



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

SET TOP BOX

MODEL NUMBER: E76

FCC ID: DKN-PHX

REPORT NUMBER: R11893030-E1

ISSUE DATE: 2017-09-28

**Prepared for
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NVLAP LAB CODE 200246-0

Revision History

<u>Ver.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
1	2017-09-28	Initial Issue	Brian T. Kiewra
2	2017-10-03	Corrected antenna gain in section 5.3	Brian T. Kiewra
3	2017-10-06	Revised Section 5.5 to clarify worst-case testing Added simultaneous transmission information to Section 5.5 Added conducted testing reference to Section 7	Brian T. Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: EchoStar Technologies LLC
9601 Meridian Boulevard
Englewood, CO 80112, USA

EUT DESCRIPTION: Set top box

MODEL: E76

SERIAL NUMBER: Conducted Unit: P2-168
Radiated Unit: P2-184

DATE TESTED: 2017-08-15 to 2017-09-12

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, or any agency of the U.S. Government.

Approved & Released
For UL LLC By:



Jeffrey Moser
Operations Leader
UL – Consumer Technology Division

Prepared By:



Brian T. Kiewra
Project Engineer
UL – Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr, Suite B, Morrisville, NC 27560.

12 Laboratory Dr., RTP, NC 27709
<input type="checkbox"/> Chamber A
<input type="checkbox"/> Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
<input checked="" type="checkbox"/> Chamber NORTH
<input checked="" type="checkbox"/> Chamber SOUTH

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <http://www.nist.gov/nvlap/>.

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:

PARAMETER	UNCERTAINTY
RF output power, conducted	±0.45 dB
Power Spectral Density, conducted	±1.50 dB
Unwanted Emissions, conducted	±2.94 dB
All emissions, radiated	±5.36 dB
Conducted Emissions (0.150 – 30MHz)	±3.65 dB
Temperature	±0.07 °C
Humidity	±2.26 %
DC and Low Frequency Voltages	±1.27 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an STB that contains a ZigBee and an 802.11 a/b/g/n/ac transceiver.

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 - 2480	802.15.4 ZigBee	5.84	3.84

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes one FPCBA antenna, with a maximum gain of 4.1 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was FCE2.

The EUT driver software installed during testing was BRDCM MFG Driver WL1.

The test utility software used during testing was MTOOL v3.0.0.3.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions, 0.009 -1000 MHz and 18-26 GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Radiated emissions 1-18GHz performed with the EUT set to transmit and low, middle and high channels.

The EUT is designed to operate in only one orientation; therefore all radiated testing done in the X-Axis orientation.

EUT supports both MIMO and SISO, therefore all testing performed at CDD MIMO as worst-case.

For simultaneous transmission of multiple channels in the 2.4GHz ZigBee, 2.4GHz WLAN and 5GHz bands, tests were conducted for various configurations having the highest power. No noticeable new emission was found.

5.1. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Broadband Modem	D-Link	EBR-2310	F311393000205	N/A
Solid state hard drive	WD Elements	DAADCA	WX51A1424754	N/A
Solid state hard drive	WD Elements	AAAFFA	WX81A31A3906	N/A
Laptop	Hewlett-Packard	EliteBook 740	5CG4382SLC	N/A
Laptop	Hewlett-Packard	EliteBook 8470P	CNU342CP7Y	N/A

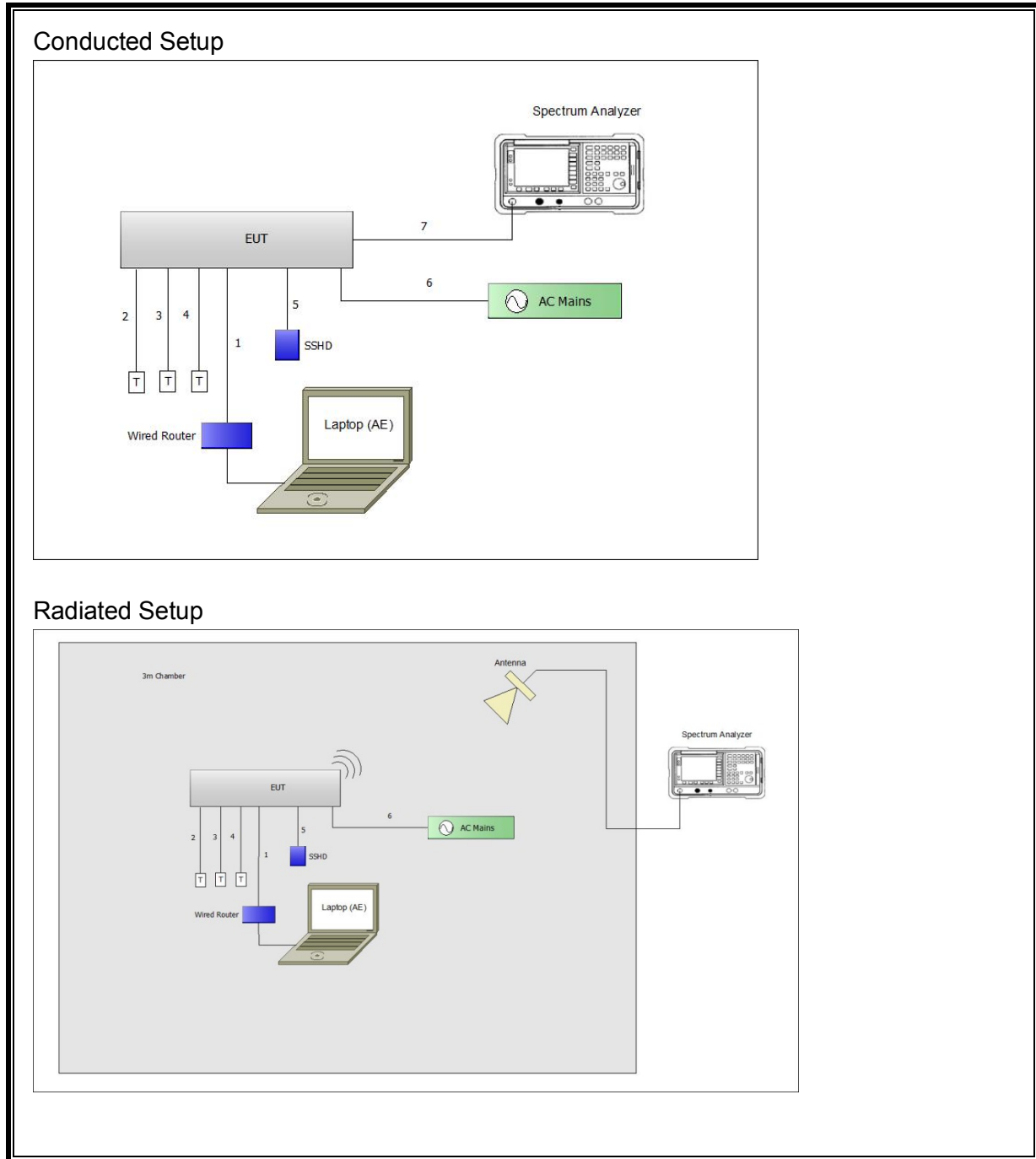
I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Ethernet	1	CAT-5	Communication	0.5m	Connected to wired router
2	Coax	1	RG-7	Communication	0.5m	Terminated
3	HDMI	1	Standard	Video	2m	Terminated
4	Component Video	1	RGB	Video	2m	Terminated
5	USB	2	Type A	Data	.25m	To SSD
6	AC	1	AC	AC Mains	>1m	None
7	Antenna	1	RF	RF	<1m	Antenna Port

TEST SETUP

The EUT is installed as a standalone unit.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used – Radiated Measurement Equipment (MOR North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2016-12-28	2017-12-31
18-40 GHz					
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2016-09-06	2017-09-30
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2016-09-06	2017-09-30
Gain-Loss Chains					
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2016-10-04	2017-10-04
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2017-03-03	2018-03-03
Receiver & Software					
SA0027	Spectrum Analyzer	Agilent	N9030A	2017-03-16	2018-03-16
SA0026 (18-40GHz RSE)	Spectrum Analyzer	Agilent	N9030A	2017-02-17	2018-02-28
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment Used					
s/n 161024690	Environmental Meter	Fisher Scientific	15-077-963	2016-12-21	2018-12-21

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
30-1000 MHz					
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2017-06-15	2018-06-15
1-18 GHz					
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2017-04-05	2018-04-05
Gain-Loss Chains					
S-SAC02	Gain-loss string: 30 – 1000 MHz	Various	Various	2017-06-11	2018-06-11
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2017-08-18	2018-08-18
Receiver & Software					
SA0025	Spectrum Analyzer	Agilent	N9030A	2017-04-10	2018-04-10
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
Additional Equipment used					
s/n 161024887	Environmental Meter	Fisher Scientific	15-077-963	2016-12-23	2018-12-23

Test Equipment Used - Line Conducted Measurement Equipment (RTP)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Equipment – Ground Plane E					
85496	EMI Test Receiver 9kHz-3.6GHz	Rohde & Schwarz	ESR3	2017-08-22	2018-08-22
ATA509	Coaxial cable, 20 ft., BNC -male to BNC-male	UL	RG-223	2017-08-23	2018-08-23
HI0085	Temp/Humid/Pressure Meter	Extech	SD700	2017-02-27	2018-02-27
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
ATA508	Transient Limiter, 0.009 to 100 MHz	Electro-Metrics	EM 7600	2017-08-23	2018-08-23
LISN002	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2017-08-22	2018-08-22

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
RTP					
SA0020	Spectrum Analyzer	Agilent Technologies	E4446A	2017-04-25	2018-04-25
PWM001	RF Power Meter	Keysight Technologies	N1911A	2017-05-18	2018-05-18
PWS001	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2017-05-18	2018-05-18
15557603	Temp/Humidity Sensor	Fisher Scientific	14-650-118	2016-11-02	2018-11-02

7. MEASUREMENT METHODS

Duty Cycle: KDB 558074 D01 v04, Section 6.0

6 dB BW: KDB 558074 D01 v04, Section 8.1.

Output Power: KDB 558074 D01 v04, Section 9.2.3.2.

Power Spectral Density: KDB 558074 D01 v04, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v04, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v04, Section 12.1.

