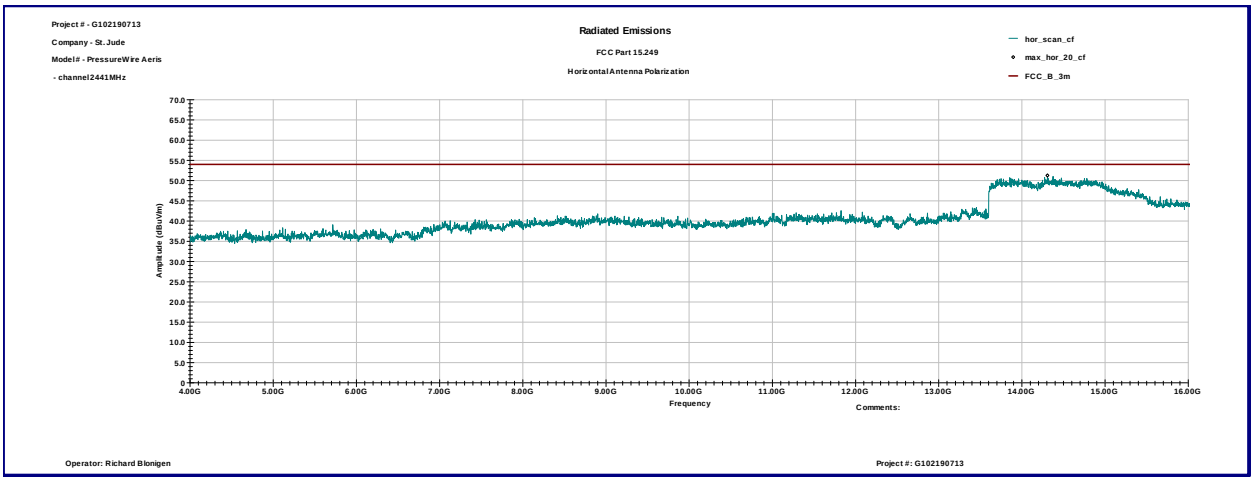


Graph 3.2.7

Vertical antenna polarization

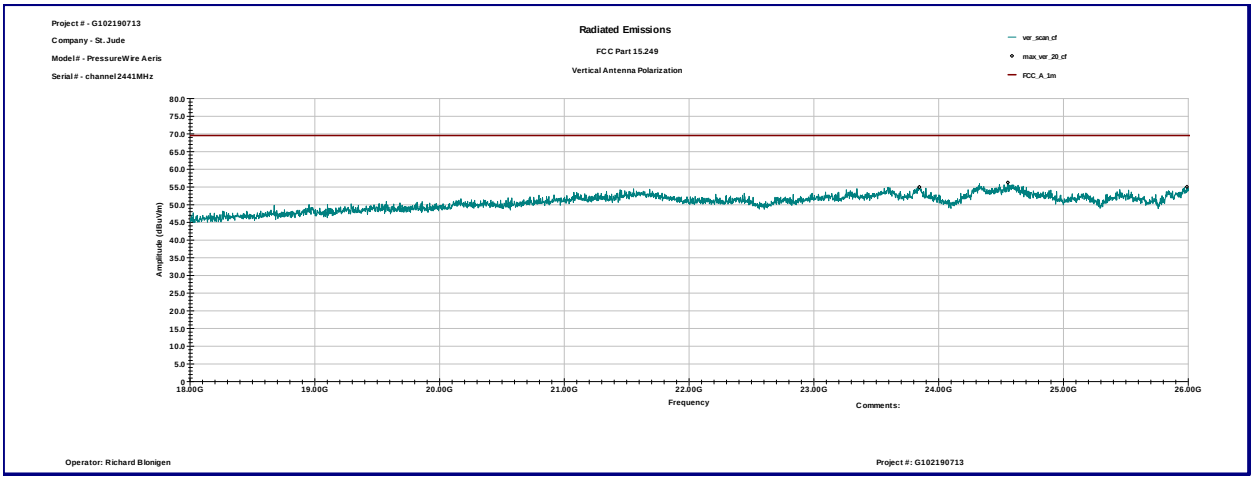


Horizontal antenna polarization

