



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

EUT

LIGHTSWITCH COVER MODULE

MODEL NUMBER: ID:084

FCC ID: DKN-301LM

REPORT NUMBER: 14M18734-2

ISSUE DATE: 2014-10-02

Prepared for

ECHOSTAR

90 INVERNESS CIRCLE EAST

ENGLEWOOD, CO 80112

Prepared by

UL LLC INC.

1285 WALT WHITMAN RD

MELVILLE, NY 11747, U.S.A.

TEL: (631) 271-6200

FAX: (877) 854-3577



NVLAP LAB CODE 100255-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2014-10-02	Initial Issue	Joseph Danisi
1	2014-10-07	Correct antenna calibration date, added clarification on emissions from 2390 to 2400MHz.	Joseph Danisi
2	2014-10-08	Add calculation in section 8.1.2 and analyzer settings	Joseph Danisi

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i>	<i>5</i>
4.2. <i>SAMPLE CALCULATION</i>	<i>5</i>
4.3. <i>MEASUREMENT UNCERTAINTY.....</i>	<i>5</i>
5. EQUIPMENT UNDER TEST.....	6
5.1. <i>DESCRIPTION OF EUT</i>	<i>6</i>
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	<i>6</i>
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i>	<i>6</i>
5.4. <i>SOFTWARE AND FIRMWARE.....</i>	<i>6</i>
5.5. <i>WORST-CASE CONFIGURATION AND MODE.....</i>	<i>6</i>
5.6. <i>DESCRIPTION OF TEST SETUP.....</i>	<i>7</i>
6. TEST AND MEASUREMENT EQUIPMENT	9
7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS	11
7.1. <i>ON TIME AND DUTY CYCLE RESULTS.....</i>	<i>11</i>
7.2. <i>DUTY CYCLE PLOTS</i>	<i>11</i>
8. ANTENNA PORT TEST RESULTS.....	12
8.1. <i>802.15.4 MODE IN THE 2.4 GHz BAND.....</i>	<i>12</i>
8.1.1. <i>6 dB BANDWIDTH.....</i>	<i>12</i>
8.1.2. <i>OUTPUT POWER</i>	<i>15</i>
8.1.3. <i>POWER SPECTRAL DENSITY</i>	<i>16</i>
8.1.4. <i>CONDUCTED SPURIOUS EMISSIONS.....</i>	<i>17</i>
9. RADIATED TEST RESULTS.....	23
9.1. <i>LIMITS AND PROCEDURE.....</i>	<i>23</i>
9.2. <i>TRANSMITTER ABOVE 1 GHz.....</i>	<i>24</i>
9.2.1. <i>TX ABOVE 1 GHz FOR 802.15.4 MODE IN THE 2.4 GHz BAND.....</i>	<i>24</i>
9.2.2. <i>WORST-CASE BELOW 1 GHz</i>	<i>31</i>
10. AC POWER LINE CONDUCTED EMISSIONS	33
11. SETUP PHOTOS	34

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: EHOSTAR
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112

EUT DESCRIPTION: LIGHTSWITCH COVER MODULE

MODEL: ID:084

SERIAL NUMBER: Non serialized sample

DATE TESTED: 2014-08-25 to 2014-10-02

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass

UL LLC. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL LLC. By:

Tested By:



Bob DeLisi
Program Manager – EMC
ULLLC

Joseph Danisi
Project Lead
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 1285 Walt Whitman Rd. Melville, NY 11747, USA.

UL Melville is accredited by NVLAP, Laboratory Code 100255-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/1002550.htm>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Uncertainty
Radiated Emissions, 30-200MHz, Horizontal	3.6, k=2 (95%)
Radiated Emissions, 30-200MHz, Vertical	3.8, k=2 (95%)
Radiated Emissions, 200-1000MHz, Horizontal	2.8, k=2 (95%)
Radiated Emissions, 200-1000MHz, Vertical	3.7, k=2 (95%)
Radiated Emissions, 1-18GHz (worst case, sVSWR)	4.9, k=2 (95%)

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The Lightswitch replaces existing light switch cover and allows Zigbee control of a light or switched outlet. Module is battery powered and does not connect to the home wiring. Zigbee 2.4GHz radio talks to a host and relays commands to a smart lightbulb or other smart appliance over the 2.4GHz Zigbee network

The radio module is manufactured by Echostar 90 Inverness Circle East Englewood, CO 80112

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2405 - 2475	802.15.4 ZigBee	3.46	2.22
2480	802.15.4 ZigBee	-6.51	0.22

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB antenna a maximum gain of 3 dBi

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Nodetest v5.1.1.

The EUT driver software installed during testing was N/A

The test utility software used during testing was putty to enter commands

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated Emission below 1GHz and power line Conducted Emission was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation

5.6 DESCRIPTION OF TEST SETUP

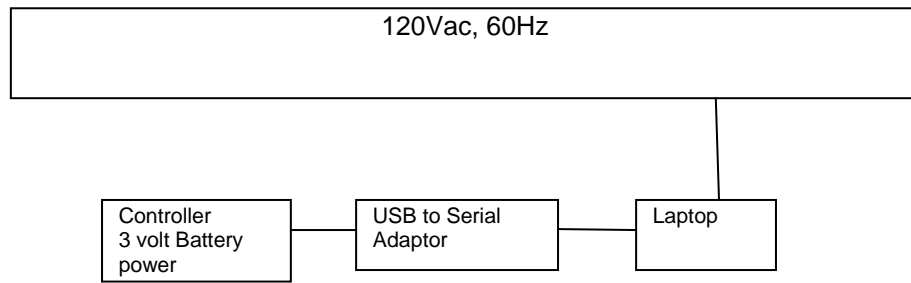
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Hewlett Packard	Elite Book	N/A	N/A
USB to serial adapter	Echostar	N/A	N/A	None
Controller	Echostar	N/A	N/A	None

TEST SETUP

The EUT is stand-alone device software exercised the radio card.

SETUP DIAGRAM FOR TESTS



Set up is only for setting the EUT parameters

EUT: Light switch
Operates on a 3Volt
battery

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
60Hz-30MHz					
EMI Receiver	Rohde & Schwarz	ESC17	75141	2014-01-14	2015-01-29
Active Loop Antenna	EMCO	6507	ME5A-288	2013-12-02	2014-12-30
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC98V	ME7A-624	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
30-1000MHz					
EMI Receiver	Rohde & Schwarz	ESC17	75141	2014-01-29	2015-01-31
Hybrid Antenna	Sunol	JB-1	84106	2014-02-19	2015-02-19
Switch Driver	HP	11713A	ME7A-627	N/A	N/A
System Controller	Sunol Sciences	SC99V	44396	N/A	N/A
Camera Controller	Panasonic	WV-CU254	44395	N/A	N/A
RF Switch Box	UL	1	44398	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22
Above 1GHz (Band Optimized System)					
Spectrum Analyzer	Agilent	E4446A	72823	2014-06-13	2015-06-13
Horn Antenna (2-4 GHz)	ETS	3161-02 (22°)**	48107	2007-09-27	See * below
Horn Antenna (4-8 GHz)	ETS	3161-03 (22°)**	48106	2007-09-27	See * below
Horn Antenna (8-12 GHz)	ETS	3160-07 (26°)**	8933	2008-11-24	See * below
Horn Antenna (12-18 GHz)	ETS	3160-08 (26°)**	8932	2007-09-27	See * below
Horn Antenna (18-26.5 GHz)	ETS	3160-09 (27°)**	8947	2007-09-26	See * below
Horn Antenna (1-18GHz)	EMCO	3115	5A-766	2013-12-03	2014-12-03
Signal Path Controller	HP	11713A	50250	N/A	N/A
Gain Controller	HP	11713A	50251	N/A	N/A
RF Switch / Preamp Fixture	UL	BOMS1	50249	N/A	N/A
System Controller	UL	BOMS2	50252	N/A	N/A
Measurement Software	UL	Version 9.5	44740	N/A	N/A
Temp/Humidity/Pressure Meter	Cole Parmer	99760-00	4268	2012-12-22	2014-12-22

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal Date	Cal Due
<p>* - Note: As allowed by the calibration standard ANSI C63.10-2009 section 4.4.2, standard gain horns need only a one-time calibration. Only if physical damage occurs will the horn antenna require re-calibration. Gain standard horn antennas (sometimes called standard gain horn antennas) need not be calibrated beyond that which is provided by the manufacturer unless they are damaged or deterioration is suspected, or they are used at a distance closer than $2D^2/\lambda$. Gain standard horn antennas have gains that are fixed by their dimensions and dimensional tolerances.** - Number in parentheses denotes antenna beam width.</p>					

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

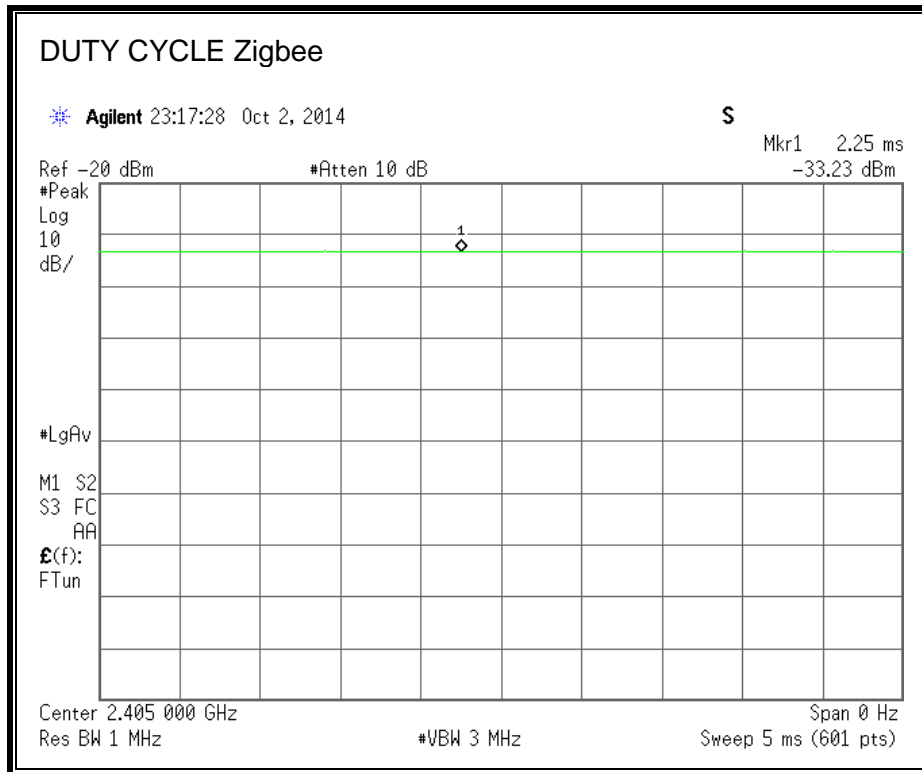
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

7.1. ON TIME AND DUTY CYCLE RESULTS

7.2. DUTY CYCLE PLOTS

2.4 GHz BAND



8. ANTENNA PORT TEST RESULTS

8.1. 802.15.4 MODE IN THE 2.4 GHz BAND

8.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

The minimum 6 dB bandwidth shall be at least 500 kHz.

