Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Maximum Permissible Exposure

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: 2/11/2016
Test Engineer: Mark Hill
Test Location: FT Chamber #1

Summary of Results

Run #	Host Unit	# of radios in host unit	# of Tx radios	Meas. Distance	Test Performed	Limit	Result
1	XR2000	4	4	20 cm	MPE Measurement	FCC: 1.0 mW/cm^2	0.106 mW/cm^2
2	XR4000	8	8	20 cm	MPE Measurement	FCC: 1.0 mW/cm^2	0.108 mW/cm^2
3	XR6000	16	12	20 cm	MPE Measurement	FCC: 1.0 mW/cm^2	0.507 mW/cm^2

Statement of Compliance

The XI-AC3470 complies with the limits specified in Table 1 for General Population/Uncontrolled Exposure specified in FCC 1.1310(e), as required by FCC 2.1091 at the separation distances listed in the summary table above.

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

EUT Information

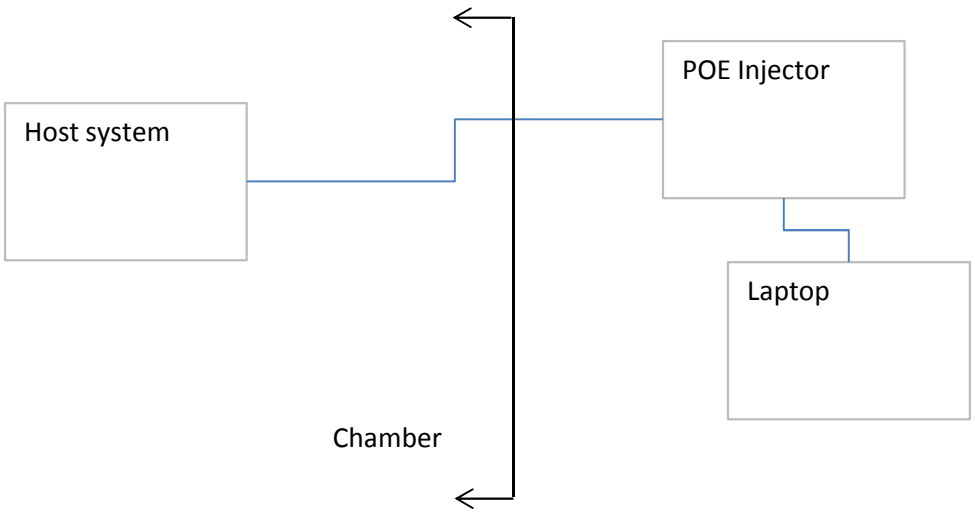
The EUT is an 802.11a/b/g/n/ac80 4x4 radio module. The module uses integral antennas. The EUT is indented to be installed in three possible host systems; XR2000, XR4000, and XR6000. Each host system supports multiple radio modules. The XR2000 supports up to 4 modules. The XR4000 supports up to 8 modules. The XR6000 supports up to 16 modules. The modules are spaced radically around the center of the host system.

EQUIPMENT UNDER TEST

Company	Model	Description	Serial Number	FCC ID
Xirrus	XI-AC3470	802.11a/b/g/n/ac 4x4 radio module	several	SK6-XIAC3470

Support Equipment

Company	Model	Description	Serial Number	FCC ID
Xirrus	XR2000	4 radio host	XR241230F5499	-
Xirrus	XR4000	8 radio host	XR4043905BCFE	-
Xirrus	XR6000	16 radio host	XR623041FFF2A	-
Xirrus	POE75U-1UP-X	POE Injector (XR2000/4000)	P21401034C1	-
Xirrus	POE240U-2MP-N	POE Injector (XR6000)	P32200074B1	-
HP	-	Laptop Computer	-	-



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Test Setup / Procedure General

The host system was placed on a non-conductive surface within the anechoic chamber. The radios were configured to transmit, as noted in the specific setup descriptions for each host system. An initial scan was performed by manually moving a hand-held field probe 360deg around the periphery of the host system at 20cm separation distance in 15deg steps, in the XY plane. The center of the probe was level with the host system (Z-axis). At the maximum point, the probe was moved along the Z axis, while maintaining the 20cm separation distance until the maximum MPE was observed. The field probe was then moved in a small steps (~1cm) in the XY plane around this location to yield the final maximized MPE measurement location. For the final measurement, the field probe was mounted on a non-conductive fixture. The maximum MPE observed was recorded along with the location of the probe relative to the product.
As the host system contained radios operating in different frequency bands, measurements were performed in different confirgurations. Refer to the sections on the individual host systems for details.

NOTES:
All separation distances stated are from the edge of the host system to the center of the measurement probe
The host units are symmetrical in terms of radio module locations. The structure of integral antennas on the modules have high front-to-back ratios with a shaped reflector.
MPE results were not spatially averaged.
The host systems do not have any accessories and therefore were tested in a standalone configuration.
Testing performed per KDB 447498, as modified as noted above.

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Conducted RF Power Summary (FCC)

Freq. Band	Mode	EUT Pwr (Measured) dBm	Derived Pwr per Chain dBm*
2.4 GHz	11b	25.3	19.3
2.4 GHz	11g	24.9	18.9
2.4 GHz	HT20BF	23.6	17.6
2.4 GHz	HT40BF	19.8	13.8
UNII1	11a	23.7	17.7
UNII1	HT20BF	23.9	17.9
UNII1	HT40BF	23.0	17.0
UNII1	AC80BF	16.9	10.9
UNII3	11a	25.0	19.0
UNII3	HT20BF	22.9	16.9
UNII3	HT40BF	21.9	15.9
UNII3	AC80BF	17.2	11.2

EUT target powers are reduced from regulatory power levels, by 1.5dB to ensure than that any production sample will be at or below the regulatory power level. Refer to operational description. MPE measurements performed at the regulatory power levels.

Power Scaling Factor = 1 for all measurements

* - Derived Pwr per Chain (dBm) = EUT Pwr (dBm) - 10log(4) (power equal across all 4 transmit chains)

Notes:

Beamforming and non-beamforming modes have the same power setting hence beamforming mode was used.
Measured RF powers are the combined conducted powers for 4 chains measured. (Refer to EMC reports.)
The host units are for indoor use only.

Legend:

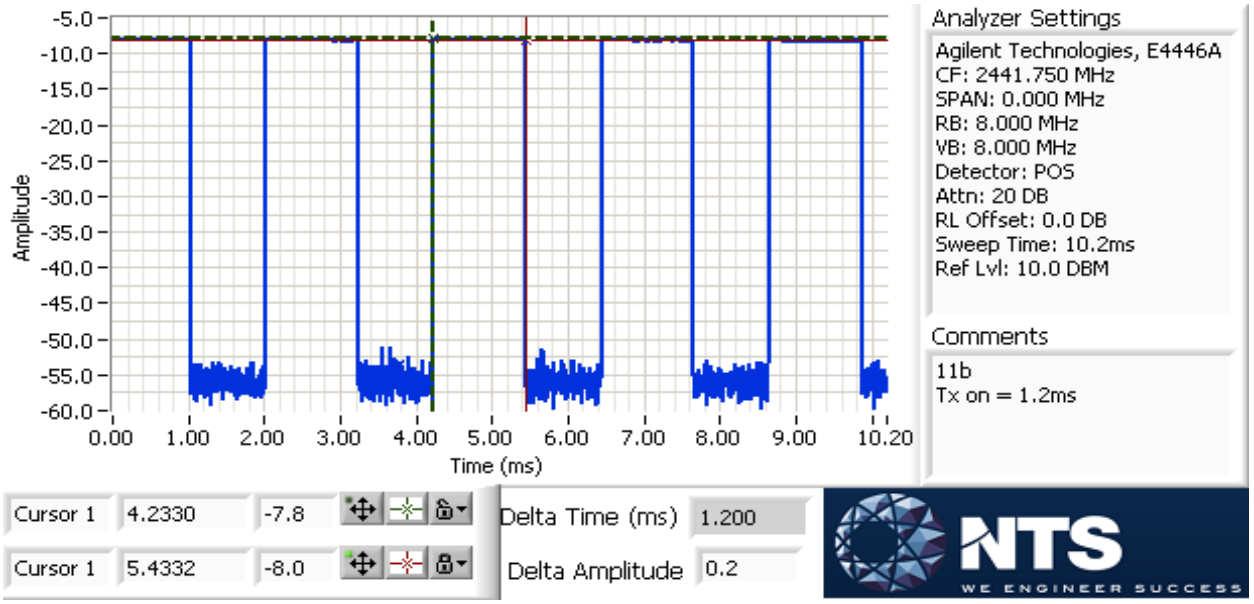
11b = 802.11b mode, 4x4
11g BF = 802.11g mode, 4x4, beamforming
HT20BF = 802.11n 20MHz mode, 4x4, beamforming (includes 11ac 20MHz data rates, for 5GHz only)
HT40BF = 802.11n 40MHz mode, 4x4, beamforming (includes 11ac 40MHz data rates)
11a = 802.11a, 4x4
AC80BF = 802.11ac, 80MHz, 4x4, beamforming