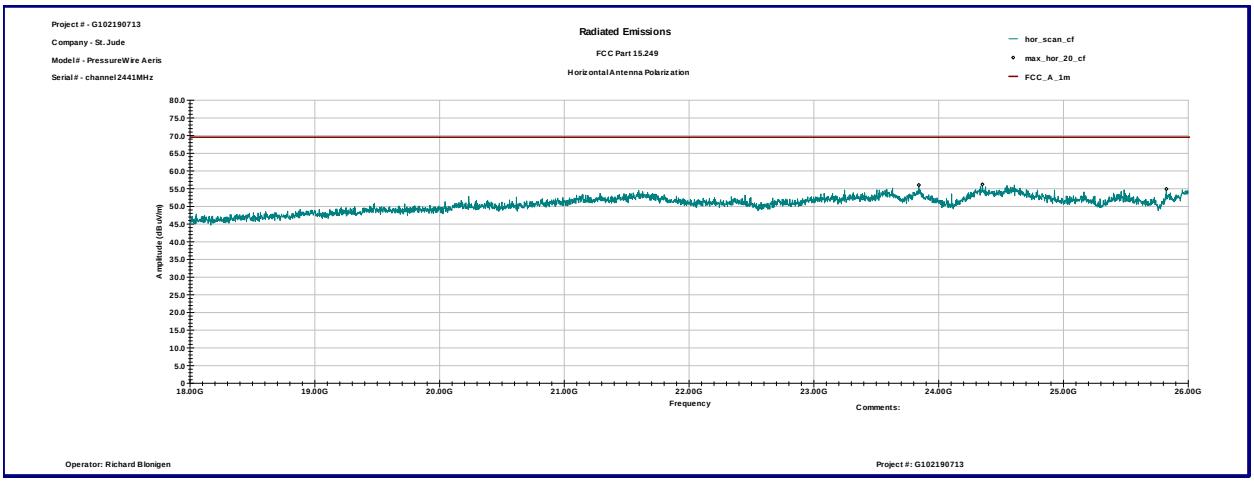


Graph 3.2.8

Vertical antenna polarization

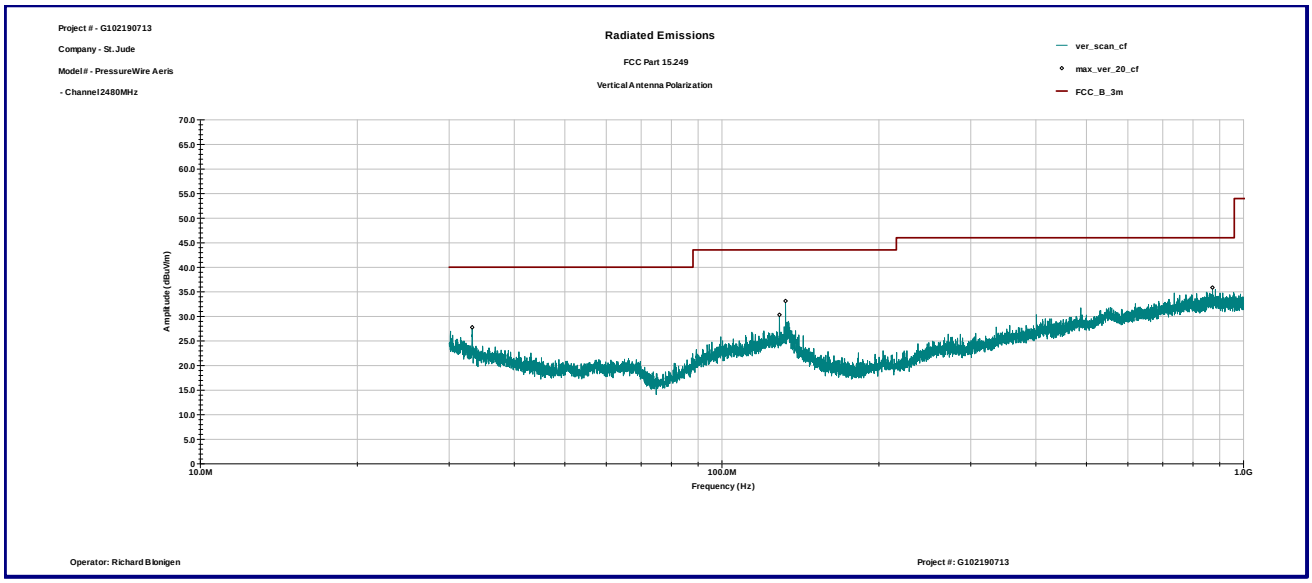


Horizontal antenna polarization

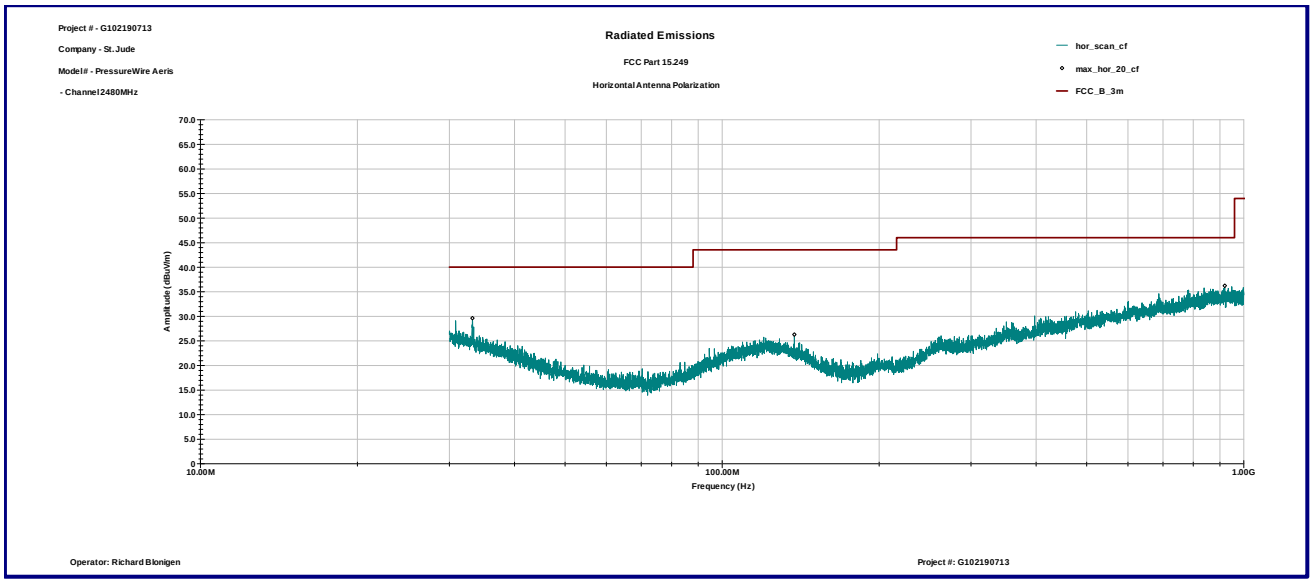


