HPC Wireless Services
46 Mill Plain Rd.
Floor 2
Danbury, CT, 06811
P.: 203.797.1112

HPC
WIRELESS SERVICES

July 17, 2015

VIA EMAIL AND HAND DELIVERY

Ms. Melanie A. Bachman
Acting Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

RE: Sirius XM Satellite Radio – Notice of Exempt Modification
310 Orange Street, New Haven, CT

Dear Ms. Bachman:

This letter and attachments are submitted on behalf of Sirius XM Satellite Radio ("Sirius XM"). Sirius XM is undertaking modifications to certain existing sites in its Connecticut network in order to implement updated technology. In order to do so, Sirius XM will modify antenna and equipment configurations at a number of existing sites. Please accept this letter and attachments as notification, pursuant to R.C.S.A. Section 16-50j-73, of construction which constitutes an exempt modification pursuant to R.C.S.A Section 16-50j-72(b)(2). In compliance with R.C.S.A. Section 16-50j-73, a copy of this letter and attachments is being sent to the Mayor of the City of New Haven, and the property owner, Frontier Communications.

Sirius XM plans to modify the existing facility at 310 Orange Street owned by Frontier Communications (coordinates 41.309131/-72.921781). Attached are drawings depicting the planned changes, and documentation of the structural sufficiency of the tower to accommodate the revised antenna configuration. Also included is a power density calculation reflecting the modification to Sirius XM's operations at the site.

The changes to the facility do not constitute a modification as defined in Connecticut General Statutes ("C.G.S.") Section 16-50i(d) because the general physical characteristics of the facility will not be significantly changed. Rather, the planned changes to the facility fall squarely within those activities explicitly provided for in R.C.S.A. Section 16-50j-72(b)(2).

1. The proposed modifications do not increase or alter the height of the existing facility. Sirius XM proposes to replace one (1) existing panel antenna and install one (1) new panel antenna at a centerline height of 239' AGL. Additionally, Sirius XM proposes to install one (1) high-band RX dish to the bulkhead wall at a height of 152'–3" AGL.

2. The proposed changes will not extend the site boundaries. Sirius XM will replace existing low band equipment cabinets with a new cabinet in the existing equipment room in the upper penthouse. Thus, there will be no expansion of Sirius XM's leased area.

3. The proposed changes will not increase the noise level at the existing facility by six decibels or more. The incremental effect of the proposed changes will be negligible.

4. The changes to the facility will not increase the calculated "worst case" power density for the combined operations at the site to a level at or above the applicable standard for uncontrolled environments as calculated for a mixed frequency site. As indicated in the attached power density calculations, Sirius XM's operations at the site will result in a power density of 0.27%; the combined site operations will result in a total power density of 14.08%.

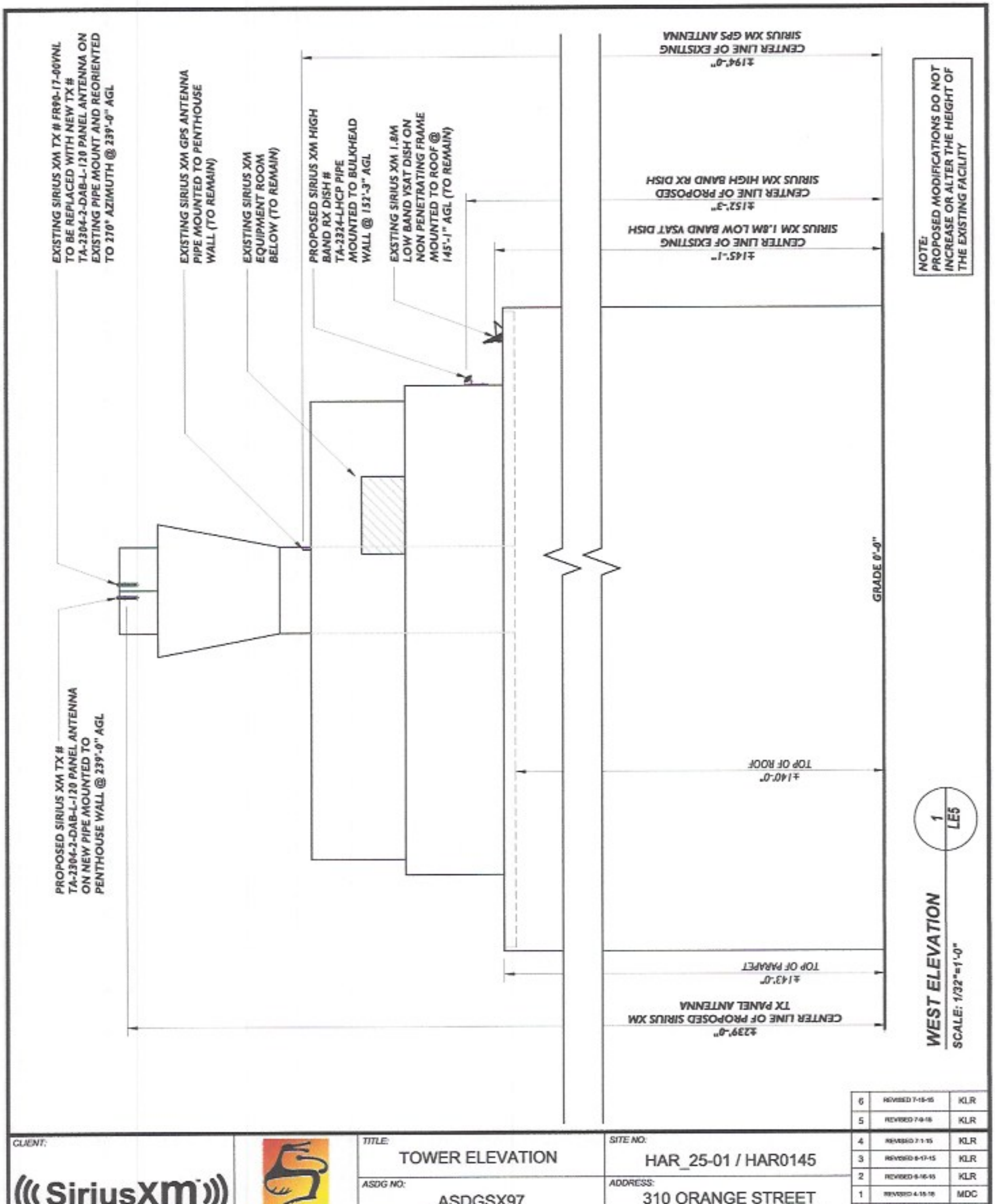
Please feel free to call me with any questions or concerns regarding this matter. Thank you for your consideration.

Respectfully submitted,

By: _____
Eric Dahl, Agent for Sirius XM Satellite Radio
860-227-1975

Attachments

cc: Honorable Toni Harp, Mayor, City of New Haven
Frontier Communications



6	REVISED 7-15-15	KLR
5	REVISED 7-9-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-16-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

CLIENT:

SiriusXM SATELLITE RADIO

1500 ECKINGTON PLACE
WASHINGTON, DC 20002
PHONE# (212) 584-5120

A SAXON DG
TOMS RIVER, NJ
PHONE# (732) 678-0155

TITLE: TOWER ELEVATION

ASDG NO: ASDGSX97

DRAWN BY: MDC

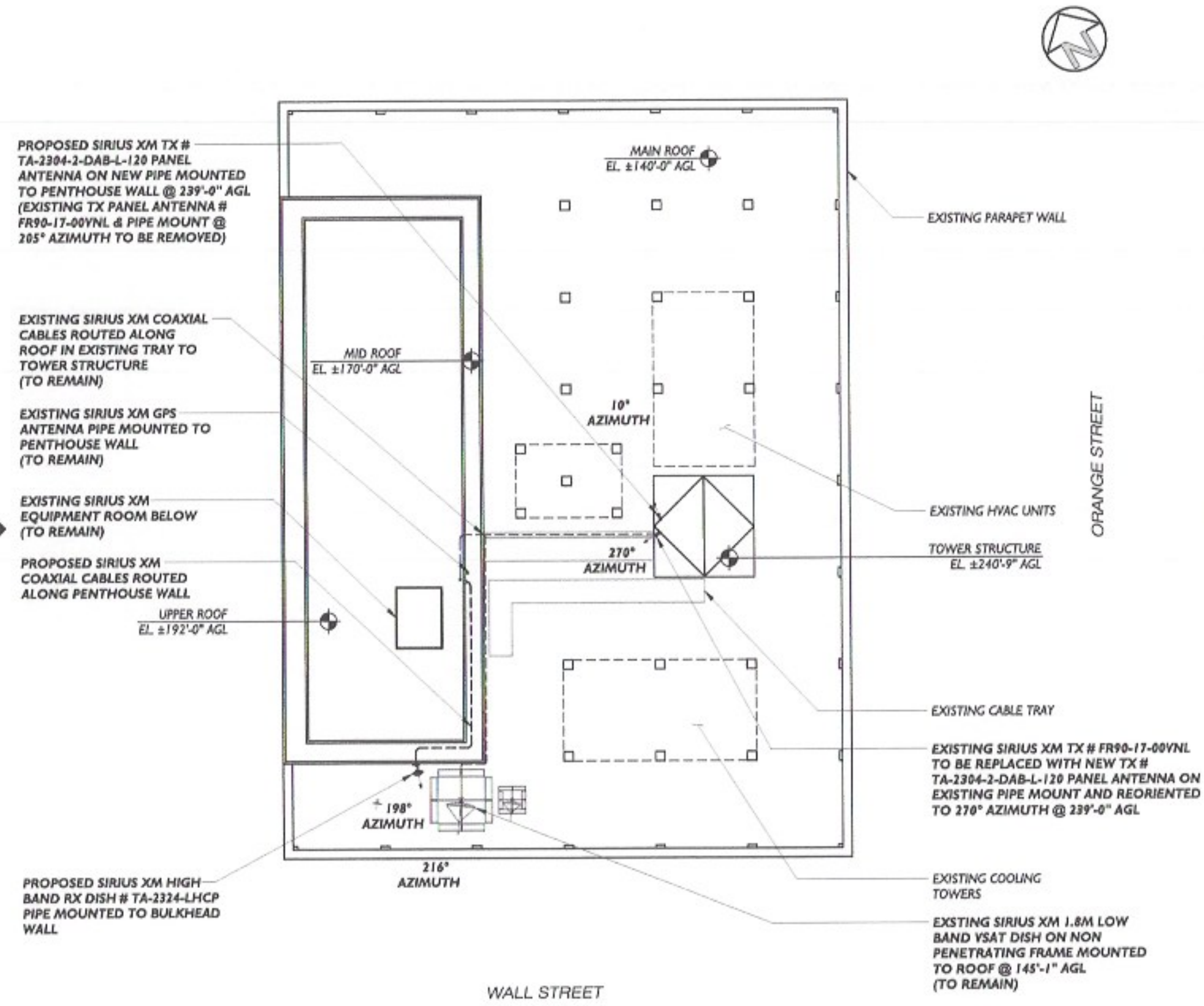
CHECKED BY:

SITE NO: HAR_25-01 / HAR0145

ADDRESS: 310 ORANGE STREET NEW HAVEN, CT 06511

COORDINATES: LATITUDE: 41.309209, LONGITUDE: -72.921907

LE5



PROPOSED ROOF PLAN

SCALE: 1/32"=1'-0"

1 LE2

6	REVISED 7-15-15	KLR
5	REVISED 7-9-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-18-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

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COORDINATES: LATITUDE: 41.309209, LONGITUDE: -72.921907

LE2

STRUCTURAL ANALYSIS REPORT

For

A Saxon Design Group, LLC
1358 Hooper Avenue, Suite 265
Toms River, NJ 08753

HAR_25-01
KM No. 150606.00

310 Orange Street
New Haven, CT 06511

Prepared By:

KM CONSULTING ENGINEERS, INC.
9 Forest Lane, Ewing, NJ 08628
Ph: (609) 538-0400 www.kmengr.com

July 7, 2015

A Saxon Design Group, LLC
310 Orange Street
HAR_25-01

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Load Case No. 1: Proposed Sirius XM high band RX dish (Model # TA-2324-LHCP) mounted on a proposed pipe mast attached to the existing bulkhead wall, Sirius XM equipment cabinet (Model # DRU-200W) mounted on existing concrete floor, (2) new panel antennas (Model #TA-2304-2-DAB-L-120) mounted on pipe masts attached to the existing penthouse wall, and removal of existing Sirius XM low band standard equipment cabinets and existing Sirius XM TX panel antenna (Model # FR90-17-00VNL).

1.0 Introduction

Pursuant to your request, a professional engineer from KM Consulting Engineers, Inc. has prepared this report describing the methodology and codes used in the review of the structural integrity for the proposed Sirius XM installation on the existing building structure. The analysis and design takes into consideration loading from the proposed equipment, antennas and steel framing attached to the existing building roof and wall structures.

One new Sirius XM high band RX dish (Model # TA-2324-LHCP) is to be mounted to a new 3½" (nom) sched 40 pipe mast attached to the existing bulkhead wall. One new Sirius XM TX panel antenna (Model # TA-2304-2-DAB-L-120) will be mounted to a new pipe mast attached to the existing penthouse wall and the existing Sirius XM TX panel antenna (Model # FR90-17-00VNL) will be replaced with one new panel antenna (Model # TA-2304-2-DAB-L-120) on the existing pipe mount.

The existing Sirius XM low band standard equipment cabinets will be replaced with a new equipment cabinet (Model # DRU-200W) and mounted on the existing concrete floor.

As a part of the analysis process, engineers from A Saxon Design Group have visited the job site and visually observed the condition of the existing structural elements of the building and reviewed the proposed loading as documented on this report.

Loads imposed by the newly proposed antennas and equipment cabinet on the existing building structure are shown in the included calculations and are provided for checking adequacy of the existing structure to support loads from the new installation. The design check assumes that the structure is maintained and in good condition with no defects and deterioration of the structural capacity.

2.0 Analysis

2.1 Design Codes

The following design codes have been used, as applicable, to complete the structural analysis of the proposed addition of steel framing on the existing structure:

Building Code
2013 Amendment to 2005 CT State Building Code

Loading
Building loads are based on the following reference standards:

- 2013 Amendment to 2005 CT State Building Code
- American Society of Civil Engineers (ASCE) 7-92, Minimum Design Loads for Buildings and Other Structures

Structural Steel Design Standard
Steel design is based on the following American Institute of Steel Construction (AISC) reference standards:

- AISC Manual of Steel Construction: Allowable Stress Design, 13th Edition

Structural Masonry Design Standard
Structural masonry design is based on the following American Concrete Institute (ACI) reference standards:

- ACI 530-05, Building Code Requirements and Specification for Masonry Structures

Antenna Design Standard
Design of the structural supports for the Antennas on the projects is based on the following standard:

- ANSI/TIA-222-G Structural Standards for Antenna Supporting Structures and Antennas

2.2 Design Loading

2.2.1 Wind Load:

- Wind Load on Equipment: Per ANSI/TIA-222-G Spec.

2.2.2 Platform Loading:

- Equipment Cabinet Load: 817 lbs (total weight)

2.3 Structural Analysis

EQUIPMENT FLOOR CAPACITY CHECK CALCULATION

Equipment Cabinet Calcs

Check for Punching:

Concrete Strength: $f'c := 3000 \ psi$

Slab Thickness: $h := 4.0 \ in$

Effective Thickness: $d := h - 1 = 3 \ in$

Effective Width: $w := 142.8 \ in$

Total Loading: $L_t := 817 \ lb$

Factored Loading: $L_f := 1.4 \cdot L_t = 1143.8 \ lb$

Punching Shear Capacity: $L_a := \phi \cdot V_n \quad \frac{1}{2}$

$L_a := 0.75 \cdot 4 \cdot f'c^{\frac{1}{2}} \cdot w = 23464 \quad lb$

$23464 > 817$ **OK**

Overall Structural Capacity

Original Design Loading:

Live Load: $LL := 100 \ psf$ (equipment room)

Equipment Room Design Load: $LL = 100 \quad psf$

Cabinet Footprint area: $8.9 \quad ft^2$

Cabinet Loading: $817 \quad lb$

Avg. Distributed Load: $\frac{817}{8.9} = 91.8 \quad psf$ **OK**

Existing equipment room acceptable to support new proposed cabinet

RX DISH CAPACITY CHECK CALCULATION

RX Dish on Pipe Mount:

RX size (in):	$R_a := 12.63$	Centerline Height (ft):	$z_a := 170$
Antenna Weight (lb):	$W_{a1} := 28$	Wind Speed:	$V := 111\ mph$
Pipe Mast (in):	$L_{pipeA1} := 44$ $D_{pipeA1} := 4$	Exposure B:	$z_g := 1200$ $\alpha := 7$

$Aspect_{ratio} := 1$

$q_z := 0.00256 \cdot K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I$

$F_A := q_z \cdot G_h \cdot (EPA_A)$

$K_Z := 2.01 \left(\frac{z_a}{z_g}\right)^{\frac{2}{\alpha}} = 1.15$

$G_h := 1.1$

$C_A := \frac{Aspect_{ratio} - 2.5}{22.5} + 1.2 = 1.133$

$K_d := 0.95 \qquad I := 1 \qquad K_{ZT} := 1$

$q_z := 0.00256\ K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I = 34.46 \quad psf$

EPA_A

$A_{pipe} := \frac{L_{pipeA1} \cdot D_{pipeA1}}{144} = 1.22 \qquad A_{Ant} := \frac{3.14 \cdot R_a^{\ 2}}{144} = 3.478$

$EPA_A := A_{pipe} + A_{Ant} = 4.701\ ft^2$

$F_A := q_z \cdot G_h \cdot (EPA_A) \cdot C_A = 201.9 \quad lb$

Total wind force of RX dish = 202 lbs. The proposed antenna is to be mounted on pipe mast attached to the existing bulkhead wall.