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3-6.6

General Conducted Emissions: ANSI C63.10:2013 Section 6.7

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.15.4	128.200	128.200	1.000	100.00%	0.00	0.010

Test Information

Date: 2017-08-22
Project: 11893030
Tester: Jeff Cabrera

8.2. 802.15.4 MODE IN THE 2.4 GHz BAND

8.2.1. 6 dB BANDWIDTH LIMITS

FCC §15.247 (a) (2)

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

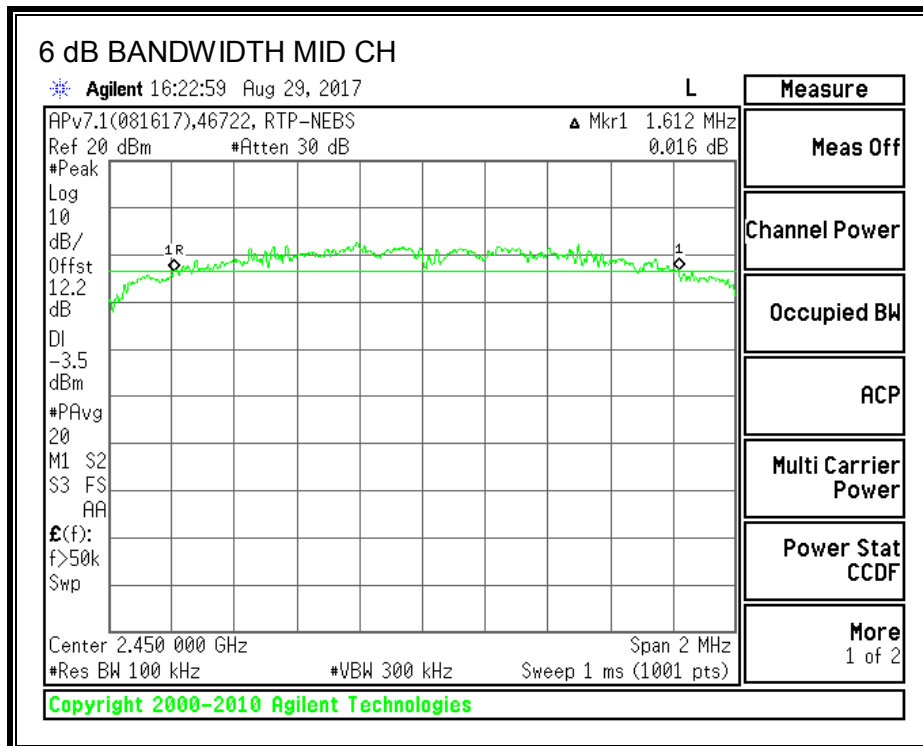
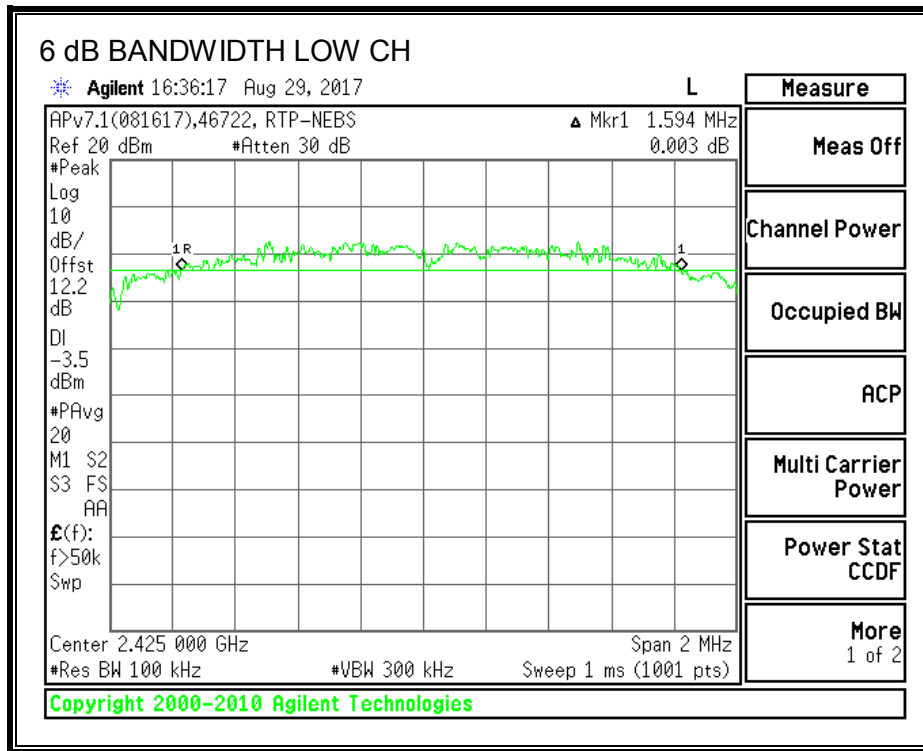
TEST PROCEDURE

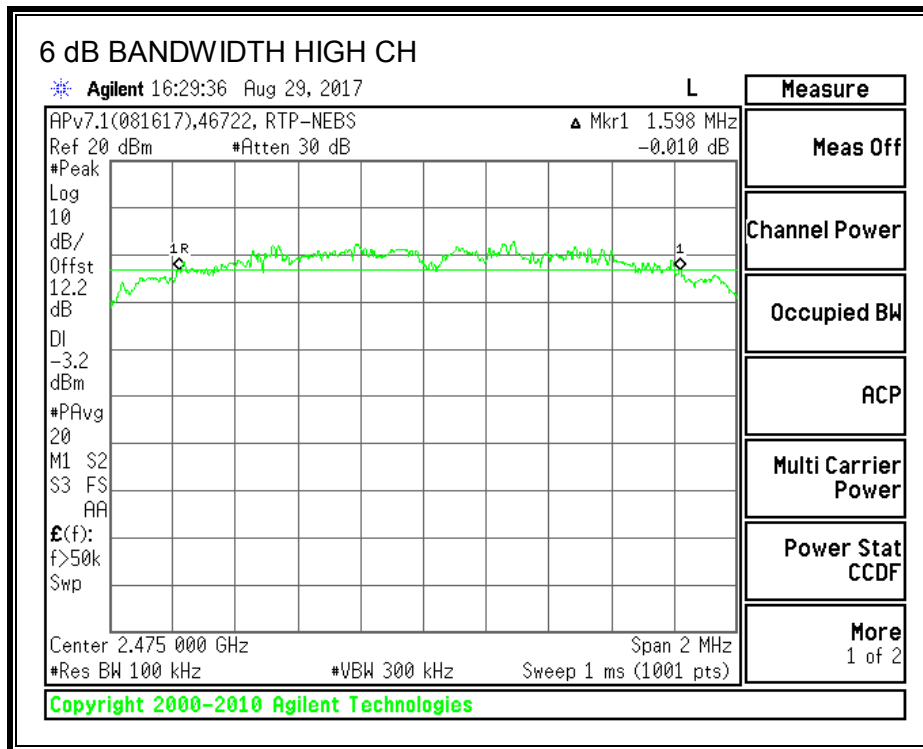
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2425	1.594	0.5
Middle	2450	1.612	0.5
High	2475	1.598	0.5

6 dB BANDWIDTH





Test Information

Date: 2017-08-29
 Project: 11893030
 Tester: John Manser

8.2.2. 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 connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 99% bandwidth of the EUT.

RESULTS

Note: PK Power

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2425	5.84	30	-24.16
Middle	2450	5.52	30	-24.48
High	2475	5.27	30	-24.73

Test Information

Date: 2017-08-29

Project: 11893030

Tester: John Manser

**8.2.3. 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.

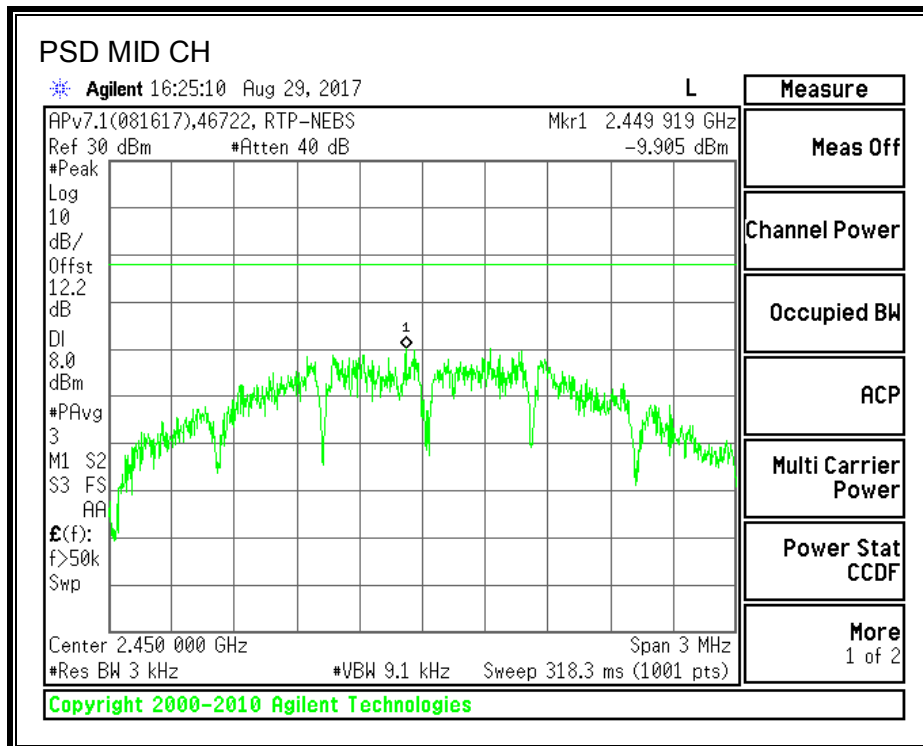
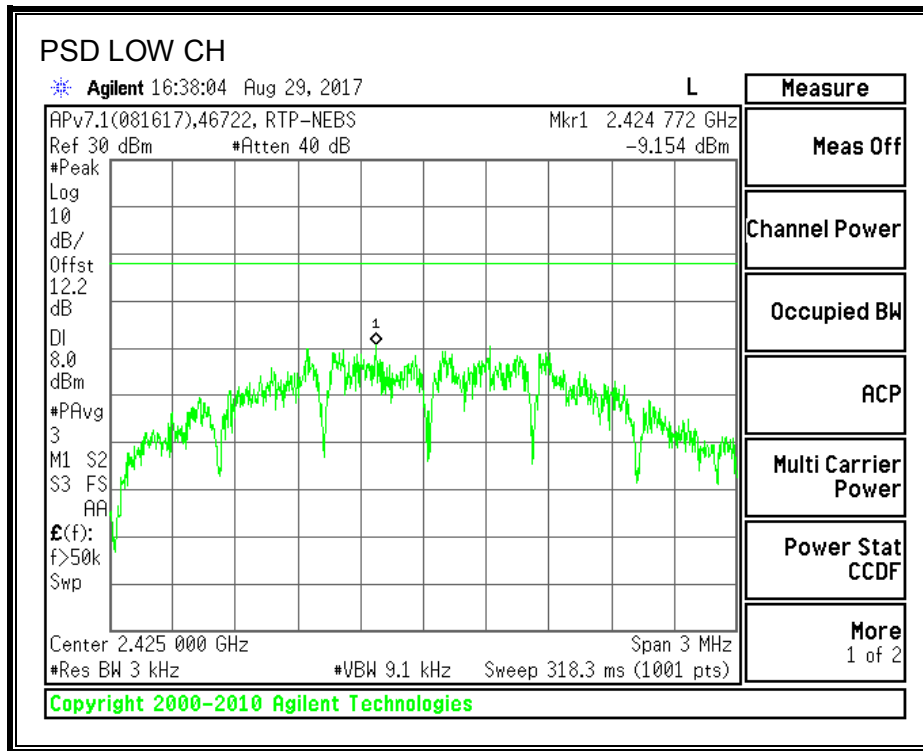
TEST PROCEDURE

