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

CERTIFICATION TEST REPORT

FOR

WIRELESS ECG FOR PATIENT MONITORING IN MRI ENVIRONMENTS

MODEL NUMBER: wECG (REF 989803192761 and REF 989803194341)

FCC ID: S6W3GECG
IC: 6331A-3GECG

REPORT NUMBER: R10608232-RF5

ISSUE DATE: 2015-04-06

Prepared for
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Revision History

Rev.	Issue Date	Revisions	Revised By
--	2015-03-11	Initial Issue	Jeff Moser
1	2015-03-30	Revised Spurious emissions data to include calculated average data per FCC 15.35c. Revised 'P/N' to 'REF' for the wECG model designations.	Jeff Moser
2	2015-04-02	Revised to add 20 dB bandwidth plots and additional Duty Cycle information.	Jeff Moser
3	2015-04-06	Revised to include maximum Average Field strength on page 8.	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: INVIVO CORP.
12501 RESEARCH PARKWAY
ORLANDO, FL, 32826, USA

EUT DESCRIPTION: WIRELESS ECG FOR PATIENT MONITORING IN MRI ENVIRONMENTS

MODEL: wECG (REF 989803192761 and REF 989803194341)

SERIAL NUMBER: SG00000044 and Non-serialized Unit

DATE TESTED: 2015-01-14 to 2015-03-04, 2015-04-02

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 2	Pass
INDUSTRY CANADA RSS-GEN Issue 4	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:

Bart Mucha
EMC Staff Engineer
UL – Consumer Technology Division

Prepared By:

Jeff Moser
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UL – Consumer Technology Division

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-210 Issue 8.

Test Deviations – Test Site validation for radiated measurements above 1GHz used ANSI C63.4:2003. The EUT height for measurements above 1GHz was 0.8m.

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.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☒ Chamber C

The onsite chambers (A & C) are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-2, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2002460.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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

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

Test	Uncertainty
Conducted Emissions (0.150-30MHz)	+/- 2.37 dB
Radiated Emissions (30-1000 MHz)	+/- 6.04 dB (3m)
Radiated Emissions (1-6 GHz)	+/- 5.96 dB
Radiated Emissions (6-18 GHz)	+/- 6.10 dB
Radiated Emissions (18-26 GHz)	+/- 6.81 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT, wECG p/n 989803192761 and 989803194341 are wireless ECG modules that are part of the MR400 Patient Monitoring Device for MRI Environments. The wECG contains a custom designed radio that is DSSS, operating under a GFSK modulation.

The custom radio contains a radio chip for the ECG communication (2435-2480 MHz). The radio module contains a chip antenna with a 1.6 dBi gain.

The only difference between the REF 989803192761 and 989803194341 are the operating frequencies:

Color codes	
	Low Frequency
	Mid Frequency
	High Frequency

3rd generation ECG module

****Frequency list below is forward channel (i.e. ECG transmit, MR400 receive)**

Network	Primary	Secondary	
1	2453.0	2461.0	**Part Number:**
2	2455.0	2463.0	**989803192761**
3	2454.0	2462.0	
4	2458.0	2466.0	**Description:**
5	2472.0	2480.0	**Wireless ECG Patient Module (Gen 3) 1-5**
6	2436	2444	**Part Number:**
7	2437	2445	**989803194341**
8	2440	2448	
9	2435	2443	**Description:**
10	2469	2477	**Wireless ECG Patient Module (Gen 3) 6-10**

No other differences exist between the two modules. The devices use the same schematic design, PCB layout and software.

Note – The module was originally intended to accommodate all 10 network channels. However, the module has 5 Network Channel ID LEDs for the user. Due to this, Invivo created two parts numbers to maintain the 5 Network Channel ID LEDS. P/N 989803192761 will host Networks 1-5 and P/N 989803194341 will host Networks 6-10. The tested unit accommodates all 10 networks.