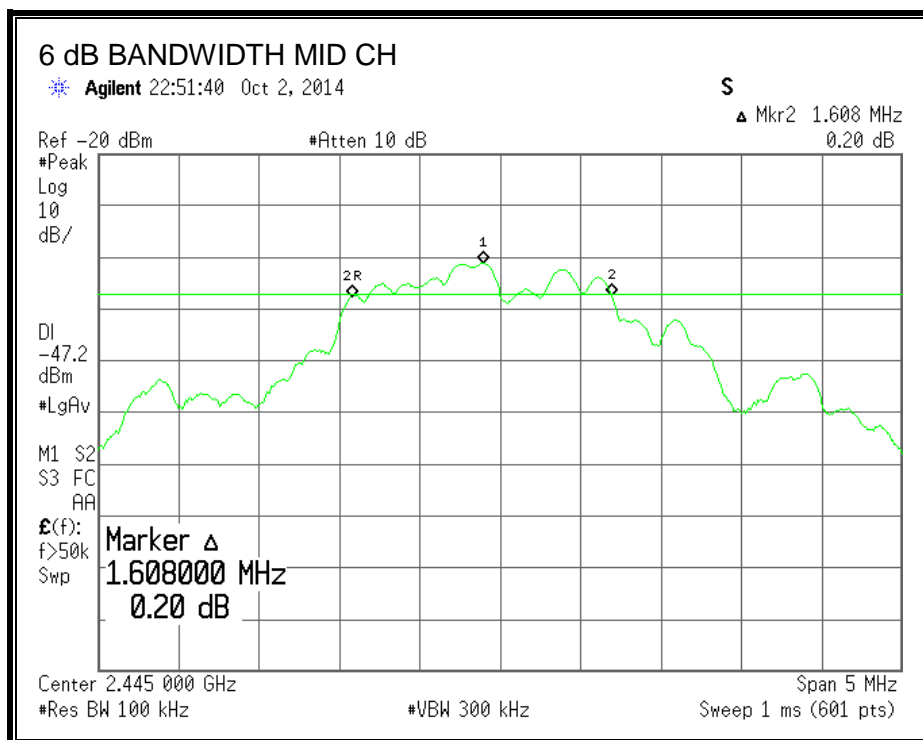
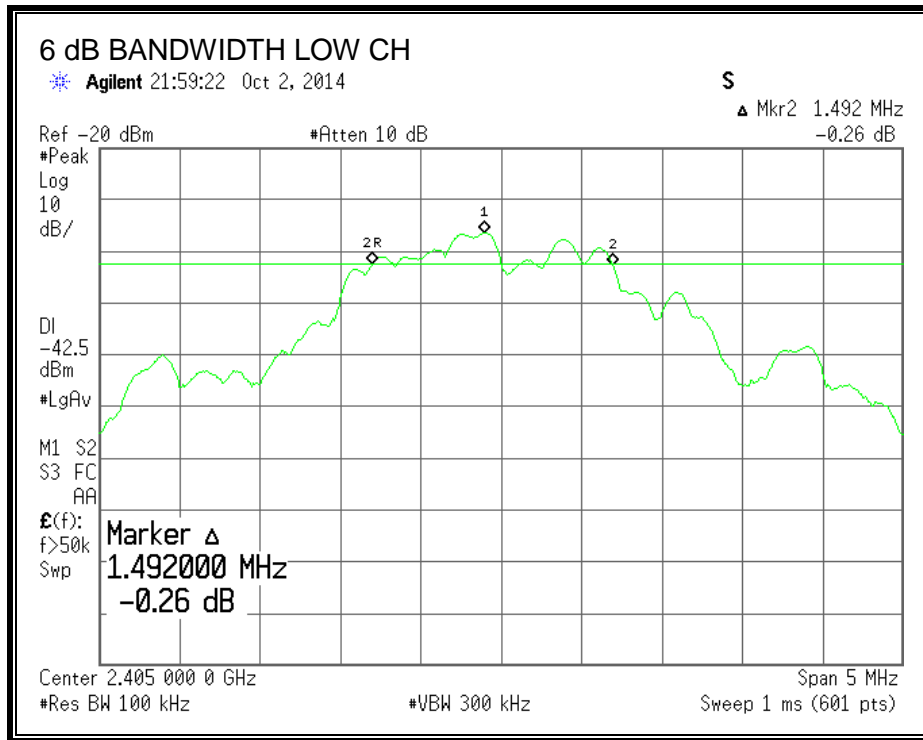
TEST PROCEDURE

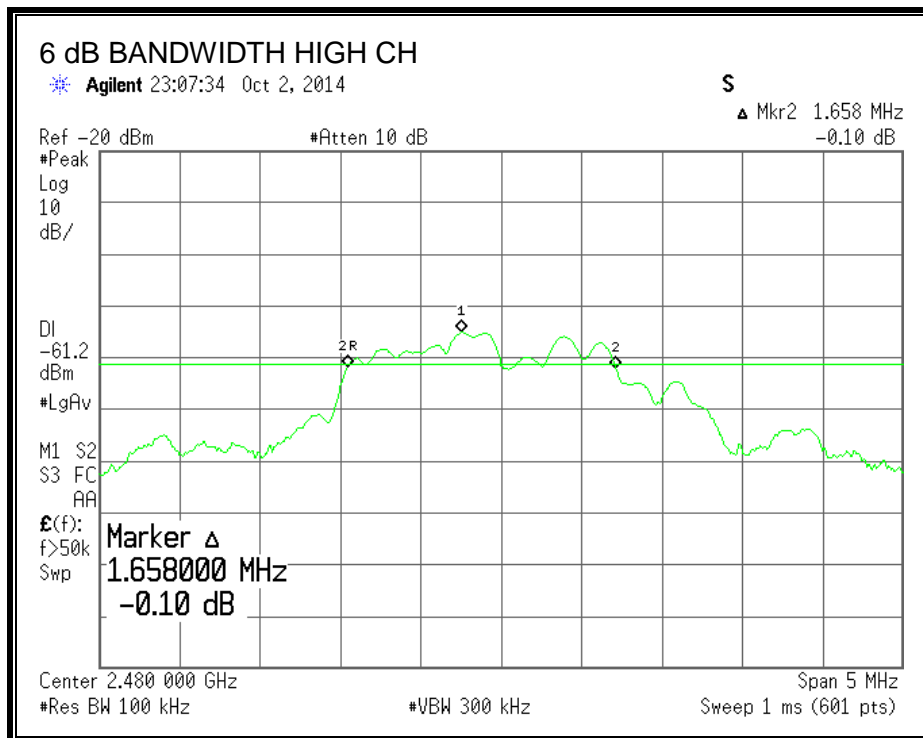
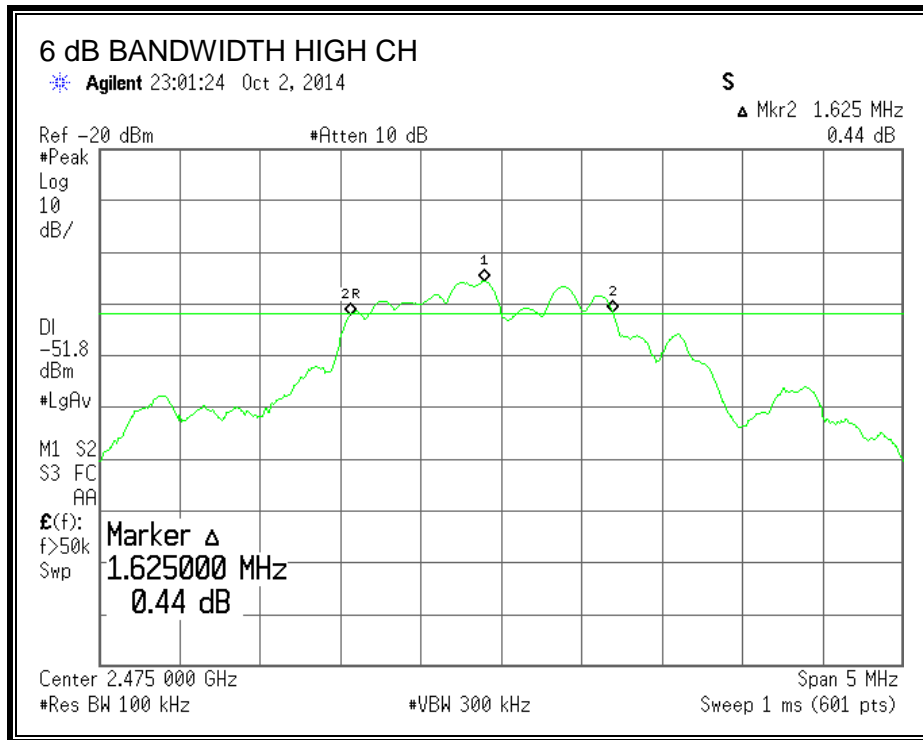
The device did not have a detachable antenna all tests conducted using radiated techniques. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.492	0.5
Middle	2445	1.608	0.5
High	2475	1.625	0.5
High	2480	1.658	0.5

6 dB BANDWIDTH





8.1.2 OUTPUT POWER

LIMITS

FCC §15.247 (b)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is measured via a radiated measurement (field strength). This value is then converted to an output conducted power measurement by means of the procedure outlined in ANSI_C63.10:2009 as referenced in the FCC document number KDB 558074, June 2014. The analyzer was set for 3MHz resolution bandwidth 8MHz video bandwidth at a 3meter distance when measuring the Radiated output power.

$$P = \frac{(Ed)^2}{30G}$$

where

P is the power, in W

E is the measured peak field strength, in V/m

d is the distance at which the measurement was made, in m

G is the numeric gain of the radiating element

Example: for this device, E = 101.69dBuV/m (0.121V/m), d = 3m, G = 3dBi (1.995).
 therefore P = 2.22mW (3.46dBm)

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Field Strength dBuV/m	Limit (dBm)	Margin (dB)
Low	2405	2.69	100.92	30	-27.31
Middle	2445	3.46	101.69	30	-26.54
High	2475	2.10	100.33	30	-27.90
High	2480	-6.51	91.72	30	-36.51

8.1.3 POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

The Peak Output power is less than 8 dBm, thus the EUT meets the Power Spectral Density criteria.

8.1.4 CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

TEST PROCEDURE

The spurious emissions were measured via a radiated measurement (field strength). All emissions were compared to the 15.209 limits in a 1MHz bandwidth with the exception of the low channel band-edge from 2390 to 2400MHz where emissions were compared to the -20dBc limits (in a 100kHz RBW) based on the radiated field strength of the fundamental.

Note: Emissions levels measured in a 1MHz bandwidth will be greater than that measured in a 100kHz bandwidth and are considered worst case.

