Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	Test-Log Number:	T69523
		Project Manager:	Dean Eriksen
Contact:	Roy Urbach		
Emissions Spec:	FCC Part 15	Class:	B
Immunity Spec:	-	Environment:	-

EMC Test Data

For The

Timble Navigation

Model

R8-M2 with 2.4GHz Module (RoHS Compliant)

Date of Last Test: 10/18/2007

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	Test-Log Number:	T69523
		Project Manager:	Dean Eriksen
Contact:	Roy Urbach		
Emissions Spec:	FCC Part 15	Class:	B
Immunity Spec:	-	Environment:	-

EUT INFORMATION

The following information was collected during the test sessions(s).

General Description

The EUT is a GPS/GNSS Receiver with a 2.4GHz data radio that is designed to receive GPS signals and corrections. Since the EUT would be placed on a tabletop during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/230 Volts, 60/50 Hz, 2 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Trimble Navigation	R8-M2 with 2.4GHz Module	GPS/GNSS Reciever with a 2.4GHz data radio	SN: RoHS A00001 PN: 60250-24	-
Cirronet	2.4GHz Module	2.4GHz data radio	SN: WIT2410T-A-020001 PN: 62481-24	-
Ault	PW174KA180	AC Adapter for Radio	Date Code 0703 rev A	DoC
PCTEL	MaxRad Omni	2.4GHz Antenna	SN: Marked 408757 PN: MFB24008	-

Other EUT Details

Add these PNs/SNs:

R8-M2* PN: 60250-24 (also SPS881 PN: 59355-24) SN: RoHSA00001

2.4GHz Radio PN: 59400-24 SN:WIT2410T-A-020001

EUT Enclosure

The EUT enclosure is primarily constructed of plastic . It measures approximately 19 cm wide by 19cm deep by 10 cm high.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Project Manager:	Dean Eriksen
Contact:	Roy Urbach		
Emissions Spec:	FCC Part 15	Class:	B
Immunity Spec:	-	Environment:	-

Test Configuration #1

The following information was collected during the test sessions(s).

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Dell	Lattitude D160	Laptop PC w/ BluetoothRadio	Service Tag 3STVK81 Trimble #S-0002692	DoC
Dell	ADP-90AHB	AC Adapter for Laptop	CN-OC8023-48661-56S-1PT6	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Interface Ports on EUT				
7-Pin Serial/Power Port	Laptop PC DB9 Serial Port and External AC Adapter DC Output	Combo Serial/Power Cable	Shielded	Power = 2m Serial = 5m
Serial DB9	Not Cabled	-	-	-
Antenna	2.4 GHz Antenna	Coax	Shielded	5.1

EUT Operation During Emissions Tests

During emissions testing the EUT was streaming data to the laptop and the radio was set in hopping mode.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

RSS 210 and FCC 15.247 Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 10/18/2007
Test Engineer: Rafael Varelas
Test Location: OATS #2
Config. Used: 1
Config Change: -
Host EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 16 °C
Rel. Humidity: 75 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	RE, 30 - 25000 MHz Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	73.4dBµV/m @ 7409.2MHz (-0.6dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

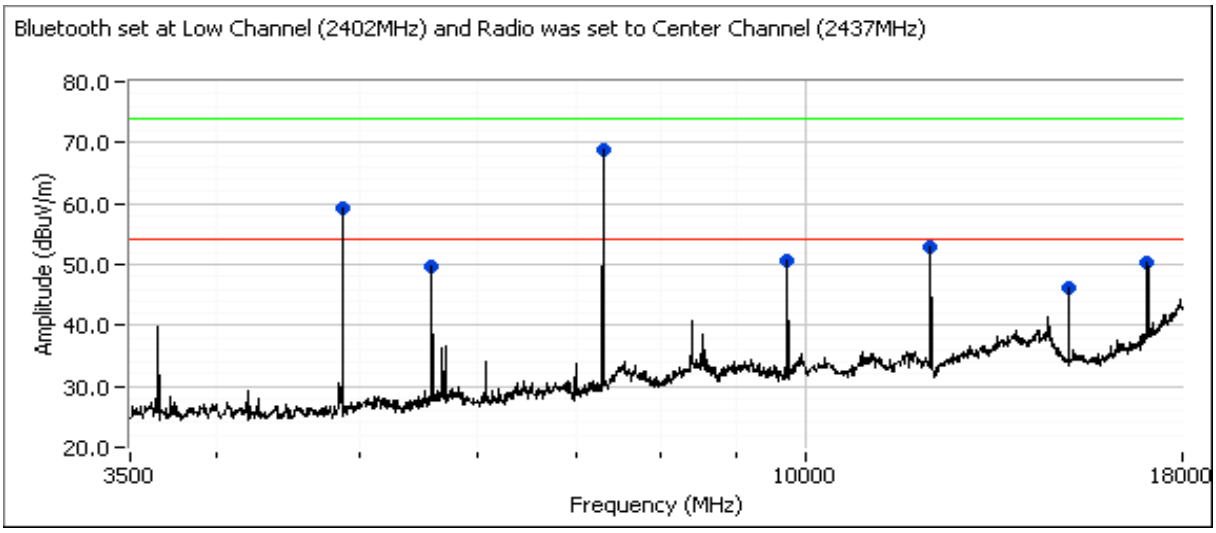
Derivation of duty cycle correction for average readings

Maximum transmit time on a single channel (refer to Theory of Operation):
= 280 bytes * 8 bits /byte * (1/460.8kbps) = 4.86 ms
The minimum hop duration for this scenario would be 6.94ms. Given that there are 86 channels in the hop set, it takes 597ms to go through the entire hop table and repeat a transmission on the same channel. Therefore, only 4.86 ms worth of data can be transmitted on a single channel in any 100ms time period.
The transmission duty cycle correction factor is then calculated as:
20 log10 (4.86ms/100ms)= -26.3 dB

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1: Radiated Spurious Emissions, 30 - 25,000 MHz.

Run #1a: Low Channel @ 2402 MHz (Bluetooth) and Center Channel @ 2437 MHz (Radio)



Bluetooth at 2402MHz

Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2401.970	79.7	V	-	-	AVG	231	1.0	
2401.970	80.0	V	-	-	PK	231	1.0	
2401.980	84.3	H	-	-	AVG	227	1.3	
2401.980	84.5	H	-	-	PK	227	1.3	

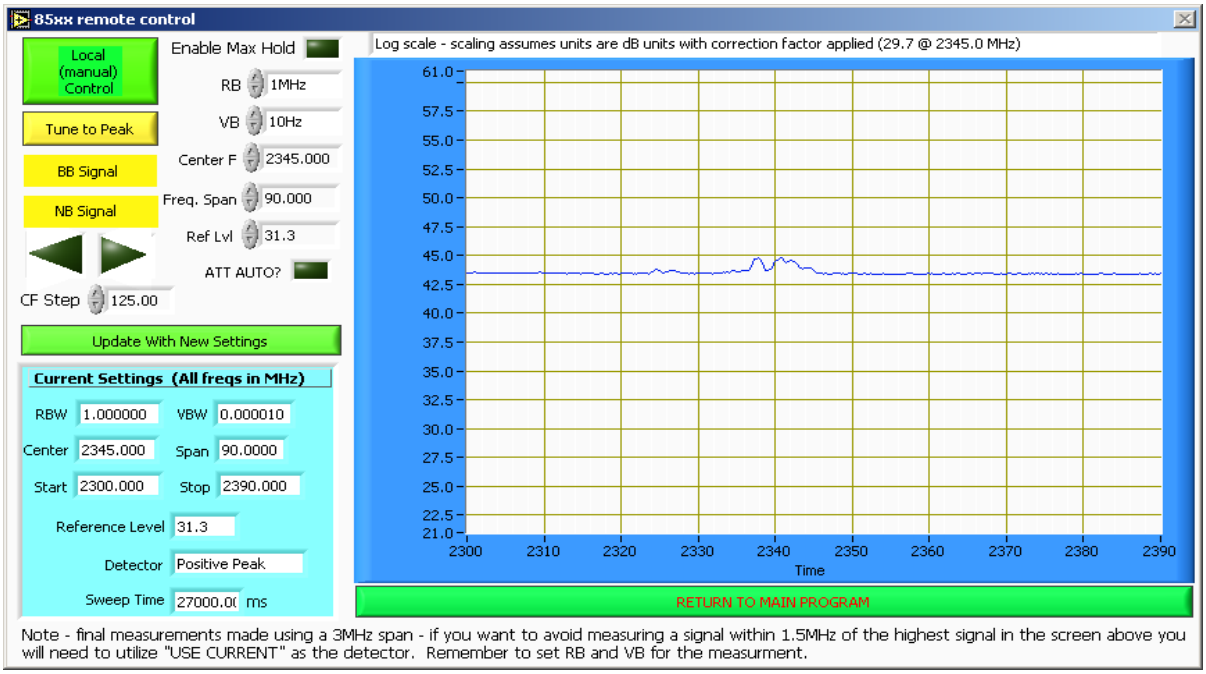
Band Edge Signal Field Strength (Bluetooth @ 2402MHz)