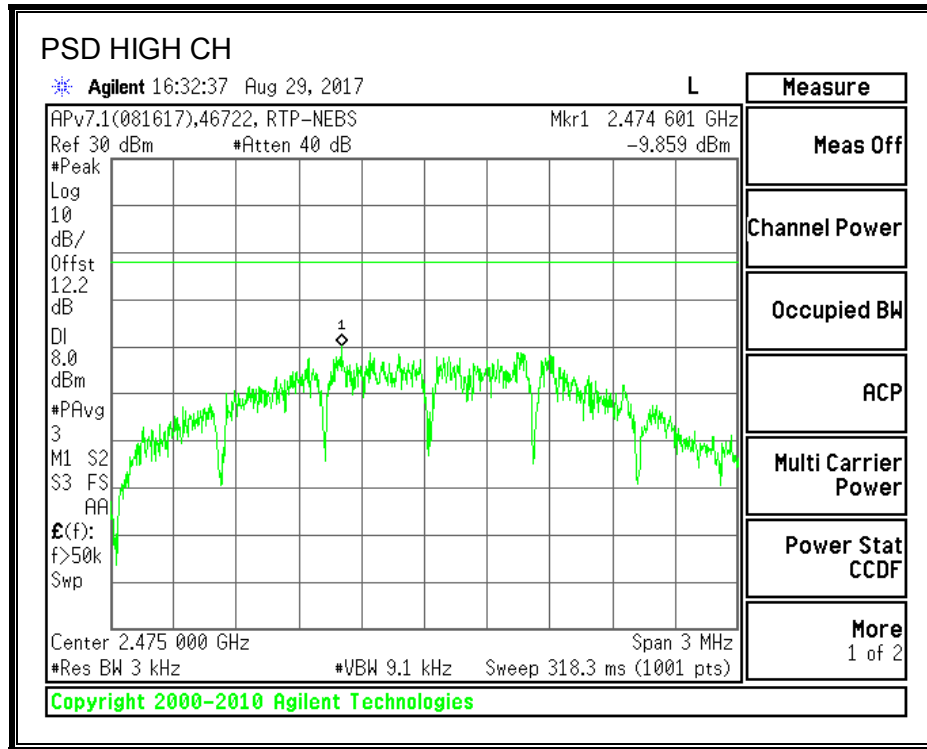
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using Section 10.2 under KDB 558074 D01 DTS Meas Guidance v04.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2425	-9.15	8	-17.15
Middle	2450	-9.91	8	-17.91
High	2475	-9.86	8	-17.86

POWER SPECTRAL DENSITY





Test Information

Date: 2017-08-29
 Project: 11893030
 Tester: John Manser

8.2.4. 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 transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

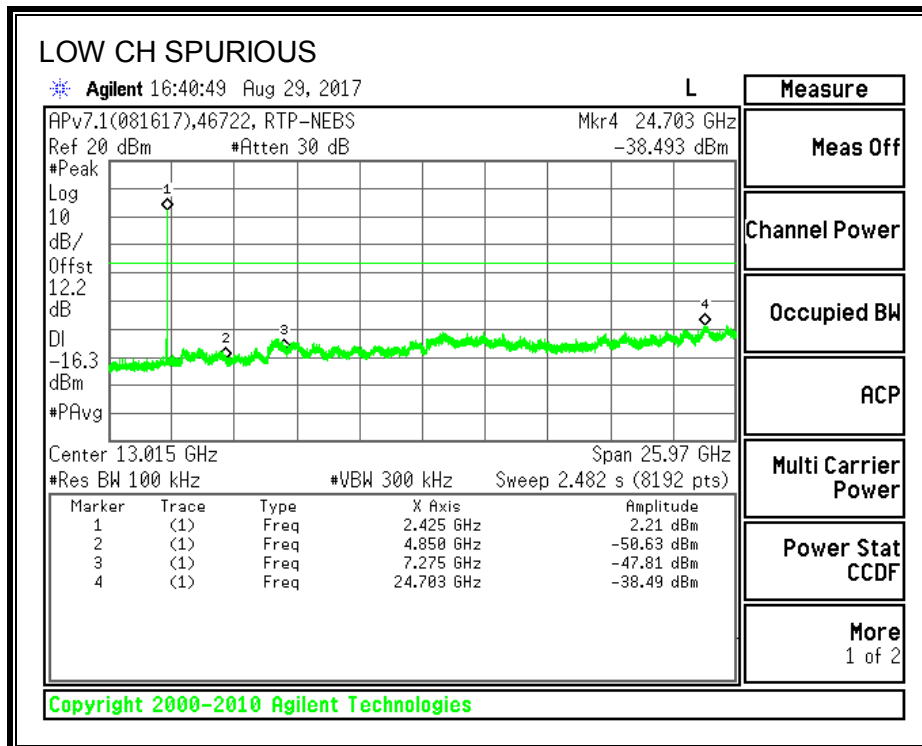
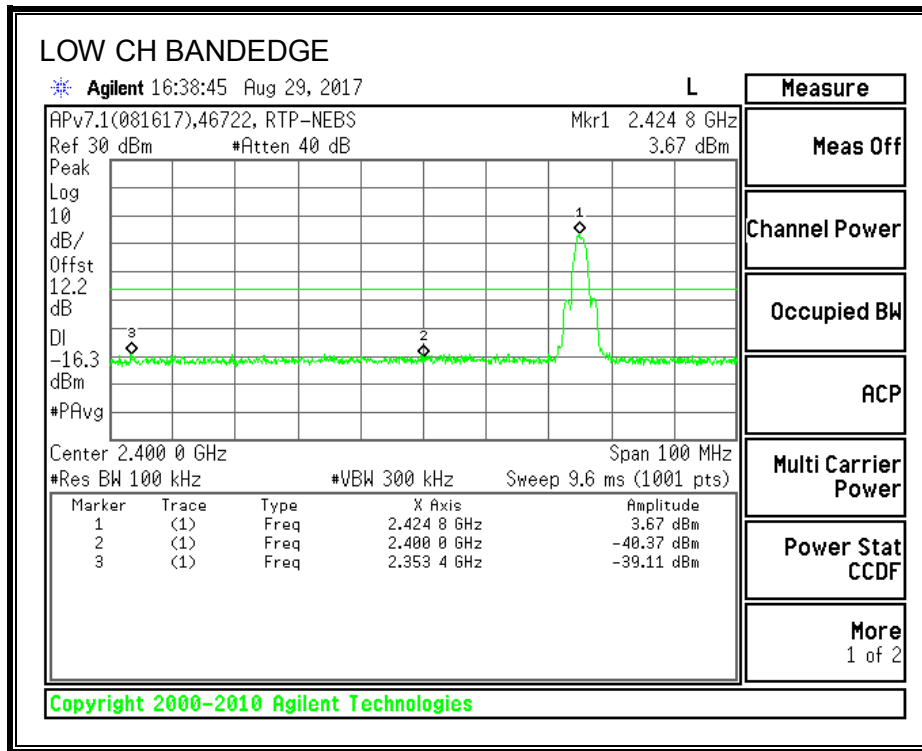
Test Information