Check connections for shear:

Total Weight:

$W_{total} := W_{a1} + 20 = 48$ *lbs* *(assume 20# for connections)*

Maximum force due to combination of loads: $F_{max} := \sqrt{F_A^{\,2} + W_{total}^{\,2}} = 208$

From HILTI North American Techical Guide 2008:
5/8" dia. HY-70, 3.5" embedment- allowable shear = 1405 lb

Existing/Proposed Mounts (required):
(4) Bolts per antenna= 5620 lbs (allowable) > 208 lbs (actual) **OK**

5/8" diameter bolts acceptable to support proposed dish

Check pipe stress for proposed pipe mount:

Pipe Stress and Deflection:

$$\Delta := \left(\frac{P \cdot b^2}{6 \cdot 29000 \cdot I}\right) \cdot (3\,L - b)$$

3.5" sched 40:

$L := 20$ $S := 2.394$ $P := \frac{F_A}{1000} = 0.202$
$b := 10$ $I := 4.788$

$$\Delta := \frac{P \cdot b^2}{6 \cdot 29000 \cdot I} \cdot (3\,L - b) = 0.001 \quad in$$

$M_{pipe} := P \cdot b = 2.019 \quad k \cdot in$

$f_t := \frac{M_{pipe}}{S} = 0.8 \quad ksi > 24\ ksi$ **OK**

3.5" sched 40 pipe or greater acceptable for antenna mast

PANEL ANTENNA CAPACITY CHECK CALCULATION

Check wind force on panel antenna:

Panel Antenna mounted to penthouse wall:

Antenna size (in):	$H_a := 39.5$ $W_a := 5$	Centerline Height (ft):	$z_a := 254.75$
		Wind Speed:	$V := 111\ mph$
Antenna Weight (lb):	$W_{a1} := 8$	Exposure B:	$z_g := 1200$ $\alpha := 7$
Pipe Mast (in):	$L_{pipeA1} := 50$ $D_{pipeA1} := 2.375$	Mount Connections:	$Y_a := 1.67$ $Z_a := 0.83$

$$Aspect_{ratio} := \frac{H_a}{W_a} = 7.9$$

$$q_z := 0.00256 \cdot K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I$$

$$F_A := q_z \cdot G_h \cdot (EPA_A)$$

$$K_Z := 2.01 \left(\frac{z_a}{z_g}\right)^{\frac{2}{\alpha}} = 1.291$$

$$G_h := 1.1$$

$$C_A := \frac{Aspect_{ratio} - 2.5}{22.5} + 1.2 = 1.44$$

$$K_d := 0.95 \qquad I := 1 \qquad K_{ZT} := 1$$

$$q_z := 0.00256\ K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I = 38.681 \quad psf$$

$$A_{pipe} := \frac{L_{pipeA1} \cdot D_{pipeA1}}{144} = 0.82 \qquad A_{Ant} := \frac{H_a \cdot W_a}{144} = 1.372$$

$$EPA_A := A_{pipe} + A_{Ant} = 2.196\ ft^2$$

$$F_A := q_z \cdot G_h \cdot (EPA_A) \cdot C_A = 134.6 \quad lb$$

Each panel antenna and mounting pipe has 135 lb of wind force applied to them at the design wind speed.

Check connections for shear:

Check Bolt Connections:

$\Sigma M_A := 0$ $\Sigma F_A := 0$

$R_B := \frac{F_A \cdot Z_a}{Y_a}$ $R_A := F_A + R_B$

$R_B = 66.878$ *lb* $R_A = 201.441$ *lb*

Check Connections for Shear:

Total Weight:

$W_{total} := W_{a1} + 20 = 28$ *lbs* *(assume 20# for connections)*

Maximum force due to combination of loads: $F_{max} := \sqrt{R_A^{\,2} + W_{total}^{\,2}} = 203$

From HILTI North American Techical Guide 2008:
1/2" dia. HY-20, 6" embedment- allowable shear = 930 lb

Existing/Proposed Mounts (required):
(4) Bolts per antenna= 3720 lbs (allowable) > 203 lbs (actual) **OK**

1/2" diameter bolts acceptable to support proposed antennas

Check pipe stress for proposed pipe mounts:

Pipe Stress and Deflection:

$\Delta := \left(\frac{P \cdot b^2}{6 \cdot 29000 \cdot I}\right) \cdot (3\,L - b)$ $M := \frac{F_A \cdot Z_a \cdot 12}{1000} = 1.34$ $k \cdot in$

2.0" sched 40:

$L := Z_a \cdot 12 + \frac{H_a}{2} = 29.71$ $S := 0.5607$ $P := \frac{F_A}{1000} = 0.135$

$b := Z_a \cdot 12 = 9.96$ $I := 0.6658$

$\Delta := \frac{P \cdot b^2}{6 \cdot 29000 \cdot I} \cdot (3\,L - b) = 0.009$ *in*

$f_t := \frac{M}{S} = 2.39$ *ksi* < 23 *ksi* **OK**

2.0" sched 40 pipe for antenna masts acceptable

3.0 Results and Summary

Based on the structural analysis performed, we conclude that the existing equipment room floor can support the proposed cabinet. Further, the proposed RX dish and the proposed antennas can be mounted on the walls as referenced in the drawings provided for this site and in the calculations. The proposed Sirius XM installation is within applicable code tolerances.

Please do not hesitate to contact our office with any questions or concerns regarding this report.

Sincerely,
KM CONSULTING ENGINEERS, INC

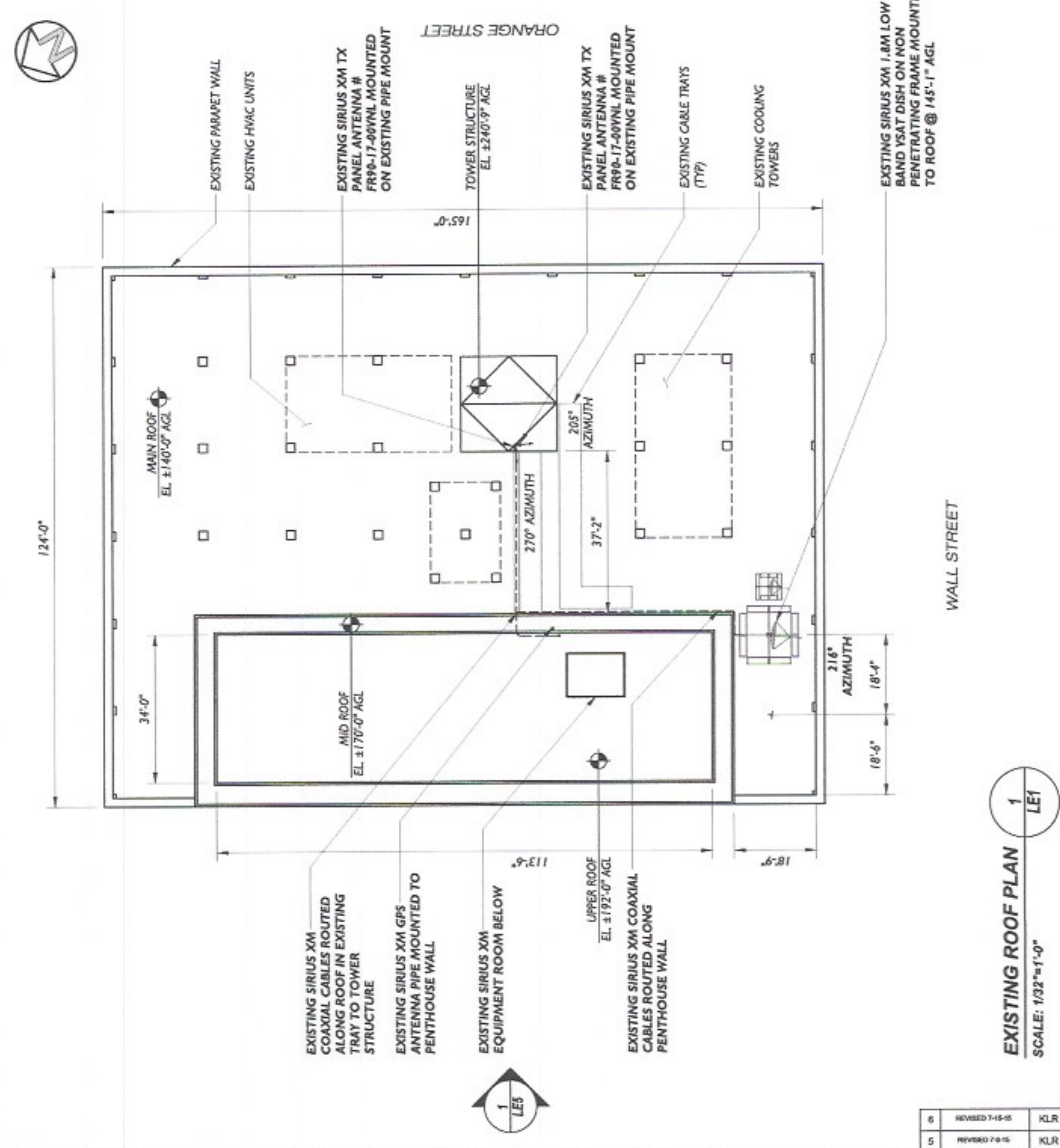
Domenic Aversa, EIT
Project Manager

STATE OF CONNECTICUT
MICHAEL L BOHLINGER
20405
LICENSED
PROFESSIONAL ENGINEER
7/7/15

Reviewed and Approved by:

Michael Bohlinger, PE
Principal
Connecticut License No. 20405

Appendix A



EXISTING ROOF PLAN

SCALE: 1/32"=1'-0"

6	REVISED 7-15-15	KLR
5	REVISED 7-9-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-16-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

CLIENT:

SiriusXM SATELLITE RADIO
1500 ECKINGTON PLACE
WASHINGTON, DC 20002
PHONE# (212) 584-5120

A SAXON DG
TOMS RIVER, NJ
PHONE# (732) 678-0155

TITLE: EXISTING ROOF PLAN

ASDG NO: ASDGSX97

DRAWN BY: MDC

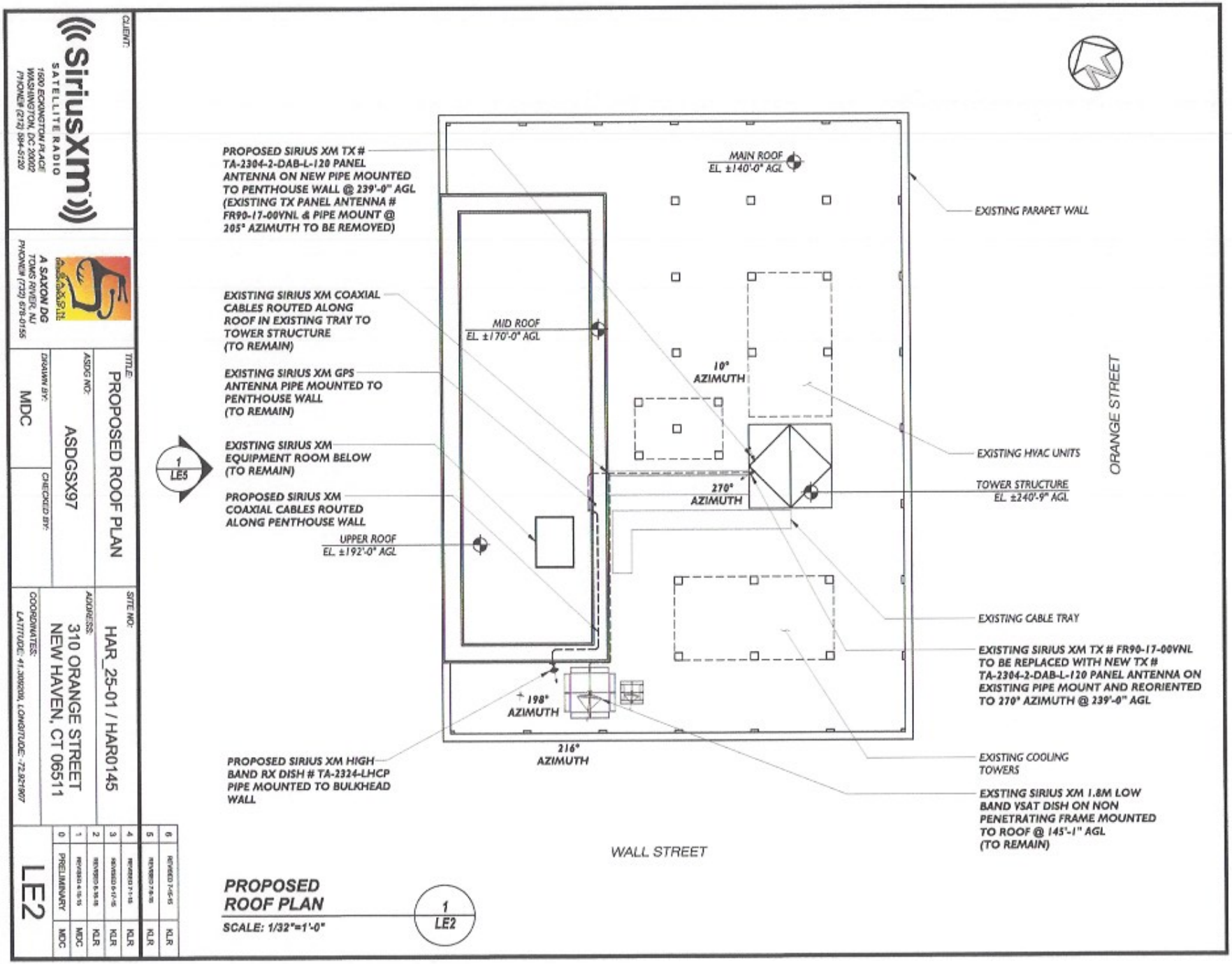
CHECKED BY:

SITE NO: HAR_25-01 / HAR0145

ADDRESS: 310 ORANGE STREET NEW HAVEN, CT 06511

COORDINATES: LATITUDE: 41.309209, LONGITUDE: -72.921907

LE1



PROPOSED ROOF PLAN

SCALE: 1/32"=1'-0"

1 LE2

CLIENT:
SiriusXM
SATELLITE RADIO
1500 EASTON PLACE
WASHINGTON, DC 20002
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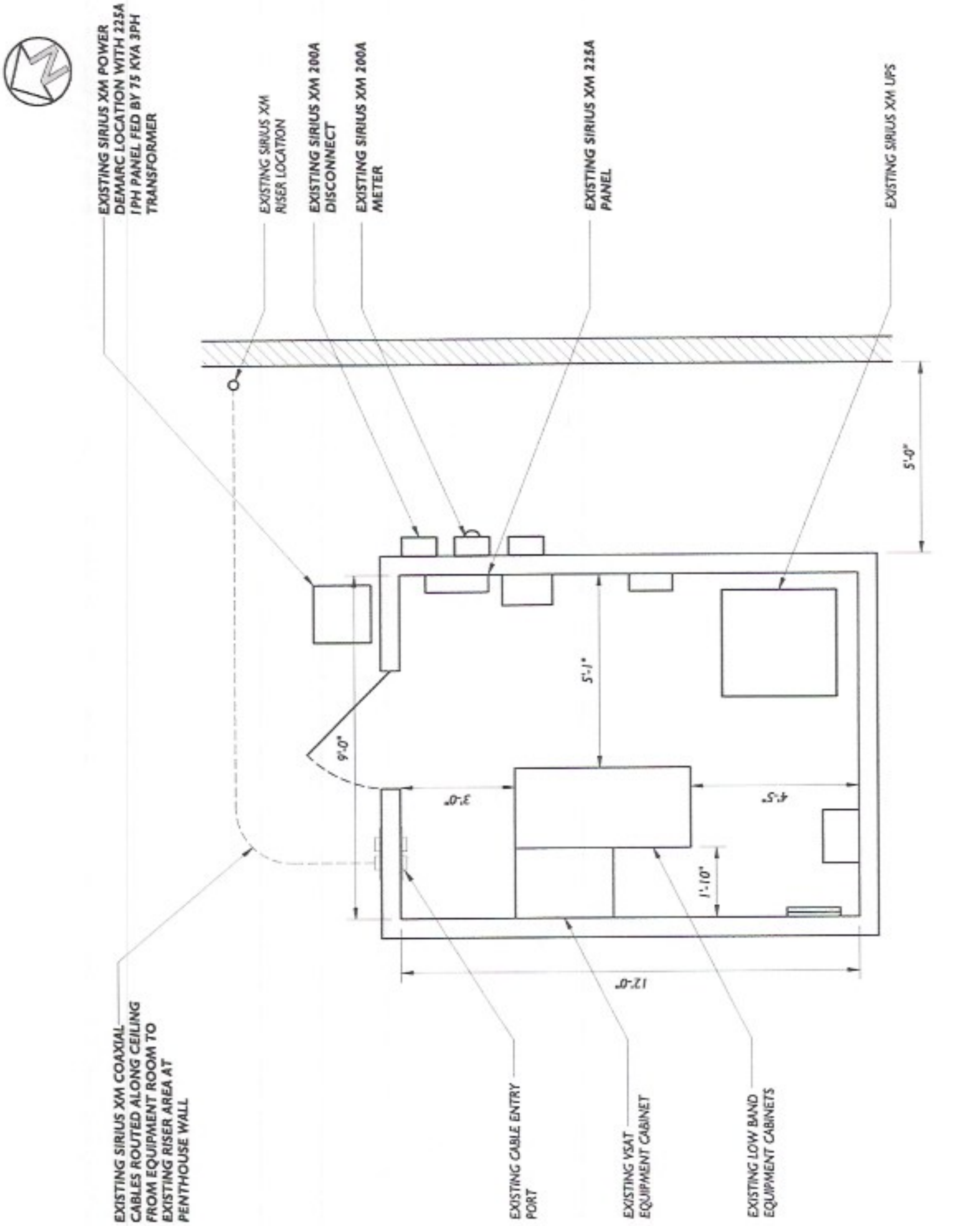
LE2