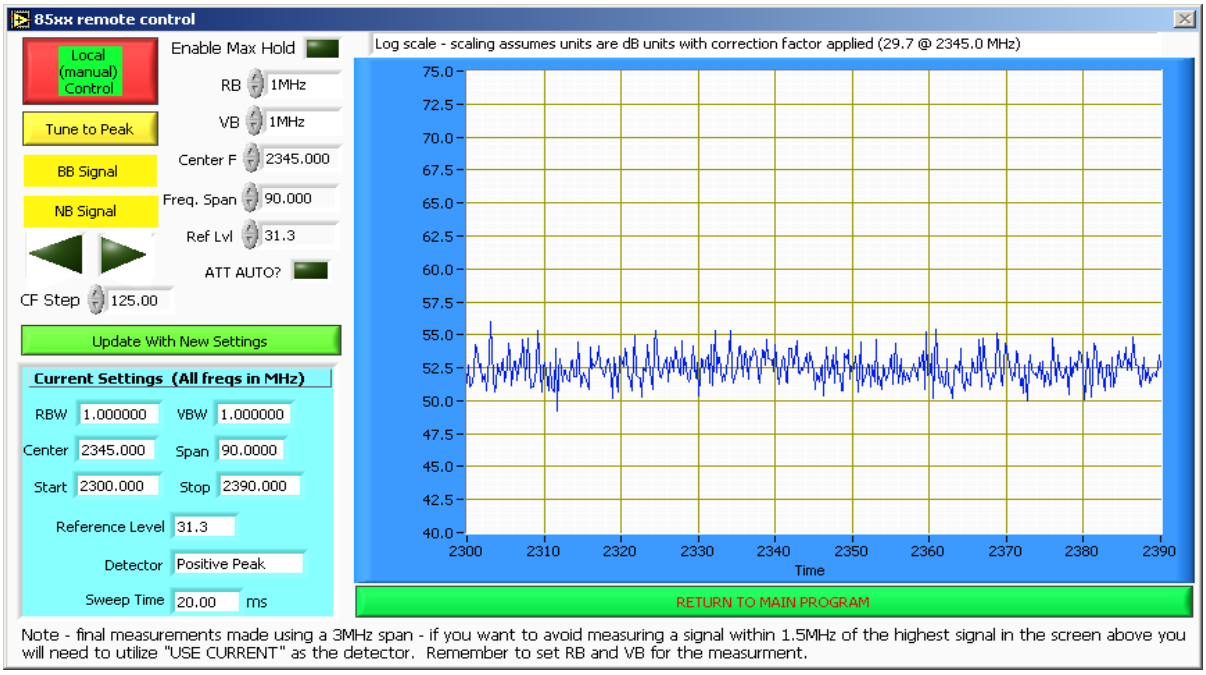
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2341.590	45.2	V	54.0	-8.8	AVG	231	1.0	
2341.590	56.3	V	74.0	-17.7	PK	231	1.0	
2388.220	45.1	H	54.0	-8.9	AVG	227	1.0	
2388.220	56.5	H	74.0	-17.5	PK	227	1.0	