Graph 3.2.9

Vertical antenna polarization

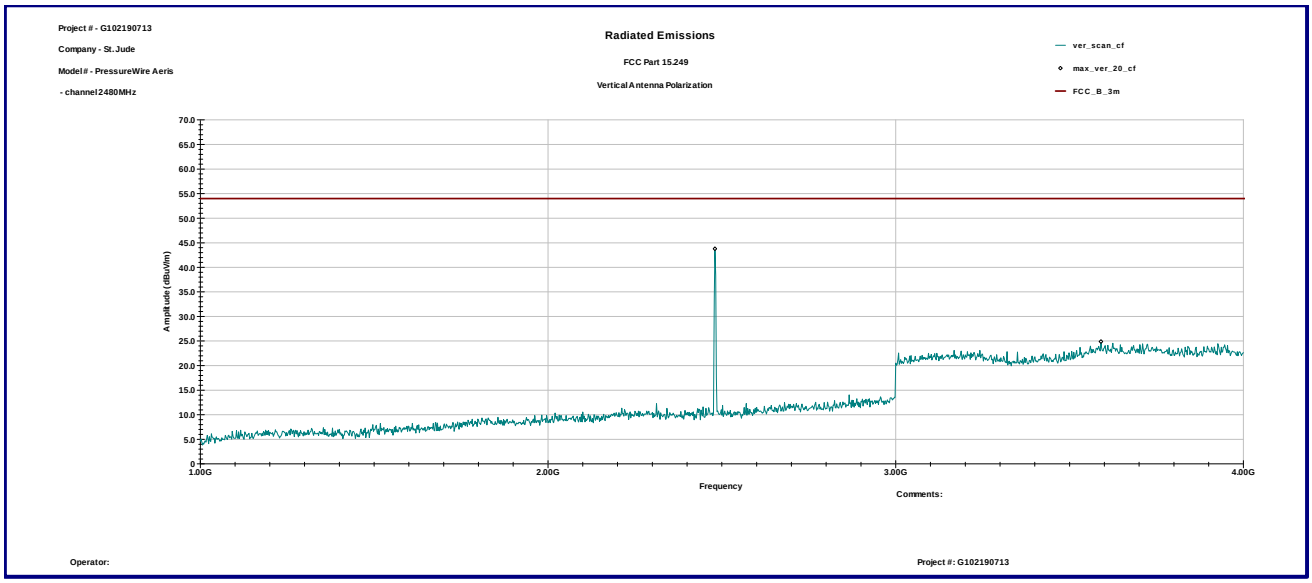


Horizontal antenna polarization

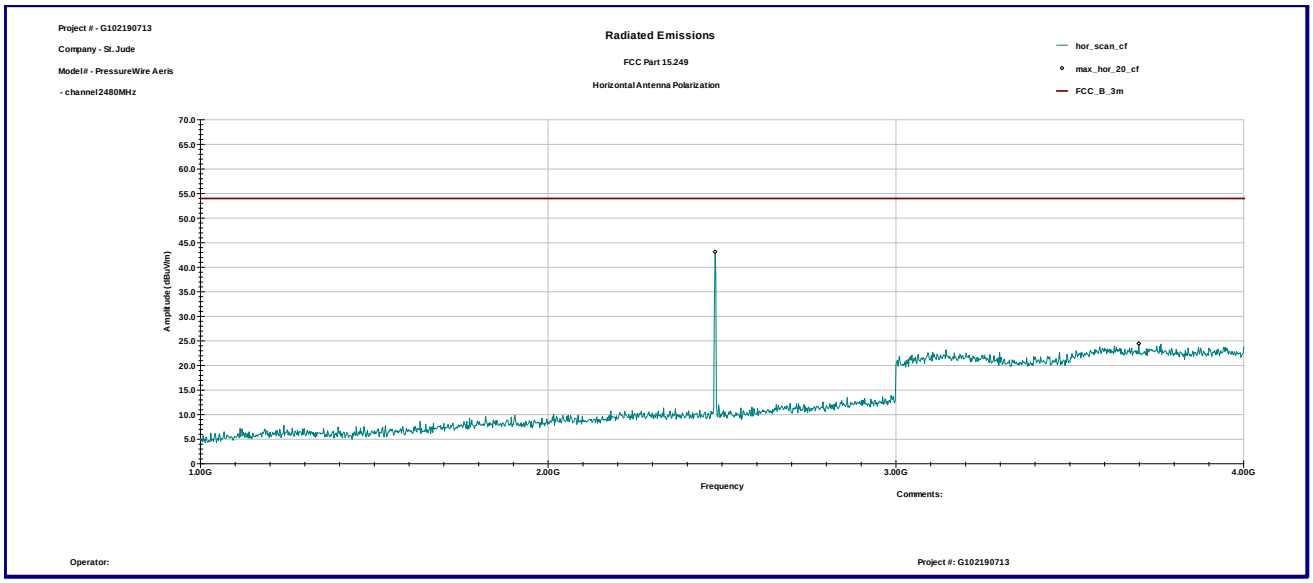


Graph 3.2.10