Conducted Bandedge applying Radiated Method



Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading dB(uVolts/meter)	-20dBc 71.11	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.405	65.97	PK	21.1	4.04	91.11	-	-	151	247	H
2.4	27.87	PK	21.1	4.03	53	71.11	-18.11	151	247	H

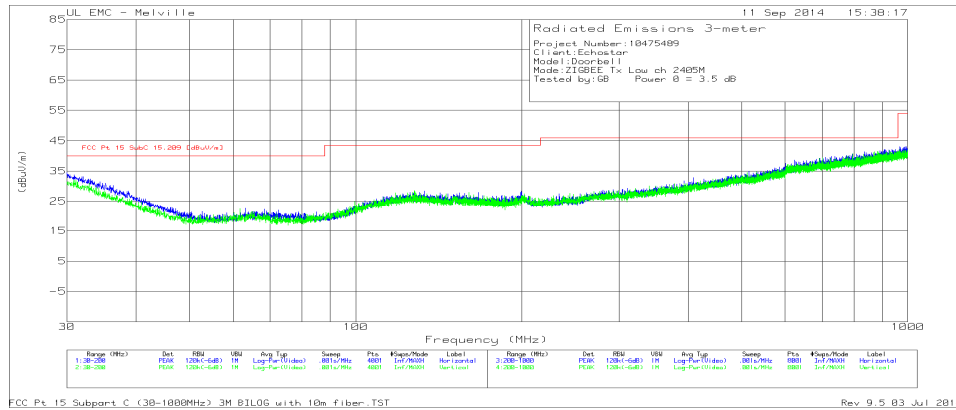
PK - Peak detector



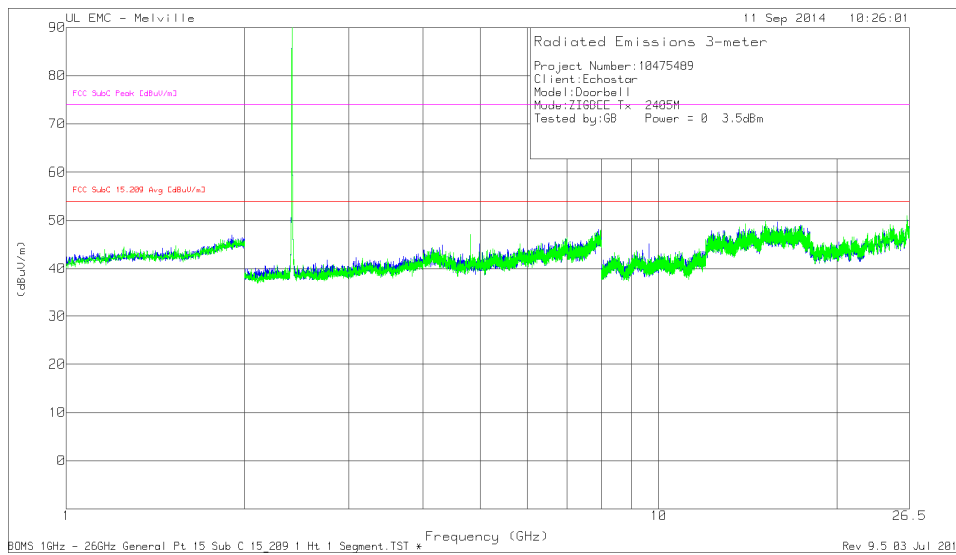
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading dB(uVolts/meter)	-20dBc 73.17	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2.405	68.03	PK	21.1	4.04	93.17	-	-	284	303	V
2.4	29.64	PK	21.1	4.03	54.77	73.17	-18.4	284	303	V

PK - Peak detector

SPURIOUS EMISSIONS 30MHz to 26GHz- LOW CHANNEL



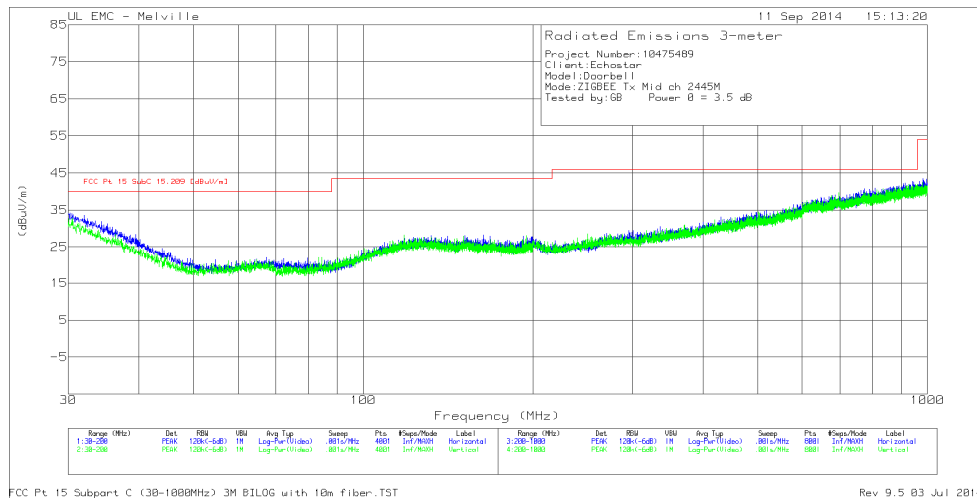
Note: All emissions were receiver noise floor



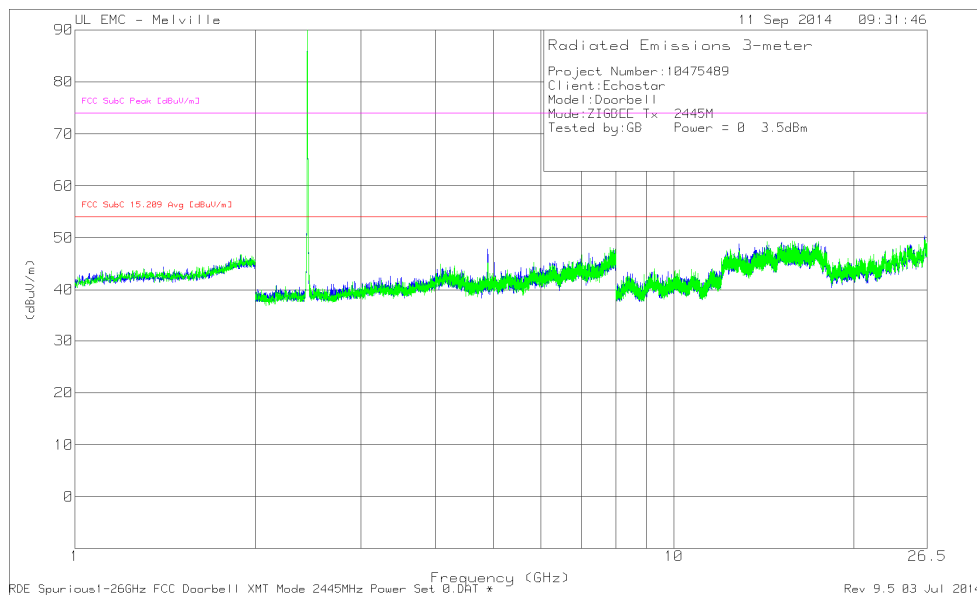
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.809	69.02	PK2	27.1	-45.28	50.84	-	-	74	-23.16	12	233	H
* 4.809	67.95	PK2	27.1	-45.28	49.77	-	-	74	-24.23	251	166	V
* 4.988	61.97	PK2	27.4	-45.23	44.14	-	-	74	-29.86	227	343	H
9.622	65.12	PK2	33.3	-49.66	48.76	-	-	74	-25.24	350	221	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
 PK2 - KDB558074 Method: Maximum Peak

SPURIOUS EMISSIONS 30MHz to 26GHz- MID CHANNEL



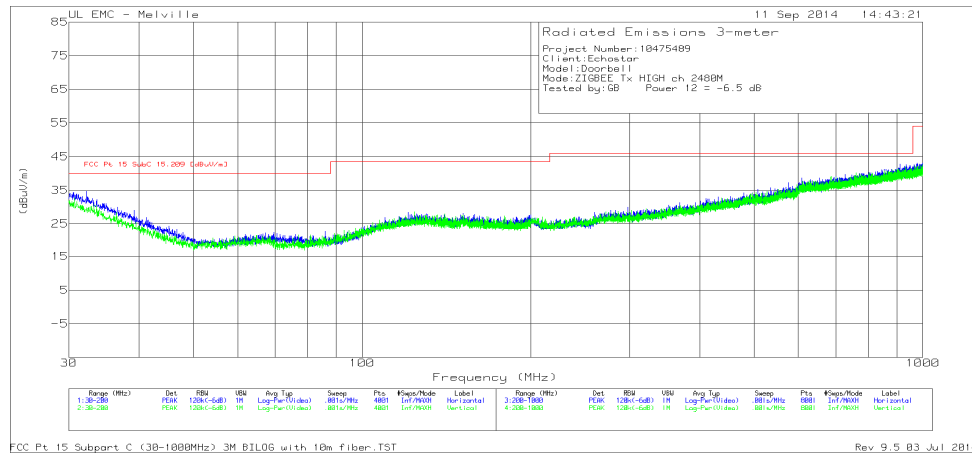
Note: All emissions were receiver noise floor



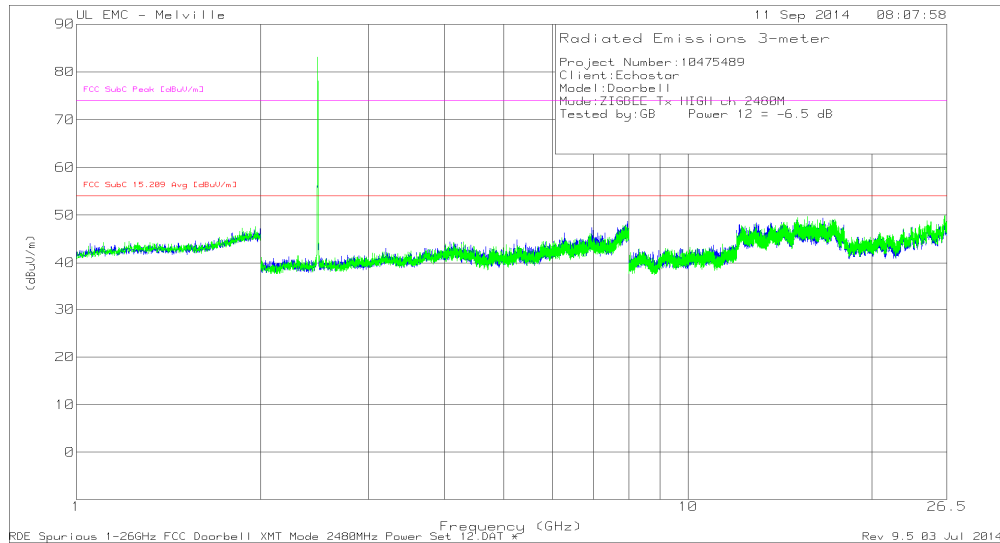
Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 4.889	69.6	PK2	27.2	-45.68	51.12	-	-	74	-22.88	7	203	H
* 4.889	67.86	PK2	27.2	-45.68	49.38	-	-	74	-24.62	251	221	V
* 5.015	62.26	PK2	27.4	-45.26	44.4	-	-	74	-29.6	185	247	H
7.22	62.06	PK2	27.9	-42.64	47.32	-	-	74	-26.68	235	342	H
12.843	59.08	PK2	37.3	-45.7	50.68	-	-	74	-23.32	286	387	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
 PK2 - KDB558074 Method: Maximum Peak

SPURIOUS EMISSIONS 30MHz to 26GHz- HIGH CHANNEL



Note: All emissions were receiver noise floor



Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5.253	62.75	PK2	27.3	-44.21	45.84	54	-8.16	74	-28.16	301	262	H
6.277	62.36	PK2	27.8	-42.9	47.26	54	-6.74	74	-26.74	68	104	H
6.964	62.17	PK2	27.9	-42.17	47.9	54	-6.1	74	-26.1	103	221	H

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
 PK2 - KDB558074 Method: Maximum Peak

9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10-2009. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and Maximum RMS average measurements.