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1a: Continued

Vertical

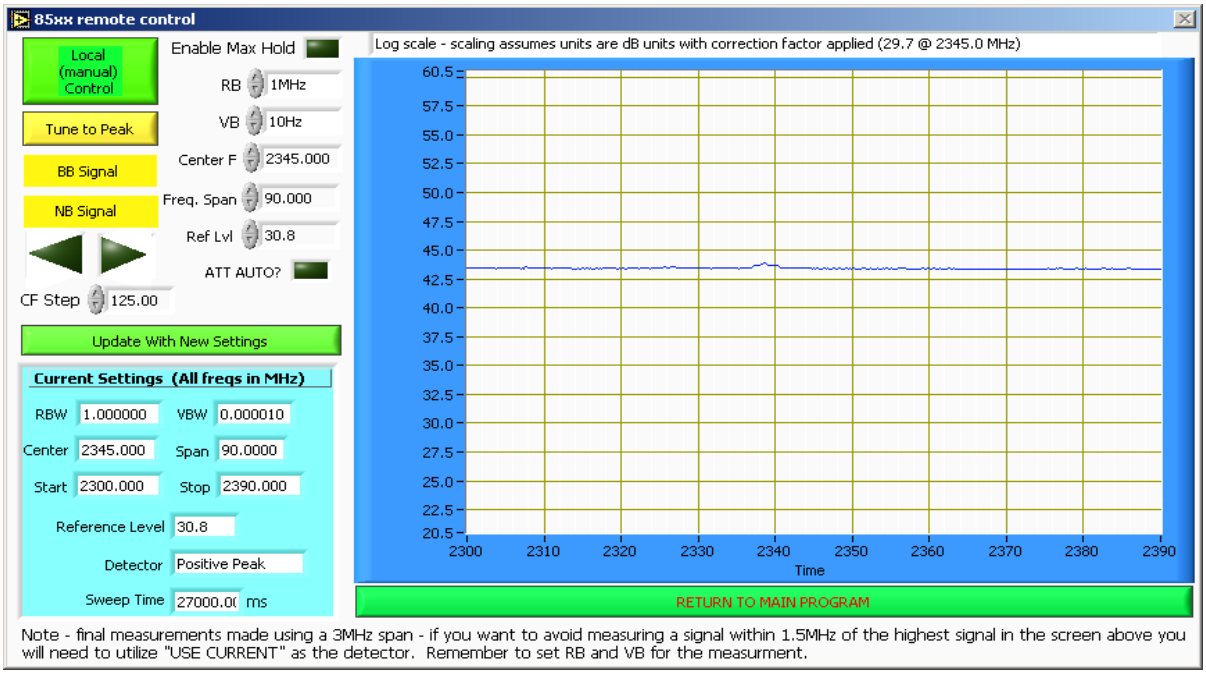


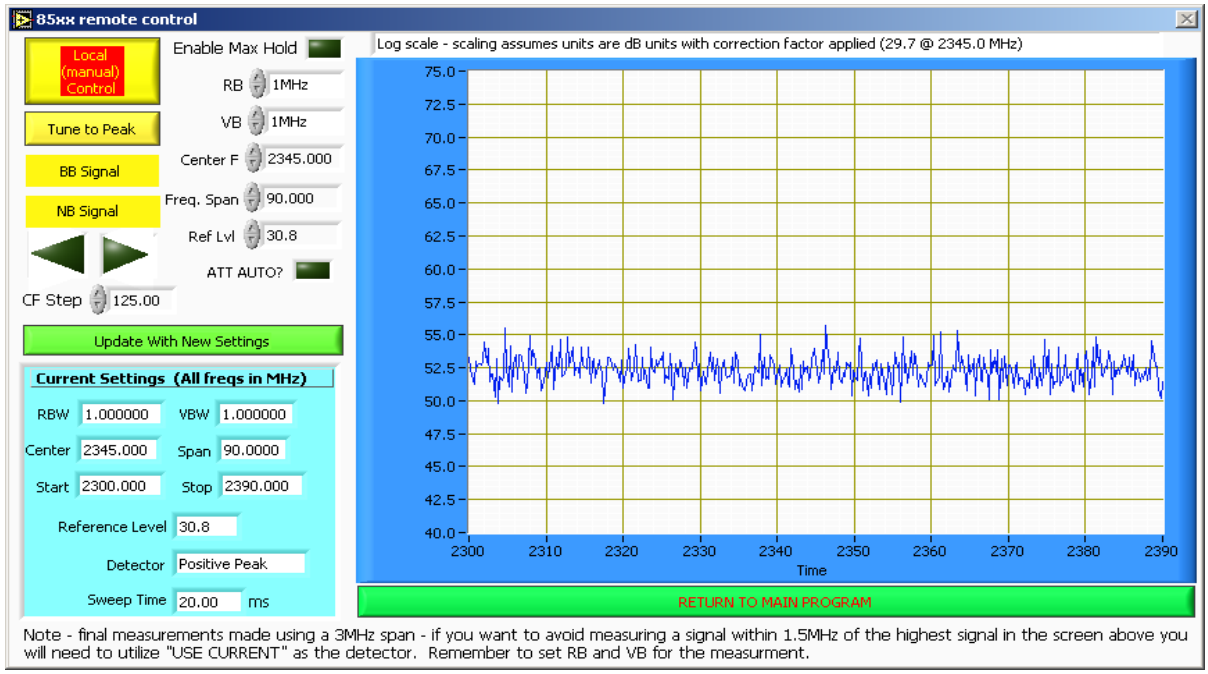


Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1a: Continued

Horizontal





Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1a: Continued

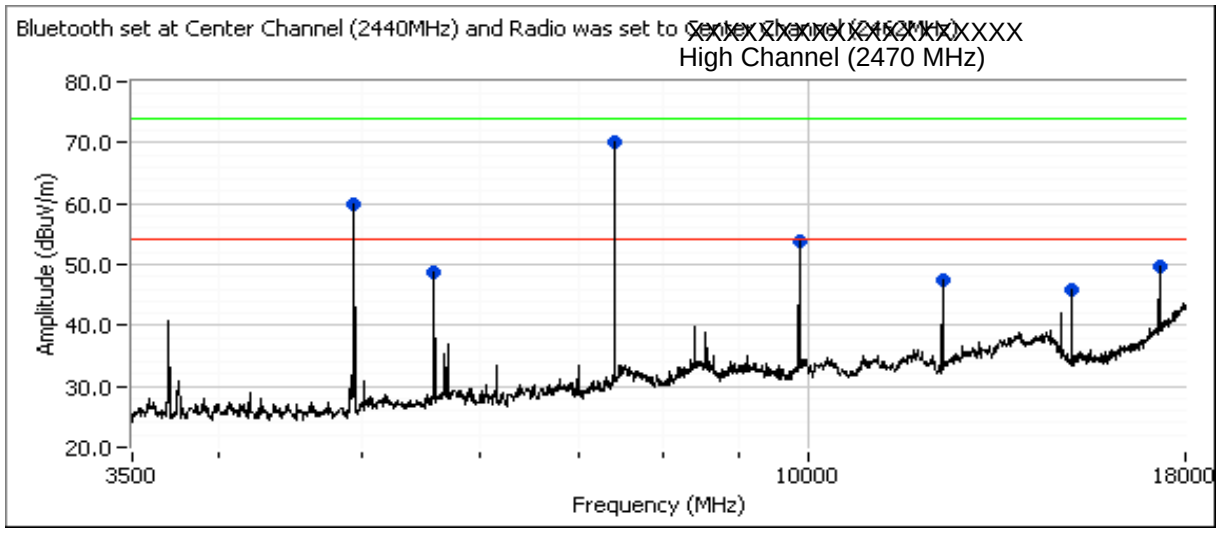
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4871.240	70.9	V	74.0	-3.1	PK	100	1.0	
4871.250	69.0	H	74.0	-5.0	PK	24	1.0	
7306.880	68.5	V	74.0	-5.5	PK	169	1.2	
7306.920	65.7	H	74.0	-8.3	PK	75	1.0	
4871.240	44.6	V	54.0	-9.4	AVG	100	1.0	Note 1
4871.250	42.7	V	54.0	-11.3	AVG	24	1.0	Note 1
9742.620	62.3	V	74.0	-11.7	PK	131	1.1	Note 2
7306.880	42.2	V	54.0	-11.8	AVG	169	1.2	Note 1
7306.920	39.4	V	54.0	-14.6	AVG	75	1.0	Note 1
17049.750	58.0	V	74.0	-16.0	PK	188	1.0	Note 2
9742.620	36.0	V	54.0	-18.0	AVG	131	1.1	Note 1, 2
12178.370	55.3	V	74.0	-18.7	PK	218	1.0	
15091.670	52.8	V	74.0	-21.2	PK	235	1.0	Note 2
5600.120	52.4	V	74.0	-21.6	PK	0	1.0	Note 2
17049.750	31.7	V	54.0	-22.3	AVG	188	1.0	Note 1, 2
12178.370	29.0	V	54.0	-25.0	AVG	218	1.0	Note 1
15091.670	26.5	V	54.0	-27.5	AVG	235	1.0	Note 1, 2
5600.120	26.1	V	54.0	-27.9	AVG	0	1.0	Note 1, 2

Note 1:	A duty cycle correction factor of 26.3dB was used to calculate the Average level from the Peak measurements.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1b: Center Channel @ 2440 MHz (Bluetooth) and High Channel @ 2470 MHz (Radio)
Radio at 2470MHz



Fundamental Signal Field Strength: Peak and average values measured in 1 MHz, and peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2469.700	111.5	H	-	-	AVG	38	1.0	
2469.700	112.1	H	-	-	PK	38	1.0	
2469.710	117.8	V	-	-	AVG	143	1.3	
2469.710	118.5	V	-	-	PK	143	1.3	

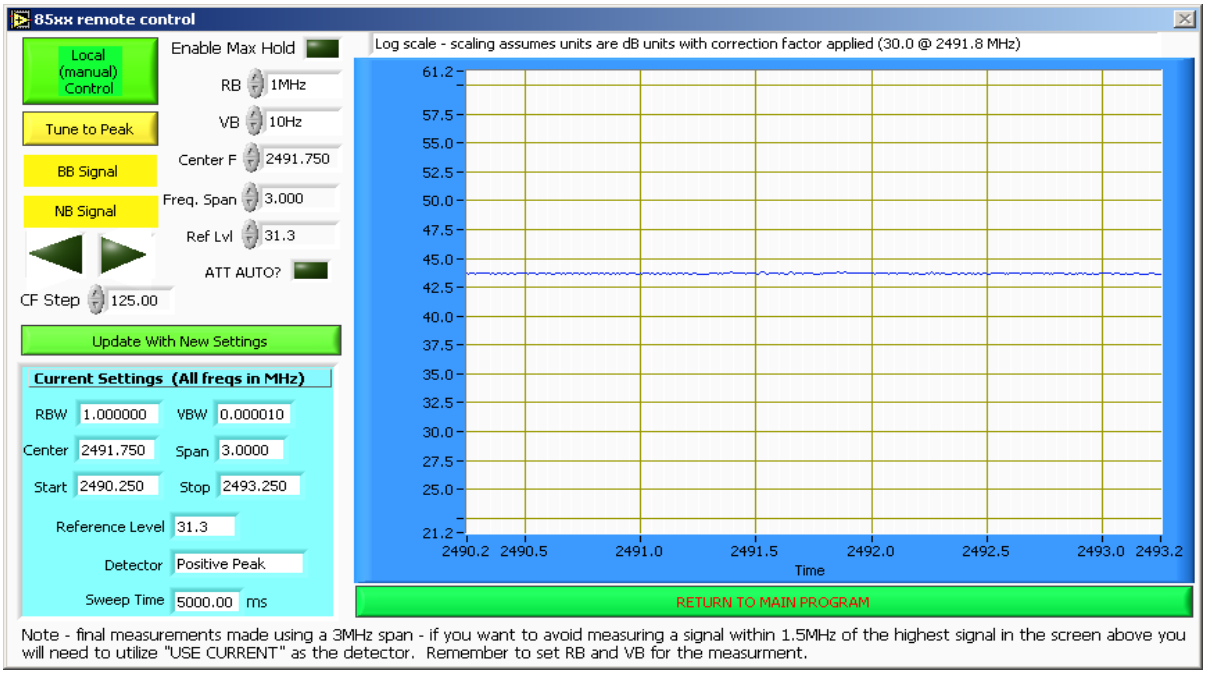
Band Edge Signal Field Strength (Radio @ 2470MHz)