Date: 2017-08-29

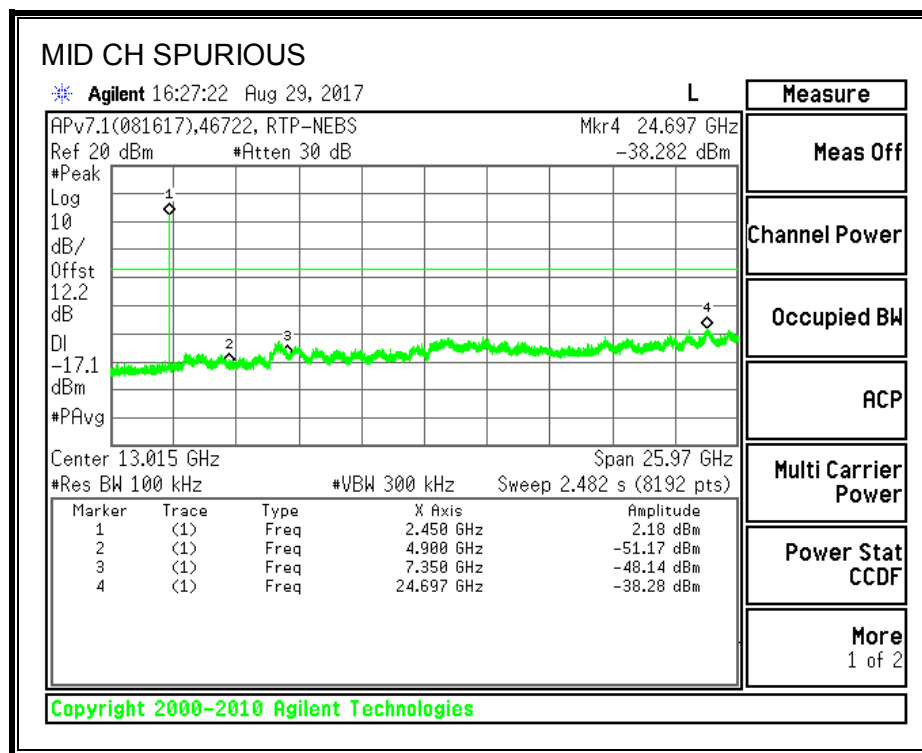
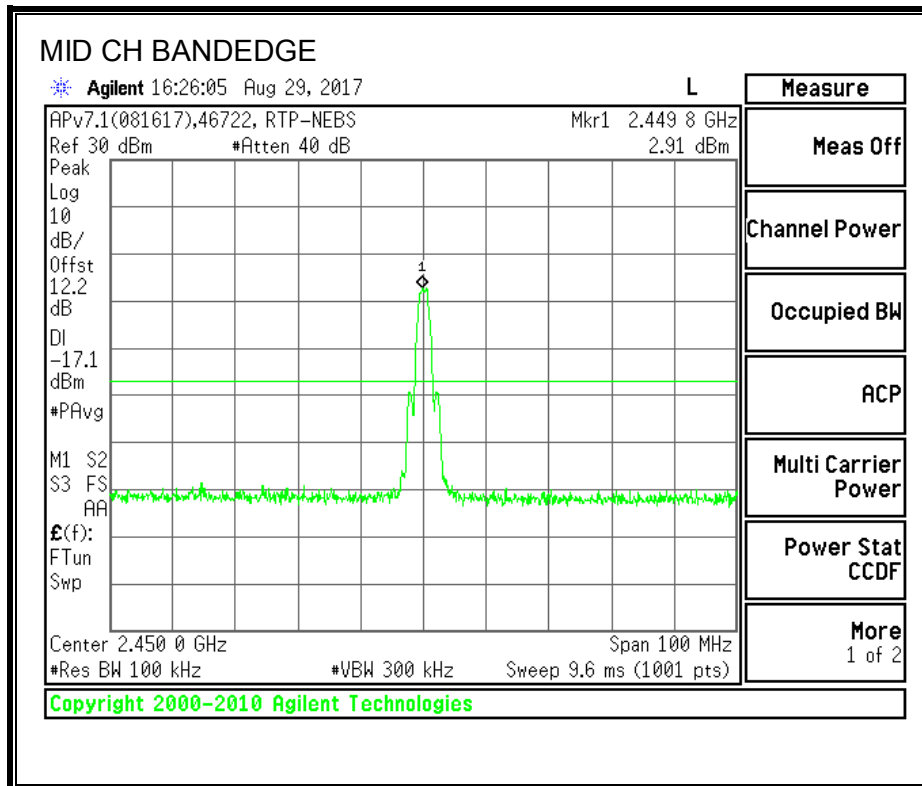
Project: 11893030

Tester: John Manser

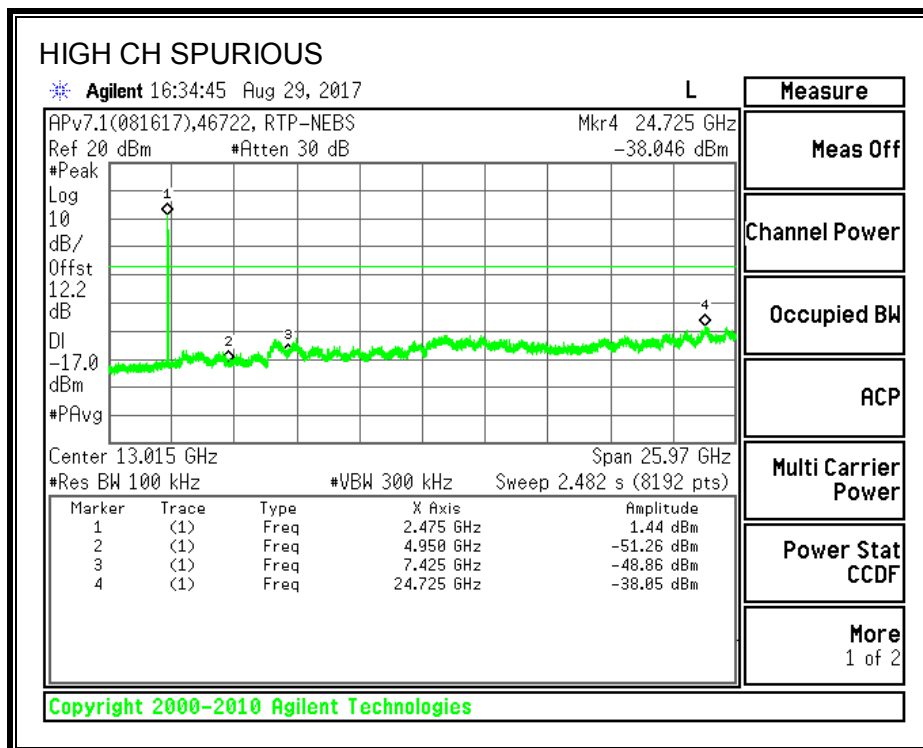
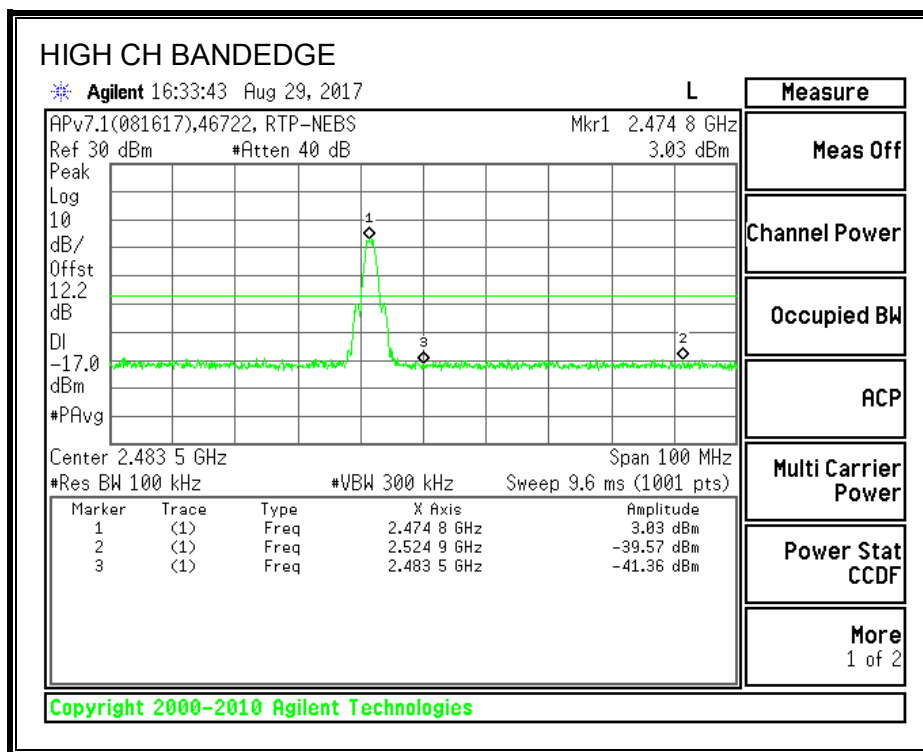
SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



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 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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 for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

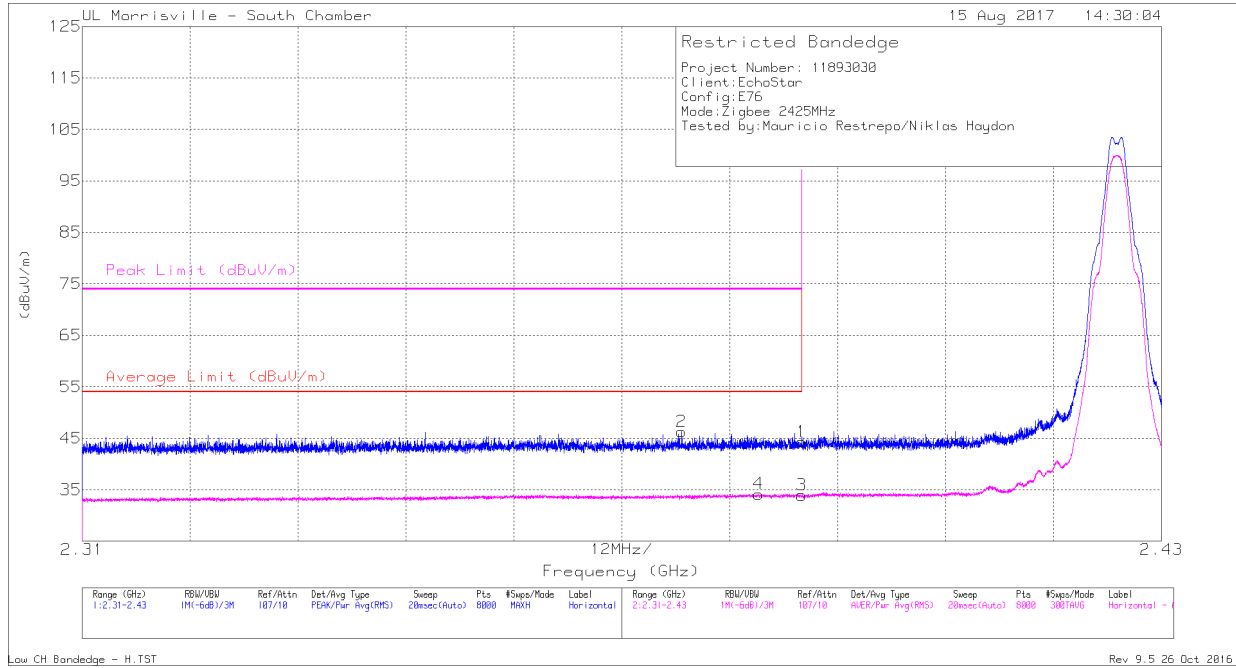
For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was RMS averaging.

The spectrum from 1 to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. For 9kHz to 1000 MHz and 18 to 26 GHz investigation, the worst-case channel was selected.