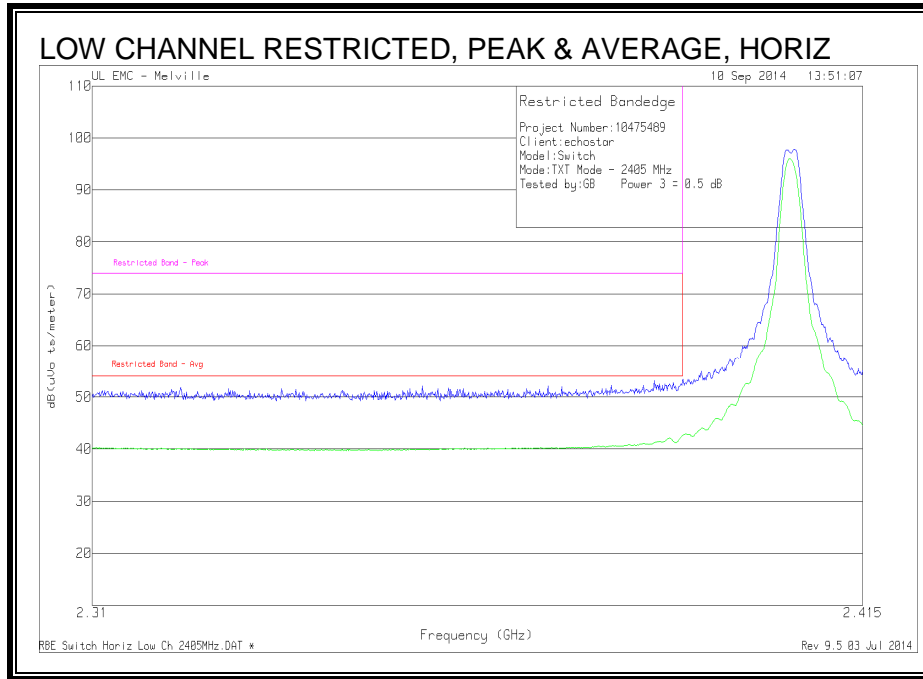
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

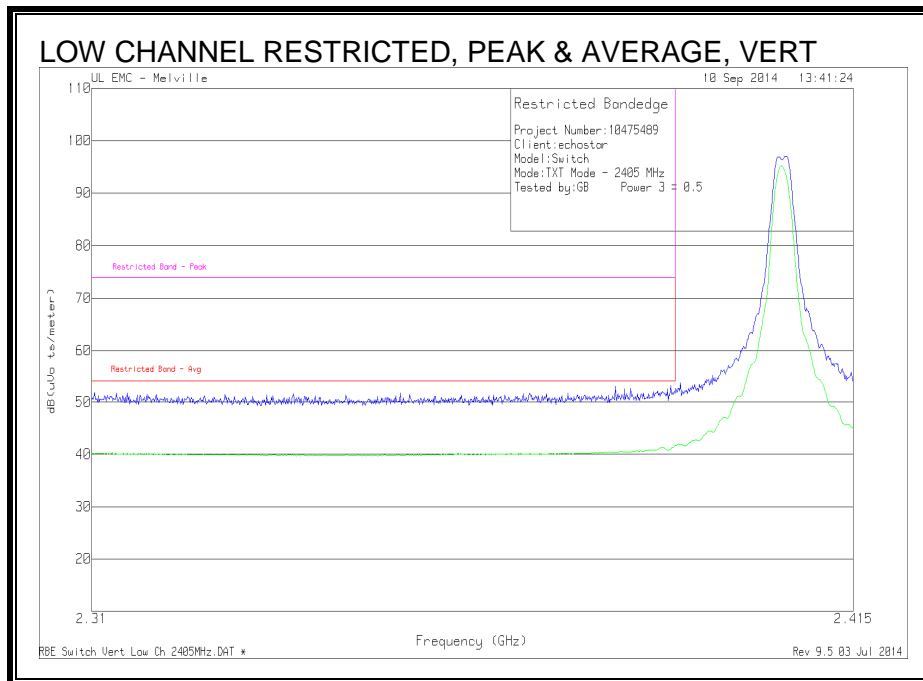
9.2 TRANSMITTER ABOVE 1 GHz

9.2.1 TX ABOVE 1 GHz FOR 802.15.4 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Low Channel Bandedge -20dBc

Horizontal-Pk 2.31 - 2.415MHz							
Test Frequency (GHz)	Meter Reading(dBuV)	Detector	AF [dB/m]	Gain/Loss (dB)	Corrected Reading dB(uVolts/meter)	-20dBc Margin (dB)	Note
2.4002	38.81	PK	21.1	3.85	63.76	-33.95	Bandedge
2.4053	72.9	PK	21.1	3.71	97.71	-	Fundamental
Horizontal-Av 2.31 - 2.415MHz							
Test Frequency (GHz)	Meter Reading(dBuV)	Detector	AF [dB/m]	Gain/Loss (dB)	Corrected Reading dB(uVolts/meter)	-20dBc Margin (dB)	Margin (dB)
2.4002	31.5	Avg	21.3	3.85	56.65	-39.34	Bandedge
2.4049	70.96	Avg	21.3	3.73	95.99	-	Fundamental

PK - Peak Detector

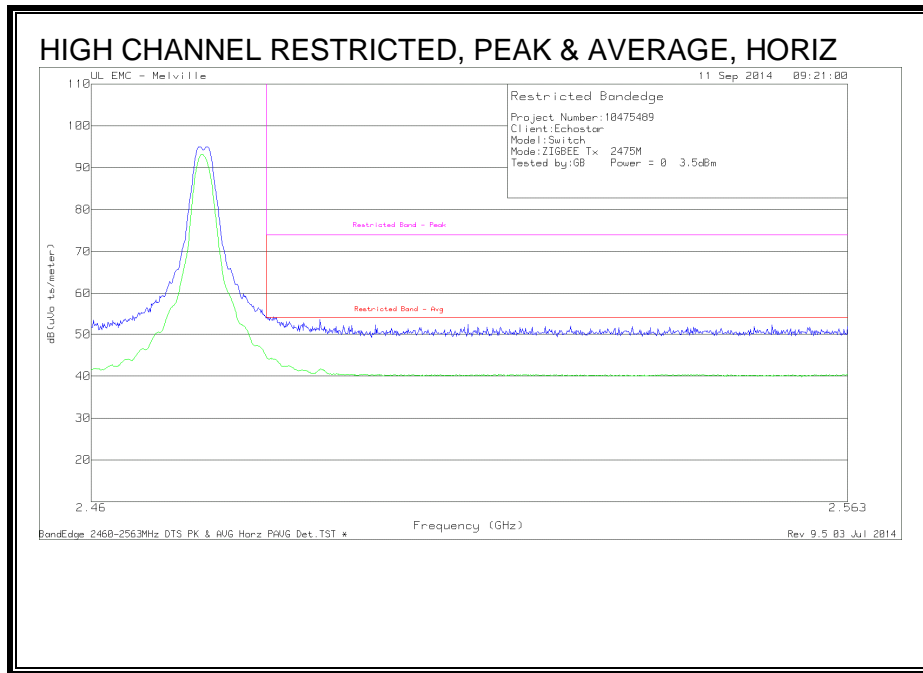
Avg - Average Detector

Vertical-Pk 2.31 - 2.415MHz							
Test Frequency (GHz)	Meter Reading(dBuV)	Detector	AF [dB/m]	Gain/Loss (dB)	Corrected Reading dB(uVolts/meter)	-20dBc Margin (dB)	Note
2.4002	37.28	PK	21.1	3.85	62.23	-34.68	Bandedge
2.4045	72.1	PK	21.1	3.71	96.91	-	Fundamental
Vertical-Av 2.31 - 2.415MHz							
Test Frequency (GHz)	Meter Reading(dBuV)	Detector	AF [dB/m]	Gain/Loss (dB)	Corrected Reading dB(uVolts/meter)	-20dBc Margin (dB)	Margin (dB)
2.4002	30.13	Avg	21.3	3.85	55.28	-38.88	Bandedge
2.4048	70.13	Avg	21.3	3.73	95.16	-	Fundamental

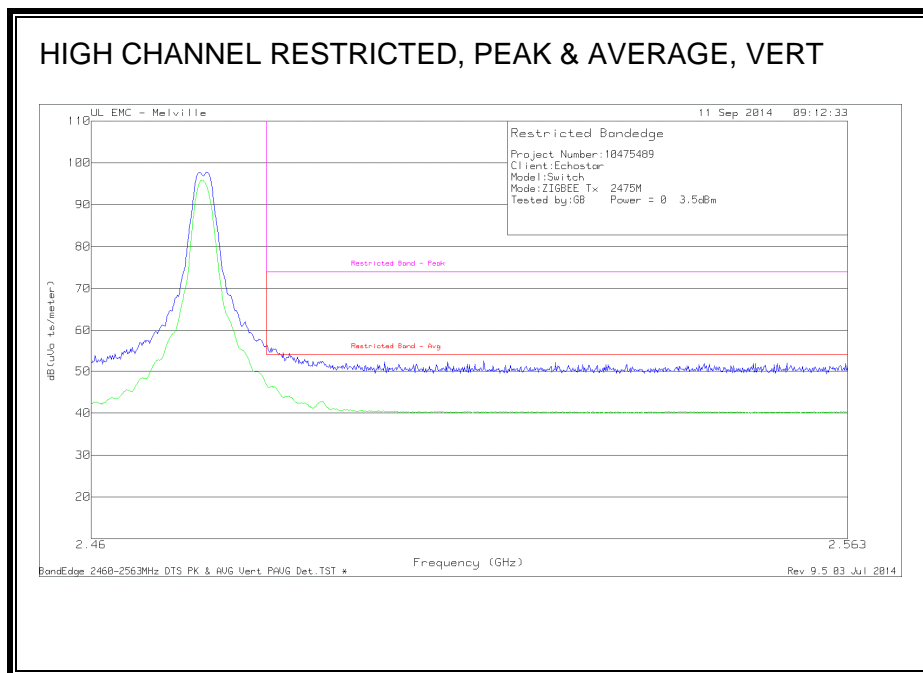
PK - Peak Detector

Avg - Average Detector

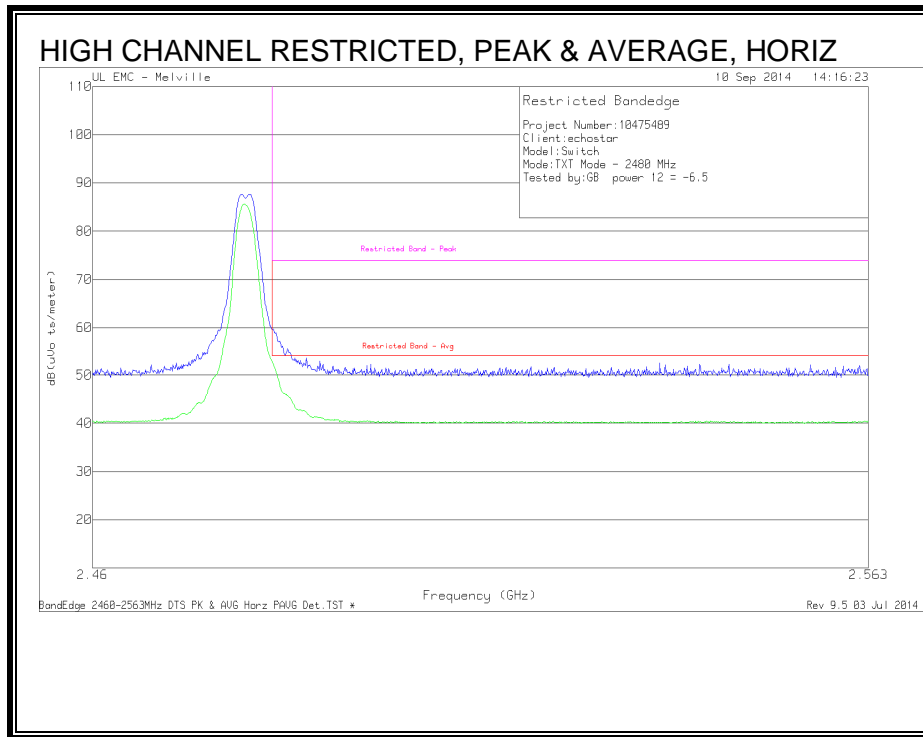
RESTRICTED BANDEDGE (ADJACENT HIGH CHANNEL, HORIZONTAL)