6	REVISED 7-15-15	KLR
5	REVISED 7-8-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-10-15	KLR
1	REVISED 4-10-15	MDC
0	PRELIMINARY	MDC



EXISTING EQUIPMENT ROOM (UPPER PENTHOUSE)
SCALE: 1/4"=1'-0"
1 / LE3

6	REVISED 7-15-15	KLR
5	REVISED 7-9-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-16-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

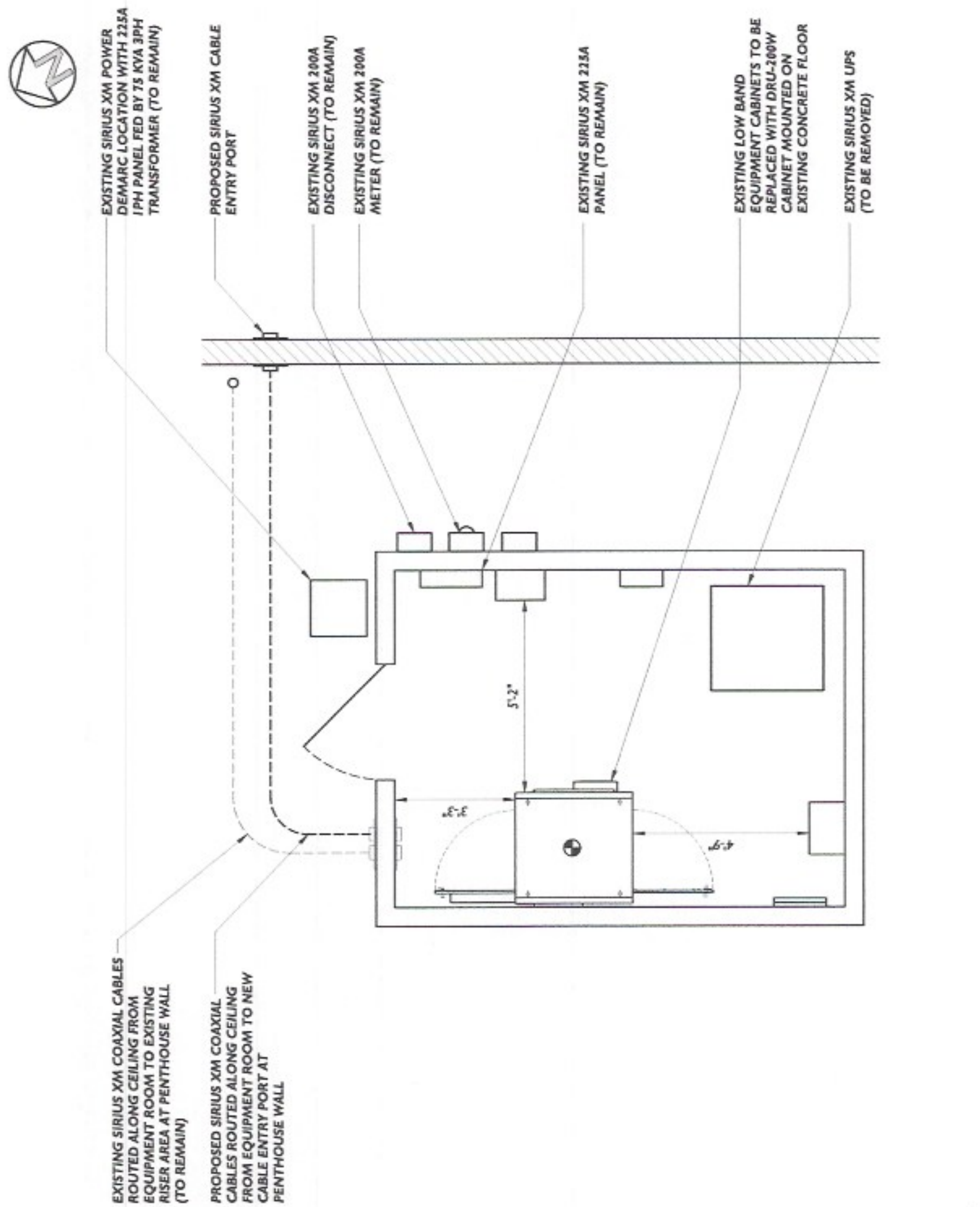
CLIENT:
SiriusXM SATELLITE RADIO
1500 ECKINGTON PLACE
WASHINGTON, DC 20002
PHONE# (212) 584-5120

A SAXON DESIGN GROUP LLC
A SAXON DG
TOMS RIVER, NJ
PHONE# (732) 678-0155

TITLE: EXISTING EQUIPMENT ROOM
ASDG NO: ASDGSX97
DRAWN BY: MDC
CHECKED BY:

SITE NO: HAR_25-01 / HAR0145
ADDRESS: 310 ORANGE STREET NEW HAVEN, CT 06511
COORDINATES: LATITUDE: 41.309209, LONGITUDE: -72.921907

LE3



PROPOSED EQUIPMENT ROOM (UPPER PENTHOUSE) 1 / LE4

SCALE: 1/4"=1'-0"

6	REVISED 7-16-15	KLR
5	REVISED 7-9-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-16-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

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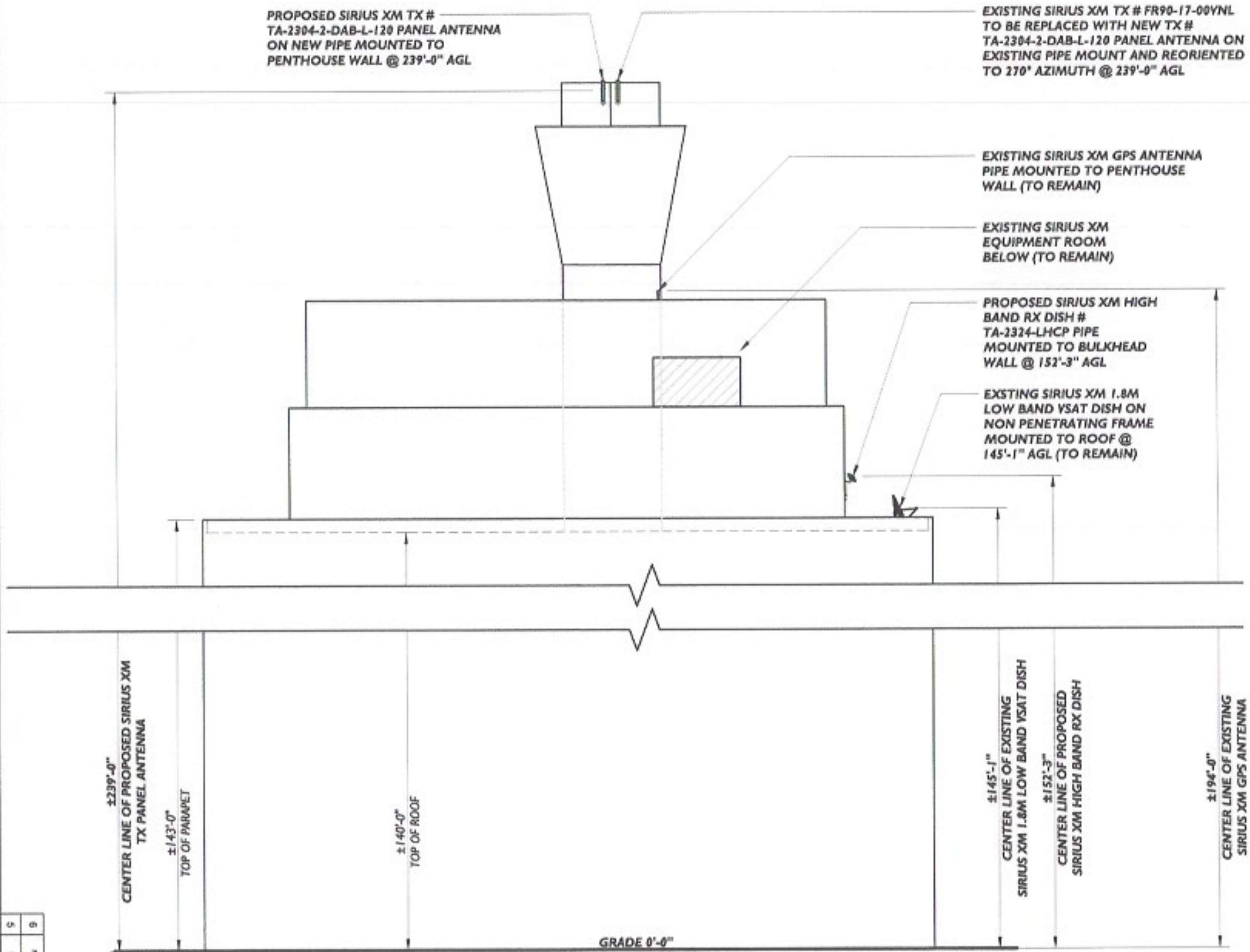
LE4



WEST ELEVATION (1 / LE5)

SCALE: 1/32"=1'-0"

NOTE:
PROPOSED MODIFICATIONS DO NOT INCREASE OR ALTER THE HEIGHT OF THE EXISTING FACILITY

CLIENT:

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2	REVISED 6-16-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

LE5

EXISTING ANTENNA COAX KEY										
ANTENNA NUMBER	ANTENNA MANUFACTURER	ANTENNA TYPE	MODEL NUMBER	AZIMUTH (REF. TO TRUE NORTH)	+/- TILT	CENTER OF ANTENNA FROM GROUND LEVEL	COAX FEEDER			
							TYPE	LENGTH	SIZE	NEW/EXISTING
1	EMS	PANEL	FR90-17-00 NYL	205°	0°	239'-0"	EW-17	186'-0"	5"	EXISTING
2	EMS	PANEL	FR90-17-00 NYL	295°	0°	239'-0"	LDF7-50A	186'-0"	1-5/8"	EXISTING
3	PRODELIN	VSAT	1183 WITH DEICING	216°	35°	±145'-1"	LMR-400	50'-0"	0.375"	EXISTING
4	TRIMBLE	GPS	57860-30	N/A	N/A	±194'-0"	LMR-400	35'-0"	0.375"	EXISTING
5										
6										

NOTES:
1) LOCATION OF EXISTING ANTENNAS ON TOWER STRUCTURE INACCESSIBLE DURING DESIGN VISIT. CONTRACTOR AND CONSTRUCTION MANAGER SHALL FIELD VERIFY PRIOR TO CONSTRUCTION.

EXISTING EQUIPMENT CABINET KEY				
CABINET NUMBER	CABINET MANUFACTURER	CABINET TYPE	MODEL NUMBER	NEW/EXISTING
1	GSI	REPEATER	HP-TWT	EXISTING

POWER REQUIREMENTS FOR EXISTING CONFIGURATION		
AMPERAGE	VOLTAGE	PHASE
200 AMPS	120/240 VAC	SINGLE PHASE

NEW ANTENNA COAX KEY										
ANTENNA NUMBER	ANTENNA MANUFACTURER	ANTENNA TYPE	MODEL NUMBER	AZIMUTH (REF. TO TRUE NORTH)	+/- TILT	CENTER OF ANTENNA FROM GROUND LEVEL	COAX FEEDER			
							TYPE	LENGTH	SIZE	NEW/EXISTING
1	TIL-TEK	PANEL	TA-2304-2-DAB-L-120	10°	2°	239'-0"	EW-17	186'-0"	5"	EXISTING
2	TIL-TEK	PANEL	TA-2304-2-DAB-L-120	270°	3°	239'-0"	LDF7-50A	186'-0"	1-5/8"	EXISTING
3	TIL-TEK	DISH	TA-2324-LHCP	198°	41°	±152'-3"	AVA5-50A	120'-0"	7/8"	NEW
4	PRODELIN	VSAT	1183 WITH DEICING	216°	35°	±145'-1"	LMR-400	50'-0"	0.375"	EXISTING
5	TRIMBLE	GPS	57860-30	N/A	N/A	±194'-0"	LMR-400	35'-0"	0.375"	EXISTING

NEW EQUIPMENT CABINET KEY				
CABINET NUMBER	CABINET MANUFACTURER	CABINET TYPE	MODEL NUMBER	NEW/EXISTING
1	UBS	REPEATER	DRU-200W	NEW

POWER REQUIREMENTS FOR NEW CONFIGURATION		
AMPERAGE	VOLTAGE	PHASE
200 AMPS (EXISTING)	120/240 VAC (EXISTING)	SINGLE PHASE (EXISTING)

*COAX CABLE LENGTHS ARE ESTIMATES; CONTRACTOR AND CONSTRUCTION MANAGER SHALL FIELD VERIFY PRIOR TO ORDERING.
**CONTRACTOR TO FIELD VERIFY ALL RF DATA WITH PROJECT RF ENGINEER PRIOR TO INSTALLATION.

6	REVISED 7-15-15	KLR
5	REVISED 7-9-15	KLR
4	REVISED 7-1-15	KLR
3	REVISED 6-17-15	KLR
2	REVISED 6-16-15	KLR
1	REVISED 4-15-15	MDC
0	PRELIMINARY	MDC

CLIENT:
SiriusXM SATELLITE RADIO
1500 ECKINGTON PLACE
WASHINGTON, DC 20002
PHONE# (212) 584-5120

A SAXON DG
TOMS RIVER, NJ
PHONE# (732) 678-0155

TITLE: ANTENNA SCHEDULE
ASDG NO: ASDGSX97
DRAWN BY: MDC
CHECKED BY:

SITE NO: HAR_25-01 / HAR0145
ADDRESS: 310 ORANGE STREET
NEW HAVEN, CT 06511
COORDINATES: LATITUDE: 41.309209, LONGITUDE: -72.921907

LE6

C Squared Systems, LLC
65 Dartmouth Drive, Unit A3
Auburn, NH 03032
(603) 644-2800
support@csquaredsystems.com

Calculated Radio Frequency Emissions

Sirius XM

HAR 25-01

310 Orange Street, New Haven, CT 06511

July 13, 2015

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1. Introduction

The purpose of this report is to investigate compliance with applicable FCC regulations for the proposed modifications to the existing Sirius XM Radio Inc. ("Sirius XM") antenna arrays mounted on the penthouse and rooftop of the SNET building located at 310 Orange Street in New Haven, CT. The coordinates of the building are 41-18-33.12N, 72-55-8.86W.

Sirius XM is proposing the following modifications:

1. The removal of two panel antennas (Model FR90-17-00VNL) and replacement with two panel antennas (Mode# TA-2304-2-DAB-L-120)
2. Adding one high-band receive dish antenna (Model#TA-2324-LHCP) to an existing bulkhead wall
3. Adding Sirius XM equipment cabinet to the existing concrete floor.

2. FCC Guidelines for Evaluating RF Radiation Exposure Limits

In 1985, the FCC established rules to regulate radio frequency (RF) exposure from FCC licensed antenna facilities. In 1996, the FCC updated these rules, which were further amended in August 1997 by OET Bulletin 65 Edition 97-01. These new rules include Maximum Permissible Exposure (MPE) limits for transmitters operating between 300 kHz and 100 GHz. The FCC MPE limits are based upon those recommended by the National Council on Radiation Protection and Measurements (NCRP), developed by the Institute of Electrical and Electronics Engineers, Inc., (IEEE) and adopted by the American National Standards Institute (ANSI).

The FCC general population/uncontrolled limits set the maximum exposure to which most people may be subjected. General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Public exposure to radio frequencies is regulated and enforced in units of milliwatts per square centimeter (mW/cm^2). The general population exposure limits for the various frequency ranges are defined in the attached "FCC Limits for Maximum Permissible Exposure (MPE)" in Attachment B of this report.

