



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8**

**CLASS II PERMISSIVE CHANGE
TEST REPORT***

FOR

BROADCOM BLUETOOTH MODULE

MODEL NUMBER: BCM20736S, BCM20737S**

**FCC ID: QDS-BRCM1078
IC: 4324A-BRCM1078**

REPORT NUMBER: 14U18382-1, Revision C

ISSUE DATE: SEPTEMBER 2, 2014

Prepared for
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190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.**

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*Test items were selected based on client's test plan
**Models differences are explained in the body of this report



NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	08/14/14	Initial Issue	F. Ibrahim
A	08/15/14	Revised Section 1	F. Ibrahim
B	8/26/14	Revised Section 5	J. Gomez
C	9/2/14	Revised Section 8.2 and added set up photo	J. Wu

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.

EUT DESCRIPTION: BROADCOM BLUETOOTH MODULE

MODEL: BCM20737S

SERIAL NUMBER: 1869321A1(Conducted), 001A1(Radiated)

DATE TESTED: JULY 31 - AUGUST 07, 2014

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:



FRANK IBRAHIM
PROGRAM MANAGER
UL Verification Services Inc.

Tested By:



Jeffrey Wu
EMC LAB ENGINEER
UL Verification Services Inc.

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, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.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:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	± 3.52 dB
Radiated Disturbance, 30 to 1000 MHz	± 4.94 dB
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a BLE module.

The radio module is manufactured by Broadcom Corporation

5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

1. BCM20732S – Base Part; Basic BLE function in the original limited SIP certification.
2. BCM20736S – Adds Simultaneous Master Slave and A4WP to BCM20732S; All have the same circuit but with additional Software features. This change doesn't affect the radio parameters from base model BCM20732S.
3. BCM20737S – Adds RSA Security and NFC bridging capabilities to the BCM20736S. All have the same circuit but with additional Software features. This change doesn't affect the radio parameters from base model BCM20732S.

The BCM20736S has one HW change. It has a pin strap to ground to be used by software to distinguish between the BCM20736S and the BCM20737S. This pin strap does NOT affect any of the radio parameters.

5.3. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	BLE	2.54	1.79

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB antenna, with a maximum gain of -1.5 dBi.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was A_20738A1-bleloopback-rom-ram-spar_0x600218-0x7555_2

The test utility software used during testing was Broadcom Bluetool, ver. 1.8.1.7.

5.6. WORST-CASE CONFIGURATION AND MODE

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.

Radiated BE, radiated harmonics and spurious testing was performed at a power level that is equal to or higher than the power from the original project as covered by report number "13U15716-1C FCC IC BLE Report". Based on the client, other RF parameters are not affected.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Elitebook 2730p	2CE8487ZMT	Doc
AC Power Adapter	HP	PPP012L-S	W97920EBMW7SXXN	Doc
Laptop	Lenovo	G560	CB08584349	Doc
AC Power Adapter	Lenovo	ADP-65KH B	11S36001646ZZ10007G9RN	Doc
Interface Board	Broadcom	20732TAG	1746861	Doc