Vertical antenna polarization

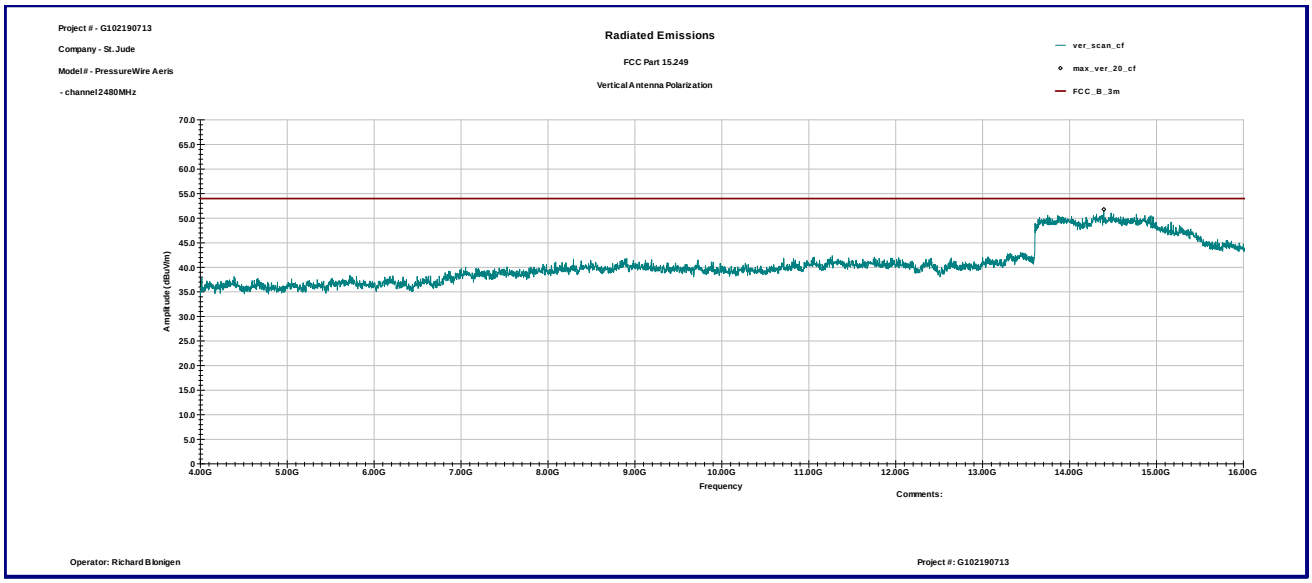


Horizontal antenna polarization

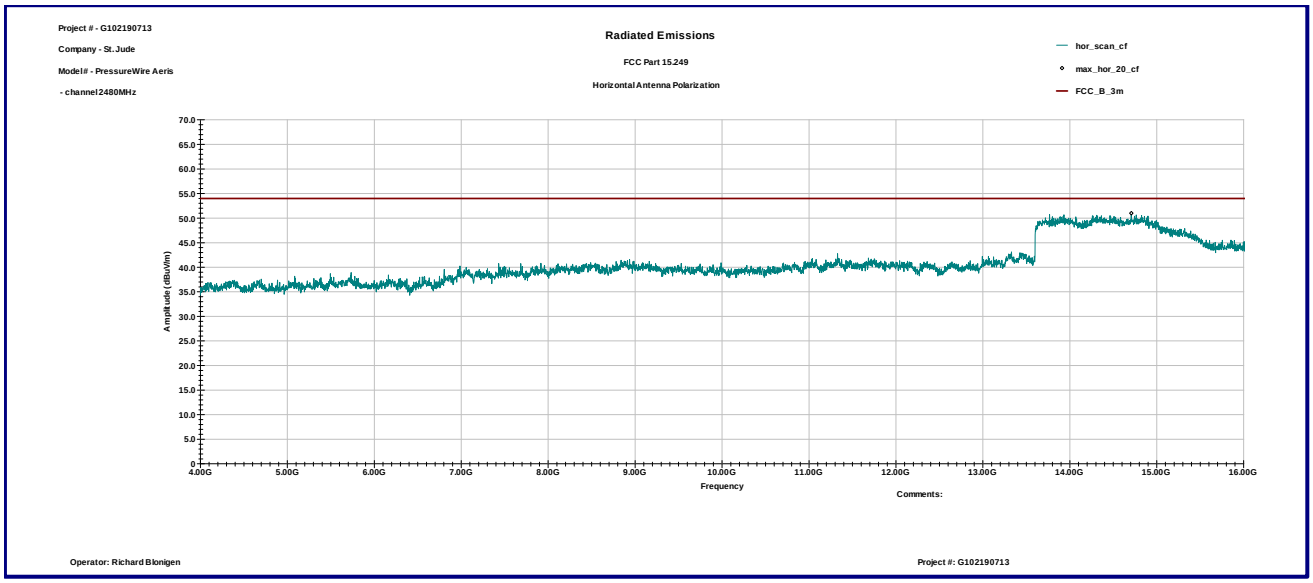


Graph 3.2.11

Vertical antenna polarization