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)



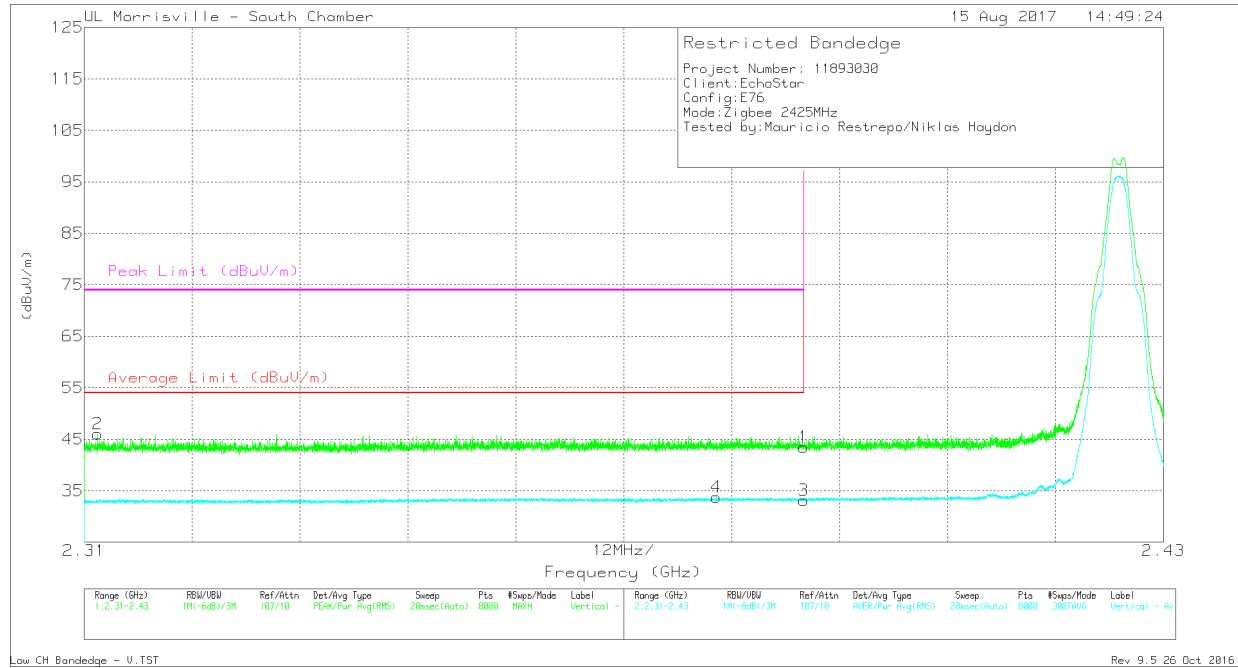
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	36.52	Pk	31.9	-24.1	44.32	-	-	74	-29.68	236	174	H
2	* 2.377	38.37	Pk	31.9	-24	46.27	-	-	74	-27.73	236	174	H
3	* 2.39	26.15	RMS	31.9	-24.1	33.95	54	-20.05	-	-	236	174	H
4	* 2.385	26.28	RMS	31.9	-24	34.18	54	-19.82	-	-	236	174	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



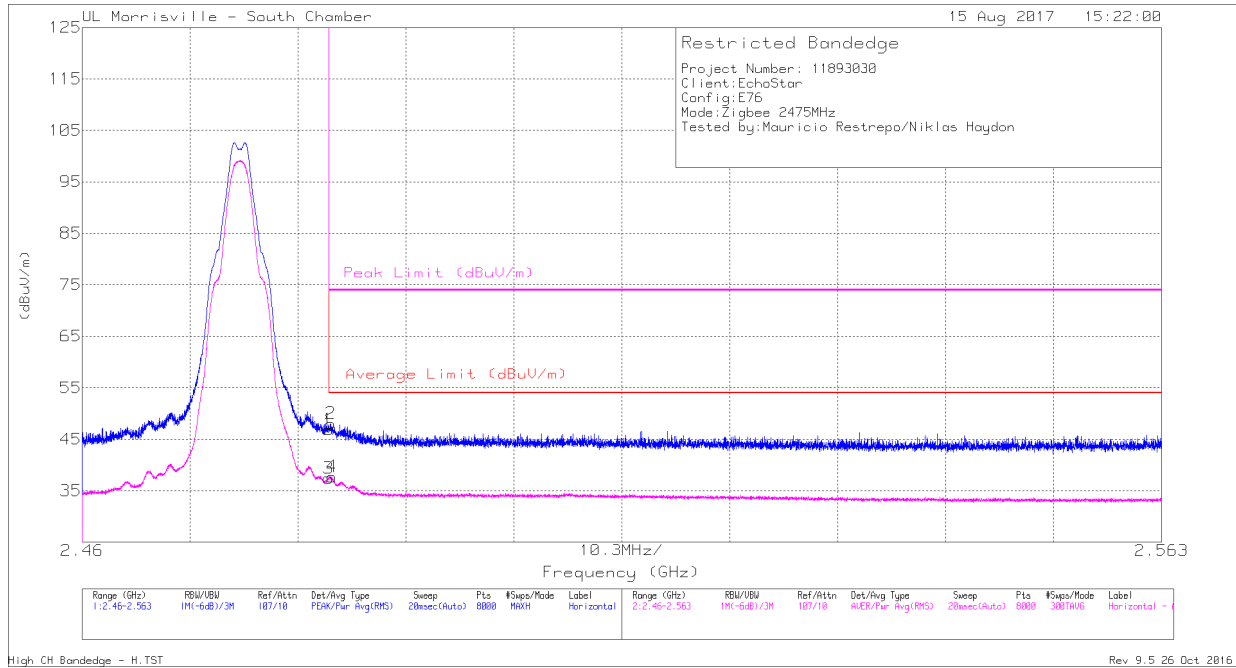
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	35.67	Pk	31.9	-24.1	43.47	-	-	74	-30.53	155	104	V
2	* 2.311	38.14	Pk	31.6	-23.7	46.04	-	-	74	-27.96	155	104	V
3	* 2.39	25.31	RMS	31.9	-24.1	33.11	54	-20.89	-	-	155	104	V
4	* 2.38	25.83	RMS	31.9	-24	33.73	54	-20.27	-	-	155	104	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



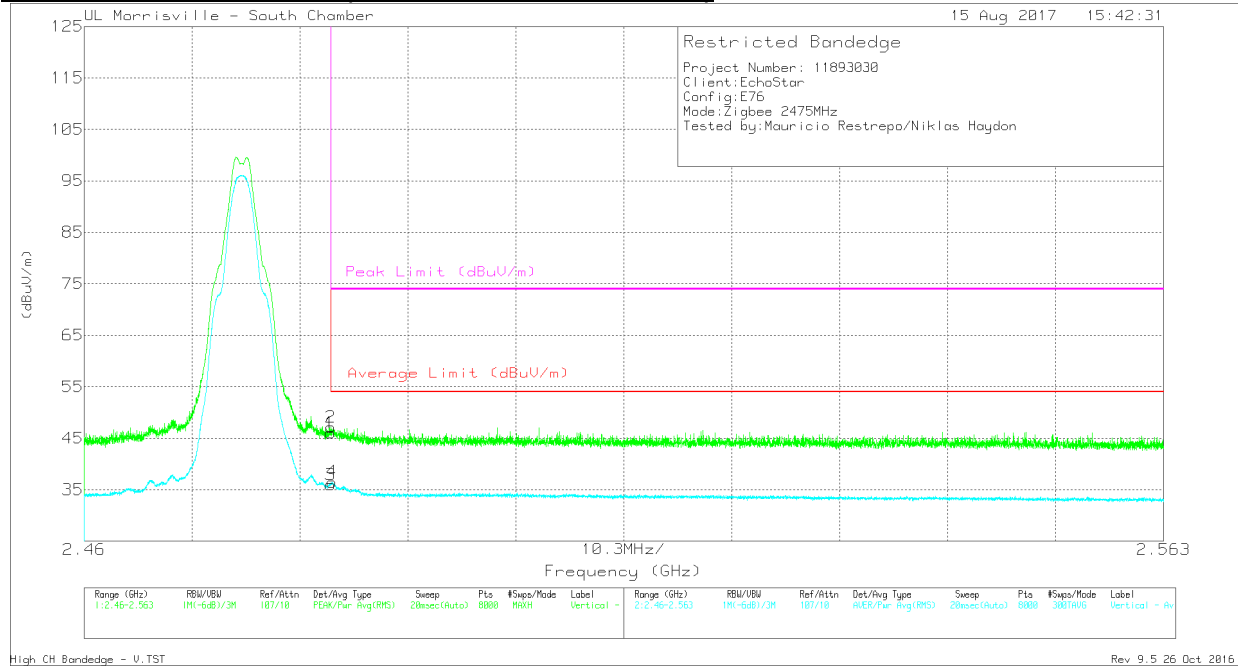
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	39.13	Pk	32.4	-24.6	46.93	-	-	74	-27.07	102	111	H
2	* 2.484	40.25	Pk	32.4	-24.6	48.05	-	-	74	-25.95	102	111	H
3	* 2.484	29.6	RMS	32.4	-24.6	37.4	54	-16.6	-	-	102	111	H
4	* 2.484	29.93	RMS	32.4	-24.6	37.73	54	-16.27	-	-	102	111	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEGE (HIGH CHANNEL, VERTICAL)