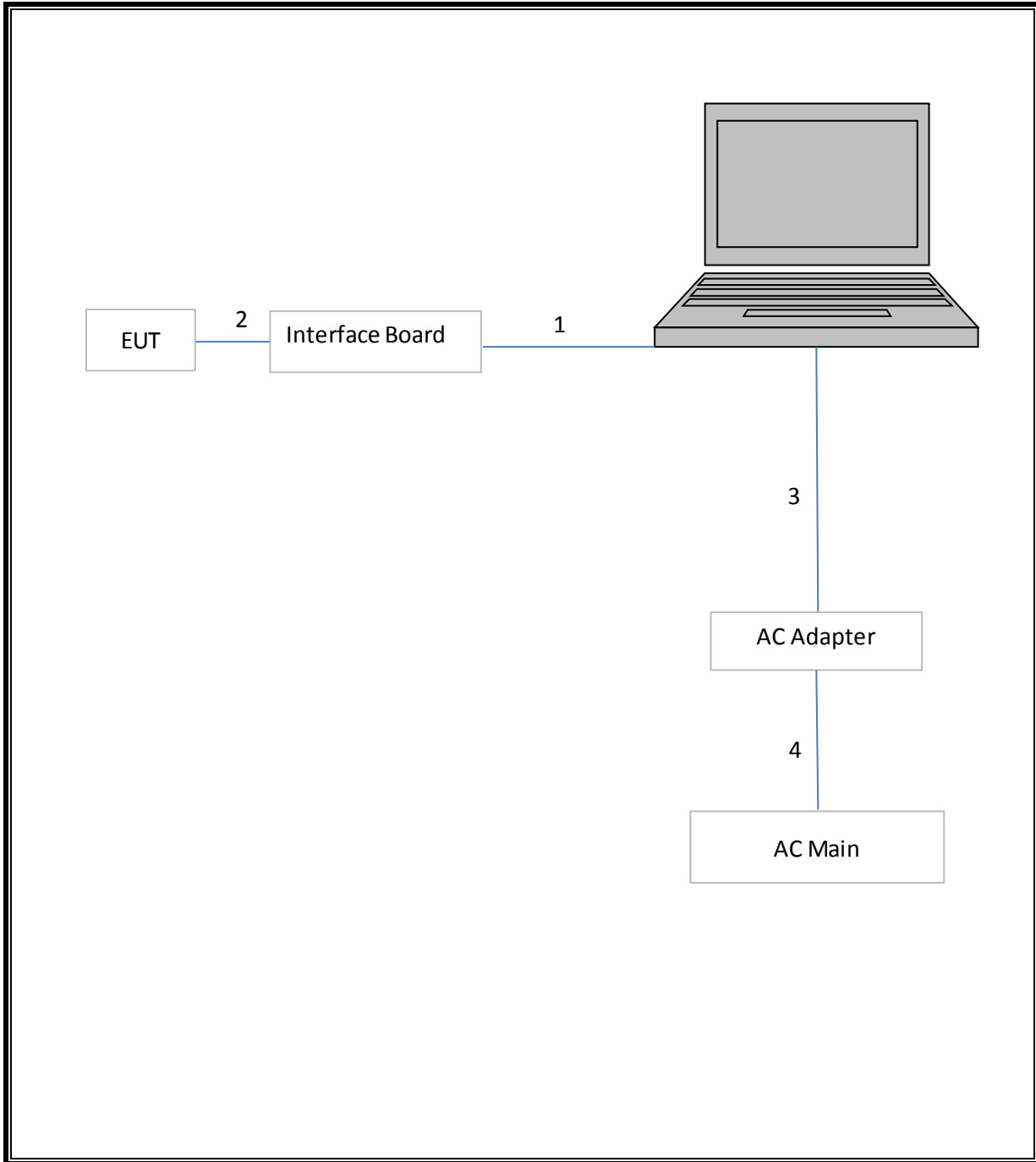
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB	1	USB	Unshielded	1.8m	N/A
2	JTAG	1	JTAG	Unshielded	0.3m	N/A
3	DC	1	DC	Unshielded	1.5m	N/A
4	AC	1	US 115V	Shielded	1.5m	N/A

TEST SETUP

The EUT is connected to an interface board via JTAG cables. The interface board is connected via USB to a laptop.

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 List					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Spectrum Analyzer, 44GHz	Agilent	E446A	T146	06/19/14	06/19/15
Spectrum Analyzer, PXA	Agilent	N9030A	T908	05/09/14	05/09/15
Antenna, Horn, 18GHz	ETS Lindgren	3117	C01022	02/28/14	02/28/15
Low Pass Filter, 5GHz	Micro-Tronics	LPS17541	F00219	01/11/14	01/11/15
High Pass Filter, 3GHz	Micro-Tronics	HPS17542	F00222	01/11/14	01/11/15
High Pass Filter, 5GHz	Micro-Tronics	HPS17543	F00224	01/11/14	01/11/15
RF PreAmplifier, 1-18GHz	Miteq	AFS42-00101800-25-S-42	F00350	01/11/14	01/11/15
Peak Power Meter	Agilent	N1911A	F00052	10/04/13	10/04/14
Peak/Average Power Sensor	Agilent	E9327A	C00964	12/24/14	12/14/15