5.2. MAXIMUM OUTPUT E-FIELD STRENGTH

The transmitter has a maximum output peak E-field as follows:

Frequency Range (MHz)	Mode	PEAK Output E-field Strength (dBuV/m)	AVERAGE Output E-field Strength (dBuV/m)
2435-2480	GFSK	92.71	75.55

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

This radio utilizes a chip antenna, manufactured by Mitsubishi (model AH11DG) and has an antenna gain of 1.6 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was FW031 version 00.01.03 and FW040 version 00.00.01.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate is determined to be as follows, based on input from the manufacturer of the radio.

All final tests in the GFSK mode were made at 1 Mb/s.

For radiated emissions below 1 GHz and 18-26 GHz, the worst-case configuration is determined to be the mode and channel with the highest field strength.

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

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Use*	Product Type	Manufacturer	Model	Comments
EUT	Wireless ECG Patient Module (Gen 3)	Invivo, a division of Philips Medical Systems	989803192761/ 989803194341	Conducted: S/N - SG00000044 Radiated: S/N - Non serialized

Note: * Use one of the following:
EUT - Equipment Under Test
AE - Auxiliary/Associated Equipment
SIM - Simulator (Not Subjected to Test) *Note: Use abbreviations:

I/O CABLES

Port No.	Name	Type*	Cable Max. >3m	Cable Shielded	Comments
0	Enclosure	N/E	—	—	None
1	ECG	I/O	N	N	(989803193721) Expression MR ECG leads, AAMI, CV

*Note: AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

TEST SETUP

The EUT has test software loaded during the test that allows it to operate in a modulated carrier mode at the low, mid and high frequencies in the band.

SETUP DIAGRAM FOR TESTS

6. TEST AND MEASUREMENT EQUIPMENT

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

Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
SA0020	Spectrum Analyzer	Agilent Technologies	E4446A	2015-02-26	2016-02-29
MM0150	Digital Multimeter, 4½ Digit (True RMS AC, AC+DC measurement)	Agilent	U1252A	2014-09-04	2016-09-30
MM0151	Digital Multimeter, 4½ Digit (True RMS AC, AC+DC measurement)	Agilent	U1252A	2014-09-04	2016-09-30
HI0041	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-02-19	2015-02-28
HI0069	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-06-27	2015-06-30

Radiated Disturbance Emissions (E-field) – Chamber C

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0066	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB1	2014-07-10	2015-07-31
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2014-02-19	2015-02-28
	18-40 GHz (calibrated as set)				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2014-07-23	2015-07-31
	Gain-Loss Chains				
SAC_G (Hybrid) 30-1000MHz	Gain-Loss string for Hyrbid antenna at 3m	Various	Various	2015-01-26	2016-01-31
SAC_G (BOM) 1-18GHz	Gain-Loss string for Hyrbid antenna at 3m	Various	Various	2015-01-26	2016-01-31
SAC_G (BOM) 18-40GHz	Gain-Loss string for Hyrbid antenna at 3m	Various	Various	2015-01-26	2016-01-31
	Receiver & Software				
SA0018	Spectrum Analyzer	Agilent	N9030A	2014-06-24	2015-06-30
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-02-19	2015-02-28

7. TEST RESULTS

7.1. 99% BANDWIDTH and 20 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

99 % BW: The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 5% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