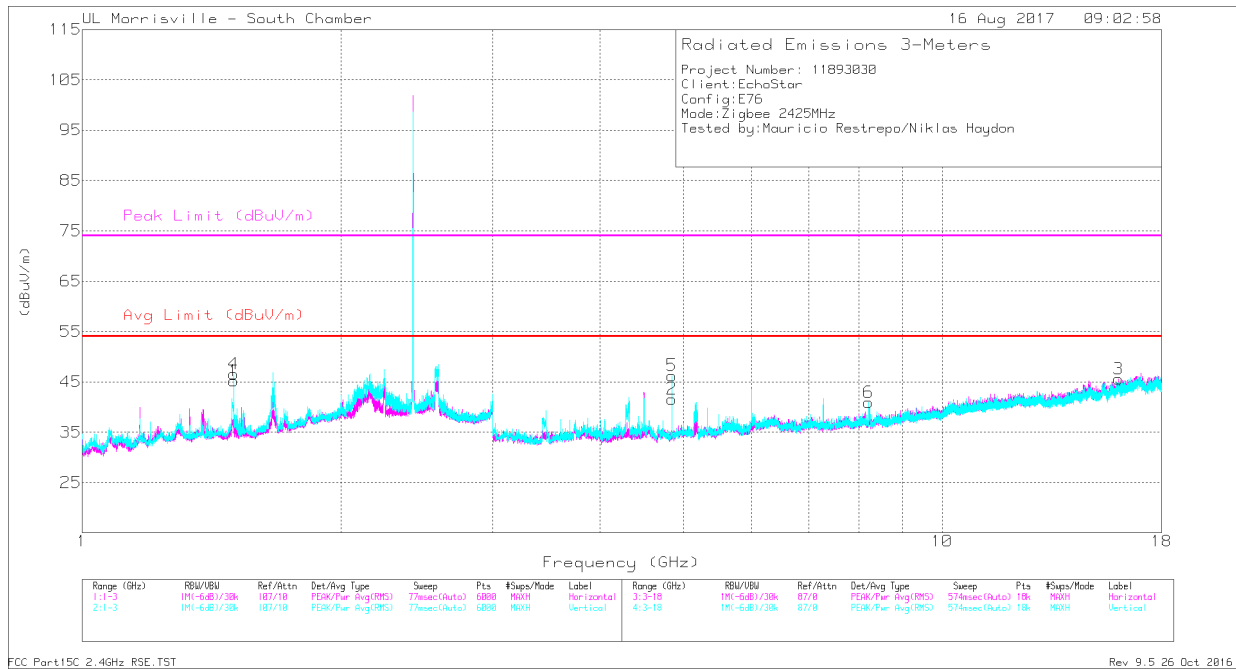


Marker	Frequency (GHz)	Meter Reading (dBUV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBUV/m)	Average Limit (dBUV/m)	Margin (dB)	Peak Limit (dBUV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	38.22	Pk	32.4	-24.6	46.02	-	-	74	-27.98	149	110	V
2	* 2.484	39.31	Pk	32.4	-24.6	47.11	-	-	74	-26.89	149	110	V
3	* 2.484	28.15	RMS	32.4	-24.6	35.95	54	-18.05	-	-	149	110	V
4	* 2.484	28.72	RMS	32.4	-24.6	36.52	54	-17.48	-	-	149	110	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 Pk - Peak detector
 RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL



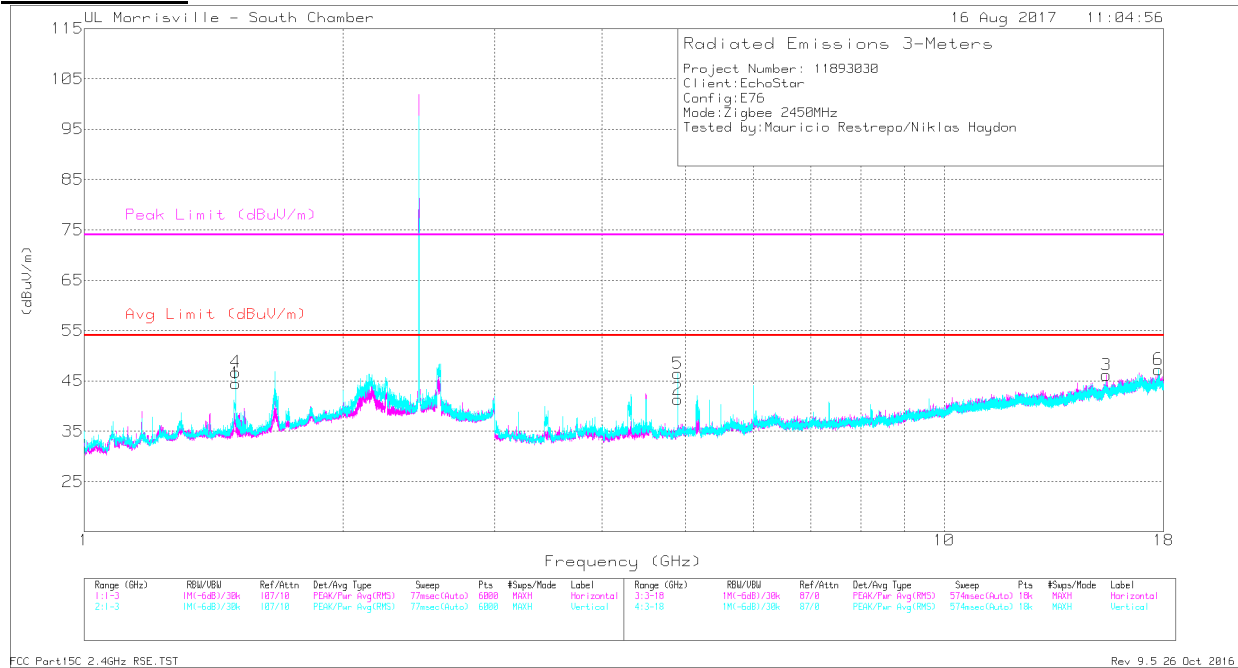
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.5	45.15	PK2	27.9	-22.5	50.55	-	-	74	-23.45	205	393	H
	* 1.5	40.42	MAv1	27.9	-22.5	45.82	54	-8.18	-	-	205	393	H
4	* 1.5	44.81	PK2	27.9	-22.5	50.21	-	-	74	-23.79	196	252	V
	* 1.5	40.66	MAv1	27.9	-22.5	46.06	54	-7.94	-	-	196	252	V
2	* 4.849	44.96	PK2	34	-31	47.96	-	-	74	-26.04	226	251	H
	* 4.85	36.98	MAv1	34	-31	39.98	54	-14.02	-	-	226	251	H
3	* 16.041	35.25	PK2	40.7	-24.5	51.45	-	-	74	-22.55	129	126	H
	* 16.042	23.88	MAv1	40.7	-24.5	40.08	54	-13.92	-	-	129	126	H
5	* 4.85	48.06	PK2	34	-31	51.06	-	-	74	-22.94	230	189	V
	* 4.85	42.03	MAv1	34	-31	45.03	54	-8.97	-	-	230	189	V
6	* 8.209	40.95	PK2	35.7	-27.6	49.05	-	-	74	-24.95	206	209	V
	* 8.21	26.39	MAv1	35.7	-27.6	34.49	54	-19.51	-	-	206	209	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

MID CHANNEL



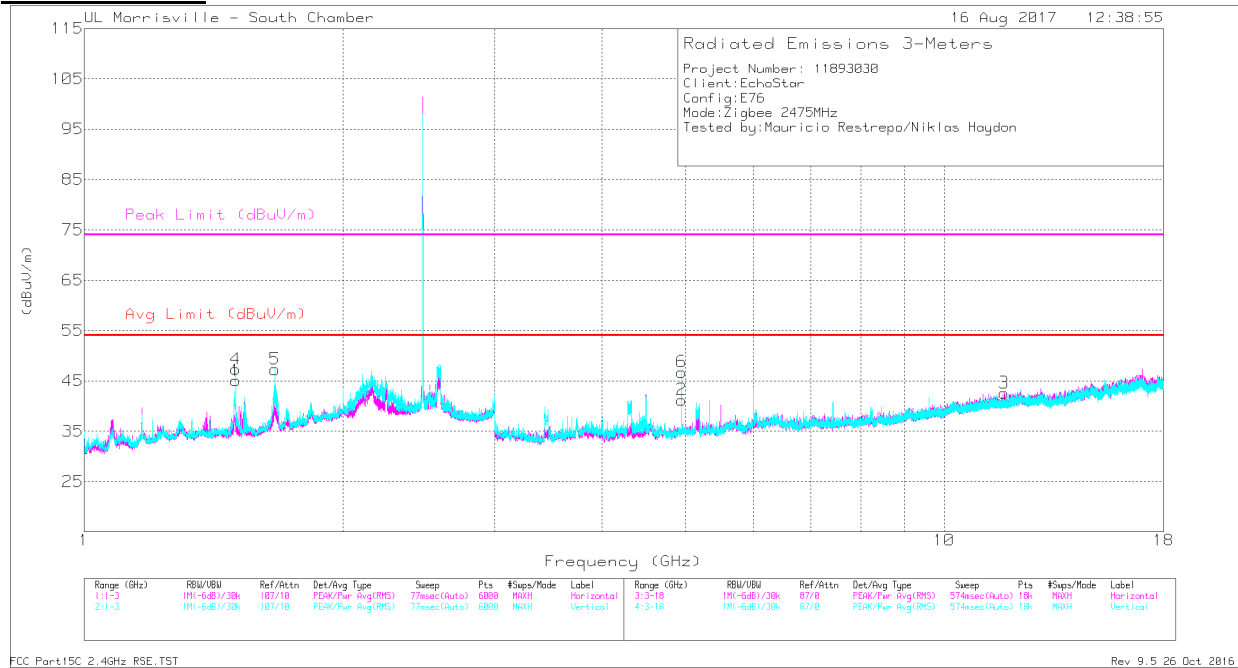
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.5	43.85	PK2	27.9	-22.5	49.25	-	-	74	-24.75	73	336	H
	* 1.5	39.79	MAv1	27.9	-22.5	45.19	54	-8.81	-	-	73	336	H
4	* 1.5	45.15	PK2	27.9	-22.5	50.55	-	-	74	-23.45	193	236	V
	* 1.5	41.04	MAv1	27.9	-22.5	46.44	54	-7.56	-	-	193	236	V
2	* 4.899	43.8	PK2	34	-31.2	46.6	-	-	74	-27.4	227	108	H
	* 4.899	36.42	MAv1	34	-31.2	39.22	54	-14.78	-	-	227	108	H
3	* 15.443	33	PK2	39.9	-22.6	50.3	-	-	74	-23.7	233	358	H
	* 15.443	21.99	MAv1	39.9	-22.6	39.29	54	-14.71	-	-	233	358	H
5	* 4.9	47.92	PK2	34	-31.2	50.72	-	-	74	-23.28	225	184	V
	* 4.9	41.83	MAv1	34	-31.2	44.63	54	-9.37	-	-	225	184	V
6	* 17.755	33.15	PK2	40.8	-22.1	51.85	-	-	74	-22.15	177	111	V
	* 17.754	21.59	MAv1	40.8	-22.1	40.29	54	-13.71	-	-	177	111	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