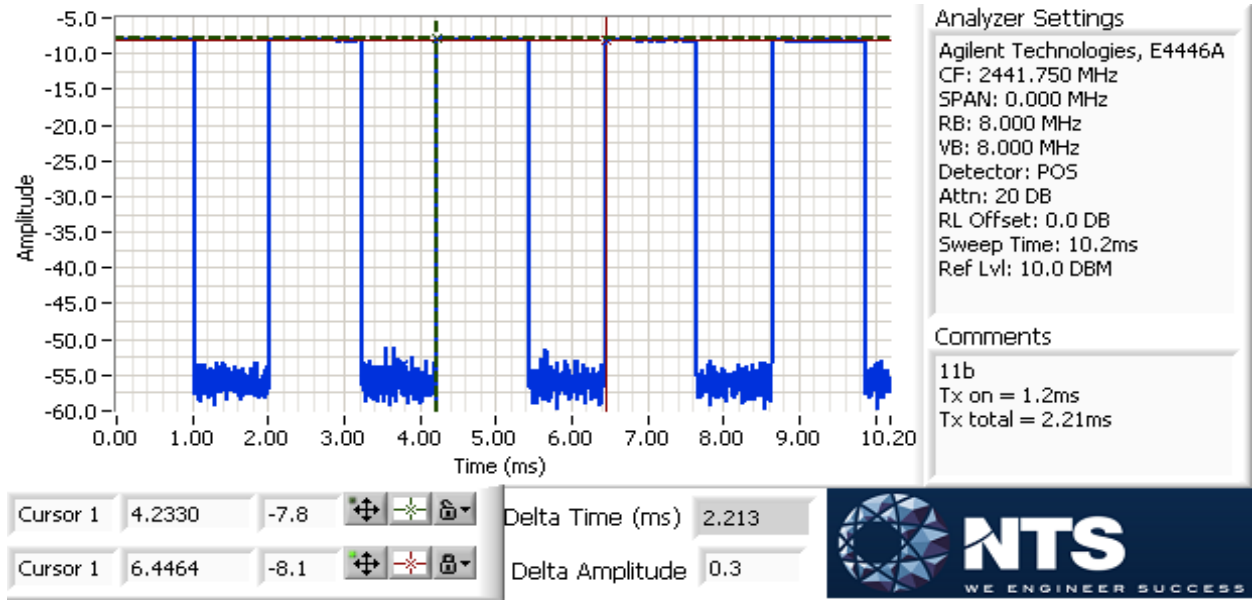
Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Duty Cycle:

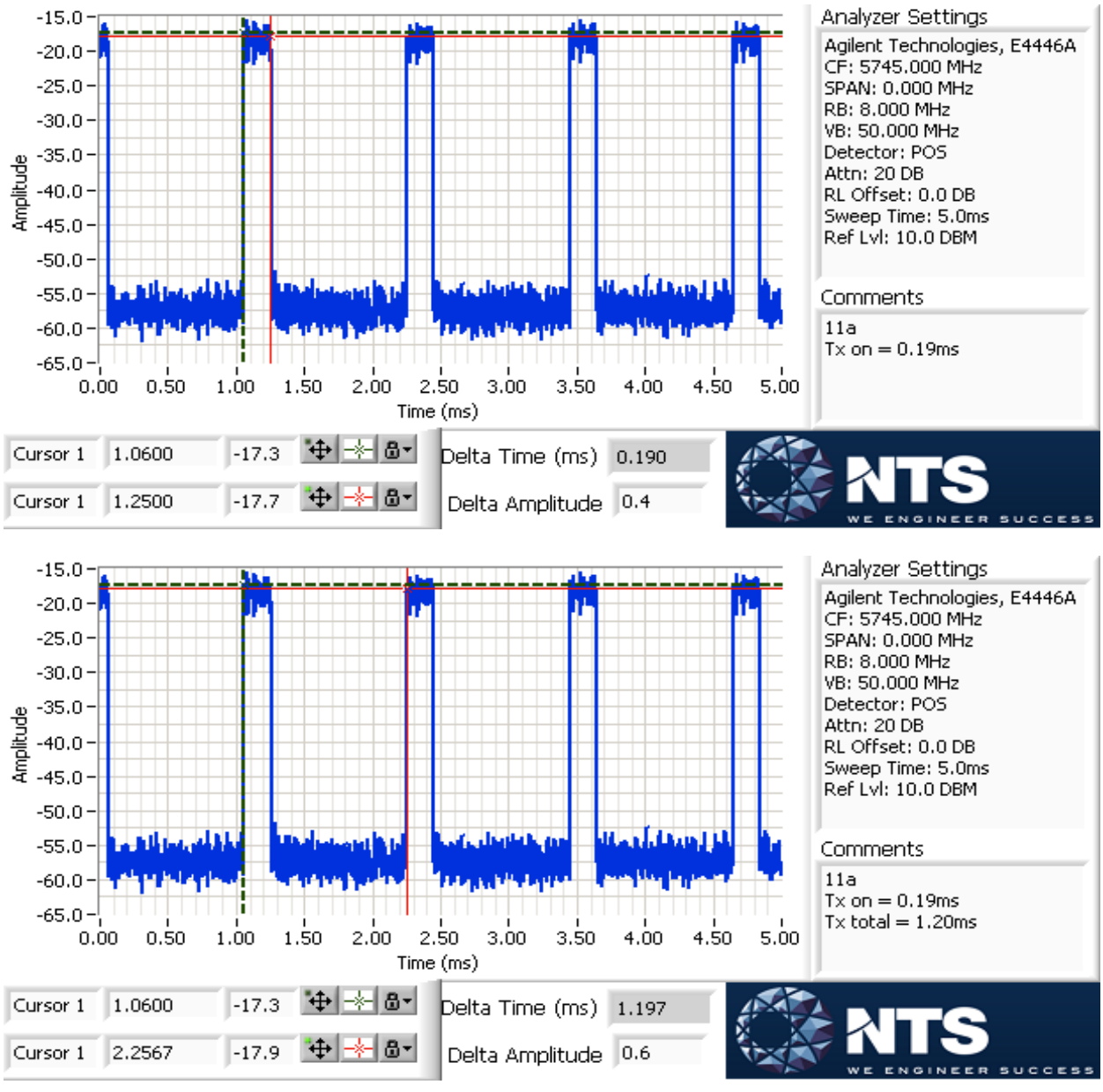
	Duty Cycle
11b:	0.543
11a:	0.158
5GHz HT20:	0.165