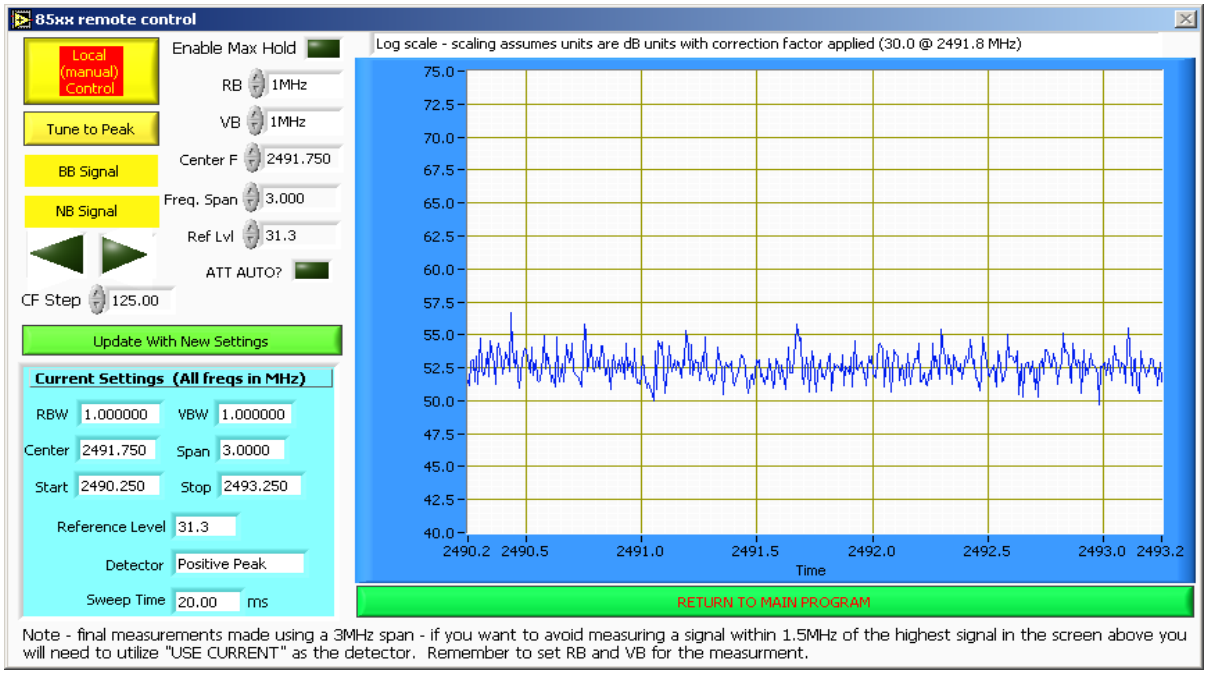
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2484.590	45.2	H	54.0	-8.8	AVG	38	1.0	
2484.590	56.1	H	74.0	-17.9	PK	38	1.0	
2485.180	45.5	V	54.0	-8.5	AVG	143	1.3	
2485.180	56.3	V	74.0	-17.7	PK	143	1.3	