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

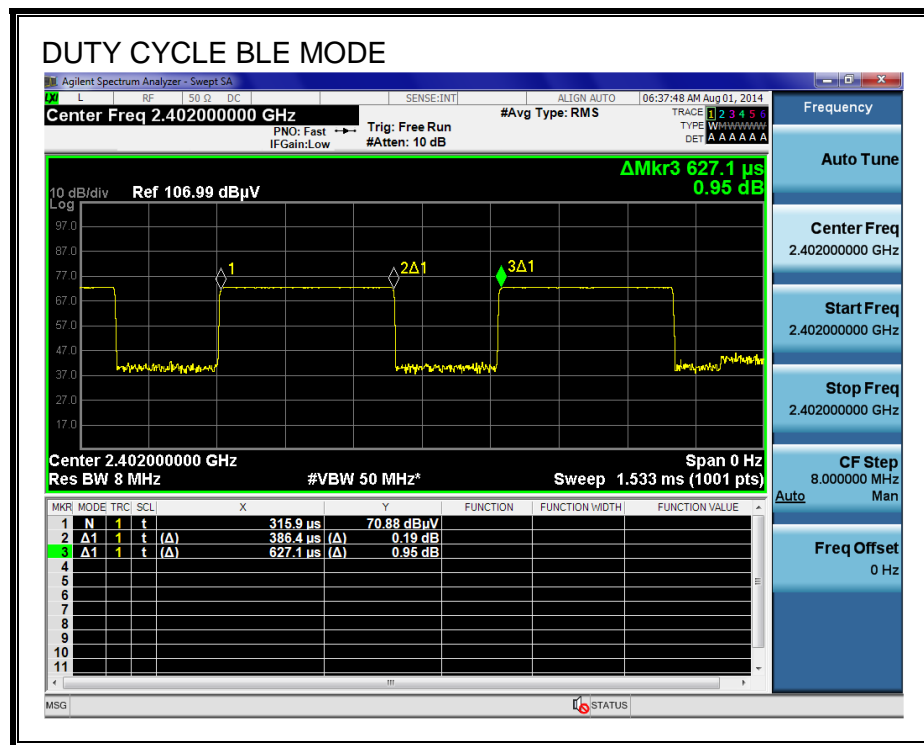
None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

7.2. 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)
BLE	0.3864	0.6271	0.616	61.62%	2.10	2.588



7.3. MEASUREMENT METHODS

Output Power: KDB 558074 D01 v03r02, Section 9.1.1.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r02, Section 12.1.

7.4. OUTPUT POWER

LIMITS

FCC §15.247 (b)

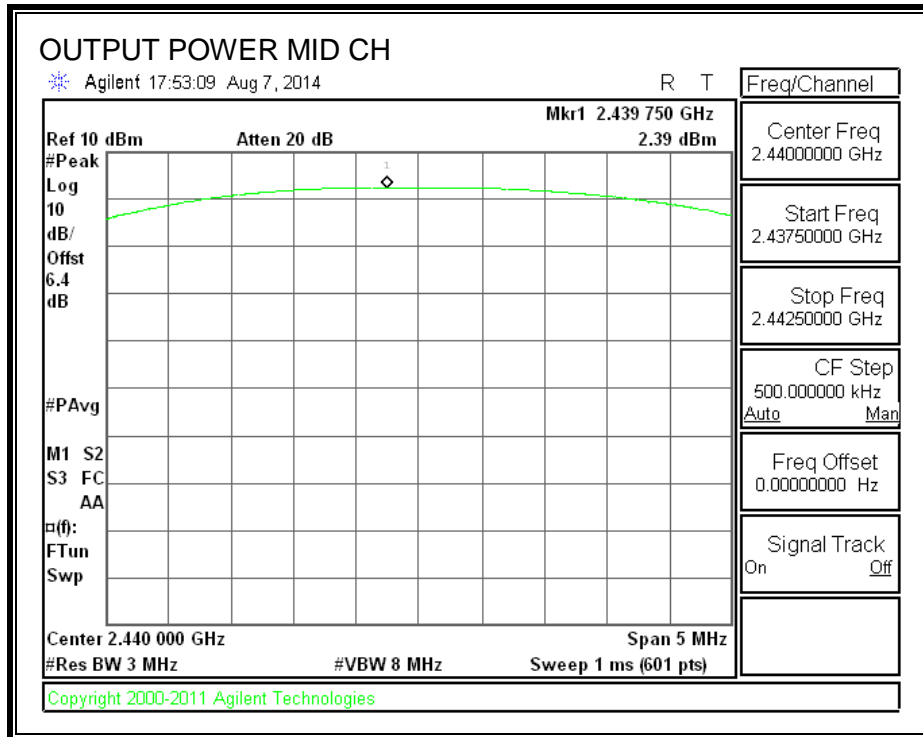
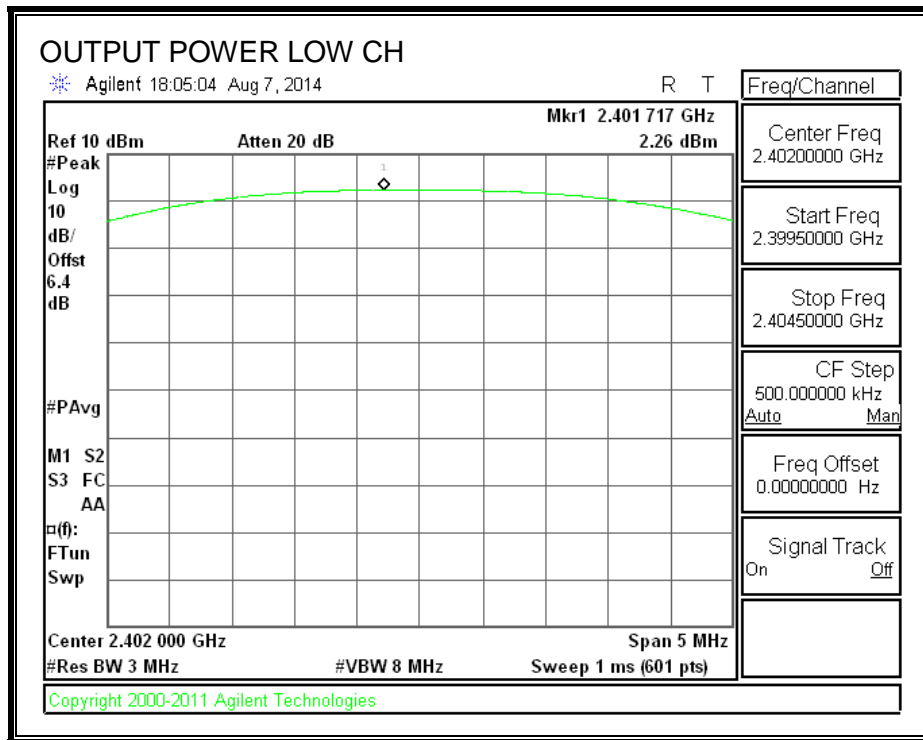
IC RSS-210 A8.4