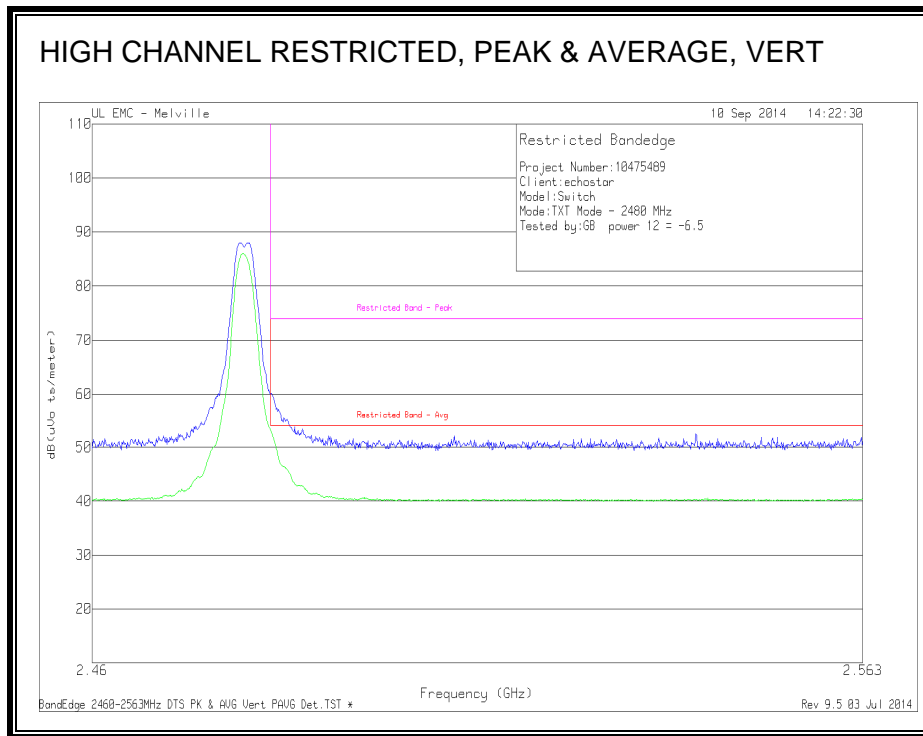
RESTRICTED BANDEDGE (ADJACENT HIGH CHANNEL, VERTICAL)



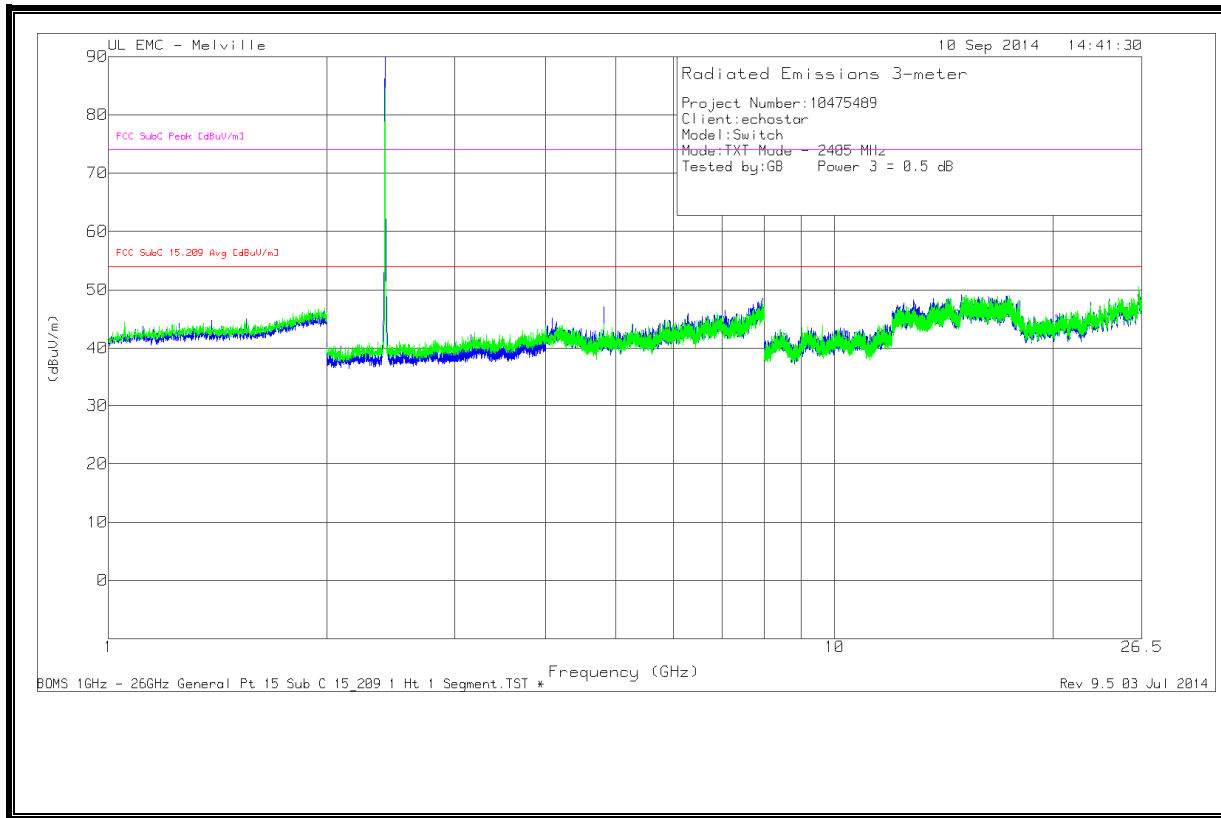
RESTRICTED BANDEGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANDEGE (HIGH CHANNEL, VERTICAL)



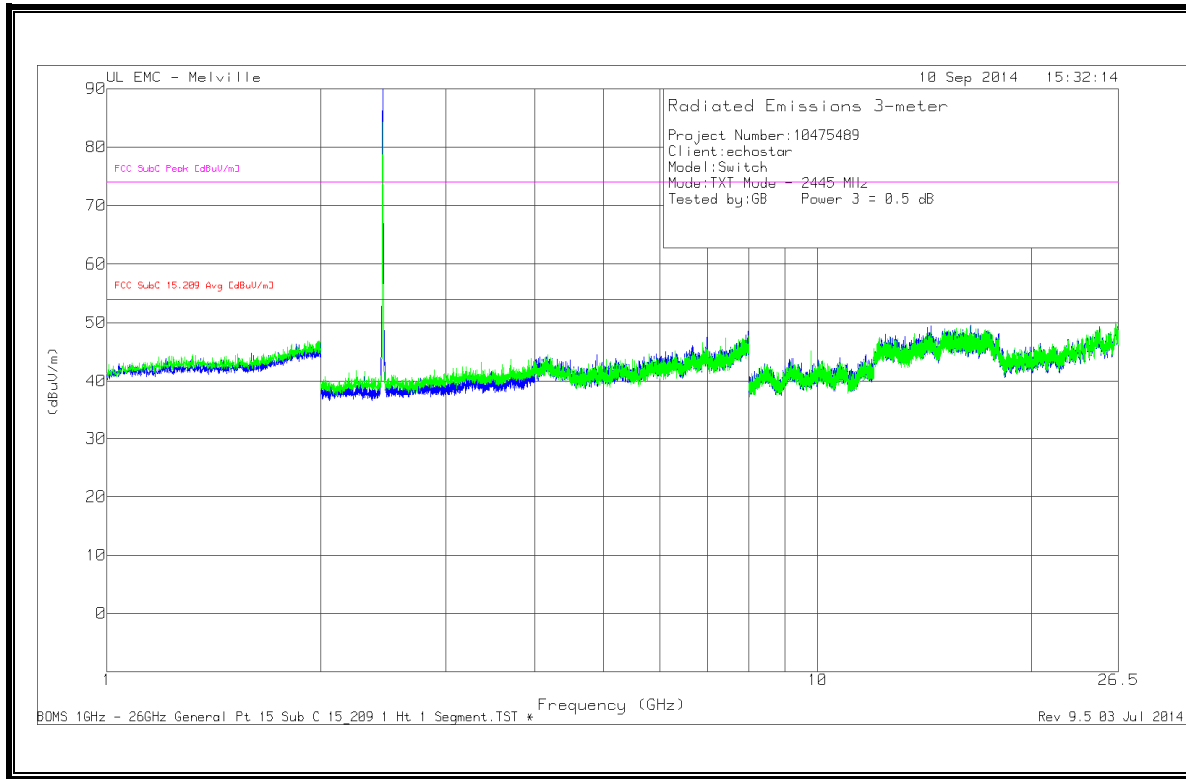
HARMONICS AND SPURIOUS EMISSIONS – LOW CHANNEL



Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.551	51.55	MAv1	25.1	-44.31	32.34	54	-21.66	-	-	228	328	H
* 4.088	49.94	MAv1	28.1	-44.4	33.64	54	-20.36	-	-	5	121	H
* 4.809	59.19	MAv1	27.1	-45.28	41.01	54	-12.99	-	-	196	131	H
* 22.517	47.52	MAv1	40.8	-46.61	41.71	54	-12.29	-	-	360	387	H
* 1.541	51.62	MAv1	25.1	-44.15	32.57	54	-21.43	-	-	328	208	V
* 4.809	57.74	MAv1	27.3	-45.28	39.76	54	-14.24	-	-	328	208	V
* 9.017	49.06	MAv1	33.2	-50.21	32.05	54	-21.95	-	-	289	315	V
* 1.549	63.37	PK2	25.1	-44.32	44.15	-	-	74	-29.85	228	328	H
* 4.09	62.22	PK2	28.1	-44.43	45.89	-	-	74	-28.11	5	121	H
* 4.809	67.33	PK2	27.1	-45.28	49.15	-	-	74	-24.85	196	131	H
* 22.515	59.64	PK2	40.8	-46.64	53.8	-	-	74	-20.2	360	387	H
* 1.541	63.8	PK2	25.1	-44.13	44.77	-	-	74	-29.23	328	208	V
* 4.809	66.05	PK2	27.3	-45.28	48.07	-	-	74	-25.93	328	208	V
* 9.017	61.2	PK2	33.2	-50.22	44.18	-	-	74	-29.82	289	315	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAv1 - KDB558074 Option 1 Maximum RMS Average