Duty Cycle = Txon/Tx total

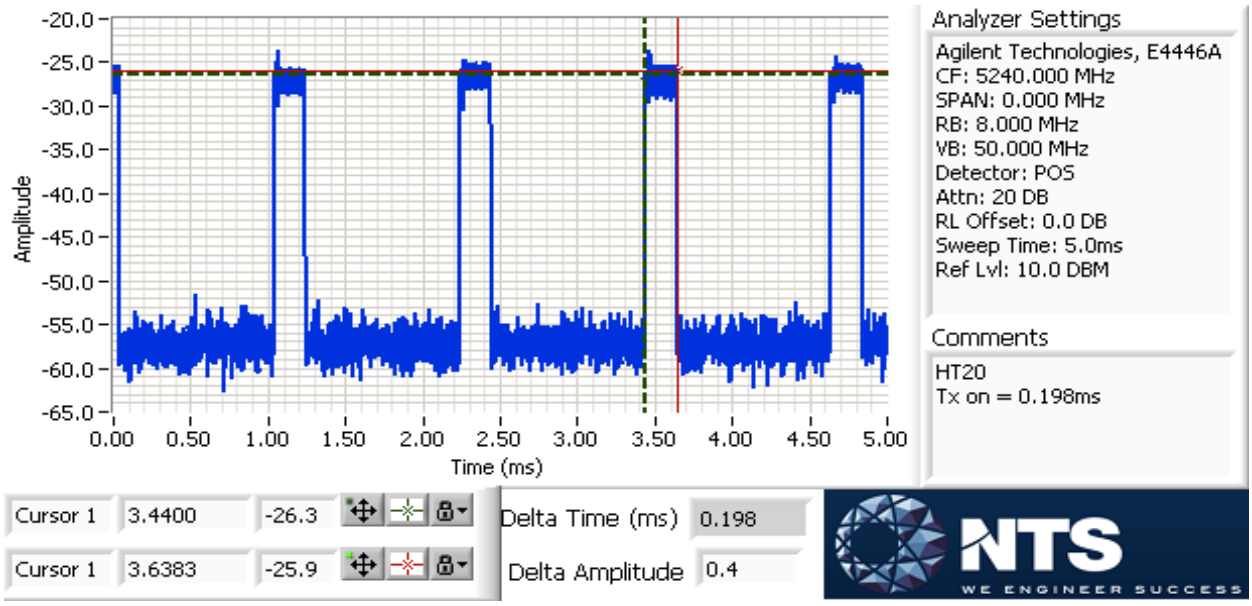


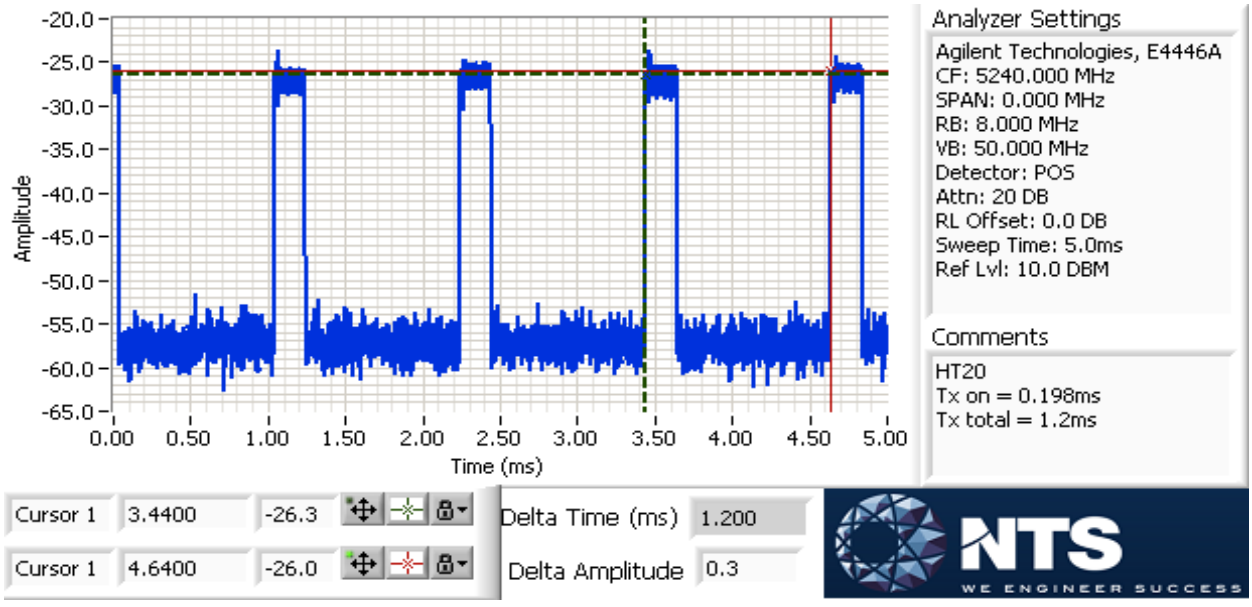


Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A





Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

MPE Measurement Results

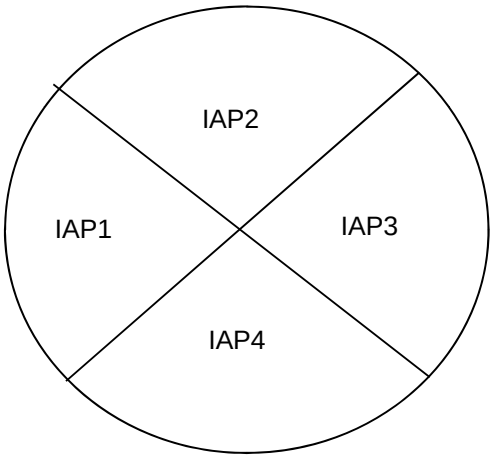
Run #1: XR2000 Radio Configuration - 4 modules

As the host system does not allow for overlapping channels within the same band, the worse case (highest total EIRP) combination of 4 radios within a host will operate with 3 modules in the 2.4 GHz band, and 1 modules in the U-NII-3 band.

Host System: XR2000 s/n: XR214230F5499
Separation Distance (cm): 20

Configuration:

Radio	Channel	Mode	Pwr (dBm)
IAP1	1	11b	25.3
IAP2	6	11b	25.3
IAP3	11	11b	25.3
IAP4	149	11a	25.0



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

The measurements were performed in the following configurations:
1) 2.4GHz radio(s) enabled, 5GHz radio(s) disabled
2) 5GHz radio(s) enabled, 2.4GHz radio(s) disabled
3) 2.4GHz radio(s) enabled, 5GHz radio(s) enabled
In addition, the following measurements were taken:
4) 2.4GHz radio(s) disabled, 5GHz radio(s) enabled with the probe at the location of maximum MPE with 2.4GHz radios only enabled
5) 2.4GHz radio(s) enabled, 5GHz radio(s) disabled with the probe at the location of maximum MPE with 5GHz radios only enabled

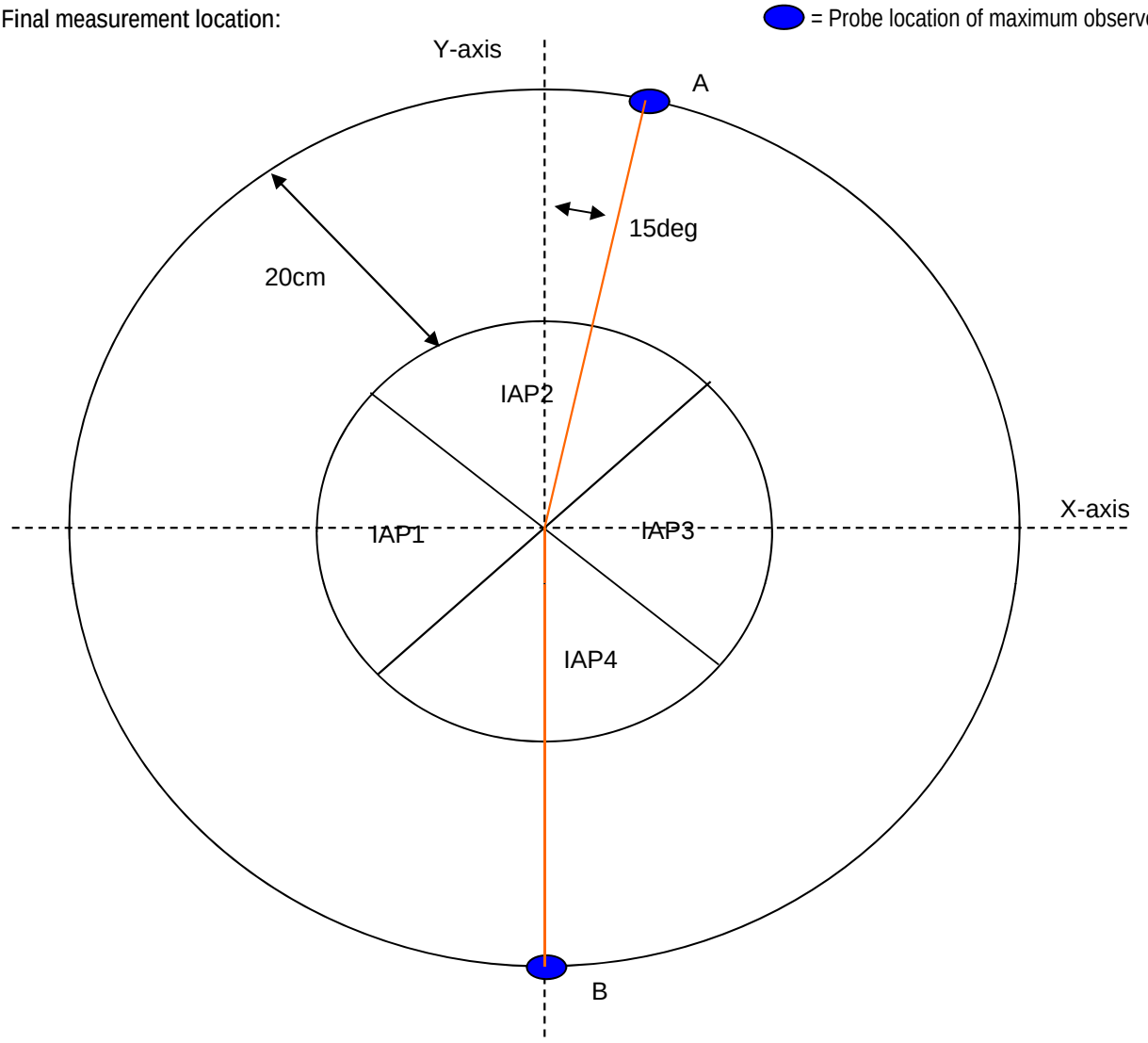
Meas. Configuration	Probe (mW/cm^2)	Probe Location	Probe Factor	Duty Cycle Factor	Power Scaling Factor	Final MPE ($mW/cm^{2)}$
1	0.054	A	1.05	0.543	1	0.104
2	0.008	B	1.16	0.158	1	0.059
3*	0.055	A	1.05	0.543	1	0.106
4	0.0004	A	1.16	0.158	1	0.003
5	0.007	B	1.05	0.543	1	0.014

* - As the location of the maximum observed MPE was at the same location as the 2.4GHz radio, and the final MPE value for 5.8GHz only operation was lower than the 2.4GHz only MPE, the probe factor and duty cycle factors from the 2.4GHz were used.