Higher exposure limits are permitted under the occupational/controlled exposure category, but only for persons who are exposed as a consequence of their employment and who have been made fully aware of the potential for exposure, and they must be able to exercise control over their exposure. General population/uncontrolled limits are five times more stringent than the levels that are acceptable for occupational, or radio frequency trained individuals. Attachment B contains excerpts from OET Bulletin 65 and defines the Maximum Exposure Limit.

Finally, it should be noted that the MPE limits adopted by the FCC for both general population/uncontrolled exposure and for occupational/controlled exposure incorporate a substantial margin of safety and have been established to be well below levels generally accepted as having the potential to cause adverse health effects.

3. RF Exposure Prediction Methods

The emission field calculation results displayed in the following figures were generated using the following formula as outlined in FCC bulletin OET 65:

$$\text{Power Density} = \left(\frac{1.6^2 \times EIRP}{4\pi \times R^2} \right) \text{x Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

R = Radial Distance = $\sqrt{(H^2 + V^2)}$

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished modifications.

4. Calculation Results

Table 1 below outlines the power density information for the site. Because the proposed Sirius XM antennas are directional in nature, the majority of the RF power is focused out towards the horizon. As a result, there will be less RF power directed below the antennas relative to the horizon, and consequently lower power density levels around the base of the building. Please refer to Attachment C for the vertical pattern of the proposed Sirius XM antennas. The calculated results for Sirius XM in Table 1 include a nominal 10 dB off-beam pattern loss to account for the lower relative gain below the antennas.

Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	%MPE
AT&T UMTS	200	880	1	500	0.0045	0.5867	0.77%
AT&T UMTS	200	1900	2	500	0.0090	1.0000	0.90%
AT&T GSM	200	1900	3	427	0.0115	1.0000	1.15%
AT&T GSM	200	880	7	296	0.0186	0.5867	3.17%
AT&T LTE	200	740	1	500	0.0045	0.4933	0.91%
Marcus	117.8						0.00%
Marcus	103						3.06%
Marcus	103						3.06%
Marcus	40						0.61%
Marcus	40						0.17%
Sirius XM	254	2345	2	2455	0.0027	1.0000	0.27%
						Total:	**14.08%**

Table 1: Carrier Information[1]

[1] The power density information for carriers other than Sirius XM was taken directly from the CSC database dated 5/4/2015. Please note that %MPE values listed are rounded to two decimal points. The total %MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not reflect the total value listed in the table.

5. Conclusion

The above analysis verifies that emissions from the existing site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the cumulative power density from the proposed transmit antennas at the existing facility is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at ground level is **14.08% of the FCC limit**.

As noted previously, obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. As a result, the predicted signal levels are more conservative (higher) than the actual signal levels will be from the finished modifications.

6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.

Daniel L. Goulet
C Squared Systems, LLC

July 13, 2015
Date

Attachment A: References

OET Bulletin 65 - Edition 97-01 - August 1997 Federal Communications Commission Office of Engineering & Technology

ANSI C95.1-1982, American National Standard Safety Levels With Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 300 kHz to 100 GHz. IEEE-SA Standards Board

IEEE Std C95.3-1991 (Reaff 1997), IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave. IEEE-SA Standards Board

Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure[2]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure[3]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz * Plane-wave equivalent power density

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

[2] Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure

[3] General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

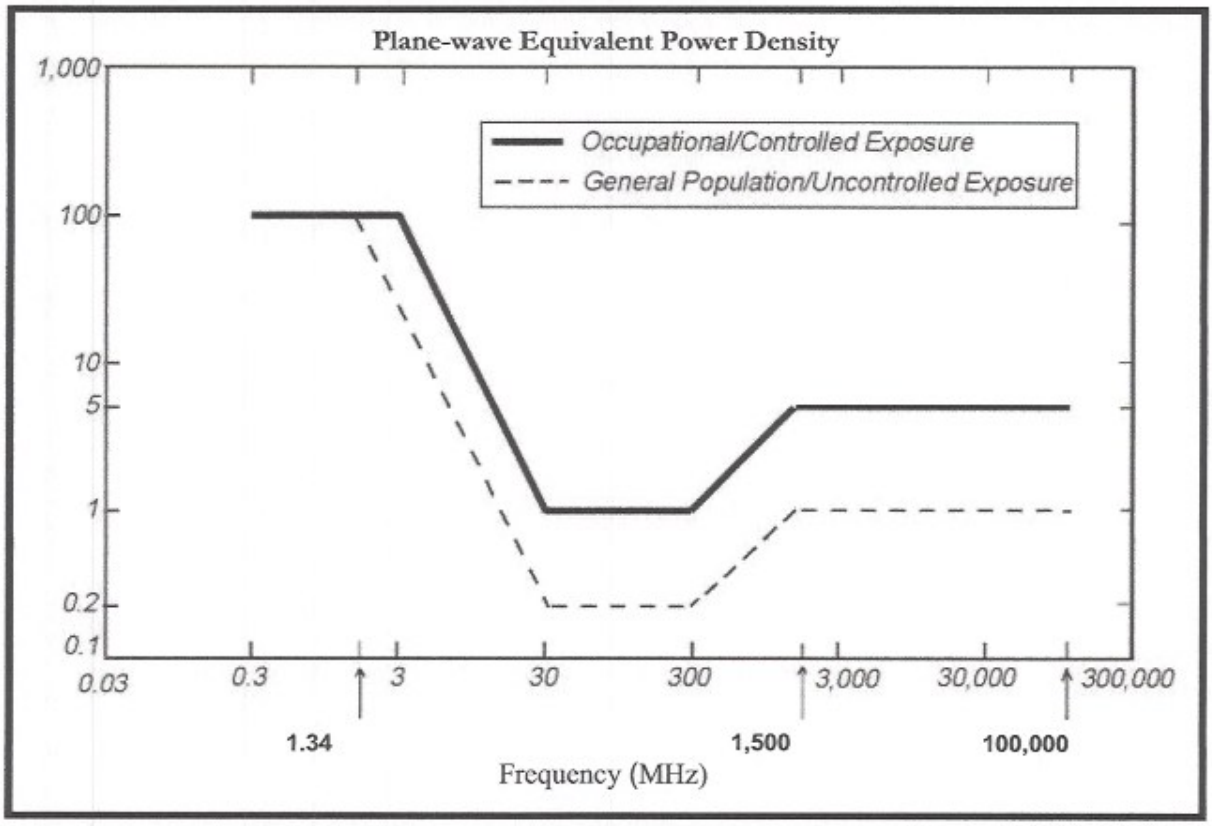
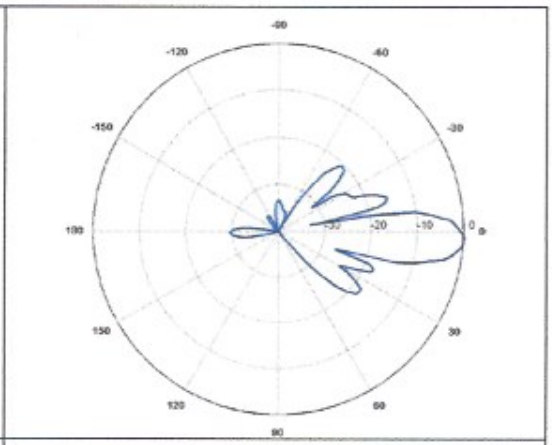


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: AT&T Antenna Data Sheets and Electrical Patterns

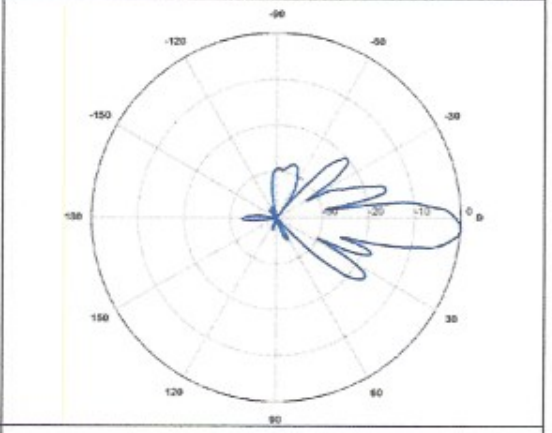
700 MHz

Manufacturer:	KMW
Model #:	AM-X-CD-16-65-00T
Frequency Band:	698-806 MHz
Gain:	13.4 dBd
Vertical Beamwidth:	12.3°
Horizontal Beamwidth:	65°
Polarization:	Dual Slant ± 45°
Size L x W x D:	72.0" x 11.8" x 5.9"



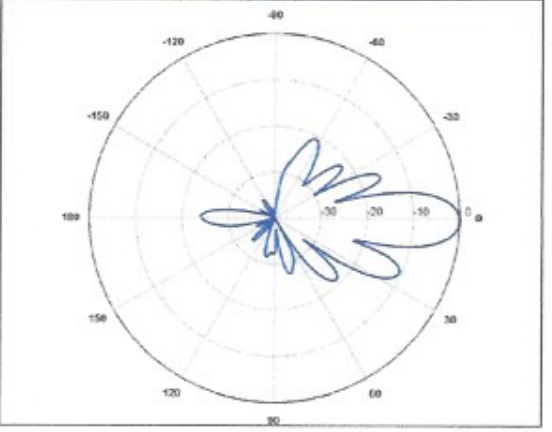
850 MHz GSM

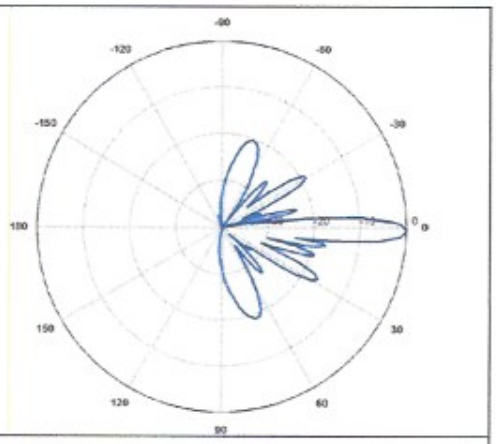
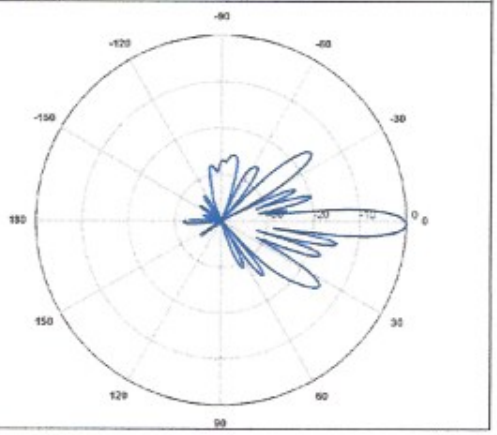
Manufacturer:	KMW
Model #:	AM-X-CD-16-65-00T
Frequency Band:	698-894 MHz
Gain:	13.9 dBd
Vertical Beamwidth:	15°
Horizontal Beamwidth:	65°
Polarization:	Dual Slant ±45°
Size L x W x D:	54.0" x 12.6" x 7.87"



850 MHz UMTS

Manufacturer:	Kathrein-Scala
Model #:	80010121
Frequency Band:	824-896 MHz
Gain:	11.5 dBd
Vertical Beamwidth:	14.5°
Horizontal Beamwidth:	86°
Polarization:	Dual Linear ±45°
Size L x W x D:	54.5" x 10.3" x 5.9"

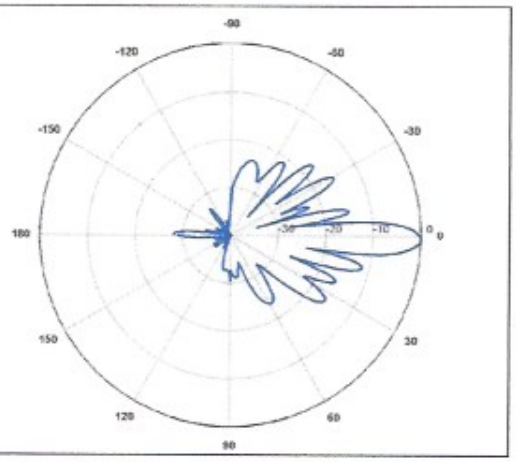


1900 MHz GSM Manufacturer: KMW Model #: AM-X-CD-16-65-00T Frequency Band: 1710-2170 MHz Gain: 15.3 dBd Vertical Beamwidth: 7.5° Horizontal Beamwidth: 65° Polarization: Dual Slant ±45° Size L x W x D: 54.0" x 12.6" x 7.87"	
1900 MHz UMTS Manufacturer: Kathrein-Scala Model #: 80010121 Frequency Band: 1850-1990 MHz Gain: 14.3 dBd Vertical Beamwidth: 6.6° Horizontal Beamwidth: 85° Polarization: Dual Linear ±45° Size L x W x D: 54.5" x 10.3" x 5.9"	

Attachment D: Sirius XM: Antenna Data Sheets and Electrical Patterns

Sirius XM

Manufacturer:	Til-Tek
Model #:	TA-2304-2-DAB
Frequency Band:	2330-2345 MHz
Gain	10.9 dBd
Vertical Beamwidth:	7.5°
Horizontal Beamwidth:	120°
Polarization:	Vertical
Size L x W x D:	39.5" x 6.5" x 3.5"



C Squared Systems, LLC
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Calculated Radio Frequency Emissions

Sirius XM

HAR 25-01

310 Orange Street, New Haven, CT 06511

August 21, 2015

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The emission field calculation results displayed in the following figures were generated using the following formula as outlined in FCC bulletin OET 65:

$$\text{Power Density} = \left(\frac{1.6^2 \times EIRP}{4\pi \times R^2} \right) \text{x Off Beam Loss}$$

Where:

EIRP = Effective Isotropic Radiated Power

R = Radial Distance = $\sqrt{\left(H^2 + V^2\right)}$

H = Horizontal Distance from antenna in meters

V = Vertical Distance from radiation center of antenna in meters

Ground reflection factor of 1.6

Off Beam Loss is determined by the selected antenna pattern

These calculations assume that the antennas are operating at 100 percent capacity and power, and that all channels are transmitting simultaneously. Obstructions (trees, buildings, etc.) that would normally attenuate the signal are not taken into account. The calculations assume even terrain in the area of study and do not take into account actual terrain elevations which could attenuate the signal. As a result, the predicted signal levels reported below are much higher than the actual signal levels will be from the finished modifications.

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Carrier	Antenna Height (Feet)	Operating Frequency (MHz)	Number of Trans.	ERP Per Transmitter (Watts)	Power Density (mw/cm^2)	Limit	%MPE
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AT&T UMTS	200	1900	2	500	0.0090	1.0000	0.90%
AT&T GSM	200	1900	3	427	0.0115	1.0000	1.15%
AT&T GSM	200	880	7	296	0.0186	0.5867	3.17%
AT&T LTE	200	740	1	500	0.0045	0.4933	0.91%
Marcus	117.8						0.00%
Marcus	103						3.06%
Marcus	103						3.06%
Marcus	40						0.61%
Marcus	40						0.17%
Sirius XM	239	2345	2	2454.8	0.0031	1.0000	0.31%
						Total:	**14.11%**

Table 1: Carrier Information[1]

[1] The power density information for carriers other than Sirius XM was taken directly from the CSC database dated 5/4/2015. Please note that %MPE values listed are rounded to two decimal points. The total %MPE listed is a summation of each unrounded contribution. Therefore, summing each rounded value may not reflect the total value listed in the table.

5. Conclusion

The above analysis verifies that emissions from the existing site will be below the maximum power density levels as outlined by the FCC in the OET Bulletin 65 Ed. 97-01. Even when using conservative methods, the cumulative power density from the proposed transmit antennas at the existing facility is well below the limits for the general public. The highest expected percent of Maximum Permissible Exposure at ground level is **14.11% of the FCC limit**.

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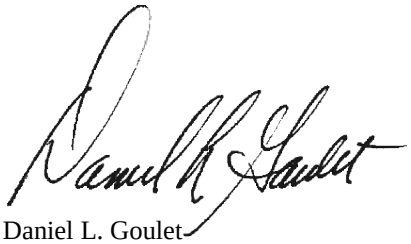
6. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate. The calculations follow guidelines set forth in ANSI/IEEE Std. C95.3, ANSI/IEEE Std. C95.1 and FCC OET Bulletin 65 Edition 97-01.