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1b: Continued

Vertical

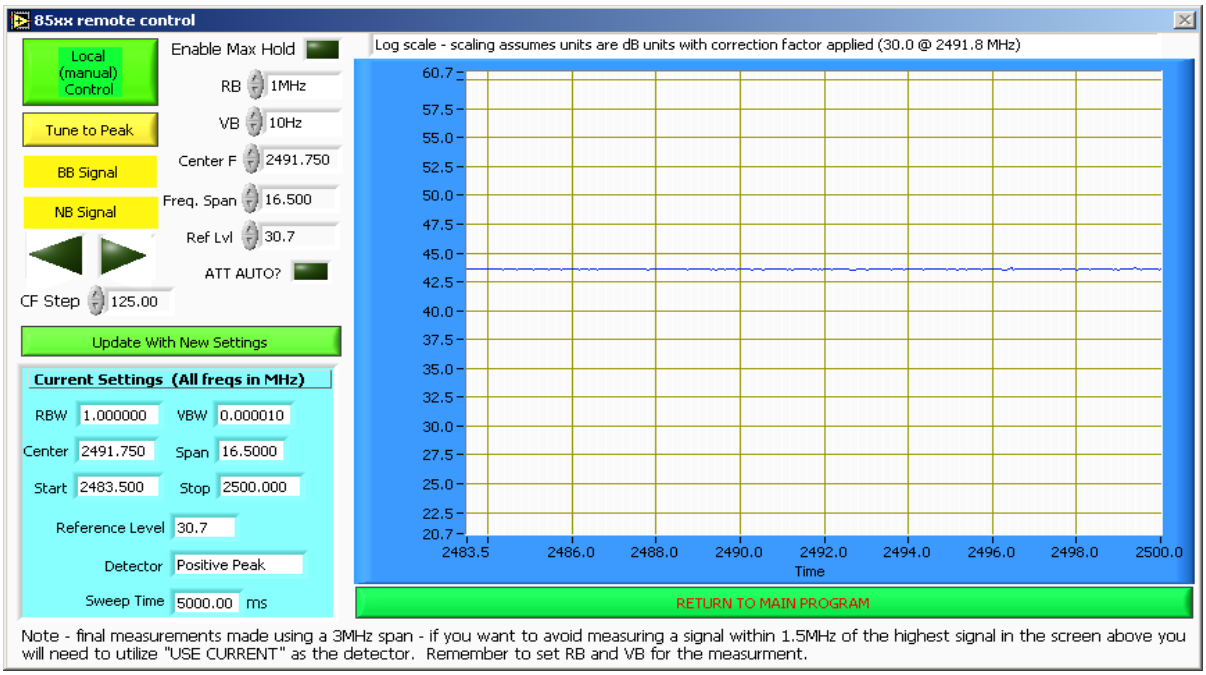




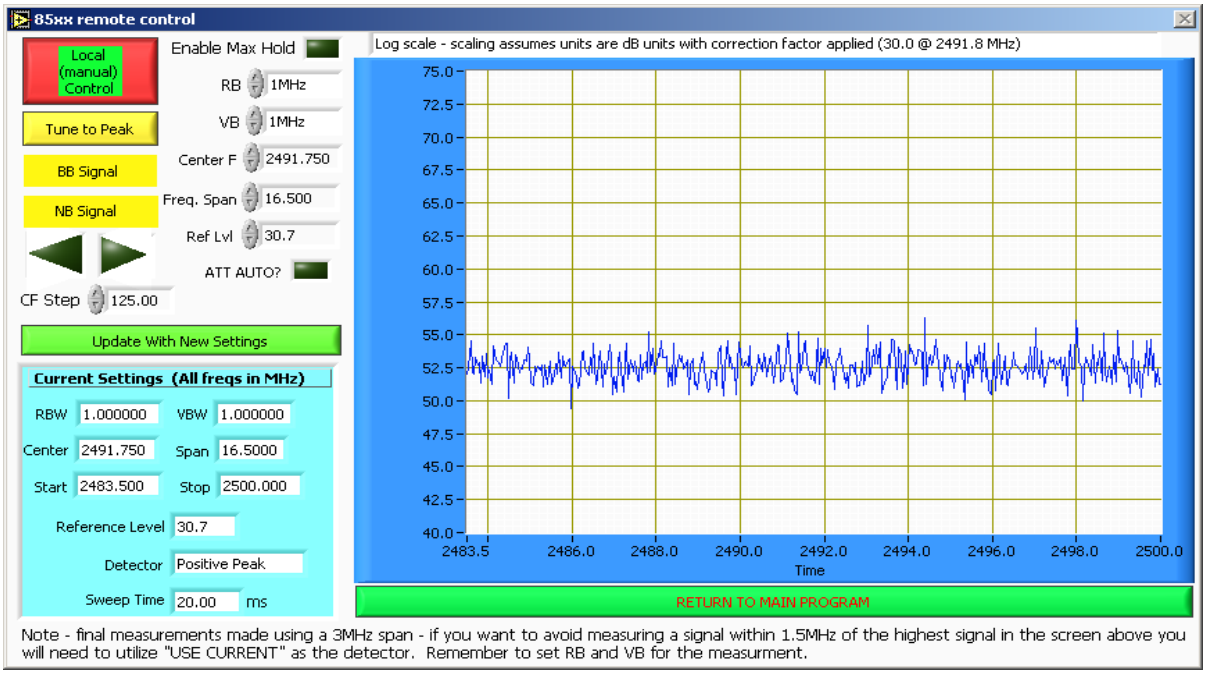
Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1b: Continued

Horizontal



Note - final measurements made using a 3MHz span - if you want to avoid measuring a signal within 1.5MHz of the highest signal in the screen above you will need to utilize "USE CURRENT" as the detector. Remember to set RB and VB for the measurment.



Note - final measurements made using a 3MHz span - if you want to avoid measuring a signal within 1.5MHz of the highest signal in the screen above you will need to utilize "USE CURRENT" as the detector. Remember to set RB and VB for the measurment.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1b: Continued

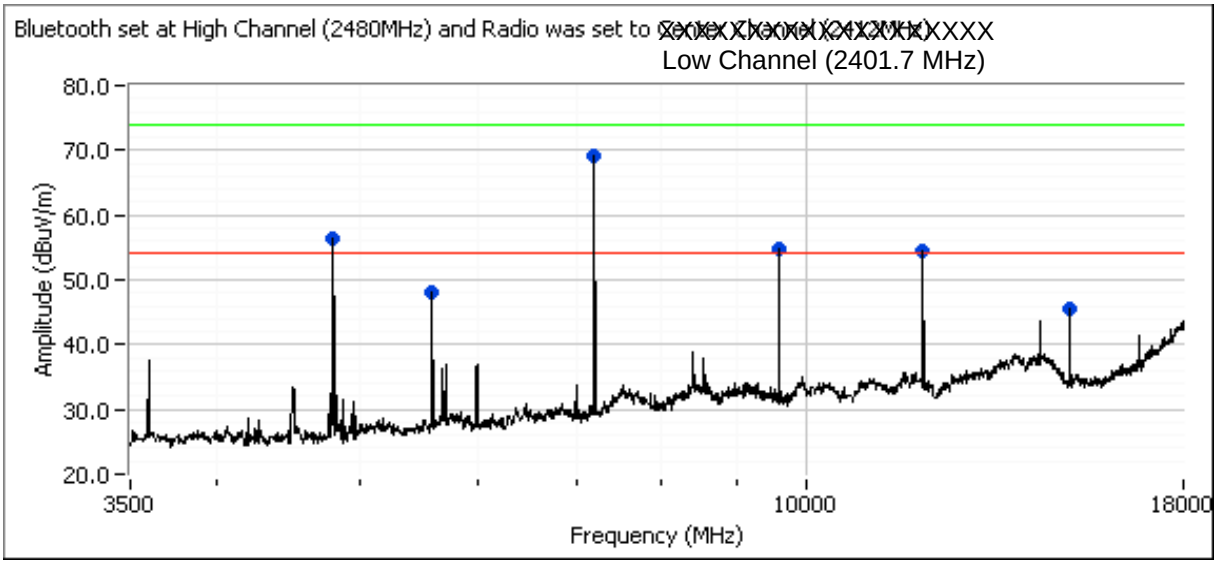
Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7409.180	73.4	V	74.0	-0.6	PK	169	1.0	
4939.750	69.8	V	74.0	-4.2	PK	74	1.5	
7409.170	67.9	H	74.0	-6.1	PK	90	1.5	
7409.180	47.1	H	54.0	-6.9	AVG	169	1.0	Note 1
4939.750	43.5	H	54.0	-10.5	AVG	74	1.5	Note 1
4939.410	62.9	H	74.0	-11.1	PK	322	1.0	
9878.890	62.9	V	74.0	-11.1	PK	178	1.4	Note 2
7409.170	41.6	H	54.0	-12.4	AVG	90	1.5	Note 1
15050.300	41.5	V	54.0	-12.5	AVG	225	1.0	Note 2
17288.010	59.6	V	74.0	-14.4	PK	185	1.0	Note 2
4939.410	36.6	H	54.0	-17.4	AVG	322	1.0	Note 1
9878.890	36.6	H	54.0	-17.4	AVG	178	1.4	Note 1, 2
12348.640	56.2	V	74.0	-17.8	PK	116	1.2	
5599.960	55.0	V	74.0	-19.0	PK	153	1.0	Note 2
17288.010	33.3	H	54.0	-20.7	AVG	185	1.0	Note 1, 2
15050.300	52.0	V	74.0	-22.0	PK	225	1.0	Note 2
12348.640	29.9	H	54.0	-24.1	AVG	116	1.2	Note 1
5599.960	28.7	H	54.0	-25.3	AVG	153	1.0	Note 1, 2

Note 1:	A duty cycle correction factor of 26.3dB was used to calculate the Average level from the Peak measurements.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: High Channel @ 2480 MHz (Bluetooth) and Low Channel @ 2401.7 MHz (Radio)



Radio at 2401.7MHz

Fundamental Signal Field Strength: Peak and average values measured in 1 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2401.530	117.9	V	-	-	AVG	143	1.3	
2401.530	118.5	V	-	-	PK	143	1.3	
2401.470	107.9	H	-	-	AVG	293	1.0	
2401.470	108.7	H	-	-	PK	293	1.0	

Bluetooth at 2480MHz

Fundamental Signal Field Strength: Peak and average values measured in 1 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2479.980	84.8	H	-	-	AVG	213	1.3	
2479.980	85.1	H	-	-	PK	213	1.3	
2479.990	79.9	V	-	-	AVG	132	1.1	
2479.990	80.3	V	-	-	PK	132	1.1	