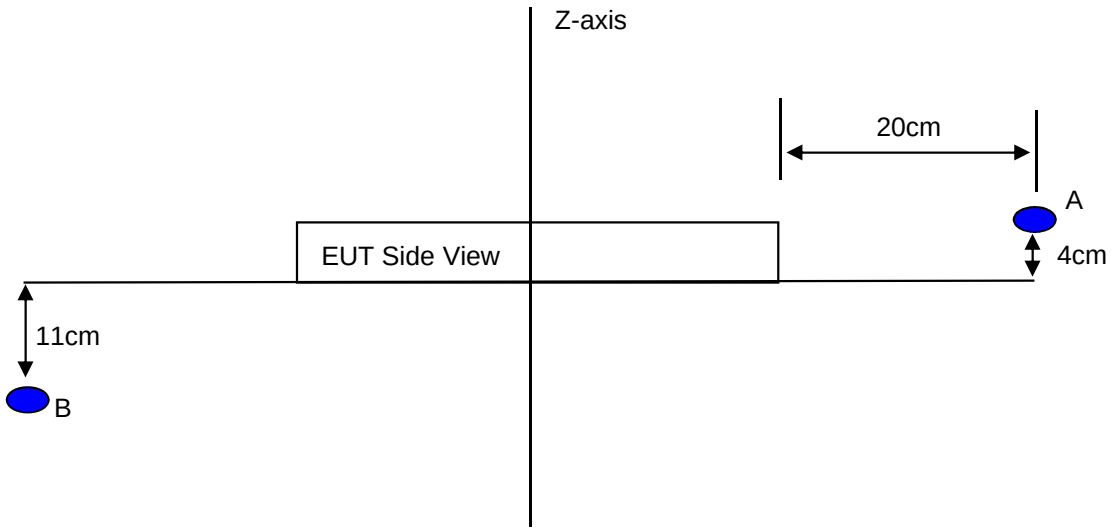
Final MPE (mW/cm^2) = Probe (mW/cm2) * Probe Factor * (1/DCF) * Power Scaling

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Final measurement location:



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Run #2: XR4000 Radio Configuration - 8 modules

As the host system does not allow for overlapping channels within the same band, the worse case (highest total EIRP) combination of 8 radios within a host will operate with 3 modules in the 2.4 GHz band, and 5 modules in the U-NII-3 band.

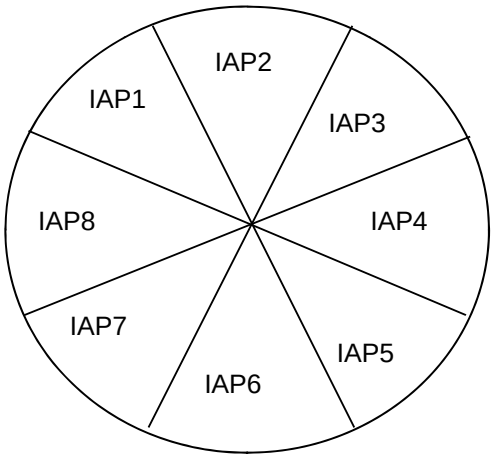
Based on the worse case modes from the single module operation

Host System: XR4000 s/n: XR4043905BCFE

Separation Distance (cm): 20

Configuration:

Radio	Channel	Mode	Pwr (dBm)
IAP1	1	11b	25.3
IAP2	6	11b	25.3
IAP3	11	11b	25.3
IAP4	149	11a	25.0
IAP5	153	11a	25.0
IAP6	157	11a	25.0
IAP7	161	11a	25.0
IAP8	165	11a	25.0



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

The measurements were performed in the following configurations:
1) 2.4GHz radio(s) enabled, 5GHz radio(s) disabled
2) 5GHz radio(s) enabled, 2.4GHz radio(s) disabled
3) 2.4GHz radio(s) enabled, 5GHz radio(s) enabled
In addition, the following measurements were taken:
4) 2.4GHz radio(s) disabled, 5GHz radio(s) enabled with the probe at the location of maximum MPE with 2.4GHz radios only enabled
5) 2.4GHz radio(s) enabled, 5GHz radio(s) disabled with the probe at the location of maximum MPE with 5GHz radios only enabled

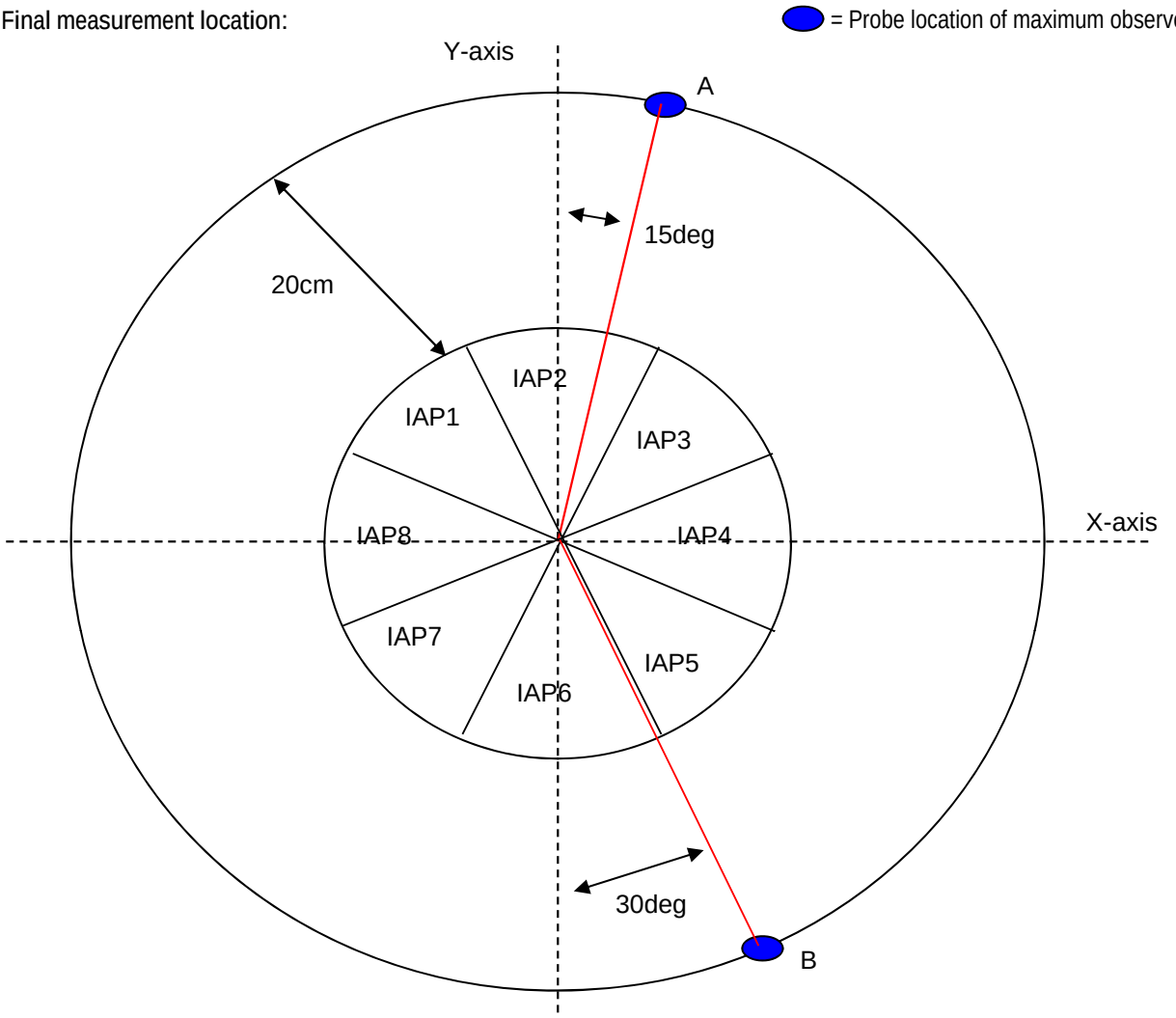
Meas. Configuration	Probe (mW/cm^2)	Probe Location	Probe Factor	Duty Cycle Factor	Power Scaling Factor	Final MPE ($mW/cm^{2)}$
1	0.056	A	1.05	0.543	1	0.108
2	0.013	B	1.16	0.158	1	0.095
3*	0.056	A	1.05	0.543	1	0.108
4	0.001	A	1.16	0.158	1	0.007
5	0.001	B	1.05	0.543	1	0.002

* - As the location of the maximum observed MPE was at the same location as the 2.4GHz radio, and the final MPE value for 5.8GHz only operation was lower than the 2.4GHz only MPE, the probe factor and duty cycle factors from the 2.4GHz were used.