August 21, 2015

Daniel L. Goulet
C Squared Systems, LLC

Date

Attachment A: References

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Attachment B: FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure[2]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	-	-	f/300	6
1500-100,000	-	-	5	6

(B) Limits for General Population/Uncontrolled Exposure[3]

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (E) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	-	-	f/1500	30
1500-100,000	-	-	1.0	30

f = frequency in MHz * Plane-wave equivalent power density

Table 2: FCC Limits for Maximum Permissible Exposure (MPE)

[2] Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure

[3] General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

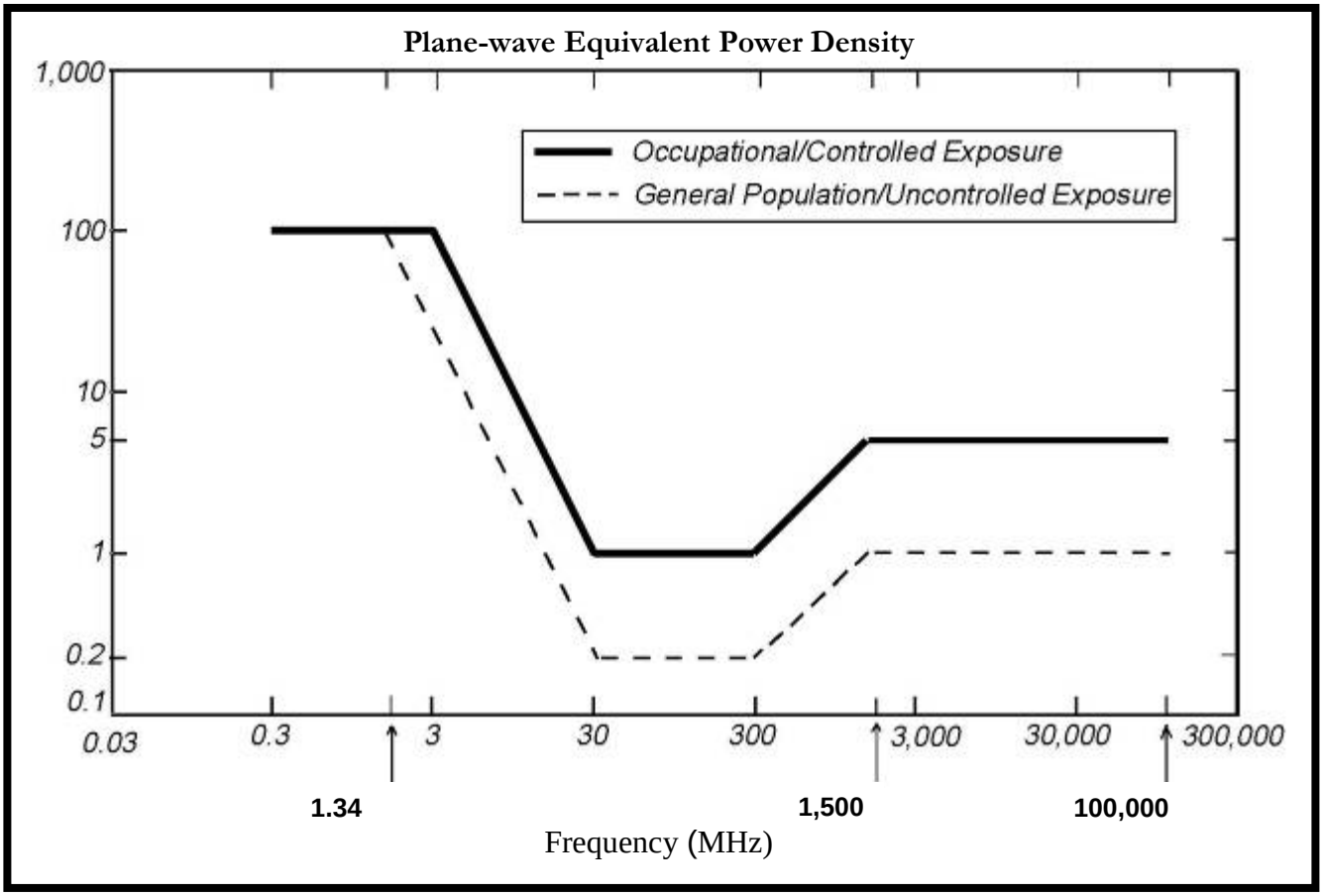
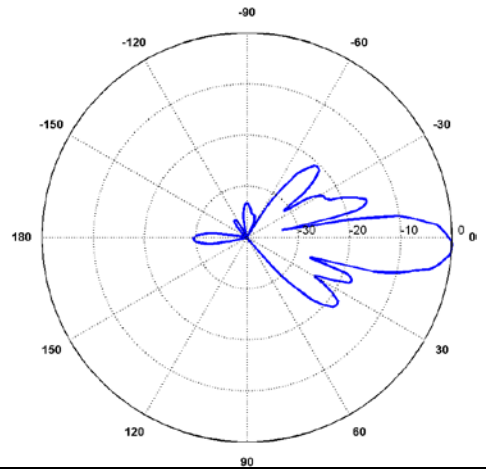


Figure 1: Graph of FCC Limits for Maximum Permissible Exposure (MPE)

Attachment C: AT&T Antenna Data Sheets and Electrical Patterns

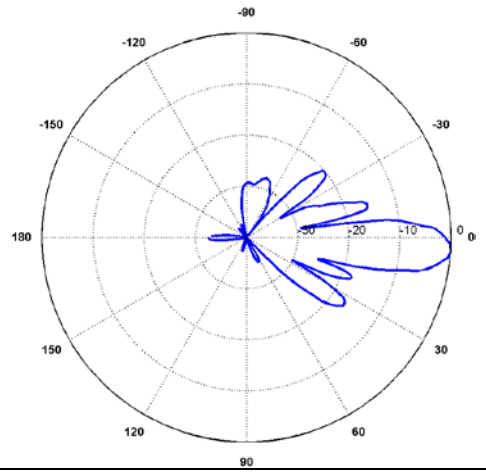
700 MHz

Manufacturer:	KMW
Model #:	AM-X-CD-16-65-00T
Frequency Band:	698-806 MHz
Gain:	13.4 dBd
Vertical Beamwidth:	12.3°
Horizontal Beamwidth:	65°
Polarization:	Dual Slant ± 45°
Size L x W x D:	72.0” x 11.8” x 5.9”



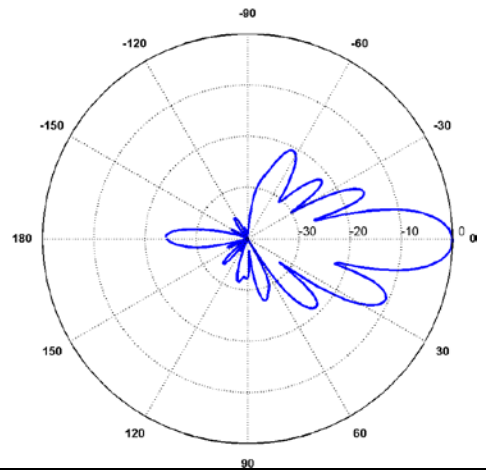
850 MHz GSM

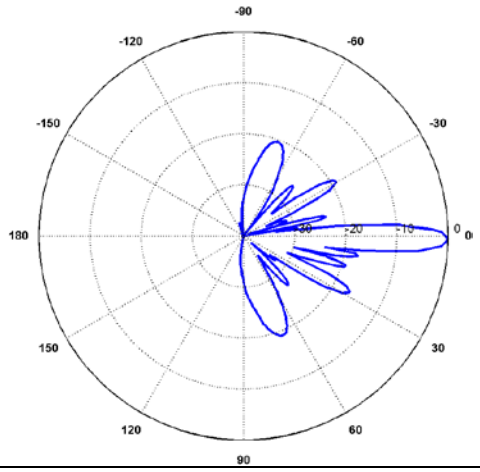
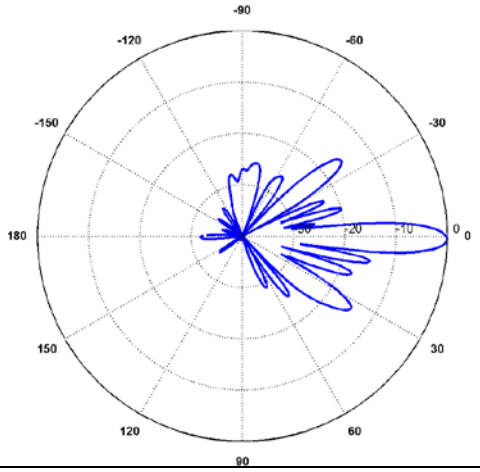
Manufacturer:	KMW
Model #:	AM-X-CD-16-65-00T
Frequency Band:	698-894 MHz
Gain:	13.9 dBd
Vertical Beamwidth:	15°
Horizontal Beamwidth:	65°
Polarization:	Dual Slant ±45°
Size L x W x D:	54.0” x 12.6” x 7.87”



850 MHz UMTS

Manufacturer:	Kathrein-Scala
Model #:	80010121
Frequency Band:	824-896 MHz
Gain:	11.5 dBd
Vertical Beamwidth:	14.5°
Horizontal Beamwidth:	86°
Polarization:	Dual Linear ±45°
Size L x W x D:	54.5” x 10.3” x 5.9”

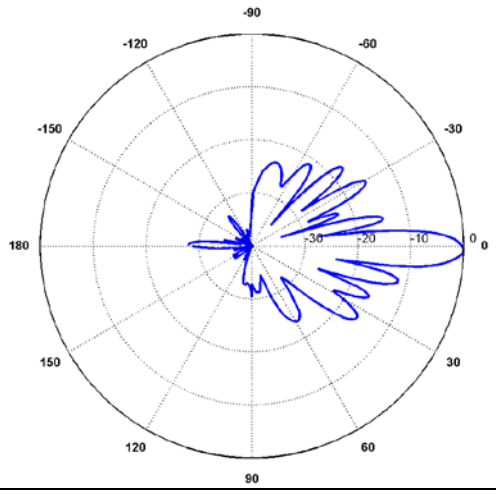


1900 MHz GSM Manufacturer: KMW Model #: AM-X-CD-16-65-00T Frequency Band: 1710-2170 MHz Gain: 15.3 dBd Vertical Beamwidth: 7.5° Horizontal Beamwidth: 65° Polarization: Dual Slant ±45° Size L x W x D: 54.0” x 12.6” x 7.87”	
1900 MHz UMTS Manufacturer: Kathrein-Scala Model #: 80010121 Frequency Band: 1850-1990 MHz Gain: 14.3 dBd Vertical Beamwidth: 6.6° Horizontal Beamwidth: 85° Polarization: Dual Linear ±45° Size L x W x D: 54.5” x 10.3” x 5.9”	

Attachment D: Sirius XM Antenna Data Sheets and Electrical Patterns

Sirius XM

Manufacturer:	Til-Tek
Model #:	TA-2304-2-DAB
Frequency Band:	2330-2345 MHz
Gain	10.9 dBd
Vertical Beamwidth:	7.5°
Horizontal Beamwidth:	120°
Polarization:	Vertical
Size L x W x D:	39.5” x 6.5” x 3.5”



STRUCTURAL ANALYSIS REPORT

For

A Saxon Design Group, LLC
1358 Hooper Avenue, Suite 265
Toms River, NJ 08753

HAR_25-01
KM No. 150606.00

310 Orange Street
New Haven, CT 06511

Prepared By:

KM CONSULTING ENGINEERS, INC.
9 Forest Lane, Ewing, NJ 08628
Ph: (609) 538-0400 www.kmengr.com

August 20, 2015

A Saxon Design Group, LLC
310 Orange Street
HAR_25-01

TABLE OF CONTENTS

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2.0 ANALYSIS……..4

3.0 RESULTS AND SUMMARY……...11

4.0 APPENDIX……...13

Load Case No. 1: Proposed Sirius XM high band RX dish (Model # TA-2324-LHCP) mounted on a proposed pipe mast attached to the existing bulkhead wall, Sirius XM equipment cabinet (Model # DRU-200W) mounted on existing concrete floor, (2) new panel antennas (Model #TA-2304-2-DAB-L-120) mounted on pipe masts attached to the existing penthouse wall, and removal of existing Sirius XM low band standard equipment cabinets and existing Sirius XM TX panel antenna (Model # FR90-17-00VNL).

1.0 Introduction

Pursuant to your request, a professional engineer from KM Consulting Engineers, Inc. has prepared this report describing the methodology and codes used in the review of the structural integrity for the proposed Sirius XM installation on the existing building structure. The analysis and design takes into consideration loading from the proposed equipment, antennas and steel framing attached to the existing building roof and wall structures.

One new Sirius XM high band RX dish (Model # TA-2324-LHCP) is to be mounted to a new 3½" (nom) sched 40 pipe mast attached to the existing bulkhead wall. One new Sirius XM TX panel antenna (Model # TA-2304-2-DAB-L-120) will be mounted to a new pipe mast attached to the existing penthouse wall and the existing Sirius XM TX panel antenna (Model # FR90-17-00VNL) will be replaced with one new panel antenna (Model # TA-2304-2-DAB-L-120) on the existing pipe mount.

The existing Sirius XM low band standard equipment cabinets will be replaced with a new equipment cabinet (Model # DRU-200W) and mounted on the existing concrete floor.

As a part of the analysis process, engineers from A Saxon Design Group have visited the job site and visually observed the condition of the existing structural elements of the building and reviewed the proposed loading as documented on this report.

Loads imposed by the newly proposed antennas and equipment cabinet on the existing building structure are shown in the included calculations and are provided for checking adequacy of the existing structure to support loads from the new installation. The design check assumes that the structure is maintained and in good condition with no defects and deterioration of the structural capacity.

2.0 Analysis

2.1 Design Codes

The following design codes have been used, as applicable, to complete the structural analysis of the proposed addition of steel framing on the existing structure:

Building Code
2013 Amendment to 2005 CT State Building Code

Loading
Building loads are based on the following reference standards:

- 2013 Amendment to 2005 CT State Building Code
- American Society of Civil Engineers (ASCE) 7-92, Minimum Design Loads for Buildings and Other Structures

Structural Steel Design Standard
Steel design is based on the following American Institute of Steel Construction (AISC) reference standards:

- AISC Manual of Steel Construction: Allowable Stress Design, 13th Edition

Structural Masonry Design Standard
Structural masonry design is based on the following American Concrete Institute (ACI) reference standards:

- ACI 530-05, Building Code Requirements and Specification for Masonry Structures

Antenna Design Standard
Design of the structural supports for the Antennas on the projects is based on the following standard:

- ANSI/TIA-222-G Structural Standards for Antenna Supporting Structures and Antennas

2.2 Design Loading

2.2.1 Wind Load:

- Wind Load on Equipment: Per ANSI/TIA-222-G Spec.

2.2.2 Platform Loading:

- Equipment Cabinet Load: 817 lbs (total weight)

2.3 Structural Analysis

EQUIPMENT FLOOR CAPACITY CHECK CALCULATION

Equipment Cabinet Calcs

Check for Punching:

Concrete Strength: $f'c := 3000 \ psi$

Slab Thickness: $h := 4.0 \ in$

Effective Thickness: $d := h - 1 = 3 \ in$

Effective Width: $w := 142.8 \ in$

Total Loading: $L_t := 817 \ lb$

Factored Loading: $L_f := 1.4 \cdot L_t = 1143.8 \ lb$

Punching Shear Capacity: $L_a := \phi \cdot V_n$

$L_a := 0.75 \cdot 4 \cdot f'c^{\frac{1}{2}} \cdot w = 23464 \ lb$

$23464 > 817$ **OK**

Overall Structural Capacity

Original Design Loading:

Live Load: $LL := 100 \ psf$ (equipment room)

Equipment Room Design Load: $LL = 100 \ psf$

Cabinet Footprint area: $8.9 \ ft^2$

Cabinet Loading: $817 \ lb$

Avg. Distributed Load: $\frac{817}{8.9} = 91.8 \ psf$ **OK**

Existing equipment room acceptable to support new proposed cabinet

RX DISH CAPACITY CHECK CALCULATION

RX Dish on Pipe Mount:

RX size (in):	$R_a := 12.63$	Centerline Height (ft):	$z_a := 152.25$
Antenna Weight (lb):	$W_{a1} := 28$	Wind Speed:	$V := 111\ mph$
Pipe Mast (in):	$L_{pipeA1} := 44$ $D_{pipeA1} := 4$	Exposure B:	$z_g := 1200$ $\alpha := 7$

$Aspect_{ratio} := 1$

$q_z := 0.00256 \cdot K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I$

$F_A := q_z \cdot G_h \cdot (EPA_A)$

$K_Z := 2.01 \left(\frac{z_a}{z_g}\right)^{\frac{2}{\alpha}} = 1.114$

$G_h := 1.1$

$C_A := \frac{Aspect_{ratio} - 2.5}{22.5} + 1.2 = 1.133$

$K_d := 0.95 \qquad I := 1 \qquad K_{ZT} := 1$

$q_z := 0.00256\ K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I = 33.391 \quad psf$

EPA_A

$A_{pipe} := \frac{L_{pipeA1} \cdot D_{pipeA1}}{144} = 1.22 \qquad A_{Ant} := \frac{3.14 \cdot R_a^{\ 2}}{144} = 3.478$

$EPA_A := A_{pipe} + A_{Ant} = 4.701\ ft^2$

$F_A := q_z \cdot G_h \cdot (EPA_A) \cdot C_A = 195.7 \quad lb$

Total wind force of RX dish = 196 lbs. The proposed antenna is to be mounted on pipe mast attached to the existing bulkhead wall.