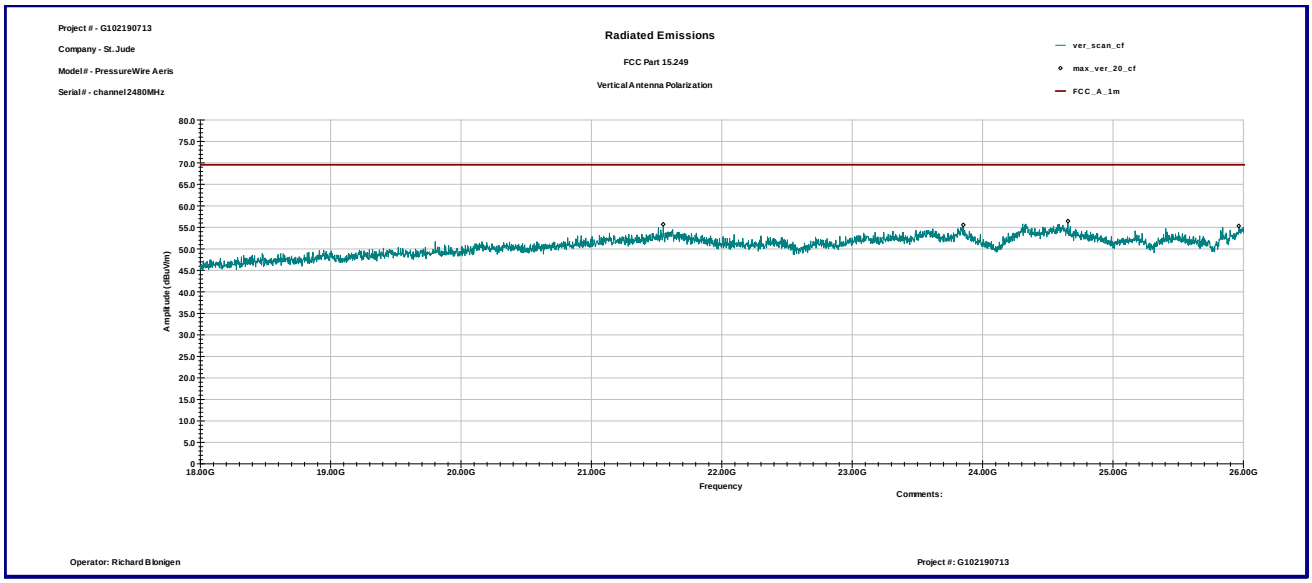


Horizontal antenna polarization

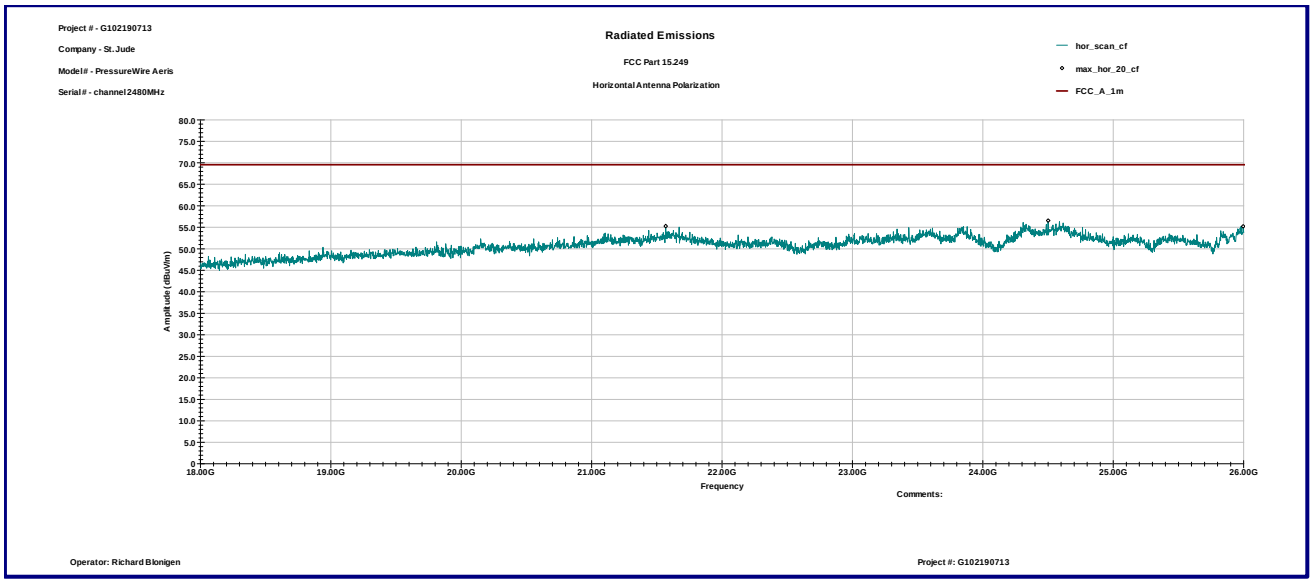


Graph 3.2.12

Vertical antenna polarization