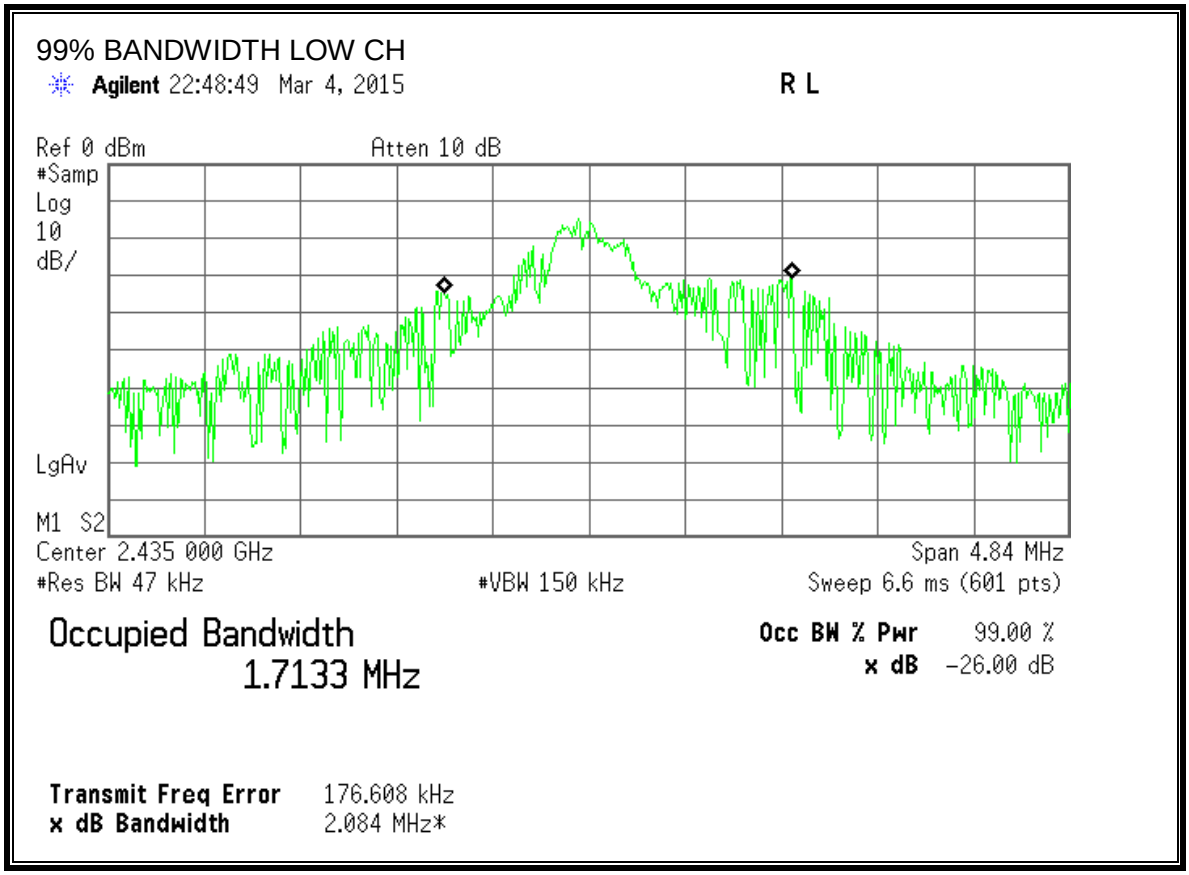
20 dB BW: The transmitter output is connected to the spectrum analyzer. The RBW is set to > 1% of the 20 dB BW. The VBW is set to 3 times the RBW. The sweep time is coupled. The detector is set to peak and a peak marker search is performed. Both sides of the signal are marked at the 20 dB points below the peak.