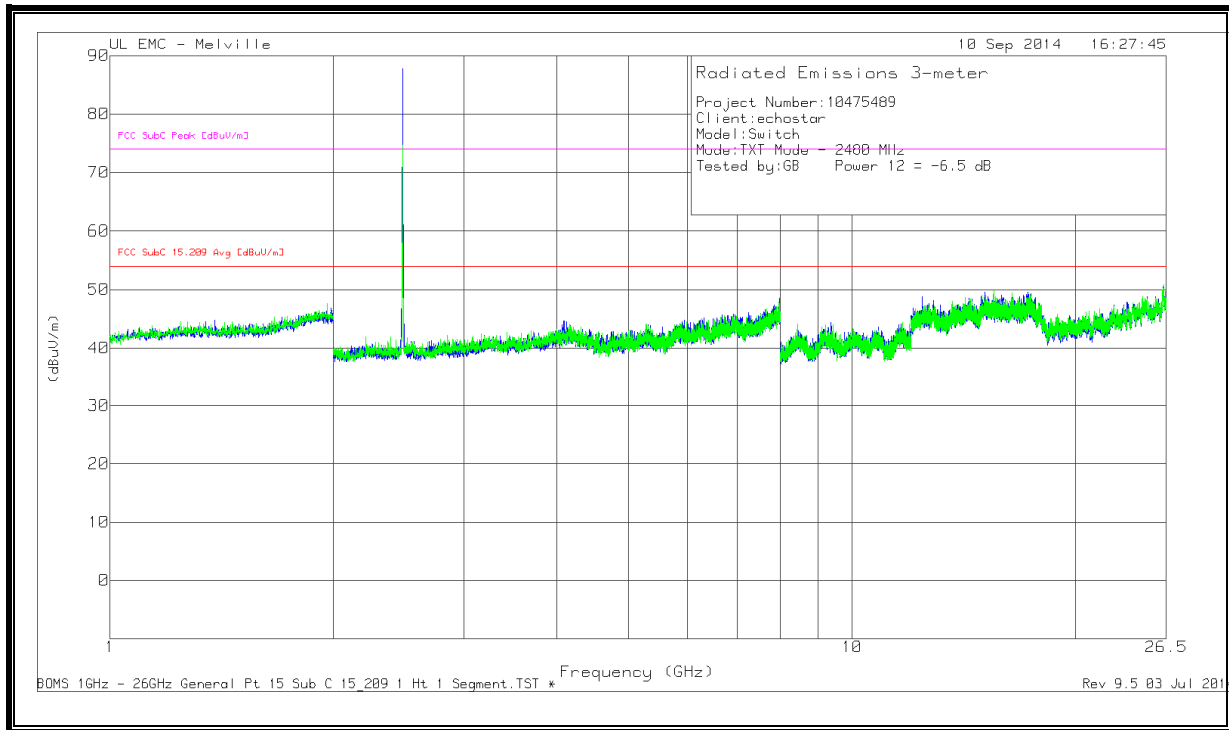
HARMONICS AND SPURIOUS EMISSIONS – MID CHANNEL



Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.597	51.45	MAv1	25.2	-44.24	32.41	54	-21.59	-	-	228	159	H
* 4.889	58.9	MAv1	27.2	-45.68	40.42	54	-13.58	-	-	14	200	H
* 9.5	47.51	MAv1	33.4	-49.19	31.72	54	-22.28	-	-	256	229	H
* 10.742	45.56	MAv1	33.2	-47.05	31.71	54	-22.29	-	-	82	193	H
* 1.53	51.68	MAv1	25.1	-44.25	32.53	54	-21.47	-	-	346	262	V
* 3.705	49.61	MAv1	22.3	-40.81	31.1	54	-22.9	-	-	15	214	V
* 7.43	49.11	MAv1	28	-42.7	34.41	54	-19.59	-	-	217	284	V
* 16.175	46.98	MAv1	37.3	-47.06	37.22	54	-16.78	-	-	273	173	V
* 1.597	63.68	PK2	25.2	-44.25	44.63	-	-	74	-29.37	228	159	H
* 4.889	67.2	PK2	27.2	-45.68	48.72	-	-	74	-25.28	14	200	H
* 9.499	59.5	PK2	33.4	-49.2	43.7	-	-	74	-30.3	256	229	H
* 10.742	57.81	PK2	33.2	-47.06	43.95	-	-	74	-30.05	82	193	H
* 1.529	63.68	PK2	25.1	-44.26	44.52	-	-	74	-29.48	346	262	V
* 3.703	62.05	PK2	22.3	-40.83	43.52	-	-	74	-30.48	15	214	V
* 7.43	60.8	PK2	28	-42.69	46.11	-	-	74	-27.89	217	284	V
* 16.175	58.93	PK2	37.3	-47.06	49.17	-	-	74	-24.83	273	173	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAV1 - KDB558074 Option 1 Maximum RMS Average

HARMONICS AND SPURIOUS EMISSIONS – HIGH CHANNEL

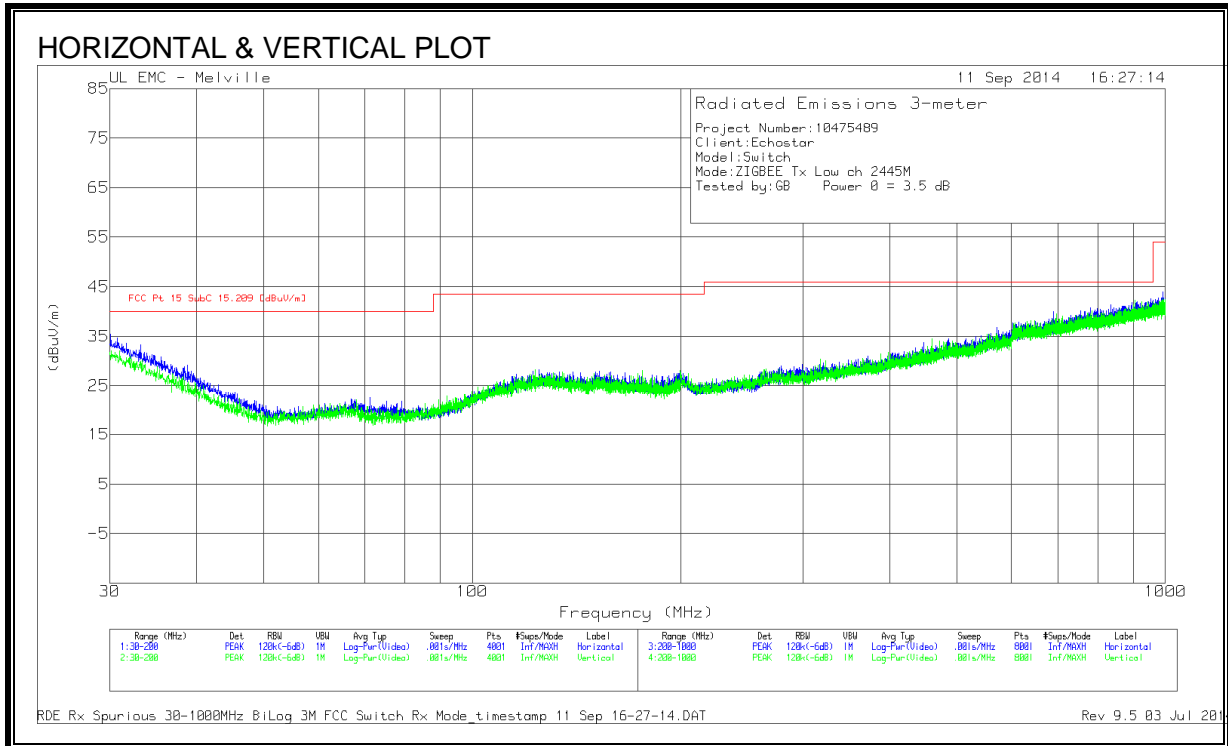


Frequency (GHz)	Meter Reading (dBuV)	Det	AF [dB/m]	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC SubC 15.209 Avg [dBuV/m]	Margin (dB)	FCC SubC Peak [dBuV/m]	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 1.386	51.66	MAv1	25	-44.5	32.16	54	-21.84	-	-	290	248	H
* 4.09	49.98	MAv1	28.1	-44.43	33.65	54	-20.35	-	-	9	237	H
* 7.255	49.5	MAv1	28	-42.48	35.02	54	-18.98	-	-	159	342	H
5.307	50.17	MAv1	27.3	-44.45	33.02	54	-20.98	-	-	120	149	H
* 8.455	48.56	MAv1	33.2	-49.91	31.85	54	-22.15	-	-	66	376	H
* 9.367	49.06	MAv1	33.4	-49.58	32.88	54	-21.12	-	-	252	165	H
* 12.43	46.12	MAv1	37.3	-48.01	35.41	54	-18.59	-	-	17	359	H
* 1.72	51.42	MAv1	26.1	-44.17	33.35	54	-20.65	-	-	275	217	V
* 2.212	50.39	MAv1	21.3	-42.32	29.37	54	-24.63	-	-	245	217	V
5.271	50.15	MAv1	27.4	-44.13	33.42	54	-20.58	-	-	40	341	V
* 8.452	48.62	MAv1	33.2	-49.94	31.88	54	-22.12	-	-	62	144	V
* 15.53	45.76	MAv1	37.3	-45.91	37.15	54	-16.85	-	-	139	280	V
* 1.386	63.91	PK2	25	-44.5	44.41	-	-	74	-29.59	290	248	H
* 4.09	62.42	PK2	28.1	-44.43	46.09	-	-	74	-27.91	9	237	H
* 7.255	61.43	PK2	28	-42.48	46.95	-	-	74	-27.05	159	342	H
5.307	62.63	PK2	27.3	-44.45	45.48	-	-	74	-28.52	120	149	H
* 8.455	60.32	PK2	33.2	-49.91	43.61	-	-	74	-30.39	66	376	H
* 9.367	60.51	PK2	33.4	-49.58	44.33	-	-	74	-29.67	252	165	H
* 12.43	58.56	PK2	37.3	-48.01	47.85	-	-	74	-26.15	17	359	H
* 1.72	63.37	PK2	26.1	-44.17	45.3	-	-	74	-28.7	275	217	V
* 2.212	62.46	PK2	21.3	-42.32	41.44	-	-	74	-32.56	245	217	V
5.271	62.12	PK2	27.4	-44.13	45.39	-	-	74	-28.61	40	341	V
* 8.452	60.95	PK2	33.2	-49.94	44.21	-	-	74	-29.79	62	144	V
* 15.53	57.56	PK2	37.3	-45.91	48.95	-	-	74	-25.05	139	280	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band
 PK2 - KDB558074 Method: Maximum Peak
 MAv1 - KDB558074 Option 1 Maximum RMS Average

9.2.2 WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION) MID CHANNEL

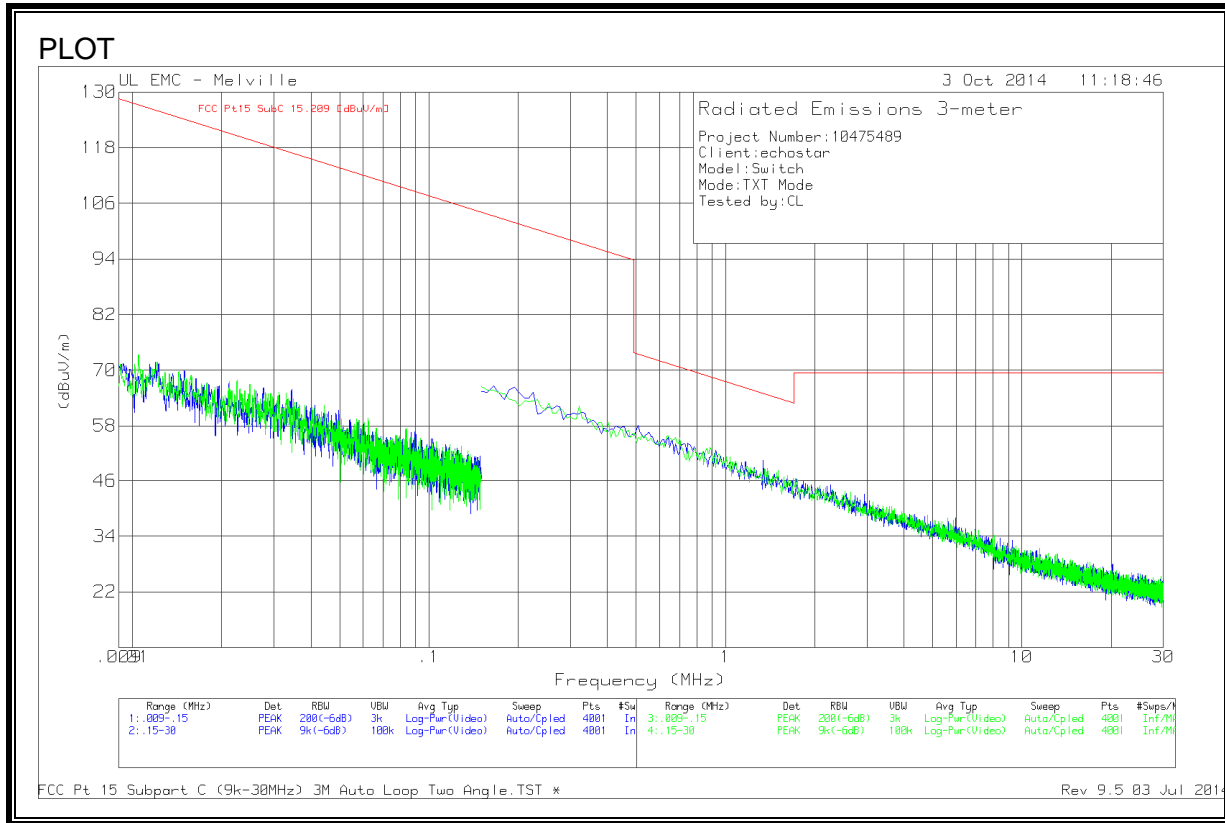


Frequency (MHz)	Meter Reading (dBuV)	Det	AF-84106 [dB/m]	GL [dB]	Corrected Reading (dBuV/m)	FCC Pt 15 SubC 15.209 [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
30.085	12.8	PK	21.9	.7	35.4	40	-4.6	0-360	400	H
30.85	11.27	PK	21.5	.8	33.57	40	-6.43	0-360	250	H
689.4	15.45	PK	20.5	4.1	40.05	46	-5.95	0-360	300	H
894.4	14.43	PK	22.7	4.7	41.83	46	-4.17	0-360	99	H
834.7	14.6	PK	22.2	4.5	41.3	46	-4.7	0-360	300	H
903.8	15.05	PK	22.5	4.8	42.35	46	-3.65	0-360	200	V