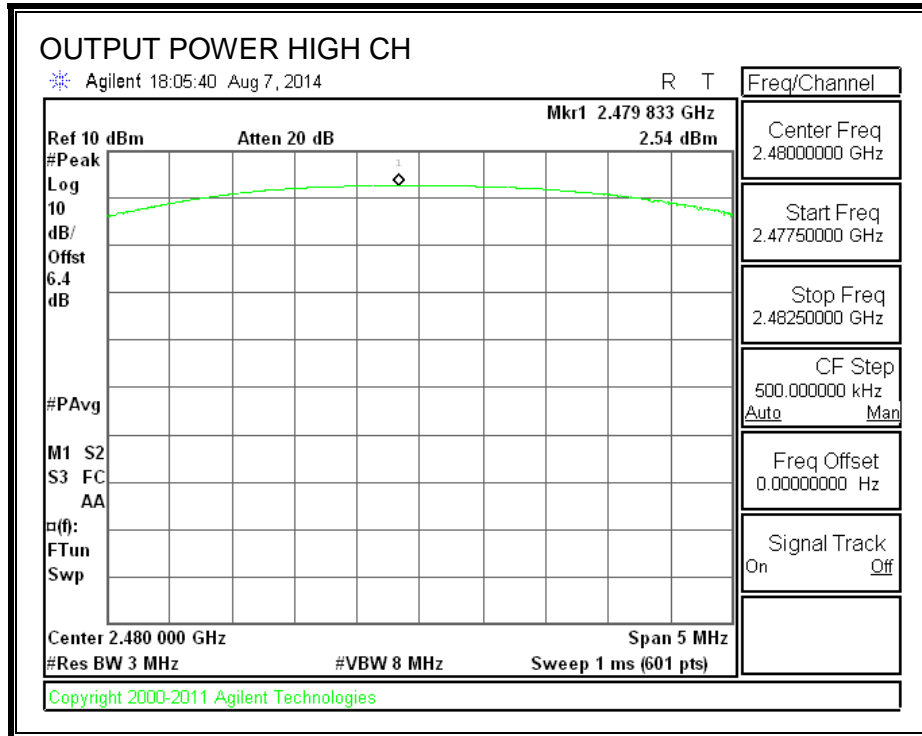
The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.26	30	-27.74
Middle	2440	2.39	30	-27.61
High	2480	2.54	30	-27.46

OUTPUT POWER





7.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 6.4 dB (including 6 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.45
Middle	2440	1.59
High	2480	1.72