Horizontal antenna polarization



3.2.1 Average correction factor calculation

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

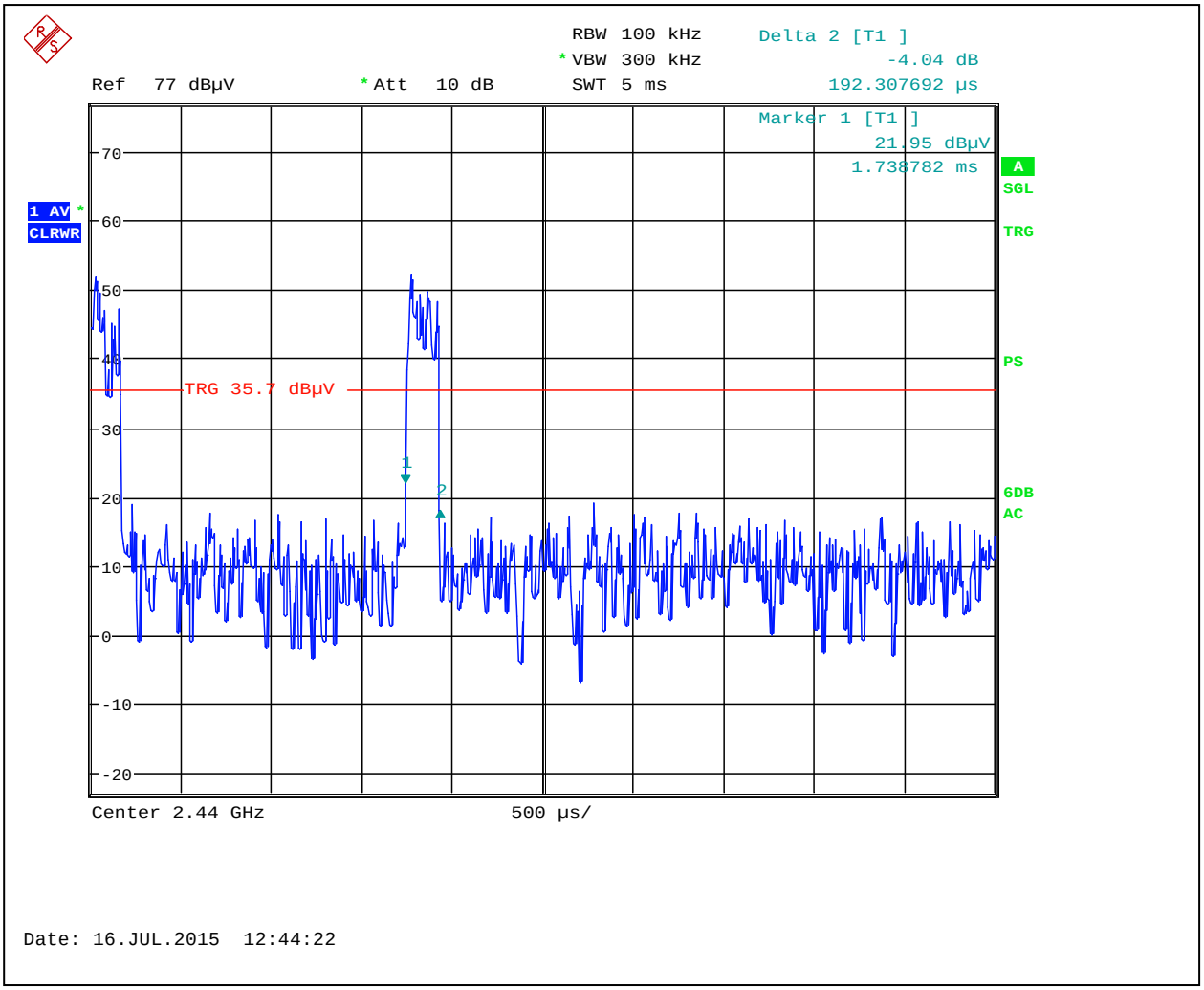
One complete pulse train, including blanking intervals = 100ms

Length of transmit = 192us
Number of transmit per pulse = 6
Time with field strength is in its maximum value = (192us x 6) =1.15ms