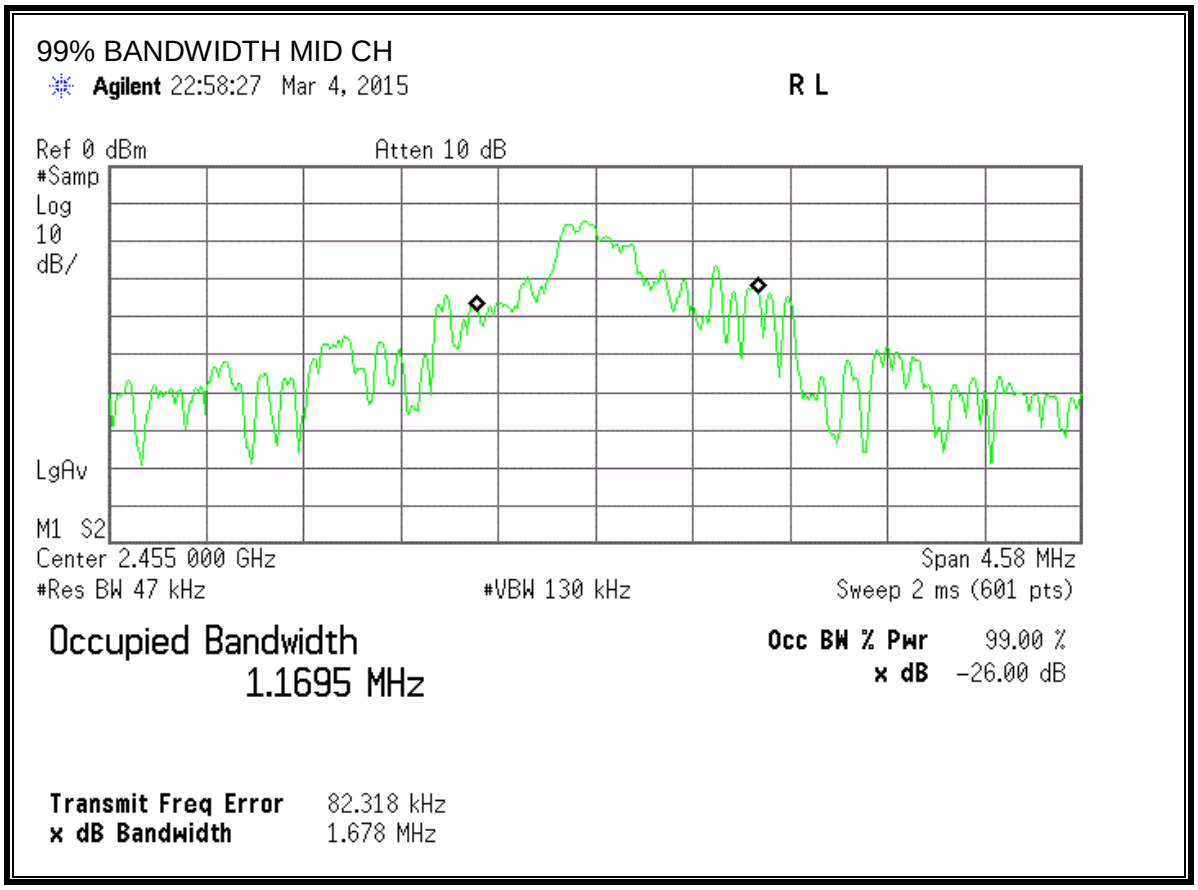
RESULTS

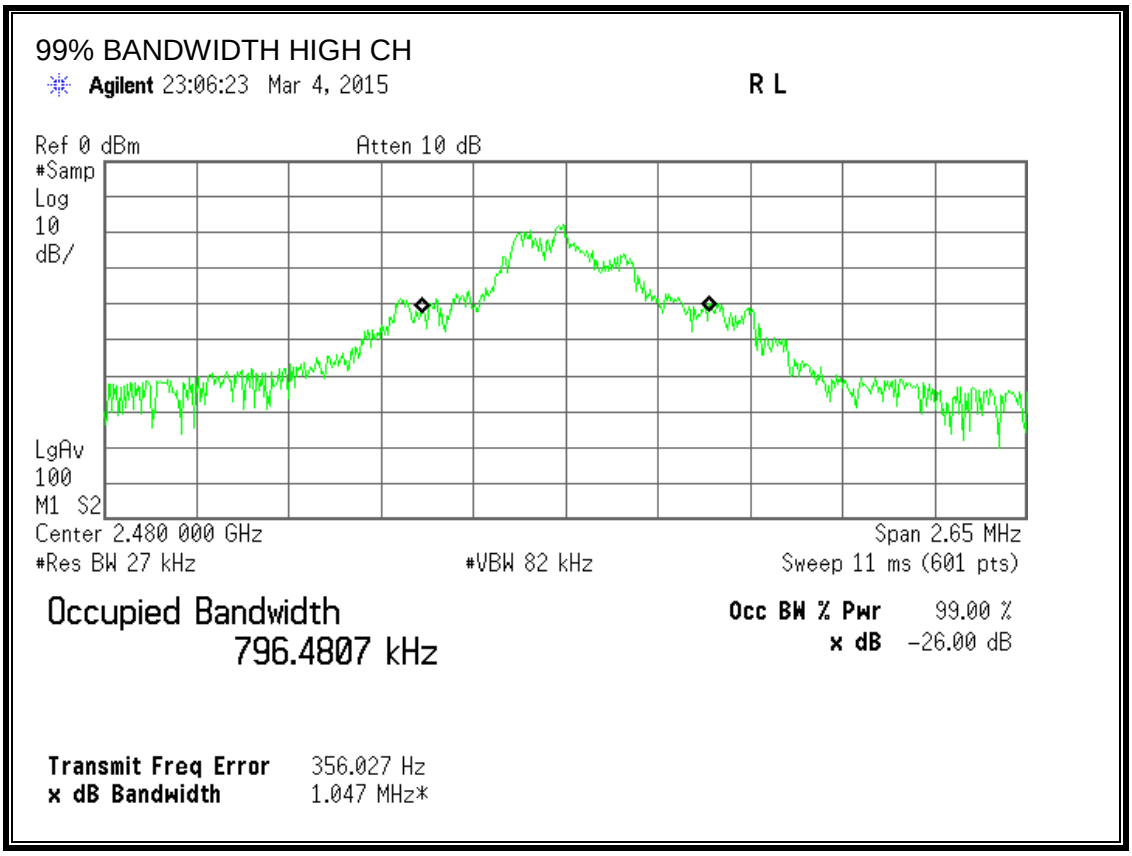
wECG

Channel	Frequency (MHz)	99% Bandwidth (MHz)	20 dB Bandwidth (MHz)
Low	2435	1.7133	1.000
Middle	2455	1.1695	0.955
High	2480	0.7964	0.550