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

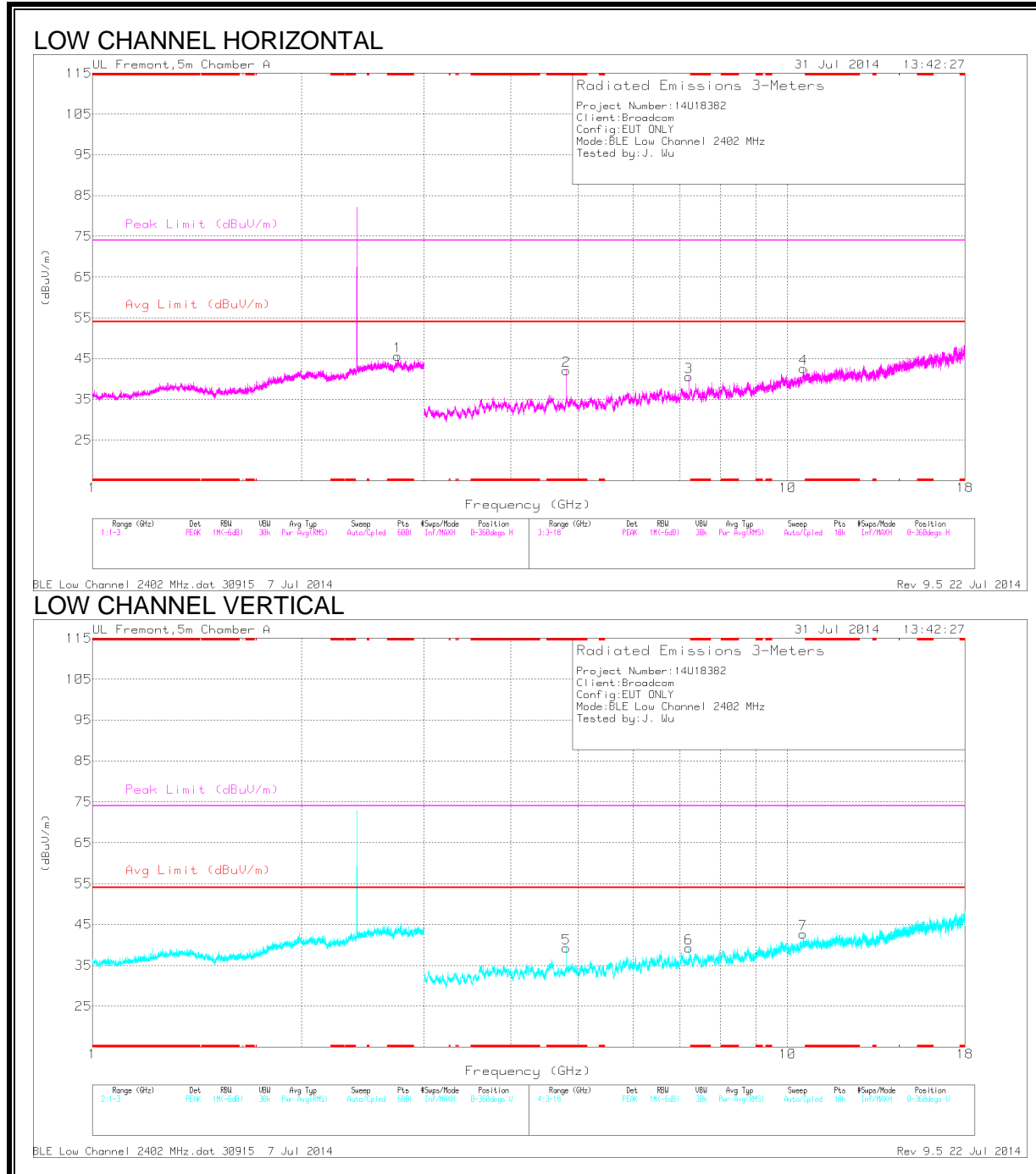
IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

8.2. TRANSMITTER ABOVE 1 GHz

HARMONICS AND SPURIOUS EMISSIONS

As the worst case tests because no other emissions found from original compliance report and new changes do not affect RF parameters