PK - Peak detector

WORST-CASE BELOW 30 MHz

SPURIOUS EMISSIONS 9KHZ TO 30 MHz (WORST-CASE CONFIGURATION) MID CHANNEL



Frequency (MHz)	Meter Reading (dBuV)	Det	AF-5A288 [dB/m]	GL-3M [dB]	Corrected Reading (dBuV/m)	FCC Pt15 SubC 15.209 [dBuV/m]	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
.01229	42.7	PK	28.5	.2	71.4	125.8	-54.4	0-360	100	H
.03441	44	PK	21.6	.2	65.8	116.86	-51.06	0-360	100	H
.16493	49.98	PK	16.4	.3	66.68	103.25	-36.57	0-360	100	H
.01051	43.69	PK	29.5	.2	73.39	127.16	-53.77	0-360	145	H
.023	41.73	PK	23.8	.2	65.73	120.35	-54.62	0-360	145	H
.15	49.76	PK	16.5	.3	66.56	104.08	-37.52	0-360	145	H

PK - Peak detector

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

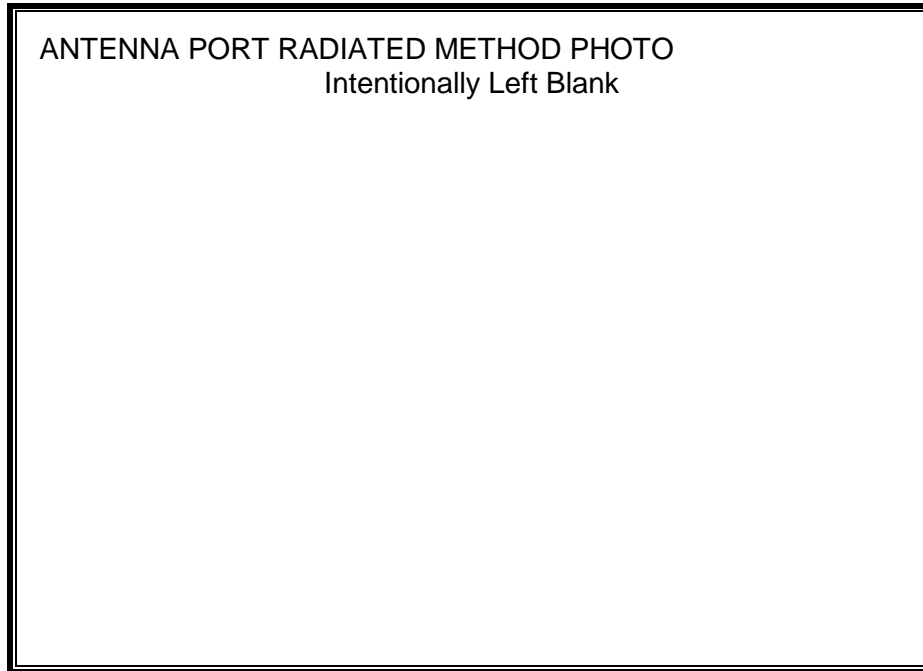
TEST PROCEDURE

ANSI C63.10-2009

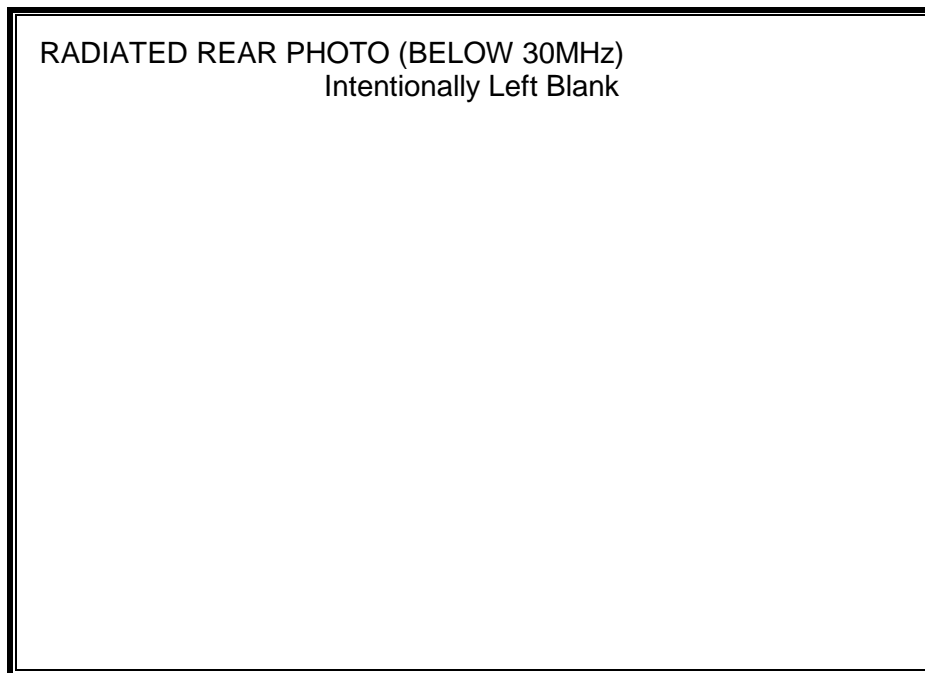
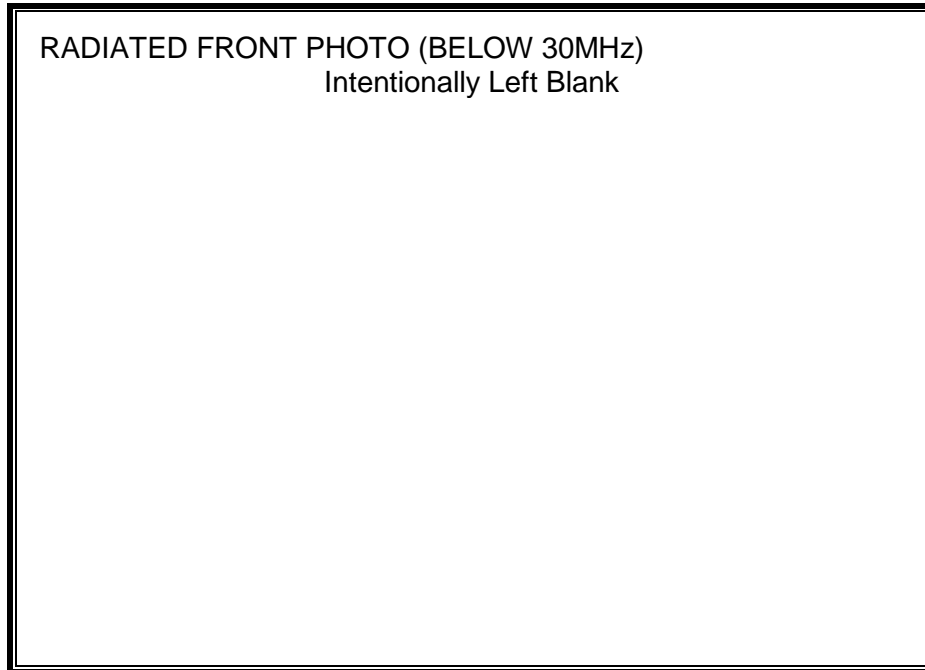
Not Applicable the equipment operates on a 3volt battery

11. SETUP PHOTOS

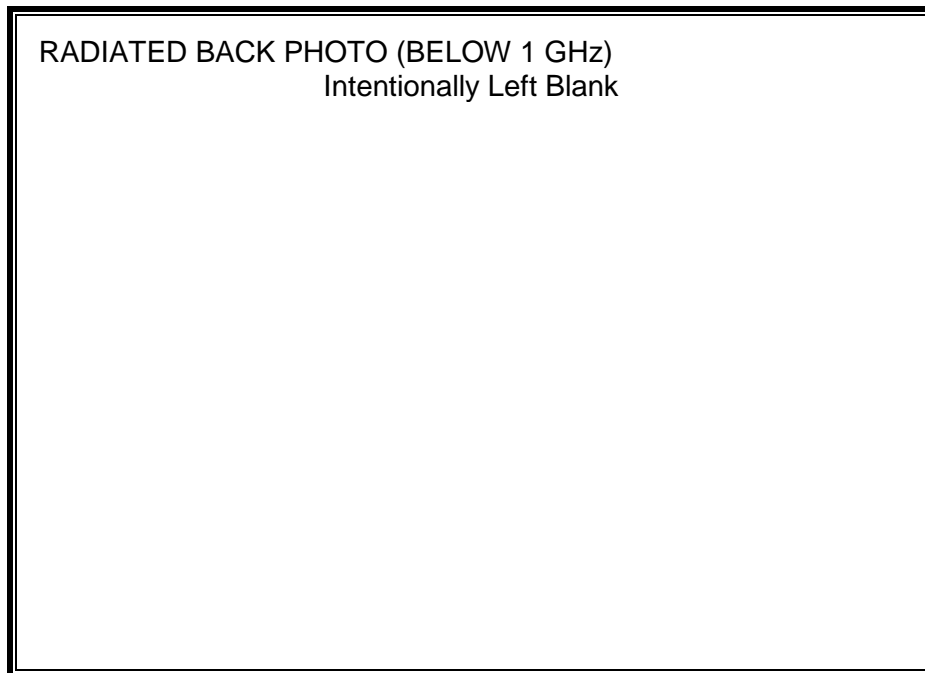
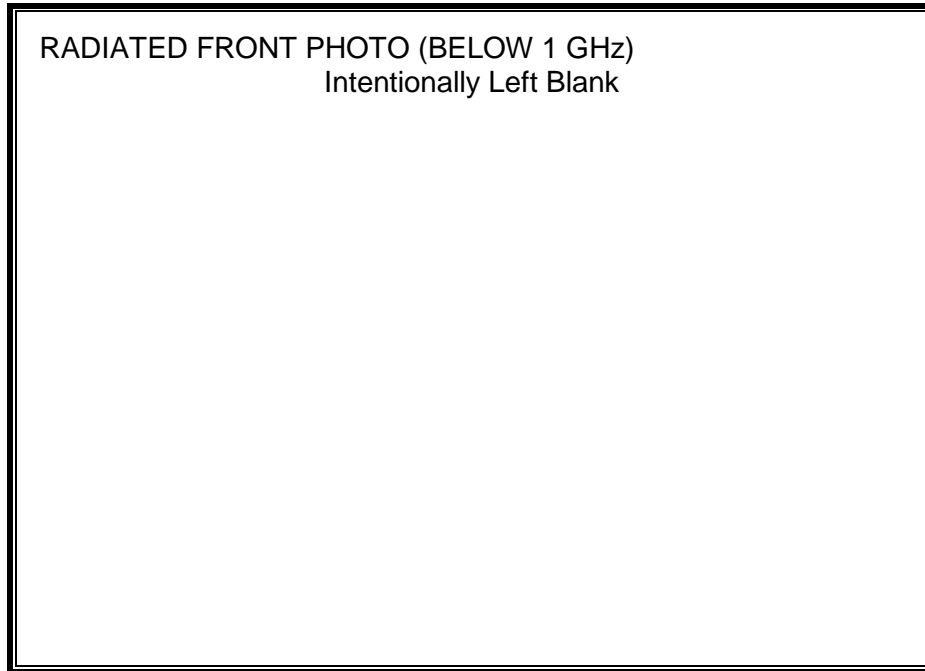
ANTENNA PORT RADIATED RF MEASUREMENT SETUP