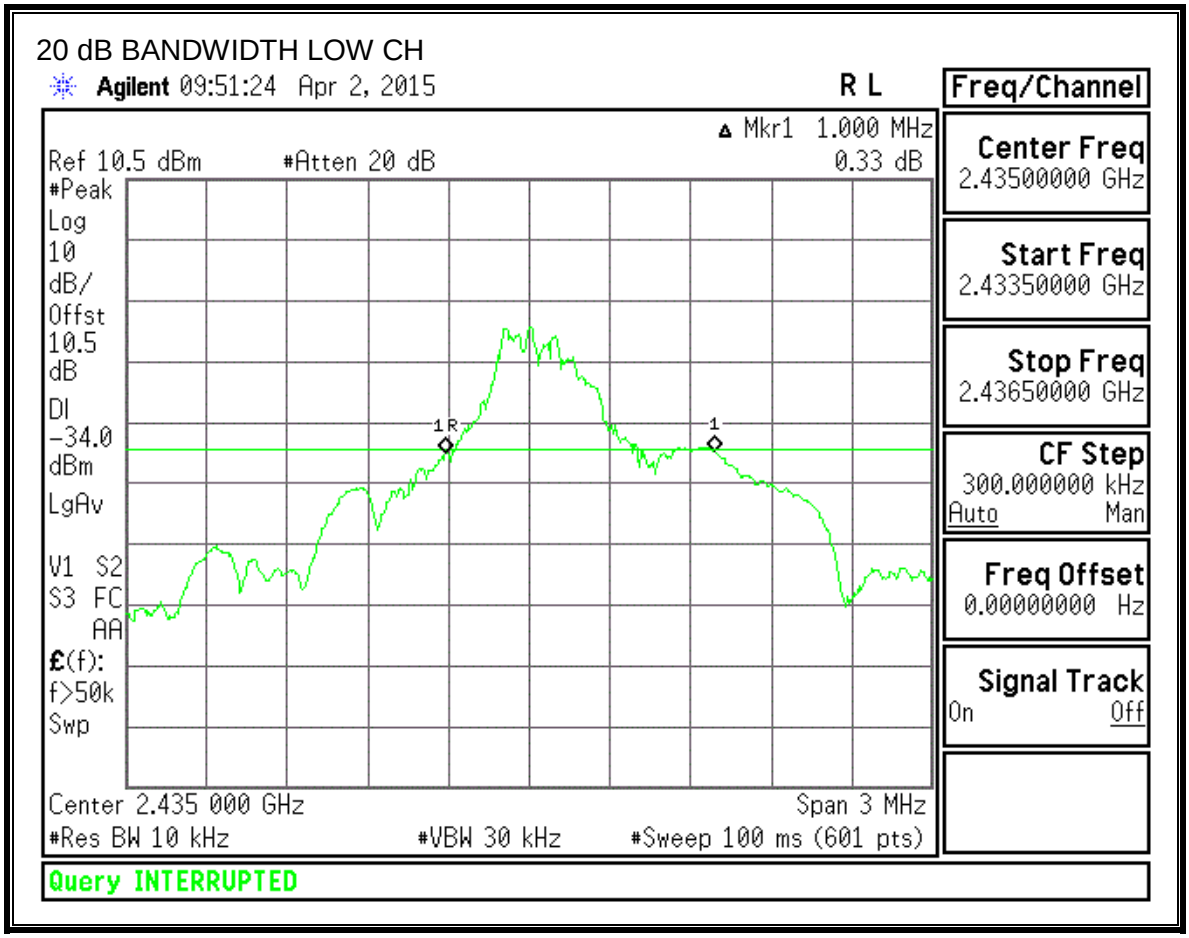
99% BANDWIDTH

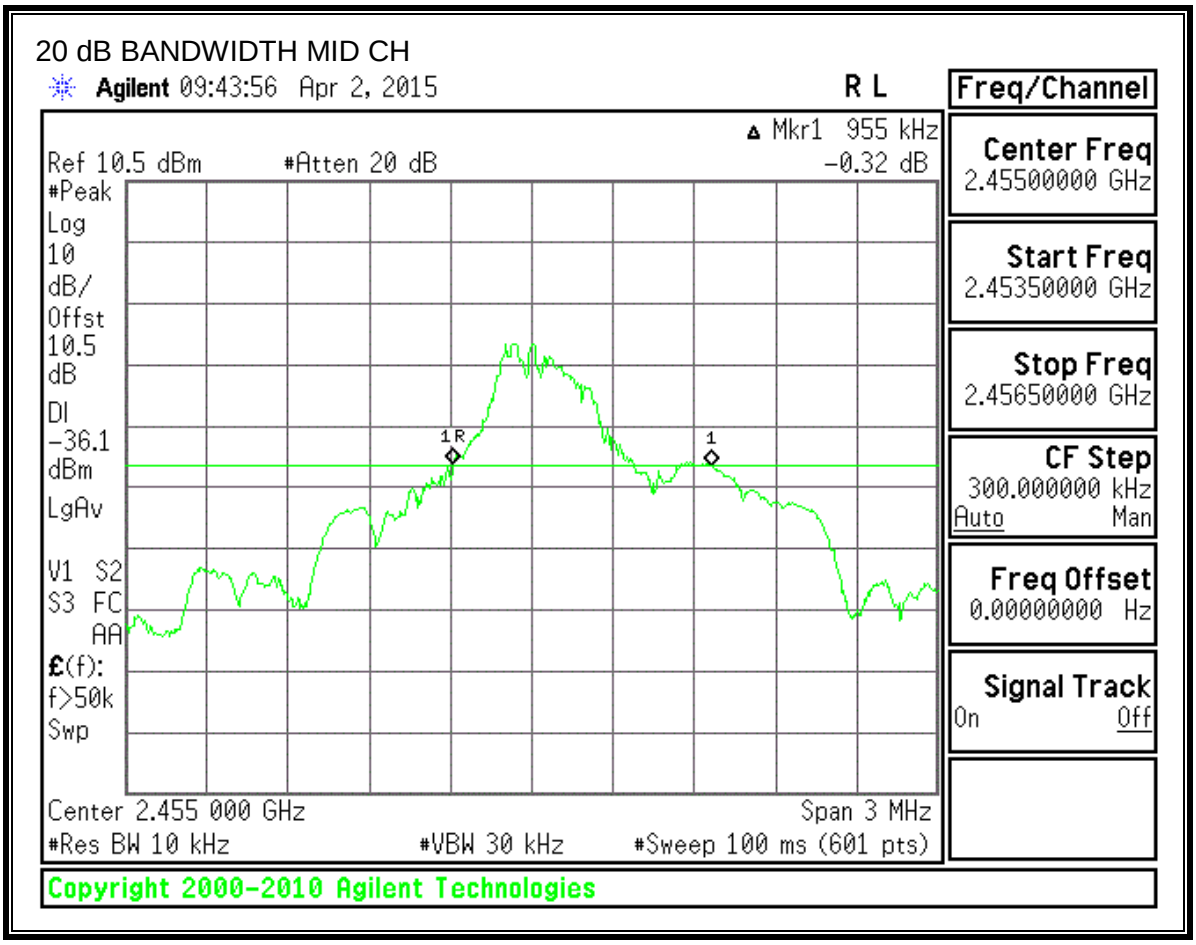