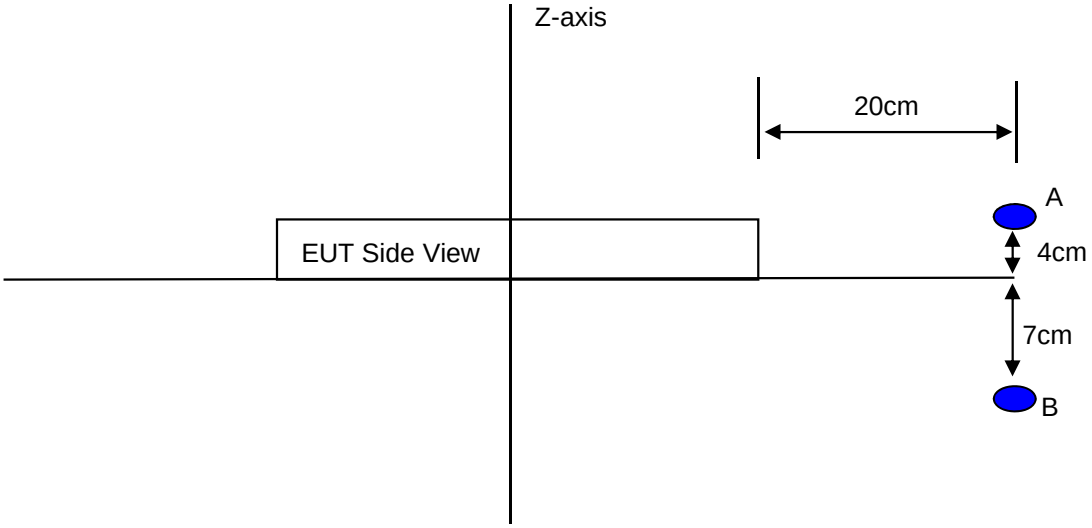
Final MPE (mW/cm^2) = Probe (mW/cm2) * Probe Factor * (1/DCF) * Power Scaling

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Final measurement location:



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Run #3: XR6000 Radio Configuration - 16 modules

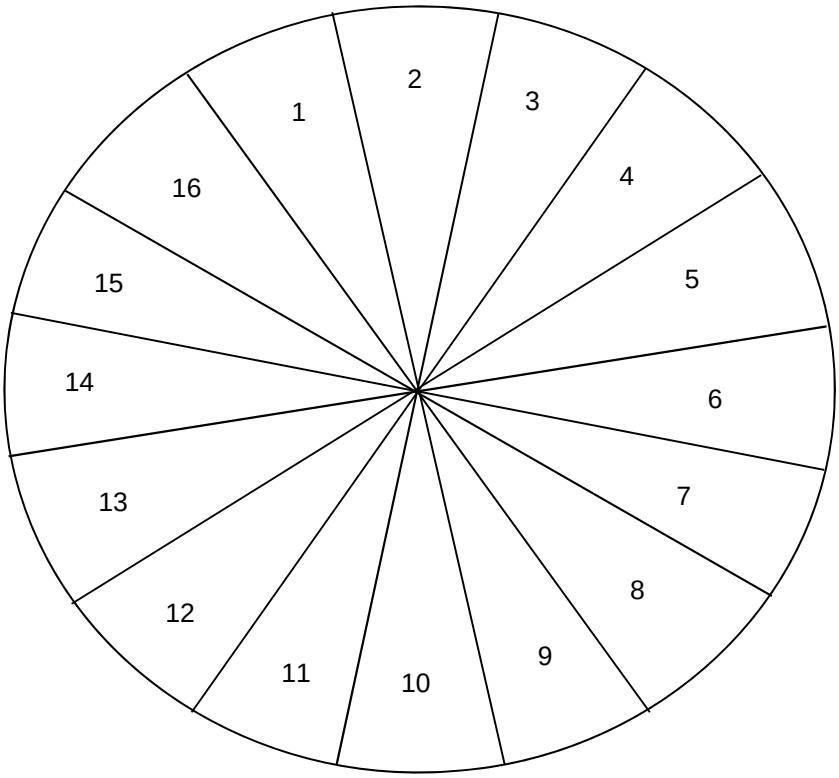
As the host system does not allow for overlapping channels within the same band, the worse case (highest total EIRP) combination of 12 radios within a host will operate with 3 modules in the 2.4 GHz band, 4 modules in the U-NII-1, and 5 modules in the U-NII-3 band. This configuration uses all available channels, so while the host can support up to 16 modules, after 12 modules operating there will not be any available channels for the remaining 4 radio modules. They will be disabled.

Host System: XR6000 s/n: XR623041FFF2A
Separation Distance (cm): 20

Configuration:

Radio	Channel	Mode	Pwr (dBm)
IAP1	6	11b	25.3
IAP2	11	11b	25.3
IAP3	1	11b	25.3
IAP8	149	11a	25.0
IAP9	153	11a	25.0
IAP10	165	11a	25.0
IAP11	161	11a	25.0
IAP12	157	11a	25.0
IAP4	36	HT20 BF	23.9
IAP5	40	HT20 BF	23.9
IAP6	44	HT20 BF	23.9
IAP7	48	HT20 BF	23.9

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

The measurements were performed in the following configurations:
1) 2.4GHz radios enabled, all 5GHz radios disabled
2) 5.8GHz radios enabled, 2.4GHz radios disabled, 5.2GHz radios disabled
3) 5.2GHz radios enabled, 2.4GHz disabled, 5.8GHs radios disabled
4) 2.4GHz radios enabled, 5.2GHz radios enabled, 5.8GHz radios enabled