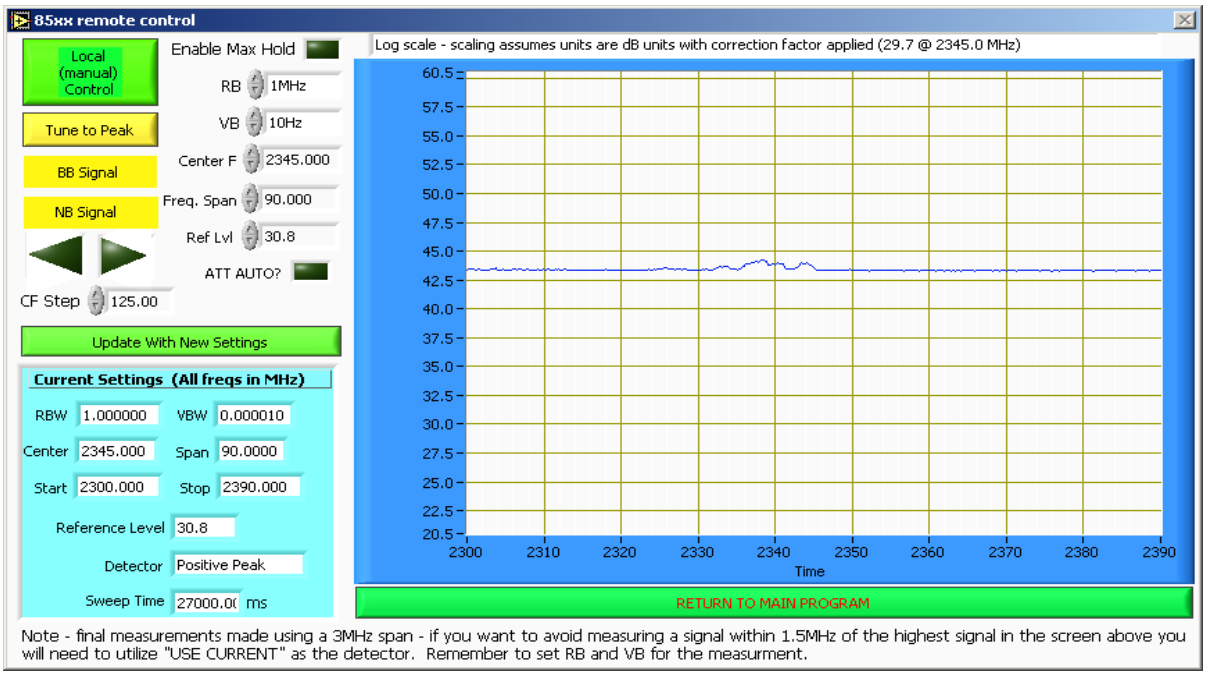
Band Edge Signal Field Strength (Radio at 2401.7MHz, Low Channel)

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2337.400	45.1	V	54.0	-8.9	AVG	143	1.3	
2337.400	56.9	V	74.0	-17.1	PK	143	1.3	
2339.480	44.9	H	54.0	-9.1	AVG	294	1.0	
2339.480	55.8	H	74.0	-18.2	PK	294	1.0	

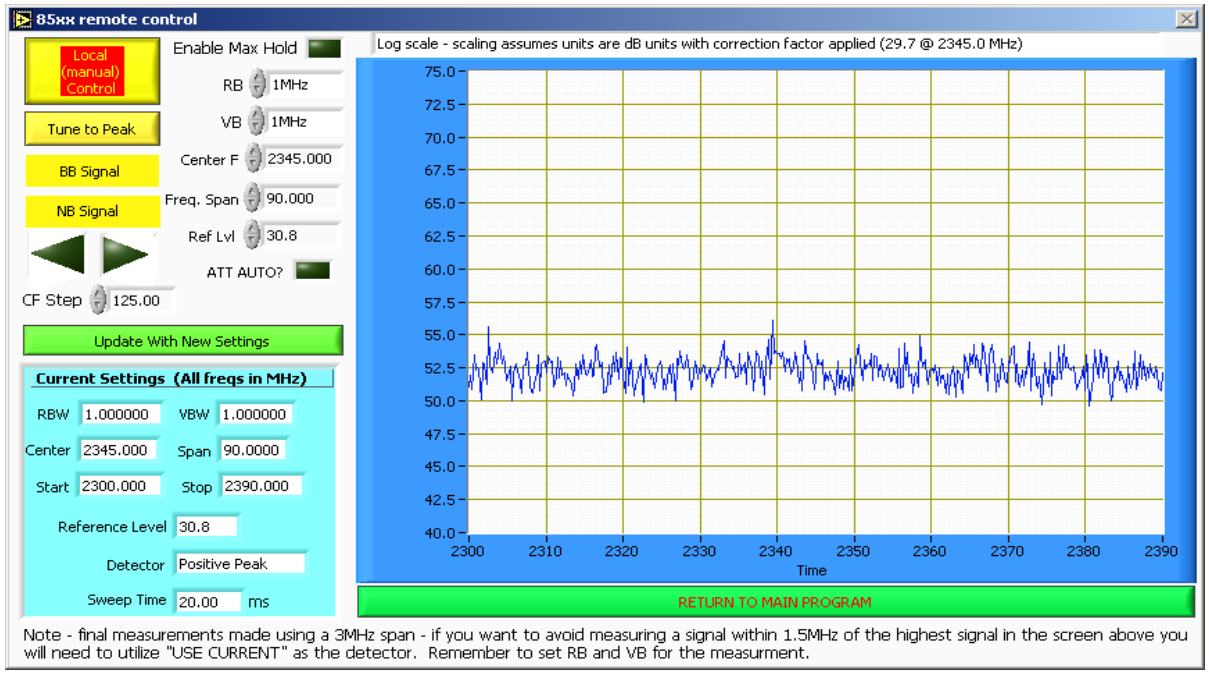
Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: Continued

Vertical



Note - final measurements made using a 3MHz span - if you want to avoid measuring a signal within 1.5MHz of the highest signal in the screen above you will need to utilize "USE CURRENT" as the detector. Remember to set RB and VB for the measurment.