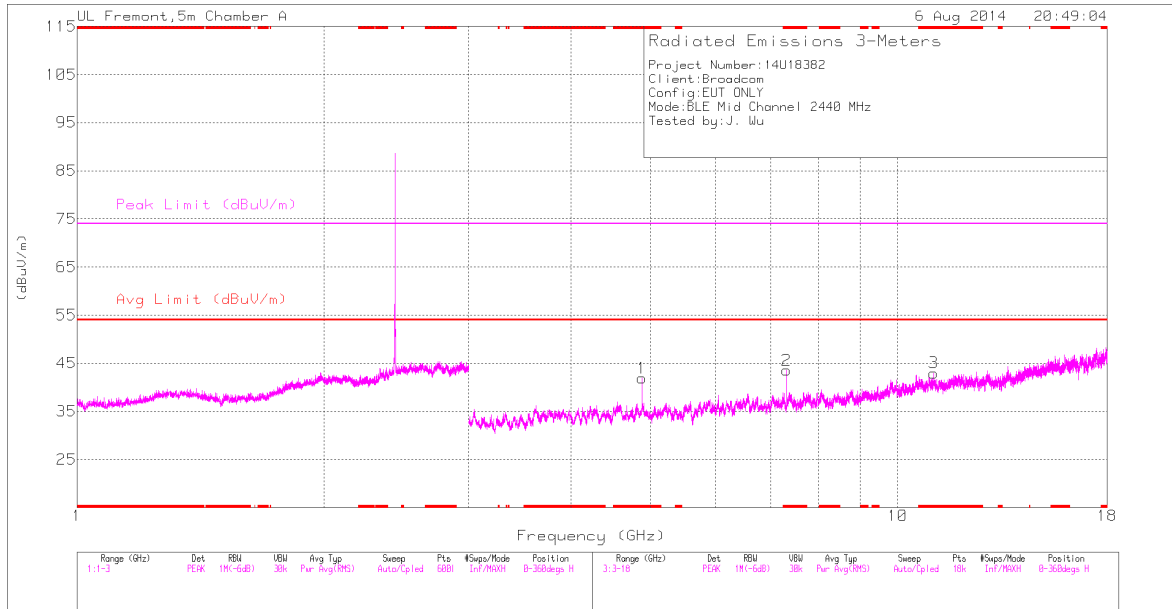
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cb/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.747	37.36	PK2	32.7	-22.6	0	47.46	-	-	74	-26.54	223	276	H
	* 2.747	29.88	MAv1	32.7	-22.7	2.1	41.98	54	-12.02	-	-	223	276	H
2	* 4.805	44.85	PK2	34	-30	0	48.85	-	-	74	-25.15	173	304	H
	* 4.804	37.43	MAv1	34	-30	2.1	43.53	54	-10.47	-	-	173	304	H
5	* 4.804	42.77	PK2	34	-30	0	46.77	-	-	74	-27.23	207	391	V
	* 4.804	34.38	MAv1	34	-30	2.1	40.48	54	-13.52	-	-	207	391	V
7	10.525	26.44	PK	37.5	-21.3	0	42.64	-	-	-	-	0-360	100	V
4	10.54	26.43	PK	37.6	-21.5	0	42.53	-	-	-	-	0-360	100	H
3	7.205	32.47	PK	35.2	-27.1	0	40.57	-	-	-	-	0-360	201	H
6	7.206	31.15	PK	35.2	-27.1	0	39.25	-	-	-	-	0-360	201	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector
 PK2 - KDB558074 Method: Maximum Peak
 MAv1 - KDB558074 Option 1 Maximum RMS Average