Check connections for shear:

Check Connections for Shear

Total Weight:

$W_{total} := W_{a1} + 20 = 48 \quad lbs$ *(assume 20# for connections)*

Maximum force due to combination of loads: $F_{max} := \sqrt{F_A{}^2 + W_{total}{}^2} = 201$

From HILTI North American Techical Guide 2008:
5/8" dia. HY-70, 3.5" embedment- allowable shear = 1405 lb

Existing/Proposed Mounts (required):
(4) Bolts per antenna= 5620 lbs (allowable) > 201 lbs (actual) **OK**

5/8" diameter bolts acceptable to support proposed dish

Check pipe stress for proposed pipe mount:

Pipe Stress and Deflection:

$$\Delta := \left(\frac{P \cdot b^2}{6 \cdot 29000 \cdot I}\right) \cdot (3\ L - b)$$

3.5" sched 40:

$L := 20$ $\quad S := 2.394$ $\quad P := \frac{F_A}{1000} = 0.196$
$b := 10$ $\quad I := 4.788$

$$\Delta := \frac{P \cdot b^2}{6 \cdot 29000 \cdot I} \cdot (3\ L - b) = 0.001 \quad in$$

$M_{pipe} := P \cdot b = 1.957 \quad k \cdot in$

$f_t := \frac{M_{pipe}}{S} = 0.8 \quad ksi > 24\ ksi$ **OK**

3.5" sched 40 pipe or greater acceptable for antenna mast

PANEL ANTENNA CAPACITY CHECK CALCULATION

Check wind force on panel antenna:

Panel Antenna mounted to penthouse wall:

Antenna size (in):	$H_a := 39.5$ $W_a := 5$	Centerline Height (ft):	$z_a := 239$
		Wind Speed:	$V := 111\ mph$
Antenna Weight (lb):	$W_{a1} := 8$	Exposure B:	$z_g := 1200$ $\alpha := 7$
Pipe Mast (in):	$L_{pipeA1} := 50$ $D_{pipeA1} := 2.375$	Mount Connections:	$Y_a := 1.67$ $Z_a := 0.83$

$$Aspect_{ratio} := \frac{H_a}{W_a} = 7.9$$

$$q_z := 0.00256 \cdot K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I$$

$$F_A := q_z \cdot G_h \cdot (EPA_A)$$

$$K_Z := 2.01 \left(\frac{z_a}{z_g}\right)^{\frac{2}{\alpha}} = 1.268$$

$$G_h := 1.1$$

$$C_A := \frac{Aspect_{ratio} - 2.5}{22.5} + 1.2 = 1.44$$

$$K_d := 0.95 \qquad I := 1 \qquad K_{ZT} := 1$$

$$q_z := 0.00256\ K_Z \cdot K_{ZT} \cdot K_d \cdot V^2 \cdot I = 37.982 \quad psf$$

$$A_{pipe} := \frac{L_{pipeA1} \cdot D_{pipeA1}}{144} = 0.82 \qquad A_{Ant} := \frac{H_a \cdot W_a}{144} = 1.372$$

$$EPA_A := A_{pipe} + A_{Ant} = 2.196\ ft^2$$

$$F_A := q_z \cdot G_h \cdot (EPA_A) \cdot C_A = 132.1 \quad lb$$

Each panel antenna and mounting pipe has 132 lb of wind force applied to them at the design wind speed.

Check connections for shear:

Check Bolt Connections:

$\Sigma M_A := 0$ $\Sigma F_A := 0$

$R_B := \frac{F_A \cdot Z_a}{Y_a}$ $R_A := F_A + R_B$

$R_B = 65.67 \ lb$ $R_A = 197.801 \ lb$

Check Connections for Shear:

Total Weight:

$W_{total} := W_{a1} + 20 = 28 \ lbs$ *(assume 20# for connections)*

Maximum force due to combination of loads: $F_{max} := \sqrt{R_A{}^2 + W_{total}{}^2} = 200$

From HILTI North American Techical Guide 2008:
1/2" dia. HY-20, 6" embedment- allowable shear = 930 lb

Existing/Proposed Mounts (required):
(4) Bolts per antenna= 3720 lbs (allowable) > 200 lbs (actual) **OK**

1/2" diameter bolts acceptable to support proposed antennas

Check pipe stress for proposed pipe mounts:

Pipe Stress and Deflection:

$$\Delta := \left(\frac{P \cdot b^2}{6 \cdot 29000 \cdot I}\right) \cdot (3\ L - b) \qquad M := \frac{F_A \cdot Z_a \cdot 12}{1000} = 1.316 \quad k \cdot in$$

2.0" sched 40:

$$L := Z_a \cdot 12 + \frac{H_a}{2} = 29.71 \qquad S := 0.5607 \qquad P := \frac{F_A}{1000} = 0.132$$

$$b := Z_a \cdot 12 = 9.96 \qquad I := 0.6658$$

$$\Delta := \frac{P \cdot b^2}{6 \cdot 29000 \cdot I} \cdot (3\ L - b) = 0.009\ in$$

$$f_t := \frac{M}{S} = 2.35\ ksi < 23\ ksi \qquad \textbf{OK}$$

2.0" sched 40 pipe for antenna masts acceptable

3.0 Results and Summary

Based on the structural analysis performed, we conclude that the existing equipment room floor can support the proposed cabinet. Further, the proposed RX dish and the proposed antennas can be mounted on the walls as referenced in the drawings provided for this site and in the calculations. The proposed Sirius XM installation is within applicable code tolerances.

Please do not hesitate to contact our office with any questions or concerns regarding this report.

Sincerely,
KM CONSULTING ENGINEERS, INC

Domenic Aversa, EIT
Project Manager

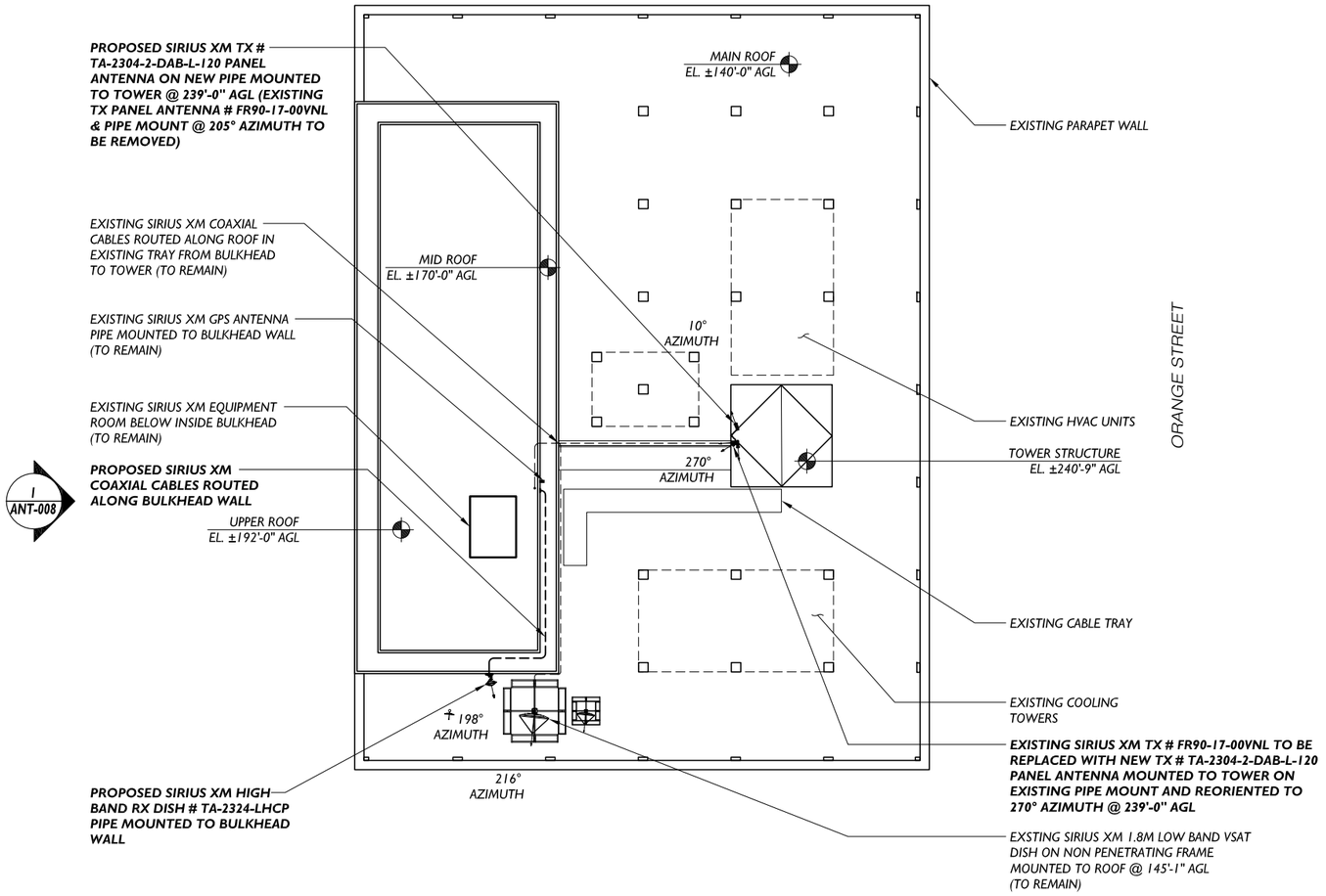
STATE OF CONNECTICUT
MICHAEL L BOHLINGER
20405
LICENSED
PROFESSIONAL ENGINEER
8/20/15

Reviewed and Approved by:

Michael Bohlinger, PE
Principal
Connecticut License No. 20405

Appendix A

Equipment Plan and Support Framing



PROPOSED ROOF PLAN

SCALE: 11"x17" : 1/32"= 1'-0" | 24"x36" : 1/16"= 1'-0"

1

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
06	08-14-15	FINAL ISSUE - SIRIUS XM CM / ENG. APPROVED	KLR	MLB
05	08-13-15	REVISED PER CLIENT COMMENTS ISSUED FOR APPROVAL	KLR	MLB
04	08-03-15	REVISED PER BUILDING COMMENTS	KLR	MLB
03	07-15-15	REVISED PER BUILDING & MAPPING INFORMATION	KLR	MLB
02	07-08-15	REVISED PER TOWER MAPPING	KLR	MLB
01	06-10-15	REVISED PER CLIENT COMMENTS	MDC	KLR
00	05-11-15	INITIAL SUBMISSION	MDC	KLR

Sirius XM™ SATELLITE RADIO

HPC WIRELESS SERVICES
22 SHELTER ROCK LANE, BUILDING C
DANBURY, CT 06810

A SAXON DESIGN GROUP
1466 HOOPER AVENUE, BSMT OFFICE SUITE
TOMS RIVER, NJ 08753
TEL # 732 678-0155 FAX # 732 412-3607

ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
CONNECTICUT LICENSE No. 20405

ASDG PROJECT No: ASDGSX97

CLIENT ID No: HAR_25-01 / HAR0145S

DESIGN TYPE: ROOFTOP

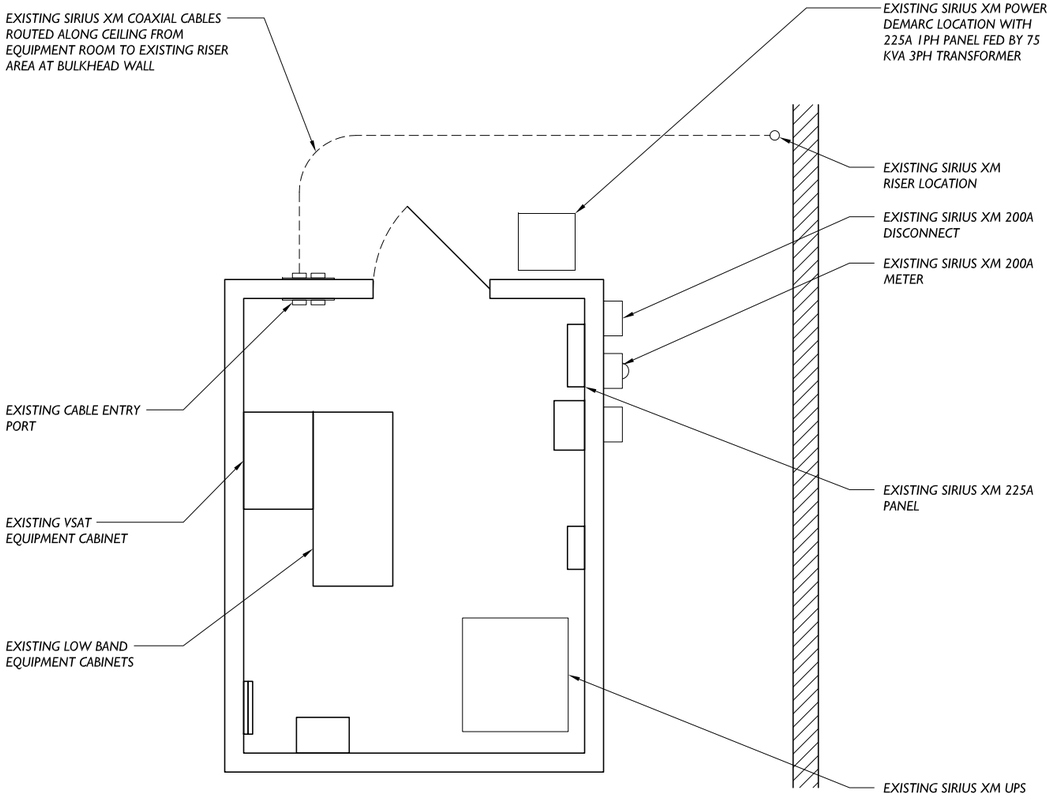
SITE INFORMATION:
310 ORANGE STREET
NEW HAVEN, CT 06511

DRAWING TITLE
EXISTING ROOF PLAN

MICHAEL L. BOHLINGER
CT LICENSE No. 20405

DATE: 05-11-15
PROJECT No: ASDGSX97
DRAWING BY: MDC
CHK BY:
DWG No.: ANT-006

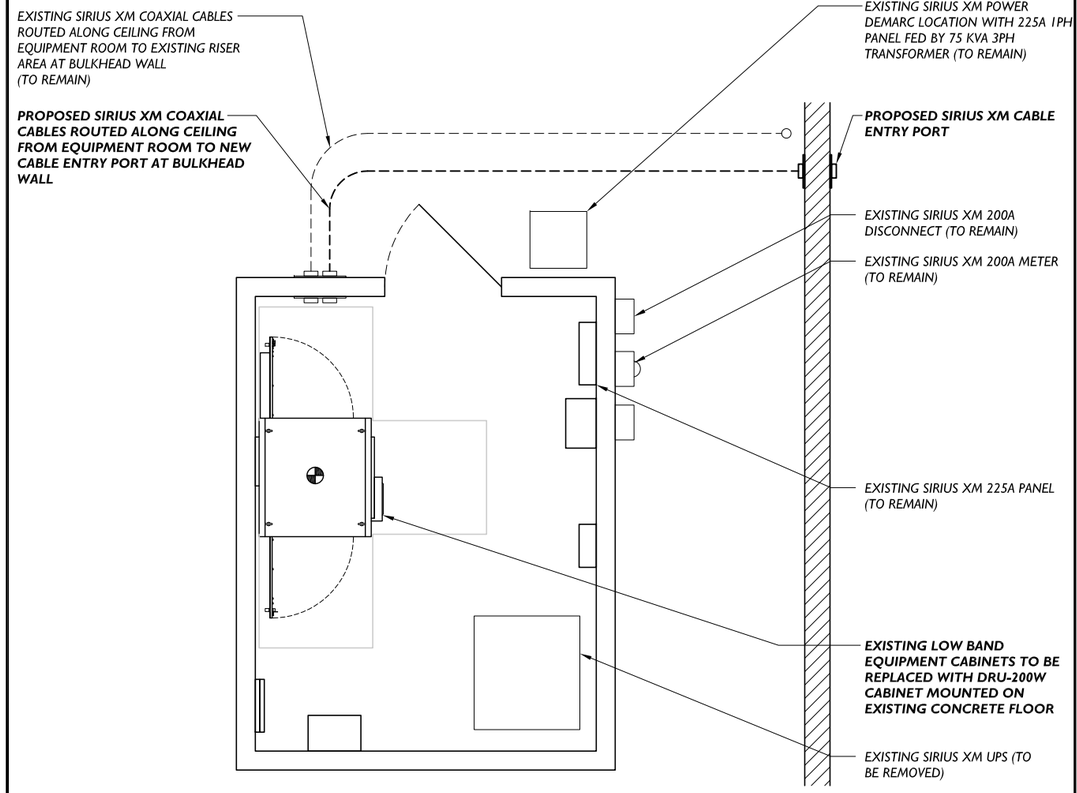
24"x36" SHEETS - SIGN & SEAL AREA



EXISTING EQUIPMENT PLAN

SCALE: 11"x17" : 1/4" = 1'-0" | 24"x36" : 1/2" = 1'-0"

1



PROPOSED EQUIPMENT PLAN

SCALE: 11"x17" : 1/4" = 1'-0" | 24"x36" : 1/2" = 1'-0"

2

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
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03	07-15-15	REVISED PER BUILDING & MAPPING INFORMATION	KLR	MLB
02	07-08-15	REVISED PER TOWER MAPPING	KLR	MLB
01	06-10-15	REVISED PER CLIENT COMMENTS	MDC	KLR
00	05-11-15	INITIAL SUBMISSION	MDC	KLR

Sirius XM™ SATELLITE RADIO

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22 SHELTER ROCK LANE, BUILDING C
DANBURY, CT 06810