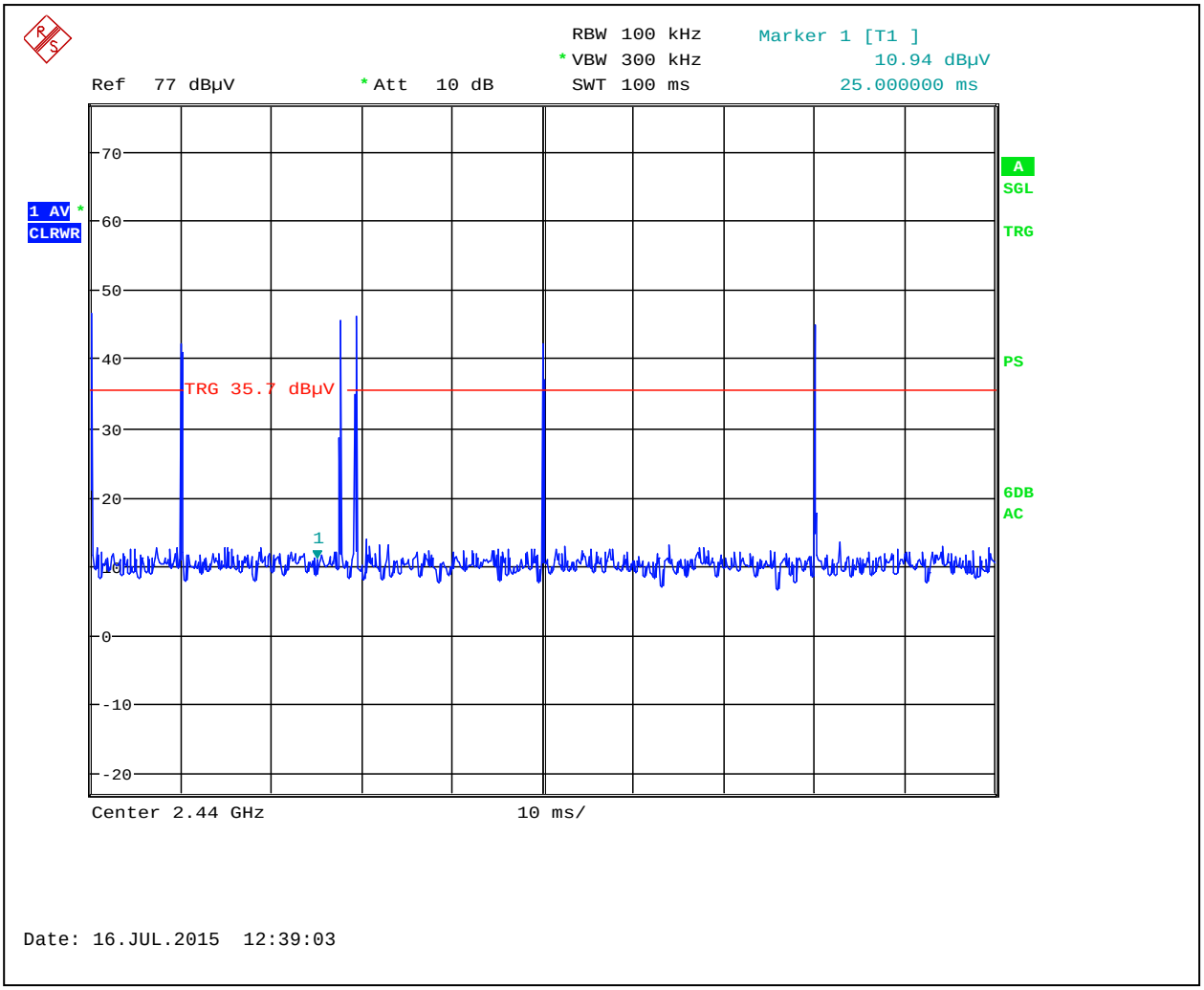
Average Correction Factor = 20Log(1.15ms/100ms) = -38.78dB
A minimum correction factor of 20dB was used.

Graphs 3-2-3 to 3-2-4 show pulse train timing.

Graph 3.2.3


RBW 100 kHz
*VBW 300 kHz
SWT 5 ms
Delta 2 [T1]
-4.04 dB
192.307692 µs
Ref 77 dBµV
*Att 10 dB
Marker 1 [T1]
21.95 dBµV
1.738782 ms
1 AV *
CLRWR
A
SGL
TRG
PS
6DB
AC
TRG 35.7 dBµV
70
60
50
40
30
20
10
0
-10
-20
1
2
Center 2.44 GHz
500 µs/
Date: 16.JUL.2015 12:44:22

Graph 3.2.4


RBW 100 kHz
*VBW 300 kHz
SWT 100 ms
Marker 1 [T1]
10.94 dBµV
25.000000 ms
Ref 77 dBµV
*Att 10 dB
1 AV *
CLRWR
A
SGL
TRG
PS
6DB
AC
TRG 35.7 dBµV
70
60
50
40
30
20
10
0
-10
-20
Center 2.44 GHz
10 ms/
Date: 16.JUL.2015 12:39:03

4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	01/07/2016	☒
Spectrum Analyzer	R & S	ESU	100398	25283	01/26/2016	☒
Bicono-Log Antenna	Teseq	CBL6112D	32859	25289	09/10/2015	☒
Horn Antenna	EMCO	3115	9507-4513	9936	07/01/2016	☒
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	11/24/2015	☒
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	11/19/2015	☒
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	11/19/2015	☒
System	Quantum Change	TILE! Instrument Control	Ver. 3.4.K.29	15259	VBU	☒

5.0 Revision History

REVISION LEVEL	DATE	REPORT NUMBER	PREPARED	REVIEWED	NOTES
0	7-22-2015	102190713MIN-001	RB	US	Original Issue
1	8-9-2016	102190713MIN-001	RB 	NS 	Change model name to C12068