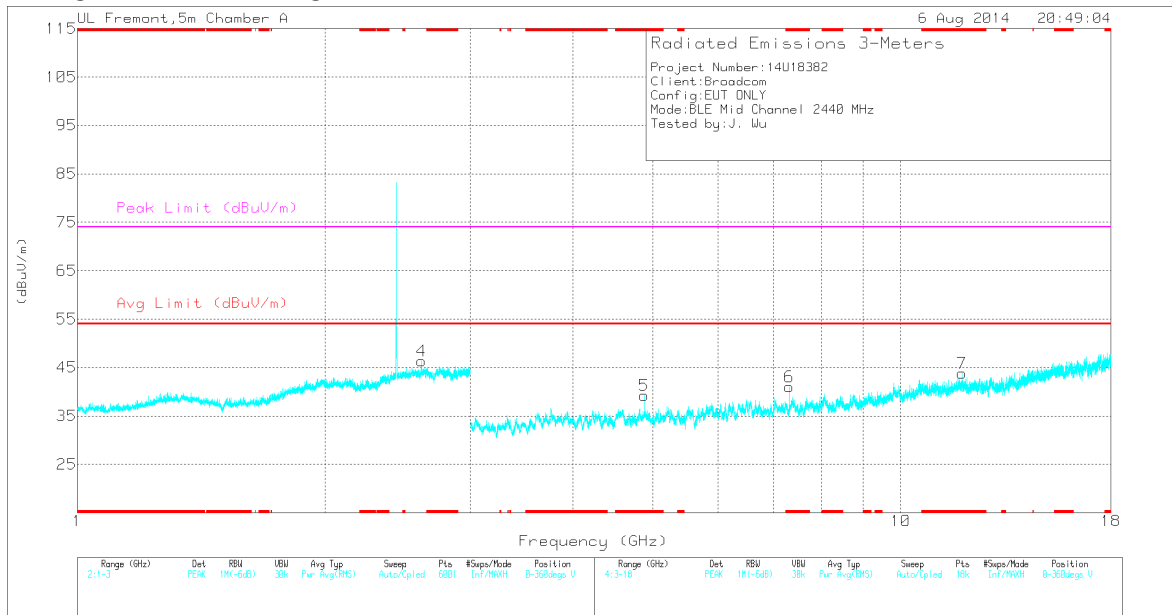
MID CHANNEL HORIZONTAL



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Rev 9.5 22 Jul 2014

MID CHANNEL VERTICAL



FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 7 Jul 2014

Rev 9.5 22 Jul 2014

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cb/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.88	43.16	PK2	34	-28.2	0	48.96	-	-	74	-25.04	65	272	H
	* 4.88	35.97	MAv1	34	-28.2	2.1	43.87	54	-10.13	-	-	65	272	H
2	* 7.321	40.89	PK2	35.2	-26.6	0	49.49	-	-	74	-24.51	18	350	H
	* 7.319	31.06	MAv1	35.2	-26.7	2.1	41.66	54	-12.34	-	-	18	350	H
3	* 11.052	33.12	PK2	37.7	-21.5	0	49.32	-	-	74	-24.68	253	272	H
	* 11.055	22.03	MAv1	37.7	-21.5	2.1	40.33	54	-13.67	-	-	253	272	H
5	* 4.88	42.49	PK2	34	-28.2	0	48.29	-	-	74	-25.71	139	335	V
	* 4.88	34.85	MAv1	34	-28.2	2.1	42.75	54	-11.25	-	-	139	335	V
6	* 7.321	39.44	PK2	35.2	-26.6	0	48.04	-	-	74	-25.96	45	258	V
	* 7.319	29.37	MAv1	35.2	-26.7	2.1	39.97	54	-14.03	-	-	45	258	V
7	* 11.876	32.99	PK2	38.8	-22	0	49.79	-	-	74	-24.21	219	375	V
	* 11.873	22.03	MAv1	38.8	-22	2.1	40.93	54	-13.07	-	-	219	375	V
4	** 2.62	36.62	PK	32.9	-23.2	0	46.32	-	-	-	-	0-360	100	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

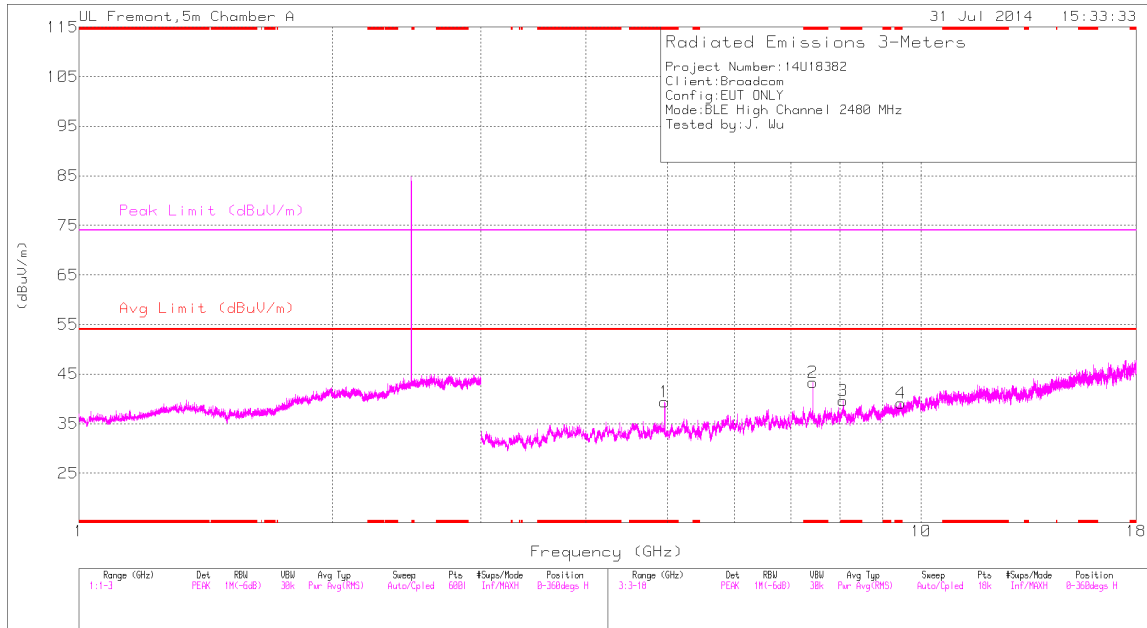
** - indicates frequency in authorized band