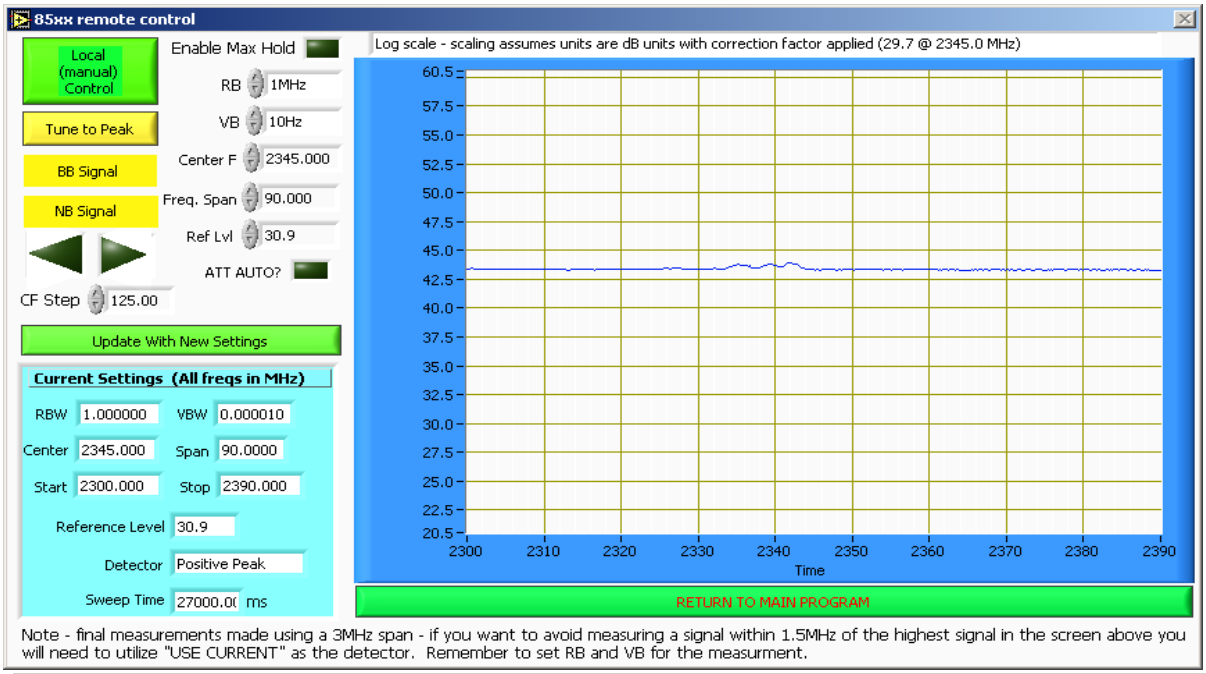


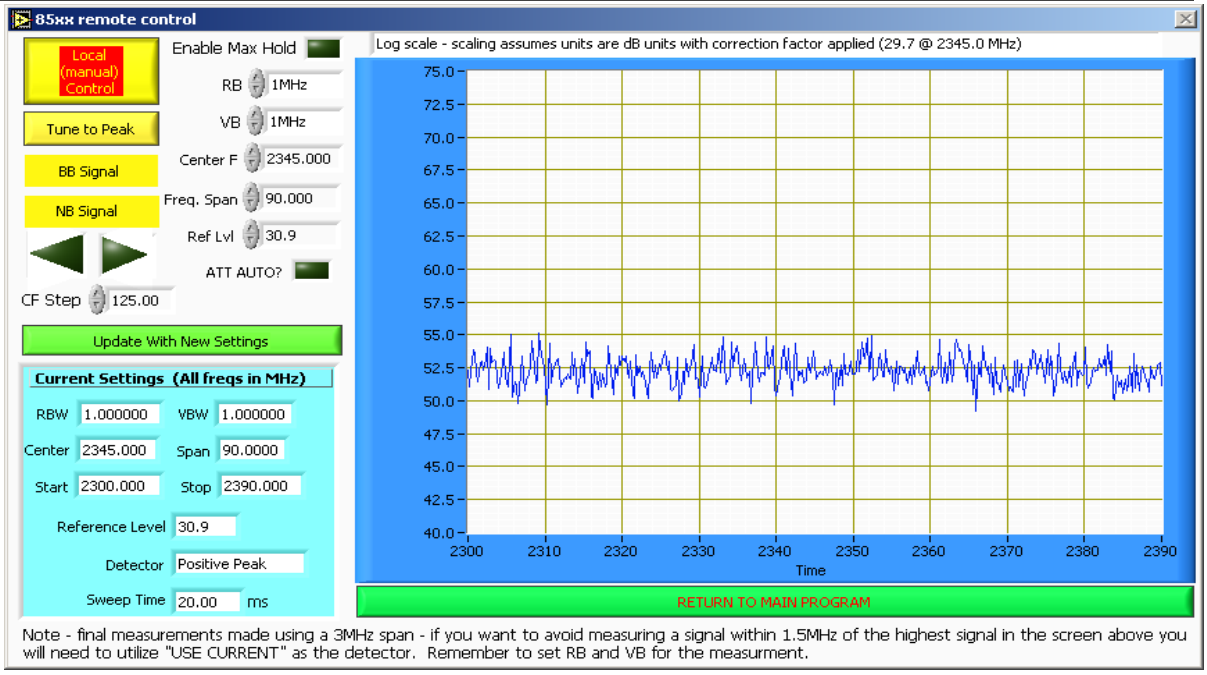
Note - final measurements made using a 3MHz span - if you want to avoid measuring a signal within 1.5MHz of the highest signal in the screen above you will need to utilize "USE CURRENT" as the detector. Remember to set RB and VB for the measurment.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: Continued

Horizontal





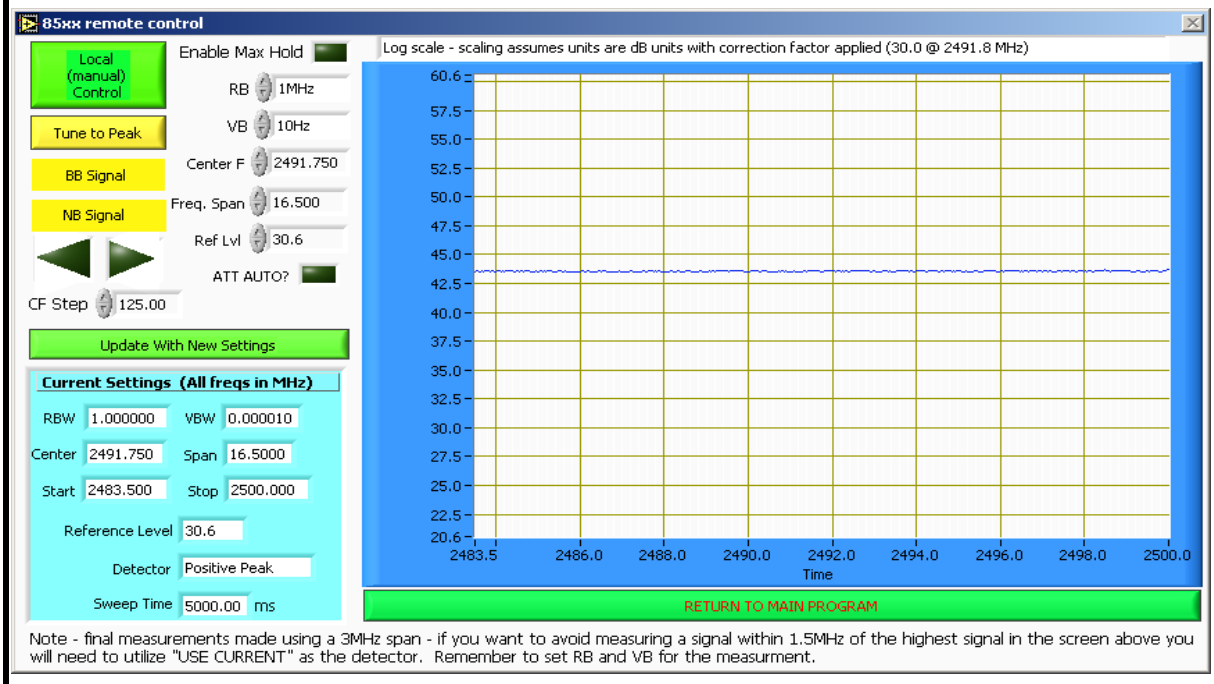
Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: Continued

Band Edge Signal Field Strength (Bluetooth at 2480MHz)

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2485.410	45.1	H	54.0	-8.9	AVG	213	1.3	
2485.410	56.6	H	74.0	-17.4	PK	213	1.3	
2484.330	45.4	V	54.0	-8.6	AVG	132	1.1	
2484.330	56.2	V	74.0	-17.8	PK	132	1.1	