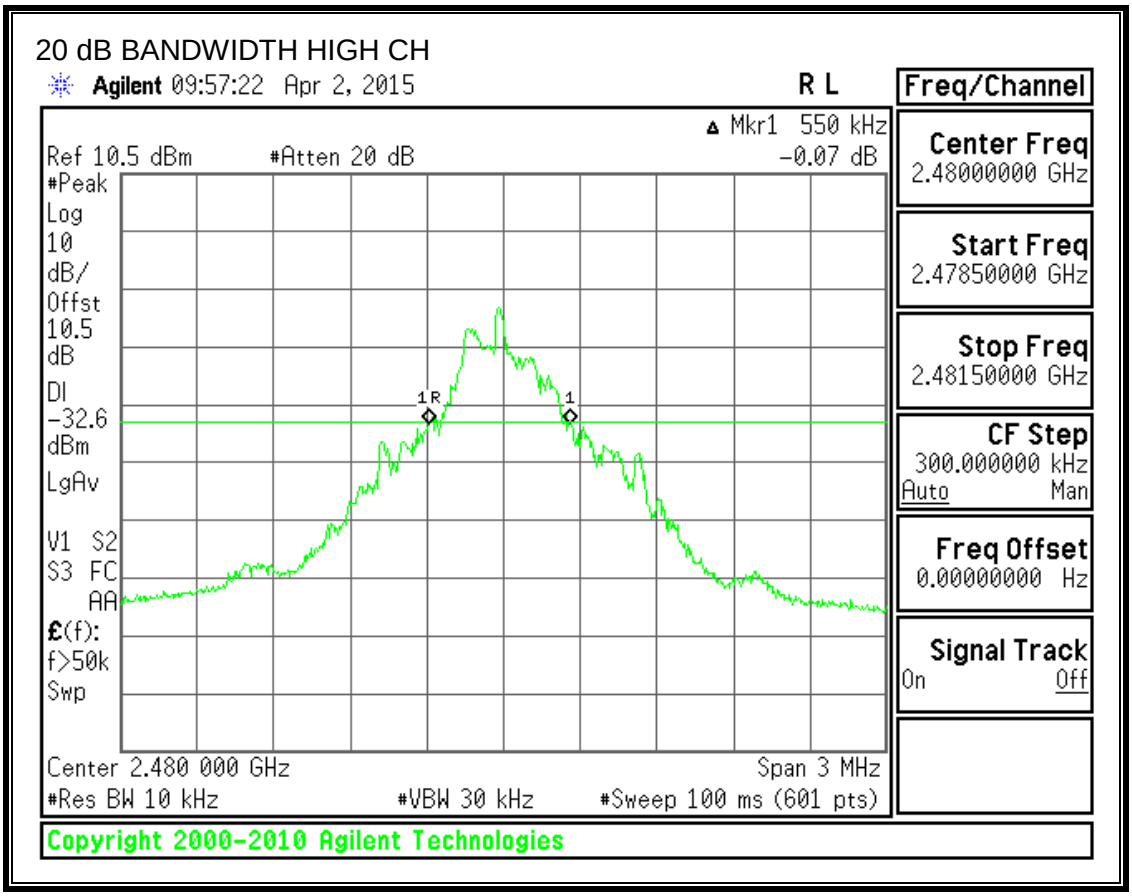




20 dB BANDWIDTH







7.2. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