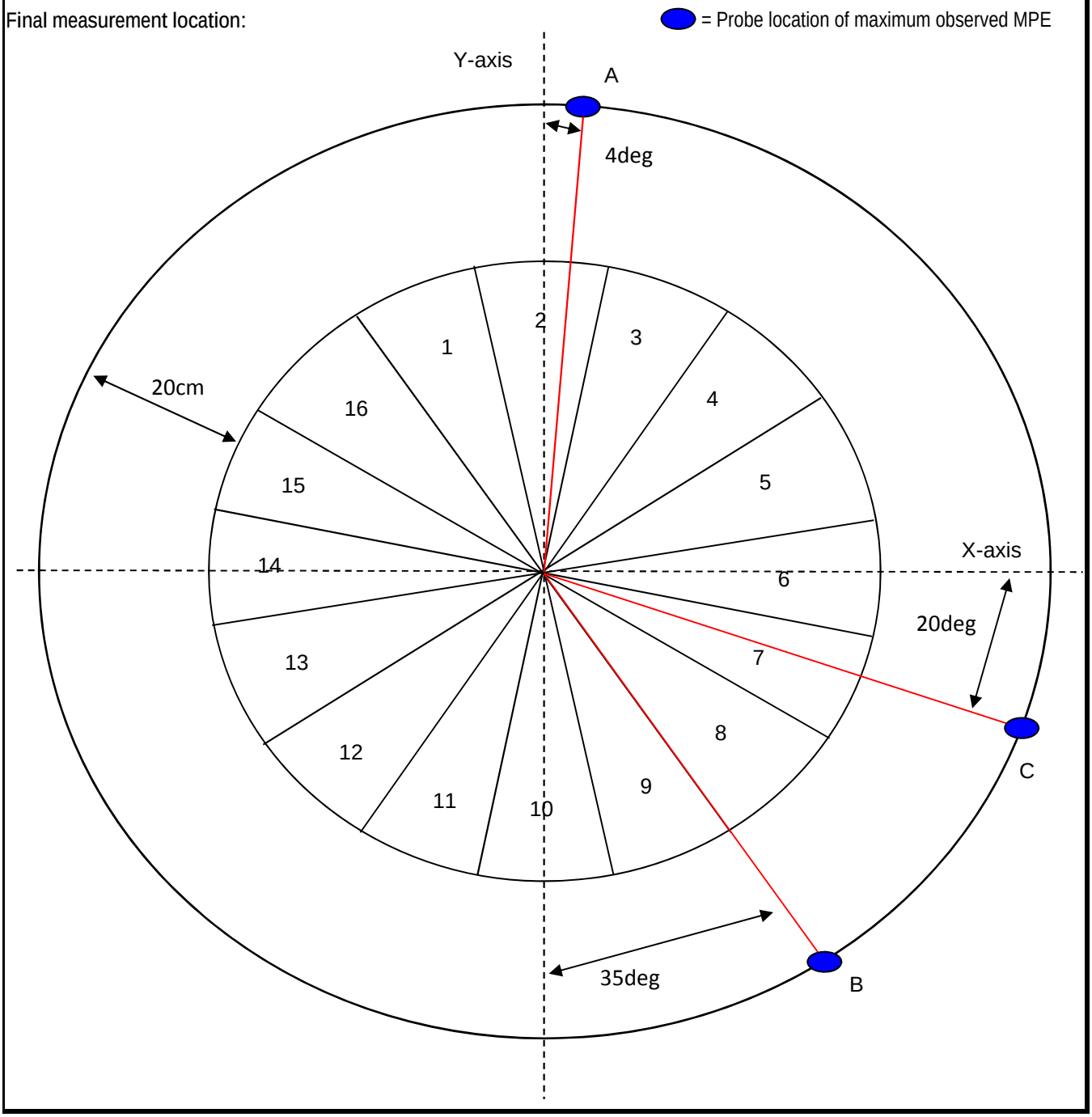
In addition, the following measurements were taken:
5) 2.4GHz and 5.8GHz radios disabled, 5.2GHz radios enabled with the probe at the location of maximum MPE with 2.4GHz radios only enabled
6) 2.4GHz and 5.2GHz radios disabled, 5.8GHz radios enabled with the probe at the location of maximum MPE with 2.4GHz radios only enabled
7) 5.2GHz and 5.8GHz radios disabled, 2.4GHz radios enabled with the probe at the location of the maximum MPE with 5.2GHz radios only enabled
8) 5.2GHz and 2.4GHz radios disabled, 5.8GHz radios enabled with the probe at the location of the maximum MPE with 5.2GHz radios only enabled
9) 5.8GHz and 5.2GHz radios disabled, 2.4GHz radios enabled with the probe at the location of the maximum MPE with 5.8GHz radios only enabled
10) 5.8GHz and 2.4GHz radios disabled, 5.2GHz radios enabled with the probe at the location of the maximum MPE with the 5.8GHz radios only enabled

Meas. Configuration	Probe (mW/cm^2)	Probe Location	Probe Factor	Duty Cycle Factor	Power Scaling Factor	Final MPE ($mW/cm^{2)}$
1	0.069	A	1.05	0.543	1	0.133
2	0.032	B	1.16	0.158	1	0.235
3	0.019	C	1.04	0.165	1	0.120
4*	0.069	A	1.16	0.158	1	0.507
5	0.0015	A	1.04	0.165	1	0.009
6	0.006	A	1.16	0.158	1	0.044
7	0.003	C	1.05	0.543	1	0.006
8	0.0057	C	1.16	0.158	1	0.042
9	0.0007	B	1.05	0.543	1	0.001
10	0.01	B	1.04	0.165	1	0.063

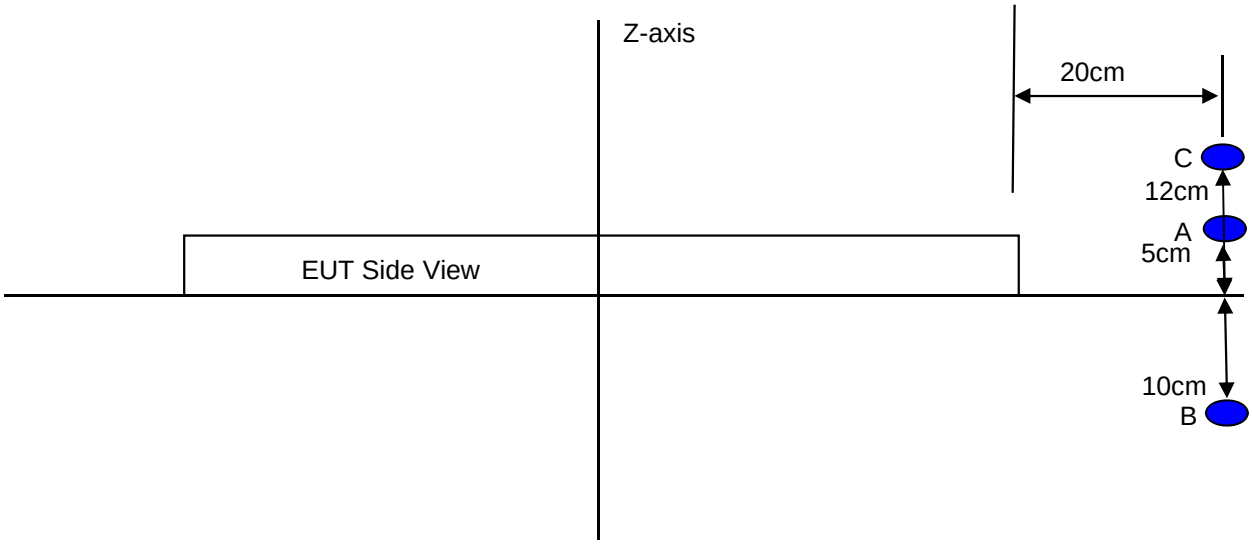
* - Correction factors for the 5.8GHz operation used, as this was the highest MPE for a single band operation (measurements 1, 2, and 3). This is a worse case estimate.
Final MPE (mW/cm^2) = Probe (mW/cm2) * Probe Factor * (1/DCF) * Power Scaling

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

Final measurement location:



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

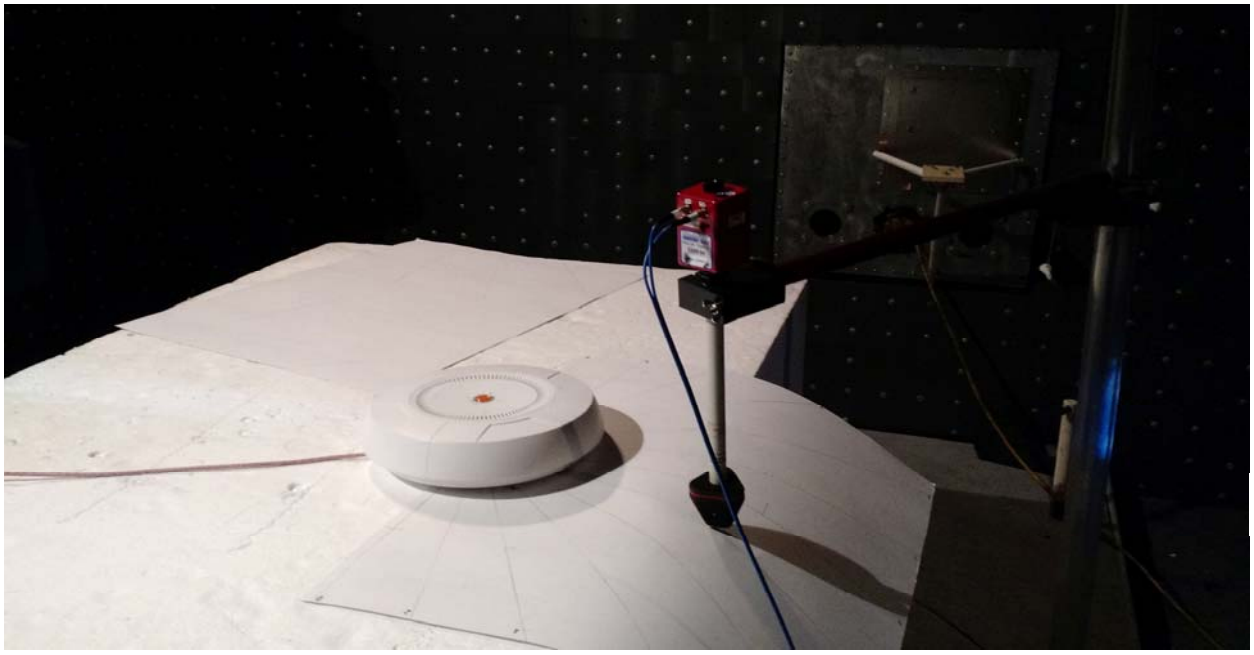
Test Equipment List

Manufacturer	Description	Model #	Asset #	Last Cal	Cal Due
ETS Lindgren	Field Probe, RF, 10 MHz - 40 GHz	HI-6053	2202	07-Jan-16	07-Jan-16
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	22-Jun-15	22-Jun-16

Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

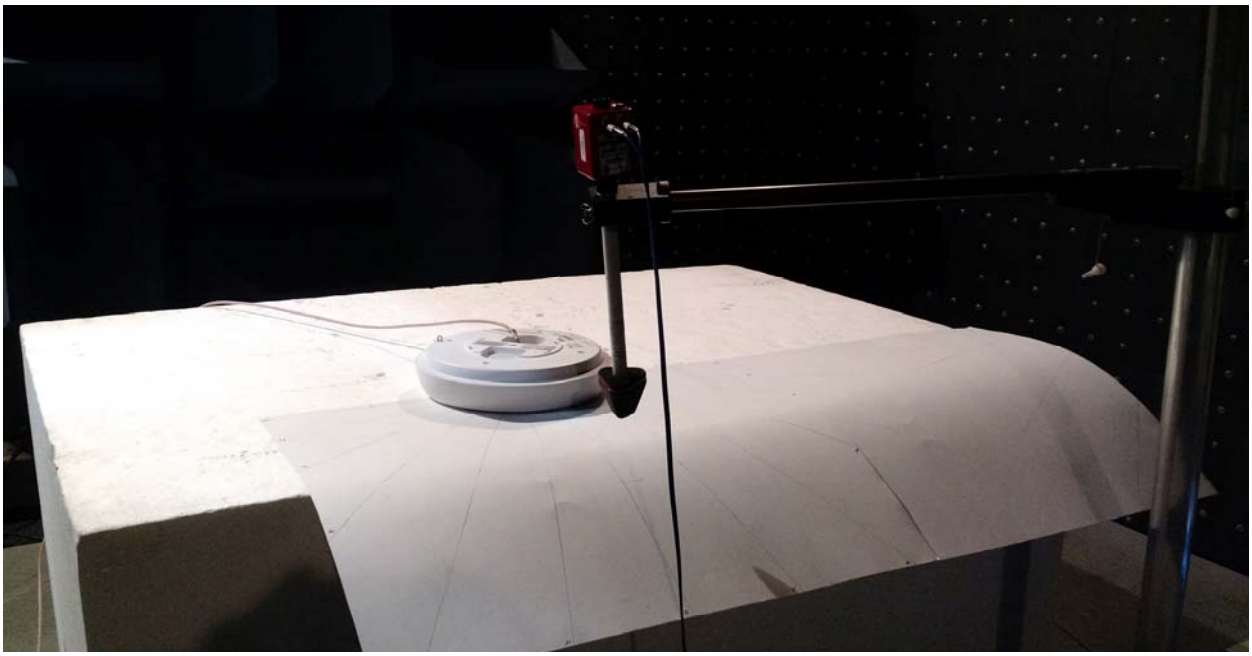
Test Configuration Photographs

XR2000 Host System (2.4 GHz Max MPE)



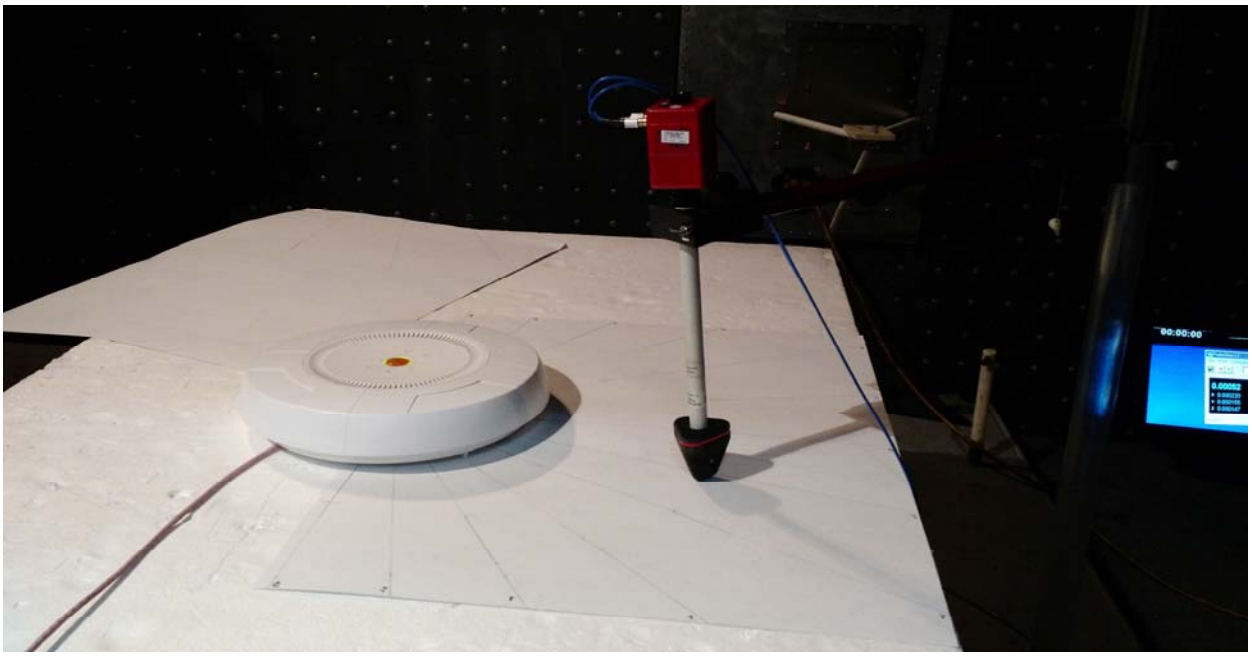
Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

XR2000 Host System (5.8 GHz Max MPE)



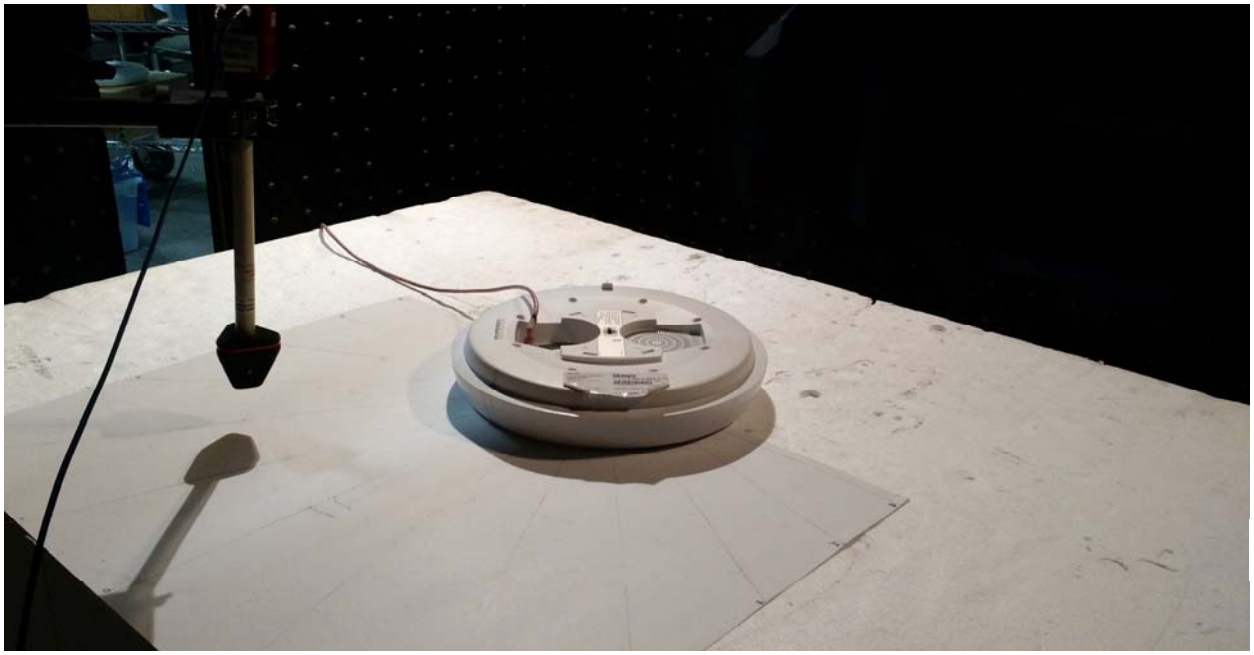
Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