A SAXON DESIGN GROUP
1466 HOOPER AVENUE, BSMT OFFICE SUITE
TOMS RIVER, NJ 08753
TEL # 732 678-0155 FAX # 732 412-3607

ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
CONNECTICUT LICENSE No. 20405

ASDG PROJECT No: ASDGSX97

CLIENT ID No: HAR_25-01 / HAR0145S

DESIGN TYPE: ROOFTOP

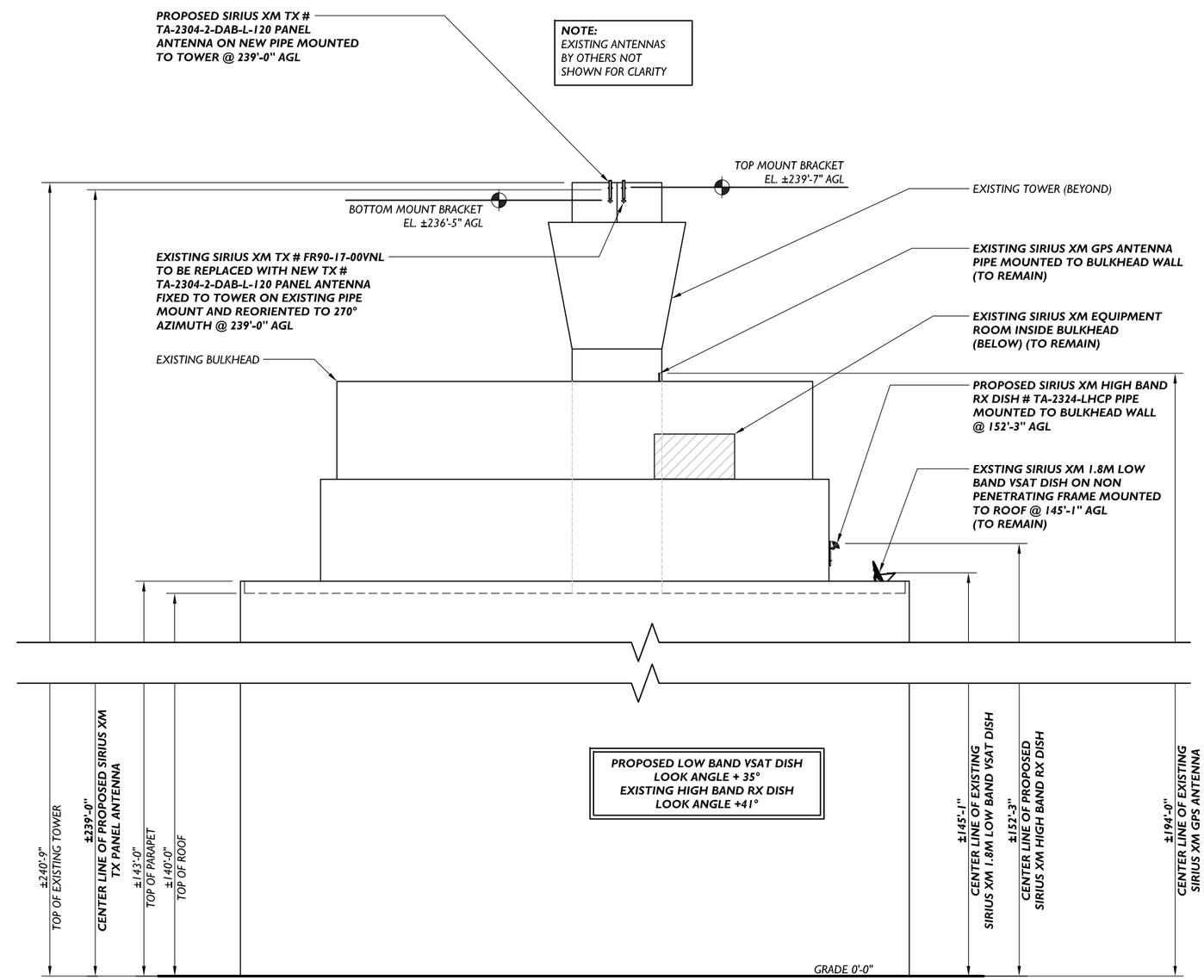
SITE INFORMATION:
310 ORANGE STREET
NEW HAVEN, CT 06511

DRAWING TITLE: EQUIPMENT PLANS

MICHAEL L. BOHLINGER
CT LICENSE No. 20405

DATE: 05-11-15
PROJECT No: ASDGSX97
DRAWING BY: MDC
CHK BY:
DWG No.: ANT-007

24"x36" SHEETS - SIGN & SEAL AREA



SITE ELEVATION - WEST

SCALE: 11"x17" : 1/32" = 1'-0" | 24"x36" : 1/16" = 1'-0"

1

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
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04	08-03-15	REVISED PER BUILDING COMMENTS	KLR	MLB
03	07-15-15	REVISED PER BUILDING & MAPPING INFORMATION	KLR	MLB
02	07-08-15	REVISED PER TOWER MAPPING	KLR	MLB
01	06-10-15	REVISED PER CLIENT COMMENTS	MDC	KLR
00	05-11-15	INITIAL SUBMISSION	MDC	KLR

Sirius XM™ SATELLITE RADIO

HPC WIRELESS SERVICES
22 SHELTER ROCK LANE, BUILDING C
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A SAXON DESIGN GROUP LLC
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TOMS RIVER, NJ 08753
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ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
CONNECTICUT LICENSE No. 20405

ASDG PROJECT No: ASDGSX97

CLIENT ID No: HAR_25-01 / HAR0145S

DESIGN TYPE: ROOFTOP

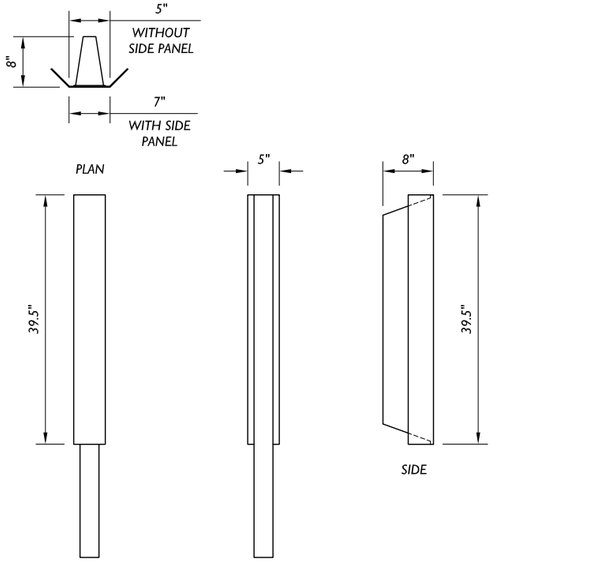
SITE INFORMATION:
310 ORANGE STREET
NEW HAVEN, CT 06511

DRAWING TITLE: ELEVATION

MICHAEL L. BOHLINGER
CT LICENSE No. 20405

DATE: 05-11-15
PROJECT No: ASDGSX97
DRAWING BY: MDC
CHK BY:
DWG No.: ANT-008

24"x36" SHEETS - SIGN & SEAL AREA

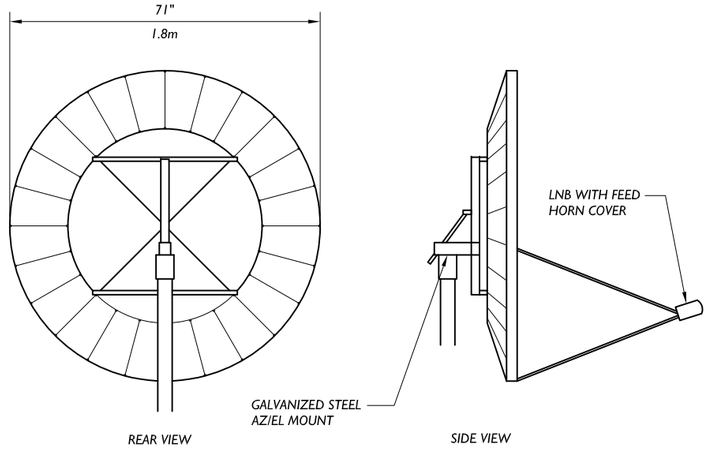


MANUF.:	TIL-TEK
MODEL #:	TA-2304-2-DAB-L-120
HEIGHT:	39.5"
WIDTH:	5" (WITHOUT SIDE PANELS)
DEPTH:	8"
WEIGHT:	8 lbs
AREA:	1.37 SF

ANTENNA SPEC.

SCALE	
11"x17" : NTS	
24"x36" : NTS	

1

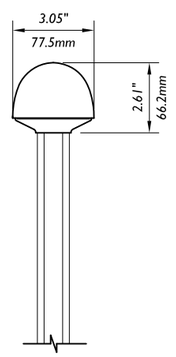


MANUFACTURER:	PRODELIN CORP
MODEL #:	1183
WEIGHT:	±160 lbs (72 kg)

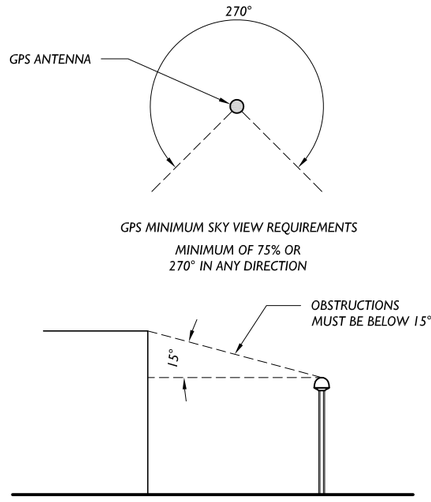
VSAT SPEC.

SCALE	
11"x17" : NTS	
24"x36" : NTS	

2



MANUFACTURER:	PRODELIN CORP
MODEL #:	BULLET III (57860-30)
WEIGHT:	±6.0 oz (170 g)



GPS ANTENNA NOTES:

1. THE ELEVATION AND LOCATION OF THE GPS ANTENNA SHALL BE IN ACCORDANCE WITH THE FINAL RF REPORT.
2. THE GPS ANTENNA IS DESIGNED TO FASTEN TO A STANDARD 1-1/4" DIAMETER, SCHEDULE 40, GALVANIZED STEEL OR STAINLESS STEEL PIPE BY MEANS OF A GPS ANTENNA BRACKET AS PER MANUFACTURER'S RECOMMENDATION. THE PIPE MUST NOT BE THREADED AT THE ANTENNA MOUNT END. THE PIPE SHALL BE CUT TO THE REQUIRED LENGTH (MINIMUM OF 18 INCHES) USING A HAND OR ROTARY PIPE CUTTER TO ASSURE A SMOOTH AND PERPENDICULAR CUT. A HACK SAW SHALL NOT BE USED. THE CUT PIPE END SHALL BE DEBURRED AND SMOOTH.
3. DO NOT SWEEP TEST GPS ANTENNA.

GPS SPEC.

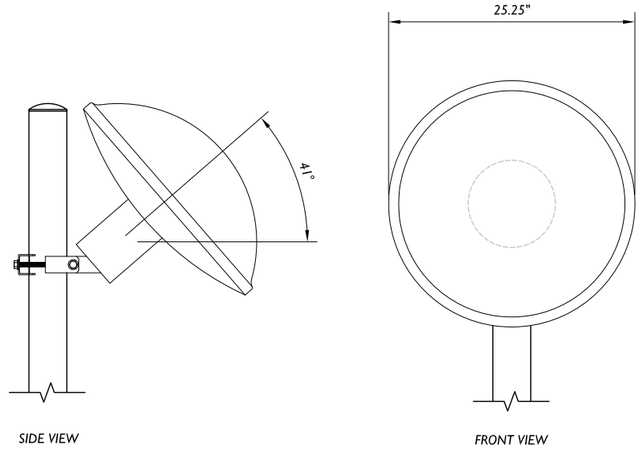
SCALE	
11"x17" : NTS	
24"x36" : NTS	

3

NOT USED

SCALE	
11"x17" : NTS	
24"x36" : NTS	

4



MANUFACTURER:	TIL-TEK
MODEL #:	TA-2324-LHCP
WEIGHT:	±28 lbs (12.7 kg)

RX DISH SPEC.

SCALE	
11"x17" : NTS	
24"x36" : NTS	

5

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
06	08-14-15	FINAL ISSUE - SIRIUS XM CM / ENG. APPROVED	KLR	MLB
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04	08-03-15	REVISED PER BUILDING COMMENTS	KLR	MLB
03	07-15-15	REVISED PER BUILDING & MAPPING INFORMATION	KLR	MLB
02	07-08-15	REVISED PER TOWER MAPPING	KLR	MLB
01	06-10-15	REVISED PER CLIENT COMMENTS	MDC	KLR
00	05-11-15	INITIAL SUBMISSION	MDC	KLR

Sirius XM SATELLITE RADIO

HPC WIRELESS SERVICES
22 SHELTER ROCK LANE, BUILDING C
DANBURY, CT 06810

ASAXON DESIGN GROUP LLC
A SAXON DESIGN GROUP
1466 HOOPER AVENUE, BSMT OFFICE SUITE
TOMS RIVER, NJ 08753
TEL # 732 678-0155 FAX # 732 412-3607

ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
CONNECTICUT LICENSE No. 20405

ASDG PROJECT No:
ASDGSX97

CLIENT ID No:
HAR_25-01 / HAR0145S

DESIGN TYPE:
ROOFTOP

SITE INFORMATION:
310 ORANGE STREET
NEW HAVEN, CT 06511

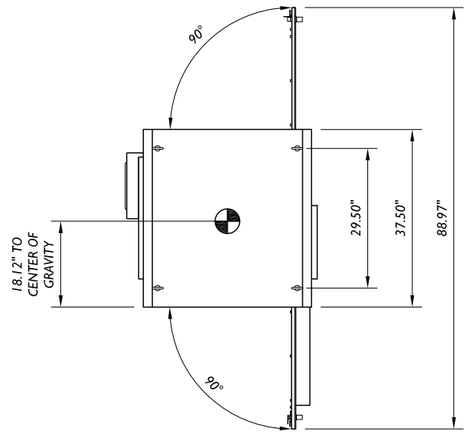
DRAWING TITLE
ANTENNA
SPECIFICATIONS

MICHAEL L. BOHLINGER
CT LICENSE No. 20405

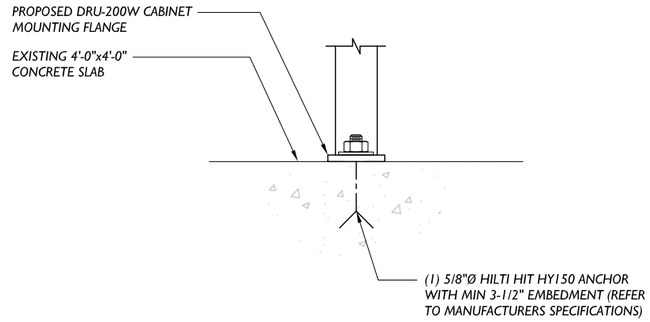
DATE:	05-11-15
PROJECT No:	ASDGSX97
DRAWING BY:	MDC
CHK BY:	
DWG No.:	ANT-009

24"x36" SHEETS - SIGN & SEAL AREA

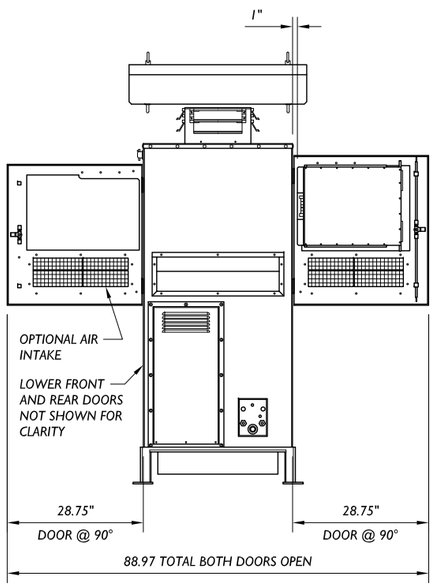
MANUFACTURER:	UBS
MODEL #:	DRU-200W
WEIGHT:	±817 lbs (294 kg)
FOOTPRINT:	6.0 SF