HIGH CHANNEL



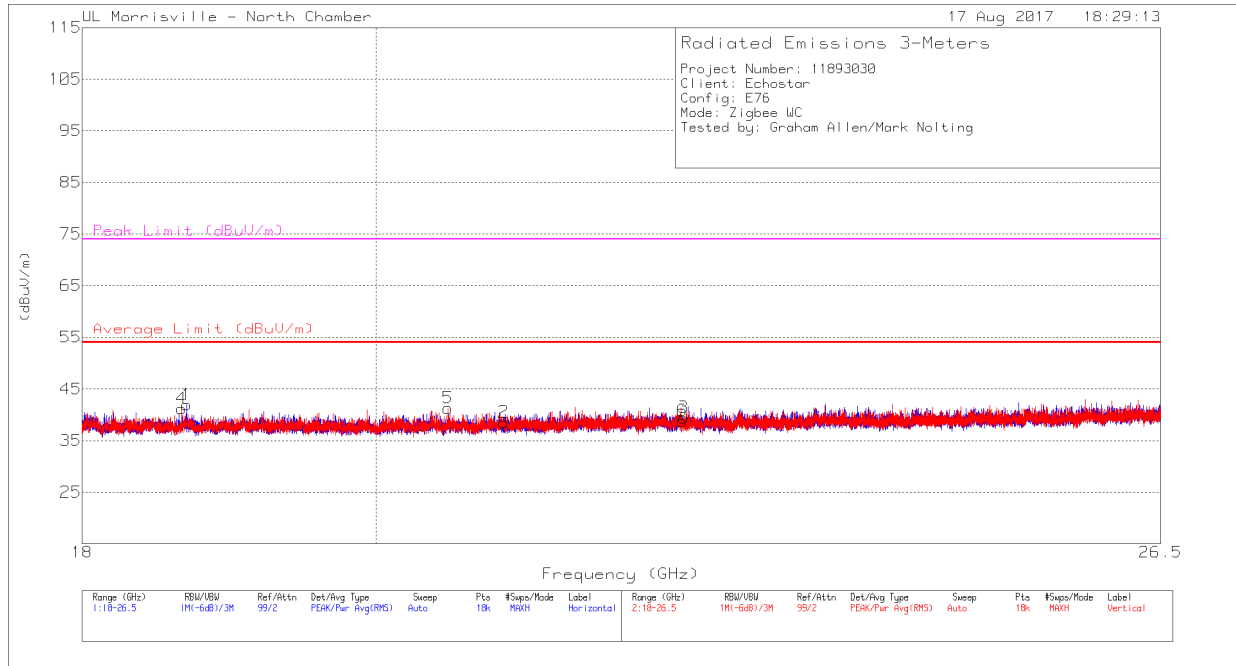
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0069 AF (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.5	43.8	PK2	27.9	-22.5	49.2	-	-	74	-24.8	61	324	H
	* 1.5	39.94	MAv1	27.9	-22.5	45.34	54	-8.66	-	-	61	324	H
2	* 4.95	44.74	PK2	34	-31.2	47.54	-	-	74	-26.46	228	222	H
	* 4.95	37.47	MAv1	34	-31.2	40.27	54	-13.73	-	-	228	222	H
3	* 11.738	34.23	PK2	38.5	-24.4	48.33	-	-	74	-25.67	236	102	H
	* 11.738	22.41	MAv1	38.5	-24.4	36.51	54	-17.49	-	-	236	102	H
4	* 1.5	44.87	PK2	27.9	-22.5	50.27	-	-	74	-23.73	196	238	V
	* 1.5	40.89	MAv1	27.9	-22.5	46.29	54	-7.71	-	-	196	238	V
5	* 1.667	49.83	PK2	28.7	-22.1	56.43	-	-	74	-17.57	207	342	V
	* 1.667	39.62	MAv1	28.7	-22.1	46.22	54	-7.78	-	-	207	342	V
6	* 4.95	48.73	PK2	34	-31.2	51.53	-	-	74	-22.47	228	184	V
	* 4.95	42.11	MAv1	34	-31.2	44.91	54	-9.09	-	-	228	184	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - Maximum Peak

MAv1 - Maximum RMS Average

SPURIOUS EMISSIONS 18 to 26 GHz (WORST-CASE CONFIGURATION, VERTICAL)



Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0076 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 18.686	49	PK2	32.7	-40.6	41.1	54	-12.9	74	-32.9	177	200	H
2	* 20.938	49.02	PK2	33.3	-41.3	41.02	54	-12.98	74	-32.98	356	163	H
3	* 22.335	48.34	PK2	33.6	-40.9	41.04	54	-12.96	74	-32.96	11	191	H
4	* 18.655	49.06	PK2	32.7	-40.8	40.96	54	-13.04	74	-33.04	90	156	V
5	* 20.521	49.79	PK2	33.1	-41.3	41.59	54	-12.41	74	-32.41	6	356	V
6	* 22.322	48.79	PK2	33.6	-40.9	41.49	54	-12.51	74	-32.51	239	292	V

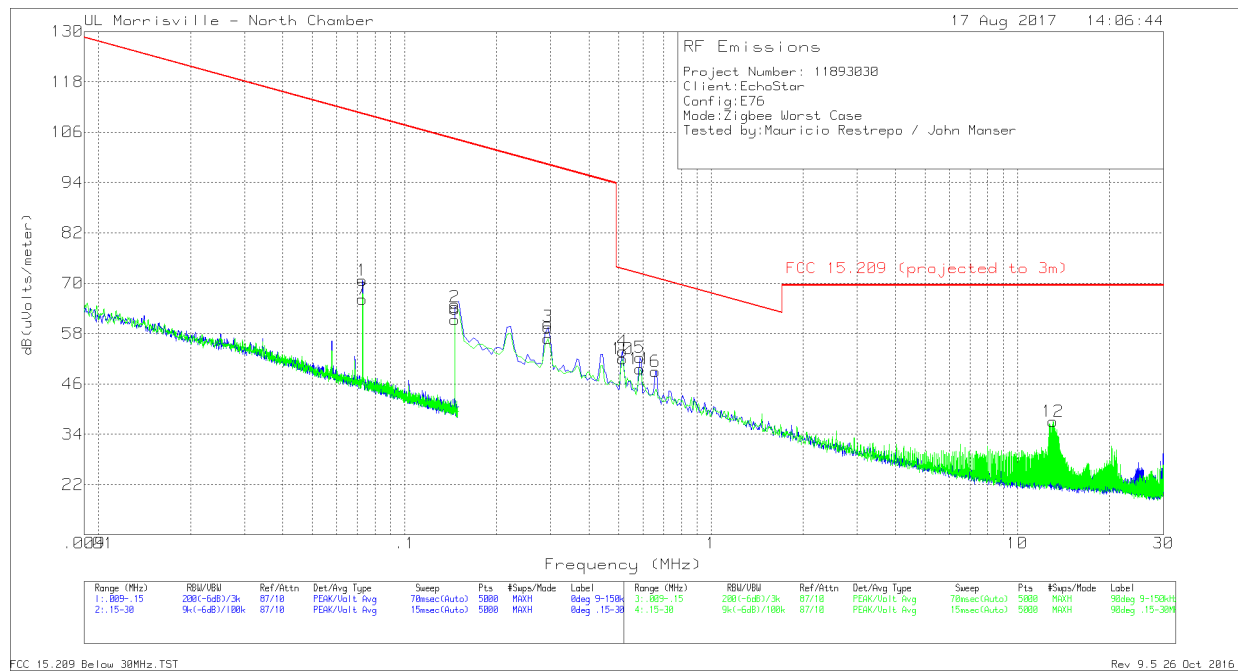
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
 PK2 - Maximum Peak
 MAv1 - Maximum RMS Average

9.3. WORST-CASE BELOW 1GHz

SPURIOUS EMISSIONS 9 kHz TO 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were $40 \cdot \log(\text{specification distance} / \text{test distance})$ per FCC 15.31 (f) (2).

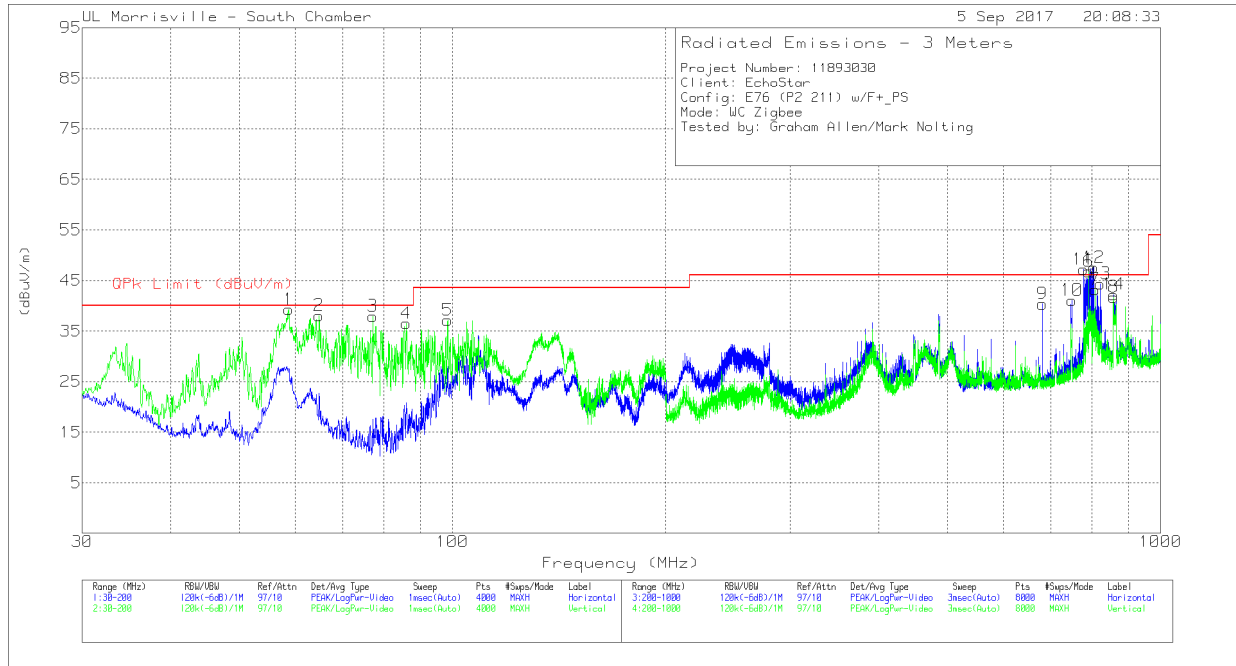
Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)
7	.07284	54.9	Pk	11.2	.1	66.2	110.36	-44.16	0-360
1	.0729	59.39	Pk	11.2	.1	70.69	110.35	-39.66	0-360
2	.14572	53.39	Pk	10.8	.1	64.29	104.33	-40.04	0-360
8	.14572	50.42	Pk	10.8	.1	61.32	104.33	-43.01	0-360
3	.2933	48.89	Pk	10.6	.1	59.59	98.26	-38.67	0-360
9	.2933	46.1	Pk	10.6	.1	56.8	98.26	-41.46	0-360
4	.51423	42.86	Pk	10.8	.1	53.76	73.38	-19.62	0-360
10	.51423	41.05	Pk	10.8	.1	51.95	73.38	-21.43	0-360
5	.58588	41.37	Pk	10.8	.1	52.27	72.25	-19.98	0-360
11	.58588	38.7	Pk	10.8	.1	49.6	72.25	-22.65	0-360
6	.65754	38.2	Pk	10.7	.1	49	71.25	-22.25	0-360
12	13.0593	26.04	Pk	10.4	.6	37.04	69.54	-32.5	0-360