XR4000 Host System (Max 2.4GHz MPE)



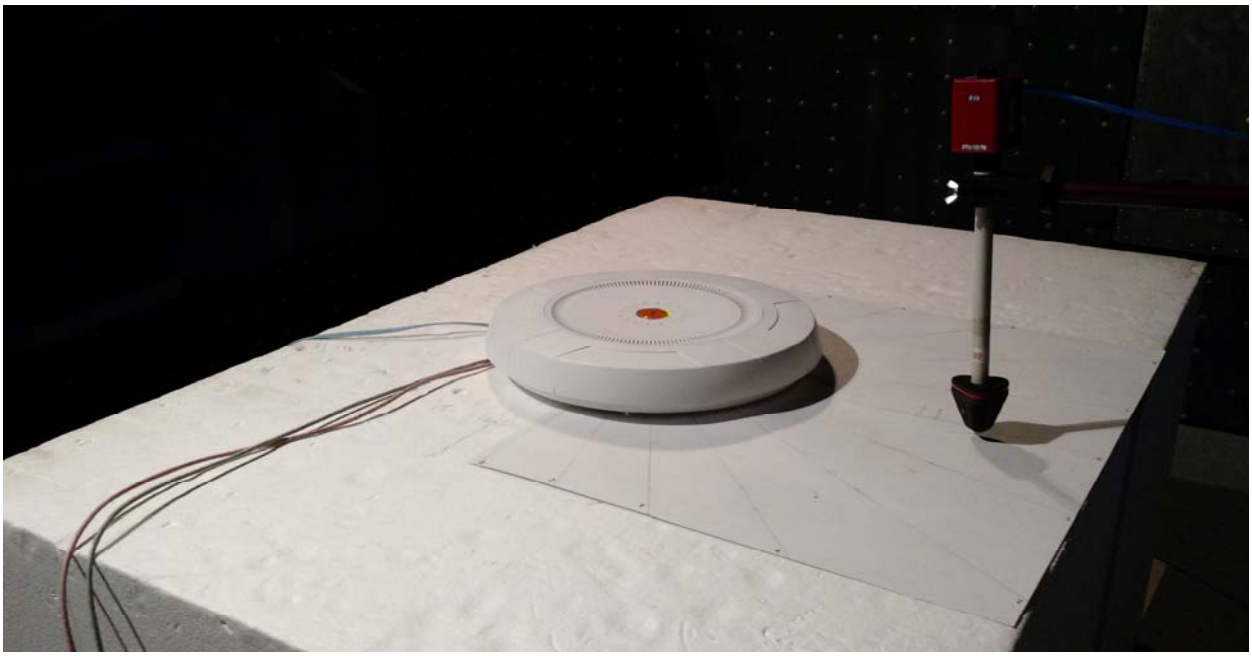
Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

XR4000 Host System (Max 5.8GHz MPE)



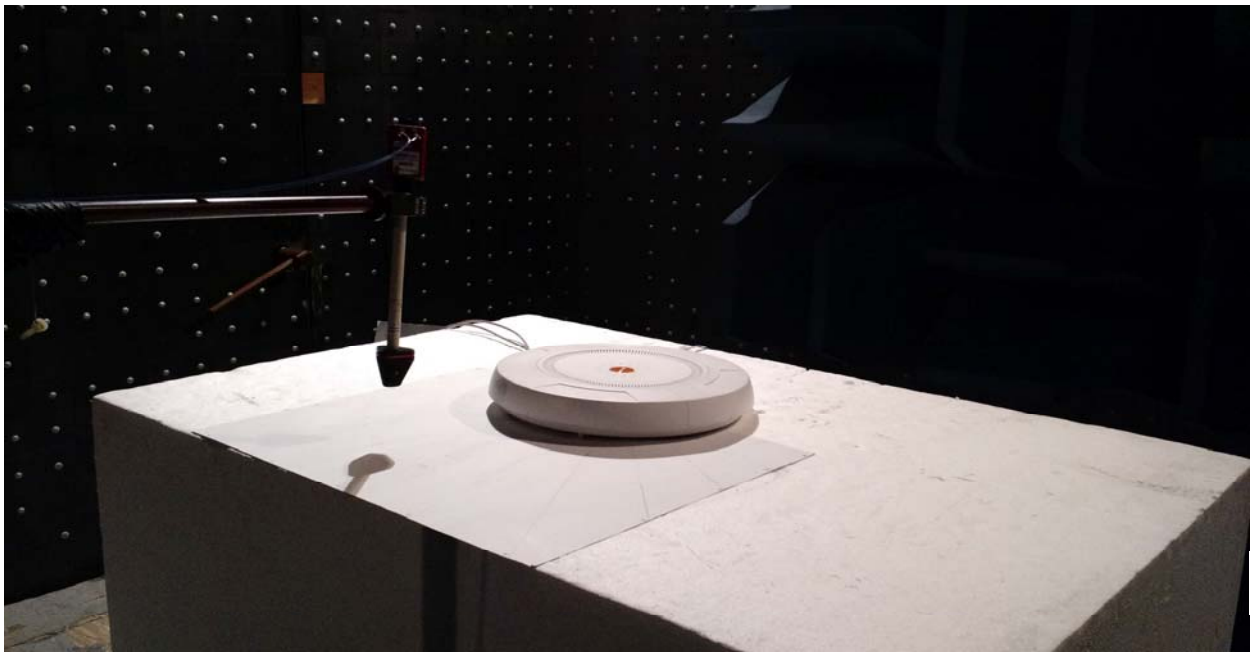
Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

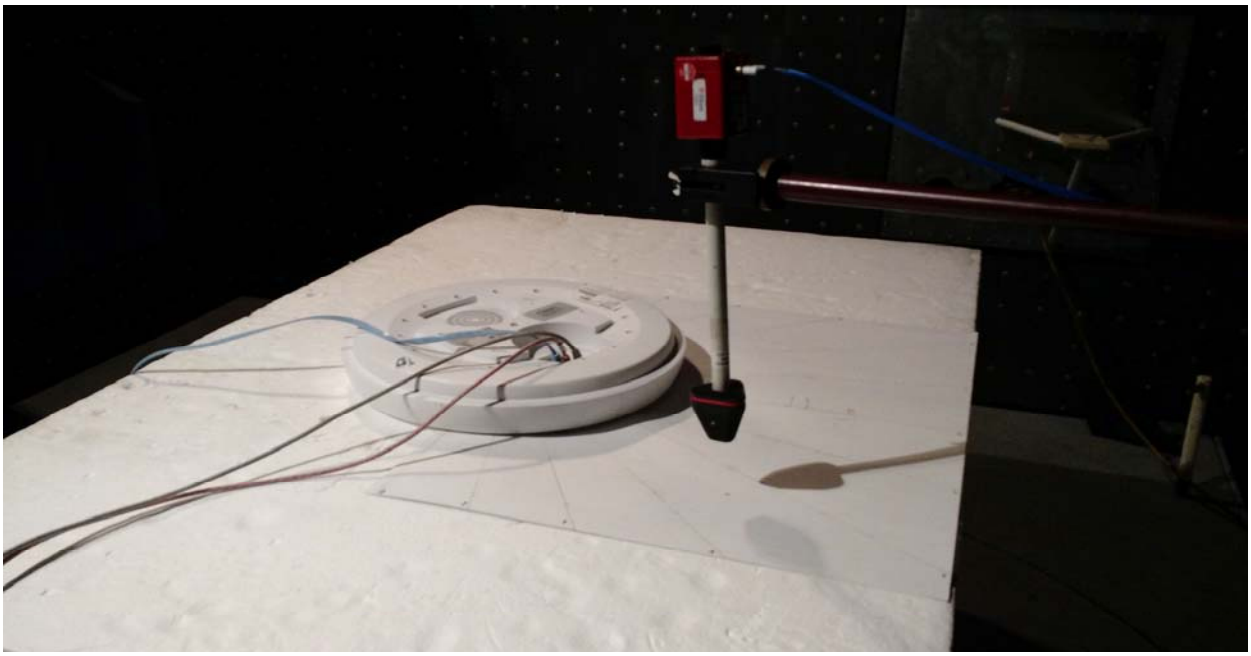
XR6000 Host System (Max 2.4GHz MPE)



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

XR6000 Host System (Max 5.2GHz MPE)



Client:	Xirrus	Job Number:	JD99498
Model:	XI-AC3470	T-Log Number:	T99598
		Project Manager:	Christine Krebill
Contact:	Paul Zahra	Project Coordinator:	-
Standard:	FCC 2.1091	Class:	N/A

XR6000 Host System (Max 5.8GHz MPE)