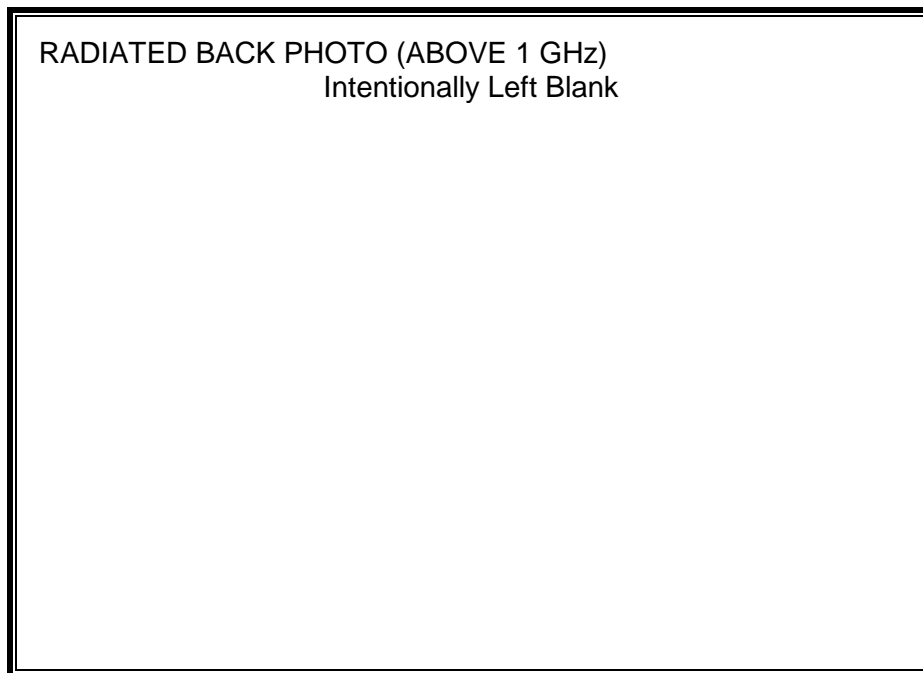
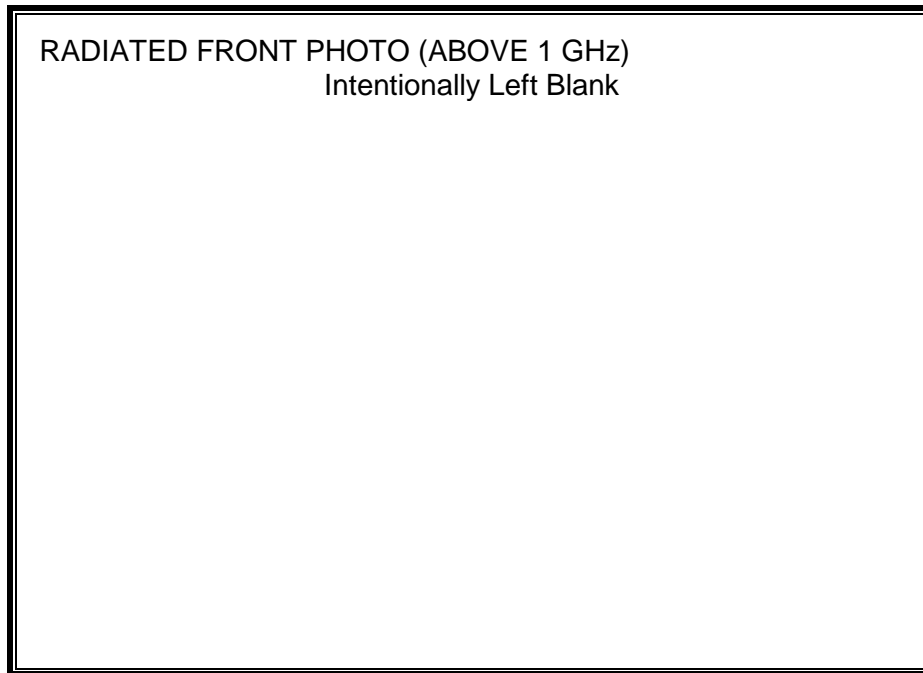
RADIATED RF MEASUREMENT SETUP (BELOW 30MHz)



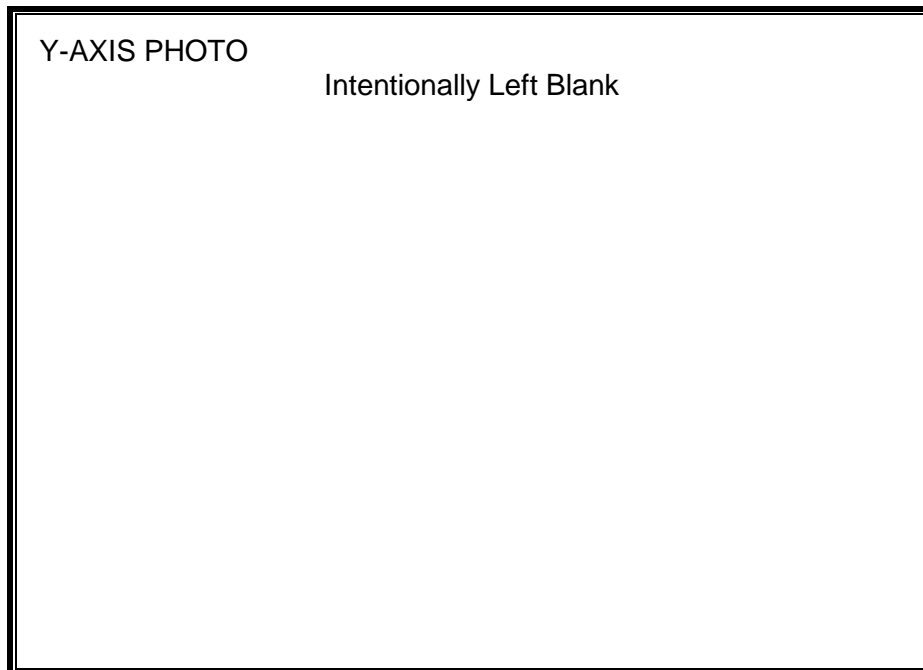
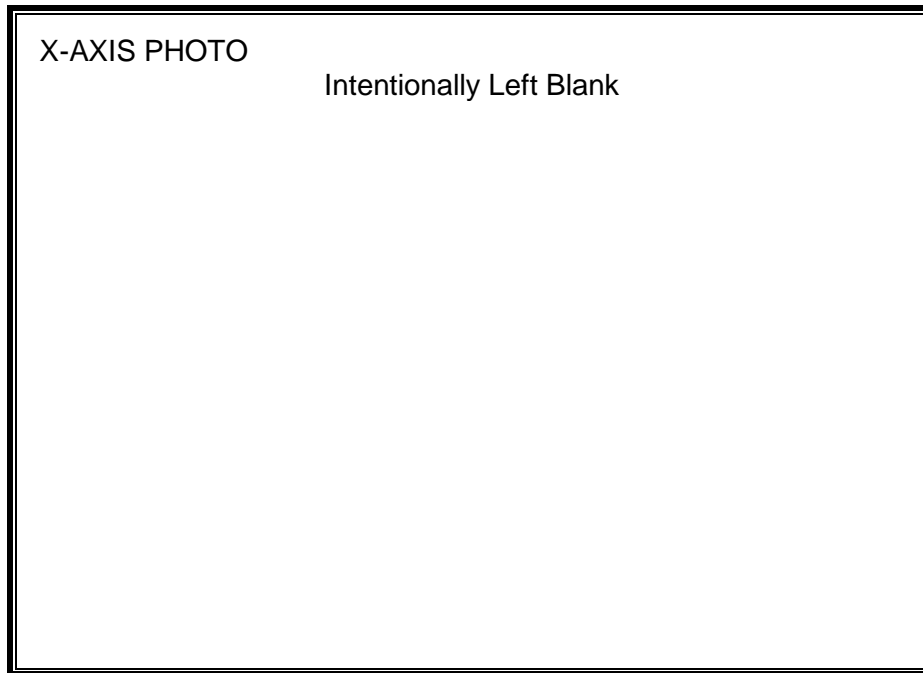
RADIATED RF MEASUREMENT SETUP (BELOW 1 GHz)

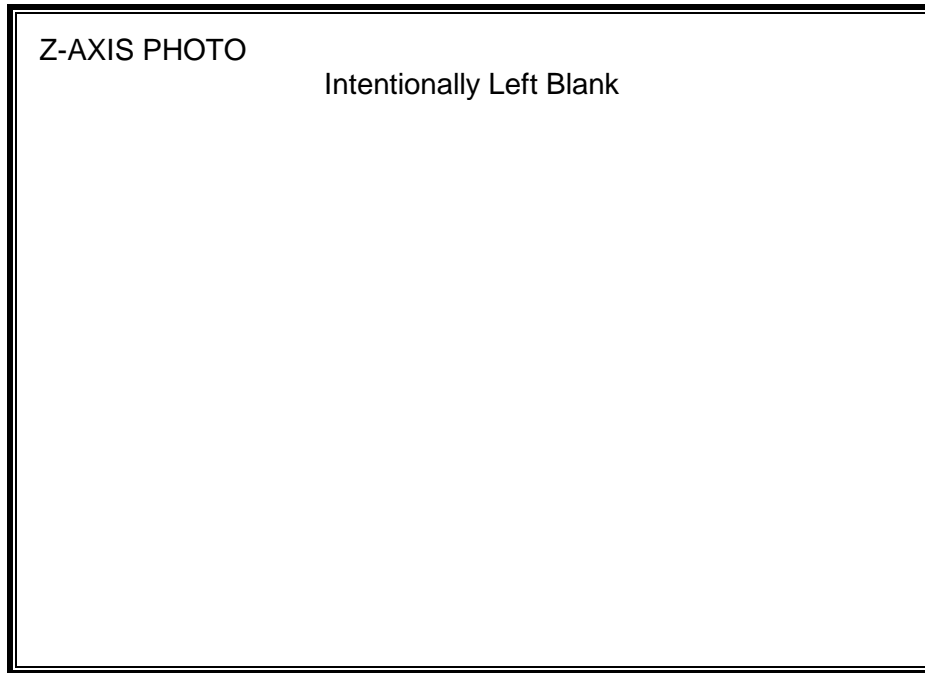


RADIATED RF MEASUREMENT SETUP (ABOVE 1 GHz)



RADIATED RF MEASUREMENT SETUP FOR PORTABLE CONFIGURATION





END OF REPORT