Pk - Peak detector

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



Markers	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Qpk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
9	680.5825	26.61	Qp	24.6	-28.4	22.81	46.02	-23.21	168	126	H
10	749.7873	42.16	Qp	25.3	-28	39.46	46.02	-6.56	278	208	H
11	777.5512	35.36	Qp	25.8	-27.9	33.26	46.02	-12.76	31	246	H
12	804.7886	38.63	Qp	26.1	-27.7	37.03	46.02	-8.99	318	118	H
13	821.4288	32.16	Qp	26.5	-27.8	30.86	46.02	-15.16	26	316	H
14	858.3556	38.72	Qp	26.6	-27.4	37.92	46.02	-8.1	198	106	H
1	58.7449	55.89	Qp	11.8	-31.4	36.29	40	-3.71	277	124	V
2	64.813	54.2	Qp	12.2	-31.4	35	40	-5	218	128	V
3	77.2092	55.29	Qp	12.3	-31.3	36.29	40	-3.71	254	117	V
4	86.0305	53.77	Qp	11.6	-31.1	34.27	40	-5.73	222	152	V
5	98.4417	51.63	Qp	13.9	-31	34.53	43.52	-8.99	250	110	V
6	791.6069	30.56	Qp	25.7	-27.8	28.46	46.02	-17.56	242	348	V
7	808.4251	37.42	Qp	26.3	-27.9	35.82	46.02	-10.2	307	121	V
8	858.0885	40.45	Qp	26.6	-27.4	39.65	46.02	-6.37	280	125	V

Qp - Quasi-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.

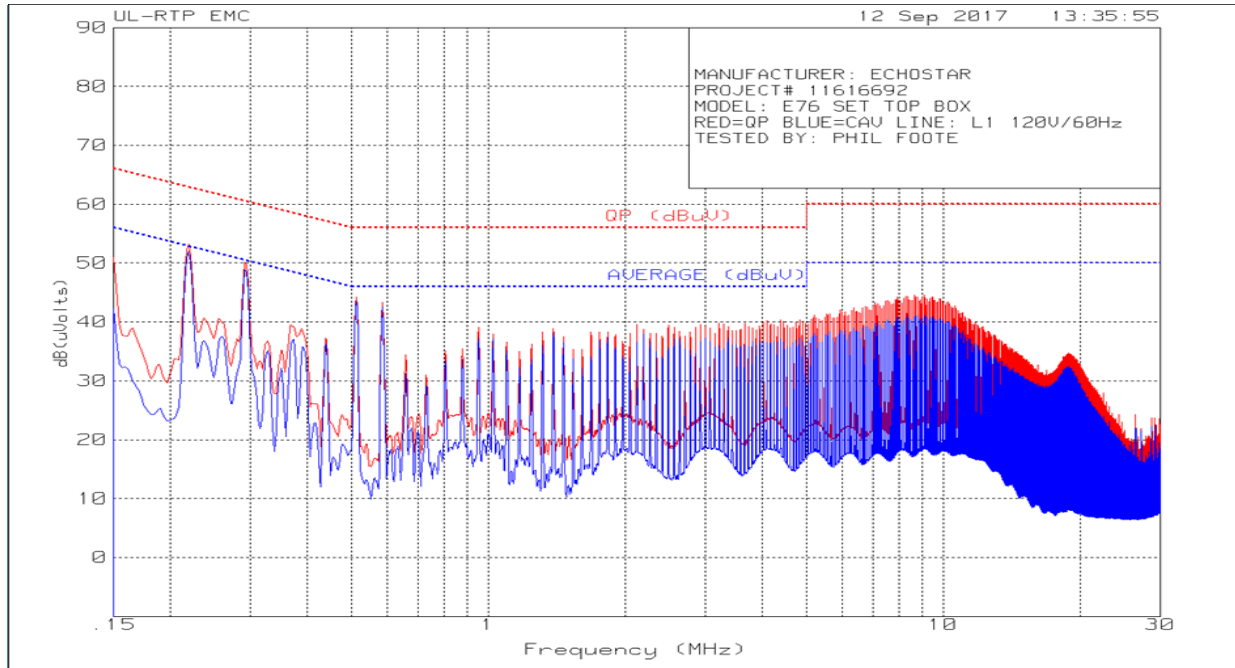
TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both lines 1 and 2.

LINE 1 RESULTS

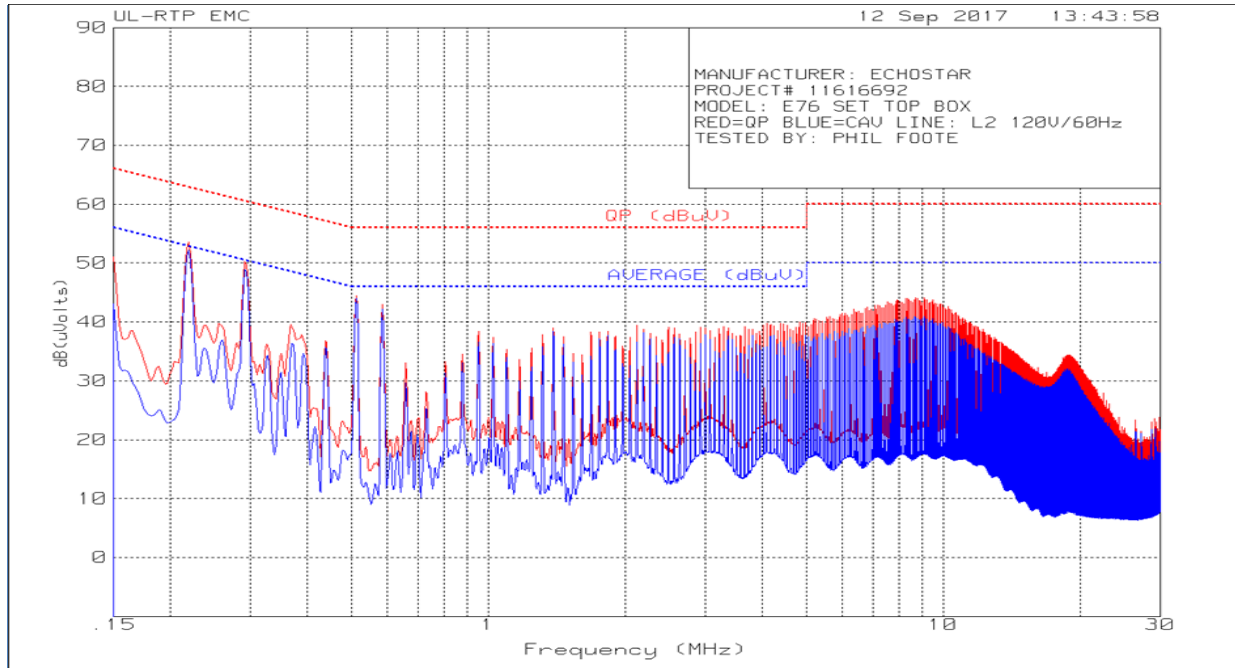


Frequency (MHz)	Meter Reading (dBuV)	Det	LISN002_DUE 2018-08-23	ATA508_509 DUE_2018-08-31	Corrected Reading dB(uVolts)	QP (dBuV)	Margin (dB)	AVERAGE (dBuV)	Margin (dB)
.21975	42.57	Ca	.2	9.2	51.97	-	-	52.83	-.86
.29175	39.56	Ca	.1	9.2	48.86	-	-	50.47	-1.61
.51225	34.39	Ca	.1	9.2	43.69	-	-	46	-2.31
.58425	33.22	Ca	.1	9.2	42.52	-	-	46	-3.48
9.07125	31.68	Ca	.1	9.4	41.18	-	-	50	-8.82
18.8745	22.71	Ca	.2	9.6	32.51	-	-	50	-17.49
.21975	43.83	Qp	.2	9.2	53.23	62.83	-9.6	-	-
.29175	40.87	Qp	.1	9.2	50.17	60.47	-10.3	-	-
.51225	34.93	Qp	.1	9.2	44.23	56	-11.77	-	-
.58425	34.06	Qp	.1	9.2	43.36	56	-12.64	-	-
9.07125	35.11	Qp	.1	9.4	44.61	60	-15.39	-	-
18.8745	24.93	Qp	.2	9.6	34.73	60	-25.27	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection

LINE 2 RESULTS



Frequency (MHz)	Meter Reading (dBuV)	Det	LISN002_DUE 2018-08-23	ATA508_509 DUE_2018-08-31	Corrected Reading dB(uVolts)	QP (dBuV)	Margin (dB)	AVERAGE (dBuV)	Margin (dB)
.21975	42.77	Ca	.2	9.2	52.17	-	-	52.83	-.66
.29175	39.58	Ca	.1	9.2	48.88	-	-	50.47	-1.59
.51225	34.72	Ca	.1	9.2	44.02	-	-	46	-1.98
.58425	32.84	Ca	.1	9.2	42.14	-	-	46	-3.86
8.77875	31.11	Ca	.1	9.4	40.61	-	-	50	-9.39
19.02075	21.75	Ca	.2	9.6	31.55	-	-	50	-18.45
.21975	44.14	Qp	.2	9.2	53.54	62.83	-9.29	-	-
.29175	40.93	Qp	.1	9.2	50.23	60.47	-10.24	-	-
.51225	35.18	Qp	.1	9.2	44.48	56	-11.52	-	-
.58425	33.67	Qp	.1	9.2	42.97	56	-13.03	-	-
8.77875	34.51	Qp	.1	9.4	44.01	60	-15.99	-	-
19.02075	24.56	Qp	.2	9.6	34.36	60	-25.64	-	-

Qp - Quasi-Peak detector

Ca - CISPR average detection