PK - Peak detector

PK2 - KDB558074 Method: Maximum Peak

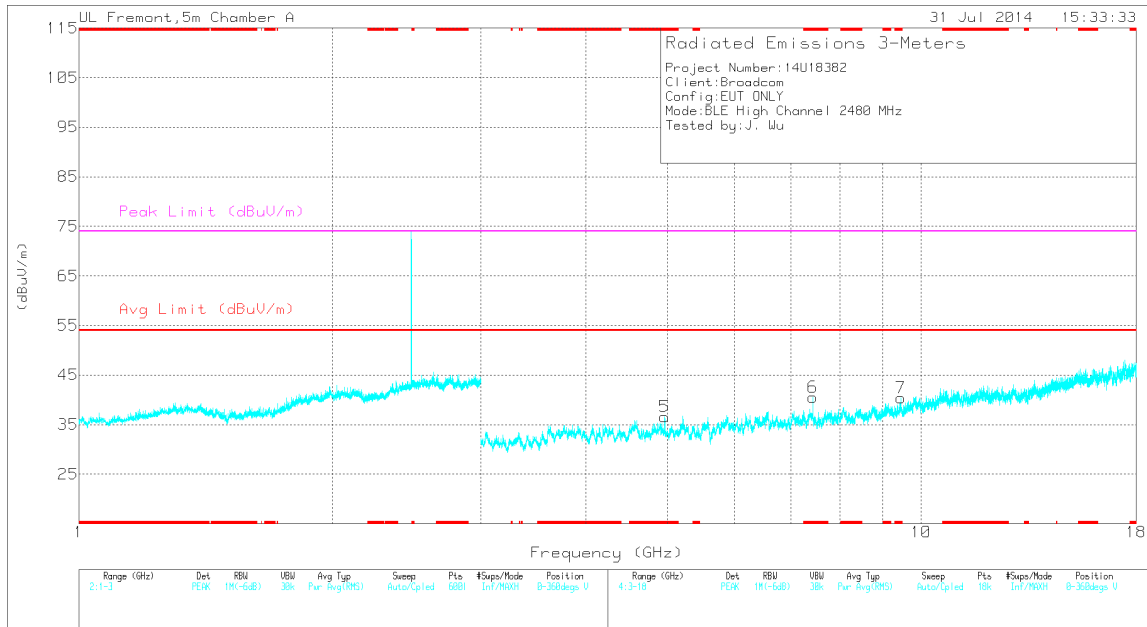
MAv1 - KDB558074 Option 1 Maximum RMS Average

HIGH CHANNEL HORIZONTAL



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HIGH CHANNEL VERTICAL



FCC Part15 Subpart C 2400MHz Spurious Emissions with Average Scan.TST 30915 7 Jul 2014 Rev 9.5 22 Jul 2014

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cb/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.959	41.71	PK2	33.9	-29.7	0	45.91	-	-	74	-28.09	250	282	H
	* 4.96	33.93	MAv1	33.9	-29.7	2.1	40.23	54	-13.77	-	-	250	282	H
2	* 7.439	39	PK2	35.3	-25.8	0	48.5	-	-	74	-25.5	69	289	H
	* 7.439	29.77	MAv1	35.3	-25.8	2.1	41.37	54	-12.63	-	-	69	289	H
3	* 8.069	35.08	PK2	35.5	-24	0	46.58	-	-	74	-27.42	65	146	H
	* 8.069	23.5	MAv1	35.5	-24	2.1	37.1	54	-16.9	-	-	65	146	H
4	* 9.456	34.32	PK2	36.5	-23	0	47.82	-	-	74	-26.18	168	145	H
	* 9.454	22.43	MAv1	36.5	-23.1	2.1	37.93	54	-16.07	-	-	168	145	H
5	* 4.96	40.96	PK2	33.9	-29.7	0	45.16	-	-	74	-28.84	3	328	V
	* 4.96	32.18	MAv1	33.9	-29.7	2.1	38.48	54	-15.52	-	-	3	328	V
6	* 7.441	39.21	PK2	35.3	-25.8	0	48.71	-	-	74	-25.29	123	261	V
	* 7.439	29.48	MAv1	35.3	-25.8	2.1	41.08	54	-12.92	-	-	123	261	V
7	* 9.464	33.81	PK2	36.5	-23.5	0	46.81	-	-	74	-27.19	274	316	V
	* 9.458	22.46	MAv1	36.5	-23	2.1	38.06	54	-15.94	-	-	274	316	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector
 PK2 - KDB558074 Method: Maximum Peak
 MAv1 - KDB558074 Option 1 Maximum RMS Average