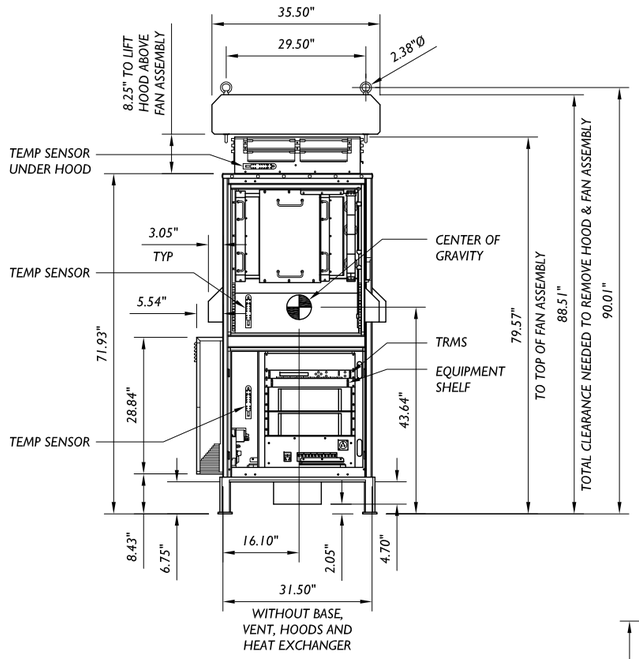
TOP VIEW



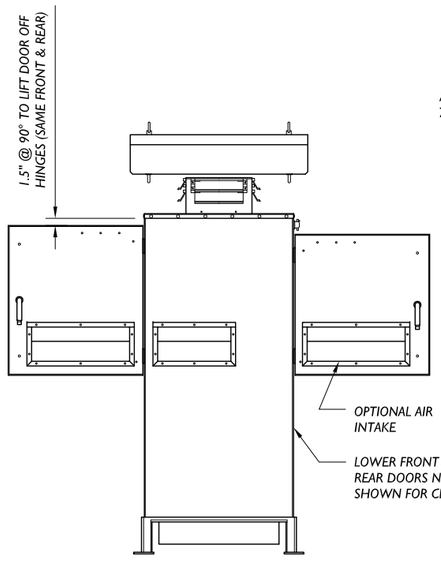
CABINET ANCHORING DETAIL



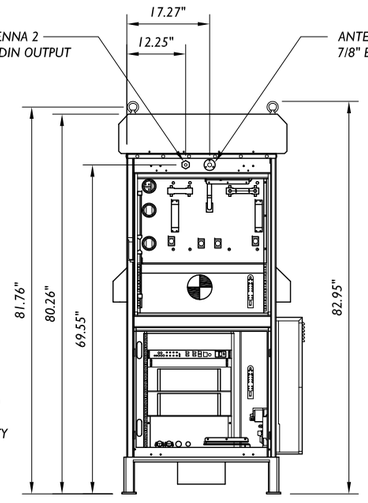
LEFT SIDE VIEW



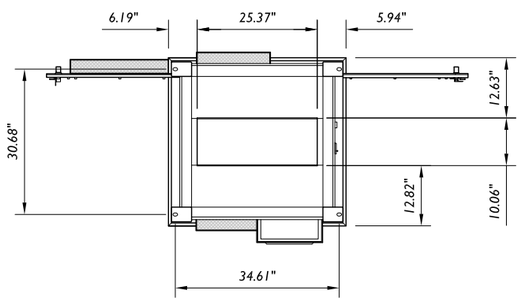
FRONT VIEW



RIGHT SIDE VIEW



REAR VIEW



BOTTOM VIEW

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
06	08-14-15	FINAL ISSUE - SIRIUS XM CM / ENG. APPROVED	KLR	MLB
05	08-13-15	REVISED PER CLIENT COMMENTS ISSUED FOR APPROVAL	KLR	MLB
04	08-03-15	REVISED PER BUILDING COMMENTS	KLR	MLB
03	07-15-15	REVISED PER BUILDING & MAPPING INFORMATION	KLR	MLB
02	07-08-15	REVISED PER TOWER MAPPING	KLR	MLB
01	06-10-15	REVISED PER CLIENT COMMENTS	MDC	KLR
00	05-11-15	INITIAL SUBMISSION	MDC	KLR

Sirius XM™ SATELLITE RADIO

HPC WIRELESS SERVICES
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DANBURY, CT 06810

A SAXON DESIGN GROUP
1466 HOOPER AVENUE, BSMT OFFICE SUITE
TOMS RIVER, NJ 08753
TEL # 732 678-0155 FAX # 732 412-3607

ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
CONNECTICUT LICENSE No. 20405

ASDG PROJECT No:
ASDGSX97

CLIENT ID No:
HAR_25-01 / HAR0145S

DESIGN TYPE:
ROOFTOP

SITE INFORMATION:
310 ORANGE STREET
NEW HAVEN, CT 06511

DRAWING TITLE
EQUIPMENT SPECIFICATIONS

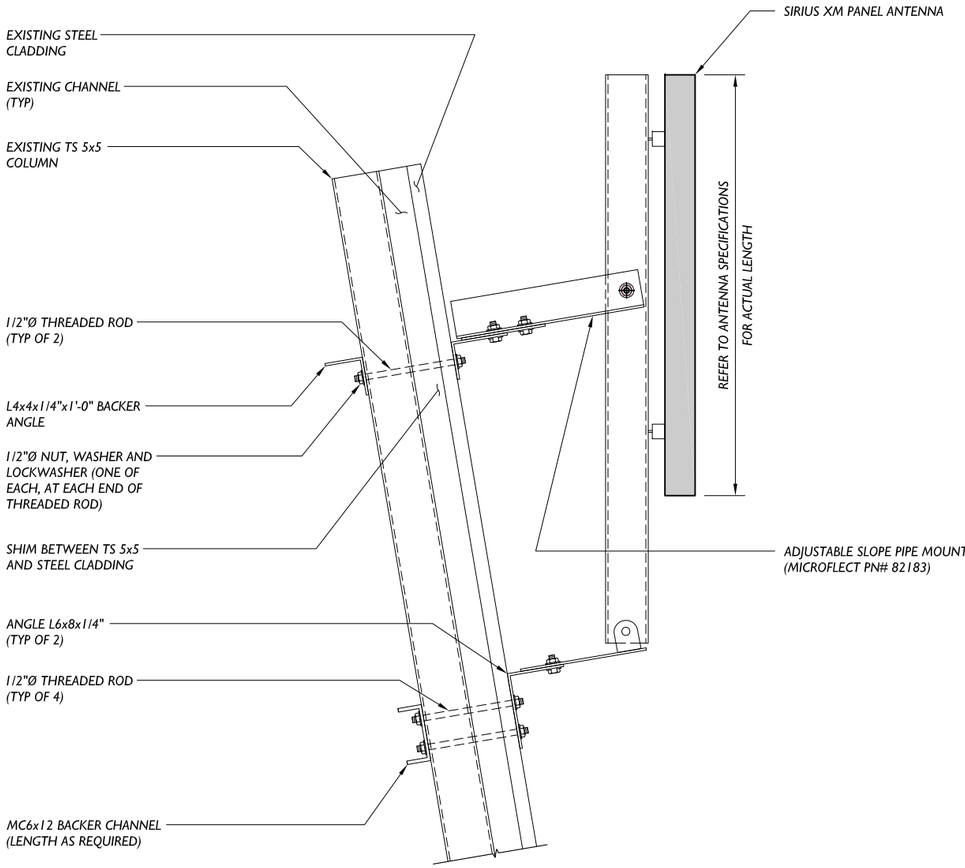
MICHAEL L. BOHLINGER
CT LICENSE No. 20405

DATE:	05-11-15
PROJECT No:	ASDGSX97
DRAWING BY:	MDC
CHK BY:	
DWG No.:	ANT-010

24"x36" SHEETS - SIGN & SEAL AREA

UBS DRU-200W CABINET DETAIL

SCALE: 11"x17" : NTS; 24"x36" : NTS



ANTENNA MOUNTING DETAIL - SECTION

SCALE: 11"x17" : 3/4" = 1'-0" | 24"x36" : 1 1/2" = 1'-0"

1

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
06	08-14-15	FINAL ISSUE - SIRIUS XM CM / ENG. APPROVED	KLR	MLB
05	08-13-15	REVISED PER CLIENT COMMENTS ISSUED FOR APPROVAL	KLR	MLB
04	08-03-15	REVISED PER BUILDING COMMENTS	KLR	MLB
03	07-15-15	REVISED PER BUILDING & MAPPING INFORMATION	KLR	MLB
02	07-08-15	REVISED PER TOWER MAPPING	KLR	MLB
01	06-10-15	REVISED PER CLIENT COMMENTS	MDC	KLR
00	05-11-15	INITIAL SUBMISSION	MDC	KLR

Sirius XM™ SATELLITE RADIO

HPC WIRELESS SERVICES
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DANBURY, CT 06810

A SAXON DESIGN GROUP
1466 HOOPER AVENUE, BSMT OFFICE SUITE
TOMS RIVER, NJ 08753
TEL # 732 678-0155 FAX # 732 412-3607

ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
CONNECTICUT LICENSE No. 20405

ASDG PROJECT No: ASDGSX97

CLIENT ID No: HAR_25-01 / HAR0145S

DESIGN TYPE: ROOFTOP

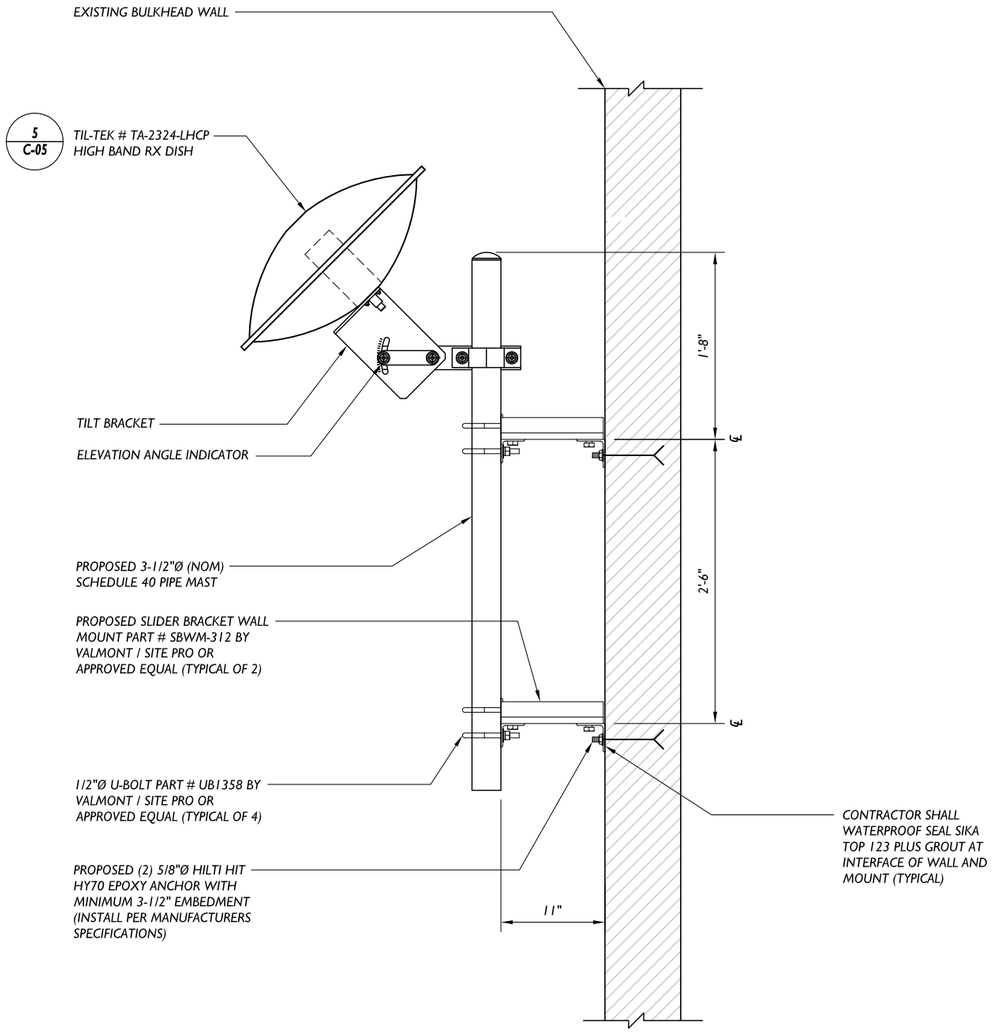
SITE INFORMATION:
310 ORANGE STREET
NEW HAVEN, CT 06511

DRAWING TITLE: ANTENNA MOUNT DETAIL

MICHAEL L. BOHLINGER
CT LICENSE No. 20405

DATE: 05-11-15
PROJECT No: ASDGSX97
DRAWING BY: MDC
CHK BY:
DWG No.: ANT-011

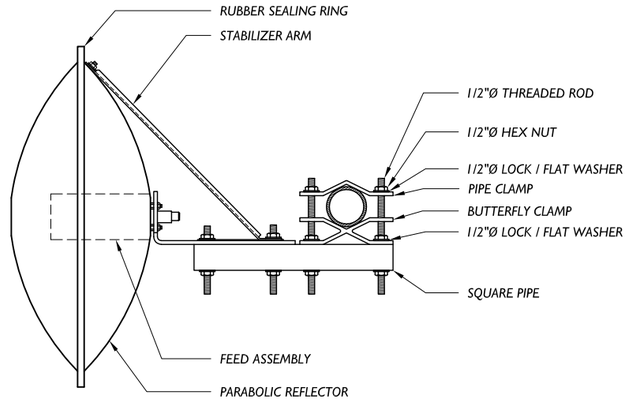
24"x36" SHEETS - SIGN & SEAL AREA



RX DISH WALL MOUNT DETAIL - SECTION

SCALE	11"x17" : 3/4" = 1'-0"
	24"x36" : 1-1/2" = 1'-0"

1



NOTES:

INSTALLATION OF FEED AND RADOME:

1. ATTACH THE FEED ASSEMBLY TO THE PARABOLIC REFLECTOR USING FOUR 1/4" HEX NUTS AS SHOWN IN ENCLOSED DIAGRAM.
2. ATTACH THE REFLECTOR BRACE TO THE PARABOLIC REFLECTOR USING THE 1/4" HARDWARE PROVIDED.
3. ATTACH THE FULL RADOME TO THE PARABOLIC REFLECTOR AS SHOWN USING THE RUBBER SEALING RING.

INSTALLATION OF MOUNTING HARDWARE:

1. ATTACH THE FEED AND REFLECTOR ASSEMBLY TO THE MOUNTING BRACKET AS SHOWN IN DIAGRAM USING FOUR 1/4" FLAT WASHERS, FOUR 1/4" LOCK WASHERS AND THE FOUR 1/4" HEX NUTS PROVIDED. **DRAIN HOLE MUST REMAIN ON THE BOTTOM.**
2. ASSEMBLE THE PIPE CLAMPS, MOUNTING BRACKET AND REFLECTOR BRACE AS SHOWN IN THE MOUNTING DIAGRAM AND SECURE TO THE MOUNTING PIPE.
3. THE MECHANICAL TILT CAN BE ADJUSTED BY LOOSENING THE TWO 1/2" HEX NUTS HOLDING THE MOUNTING BRACKET TO BUTTERFLY CLAMP. THE ANTENNA CAN THEN BE ADJUSTED TO THE DESIRED ANGLE AND THE HEX NUTS CAN BE TIGHTENED. THE ANGLE CAN BE READ AS SHOWN IN MOUNTING DIAGRAM.

CONNECTOR TORQUE RATING:

TORQUE THE 7/16 DIN CONNECTOR BETWEEN 23 - 25 N-M (17 - 18.5 LB/FT). ENSURE THAT A PROPER TORQUE WRENCH IS USED TO GUARANTEE THAT THIS RATING IS NOT EXCEEDED WHEN CONNECTING THE ANTENNA TO THE CABLE. FAILURE TO COMPLY WITH THIS SPECIFICATION WILL LEAD TO PERMANENT ANTENNA DAMAGE.

WEATHERPROOFING:

ALL CONNECTIONS BETWEEN THE ANTENNA AND THE TRANSMISSION LINE MUST BE WEATHERPROOFED ACCORDING TO STANDARD INSTALLATION PRACTICES.

RX DISH CONNECTION DETAIL - PLAN

SCALE	11"x17" : NTS
	24"x36" : NTS

2

REV.	DATE	REVISION DESCRIPTION	DRAWN BY	CHKD. BY
04	12-03-14	REVISED PER SIRIUS XM COMMENTS	KLR	MLB
03	09-24-14	FINAL ISSUE - SIRIUS XM CM / ENG. APPROVED	KLR	MLB
02	09-22-14	REVISED PER SIRIUS XM COMMENTS	KLR	MLB
01	09-16-14	REVISED PER SIRIUS XM COMMENTS	KLR	MLB
00	09-10-14	INITIAL SUBMISSION	AR	KLR

Sirius XM™ SATELLITE RADIO

HPC WIRELESS SERVICES
46 MILL PLAIN ROAD, FL 2
DANBURY, CT 06811

A SAXON DESIGN GROUP
1358 HOOPER AVENUE, STE. 265
TOMS RIVER, NJ 08753-2882
OFFICE # 732 678-0155 - FAX # 732 412-3607

ENGINEER'S LICENSE

MICHAEL L. BOHLINGER

SIGNATURE:

PROFESSIONAL ENGINEER
DISTRICT OF COLUMBIA LICENSE # PE10920

ASDG PROJECT No:
ASDGSX90

CLIENT ID No:
WDC101S / WDC_46-68

DESIGN TYPE:
ROOTOP

SITE INFORMATION:
2500 PENNSYLVANIA AVE NW
WASHINGTON, DC 20037

DRAWING TITLE
DISH MOUNT DETAILS

MICHAEL L. BOHLINGER
D.C LICENSE No. PE10920

DATE:	09-10-14
PROJECT No:	ASDGSX90
DRAWING BY:	CD
CHK BY:	
DWG No.:	C-08.04

24"x36" SHEETS - SIGN & SEAL AREA