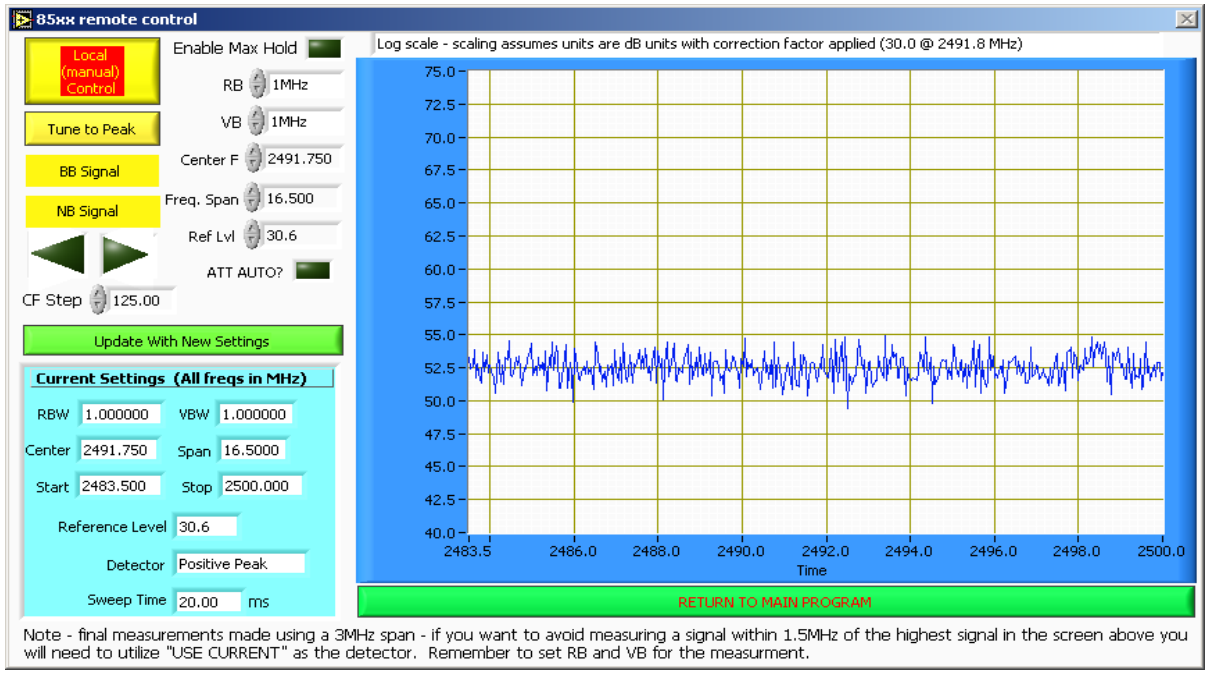
Vertical



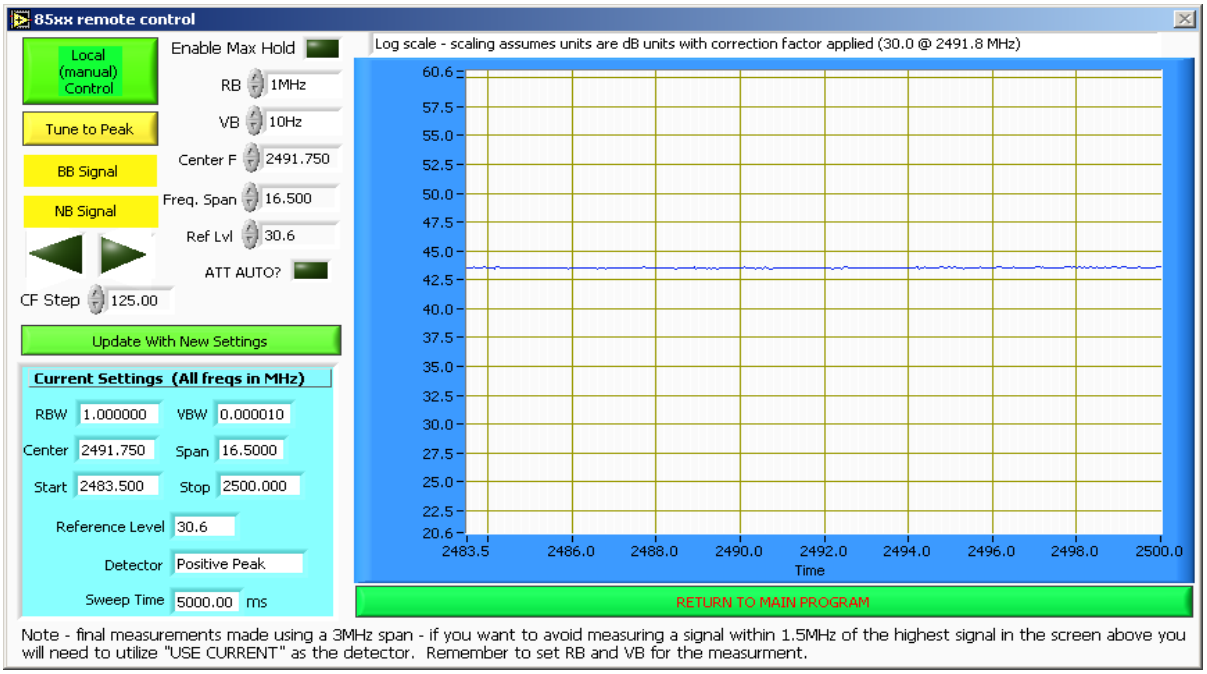
Note - final measurements made using a 3MHz span - if you want to avoid measuring a signal within 1.5MHz of the highest signal in the screen above you will need to utilize "USE CURRENT" as the detector. Remember to set RB and VB for the measurment.

Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: Continued

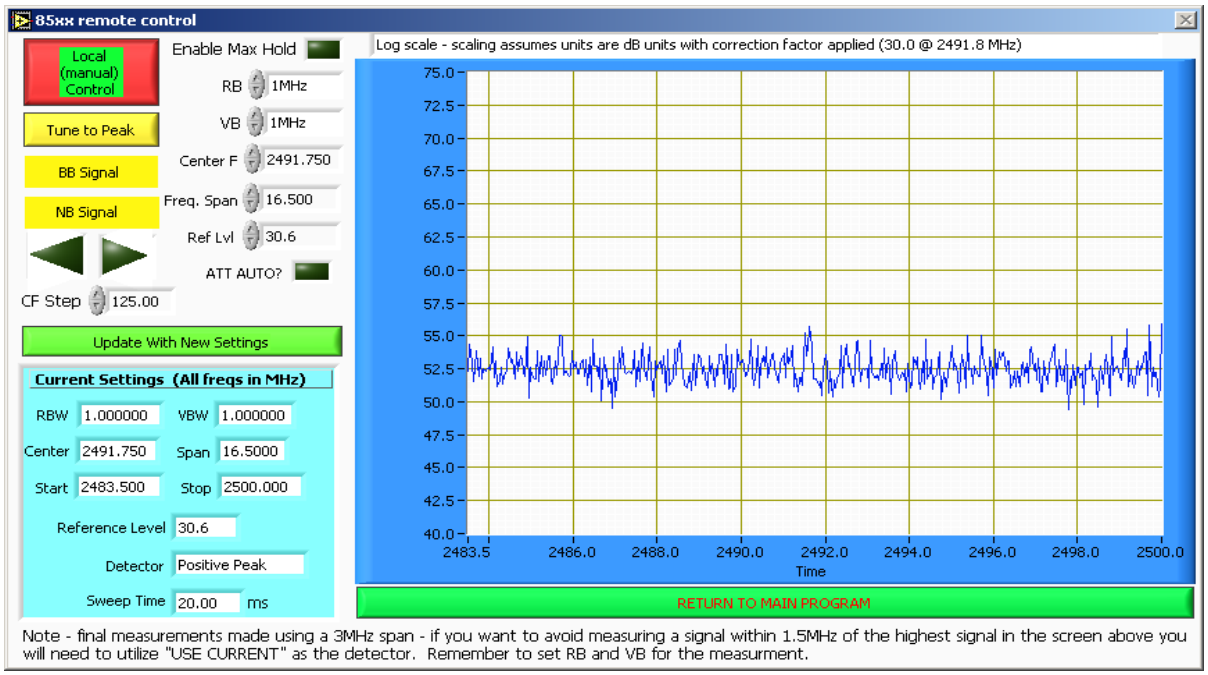


Horizontal



Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: Continued



Client:	Timble Navigation	Job Number:	J68417
Model:	R8-M2 with 2.4GHz Module (RoHS Compliant)	T-Log Number:	T69523
		Account Manager:	Dean Eriksen
Contact:	Roy Urbach		
Standard:	FCC Part 15	Class:	N/A

Run #1c: Continued

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
7204.630	70.0	V	74.0	-4.0	PK	132	1.0	Note 2
7204.630	43.7	V	54.0	-10.3	AVG	132	1.0	Note 1, 2
4803.090	61.0	V	74.0	-13.0	PK	238	1.0	
9606.190	58.7	V	74.0	-15.3	PK	126	1.1	Note 2
12007.640	55.6	V	74.0	-18.4	PK	153	1.2	
4803.090	34.7	V	54.0	-19.3	AVG	238	1.0	Note 1
5599.980	54.2	V	74.0	-19.8	PK	155	1.0	Note 2
15093.130	53.0	V	74.0	-21.0	PK	15	1.0	Note 2
9606.190	32.4	V	54.0	-21.6	AVG	126	1.1	Note 1, 2
12007.640	29.3	V	54.0	-24.7	AVG	153	1.2	Note 1
5599.980	27.9	V	54.0	-26.1	AVG	155	1.0	Note 1, 2
15093.130	26.7	V	54.0	-27.3	AVG	15	1.0	Note 1, 2

Note 1:	A duty cycle correction factor of 26.3dB was used to calculate the Average level from the Peak measurements.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.