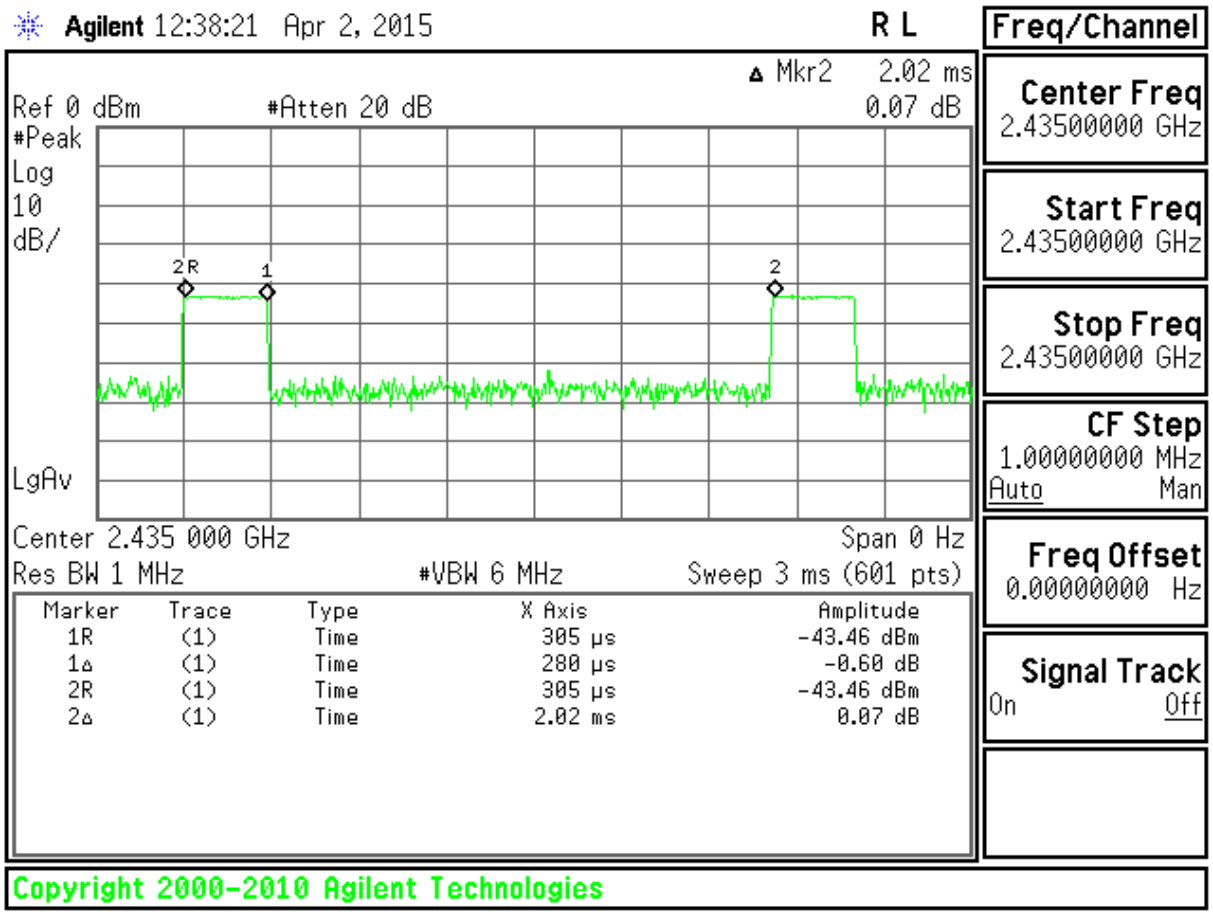
PROCEDURE

Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE

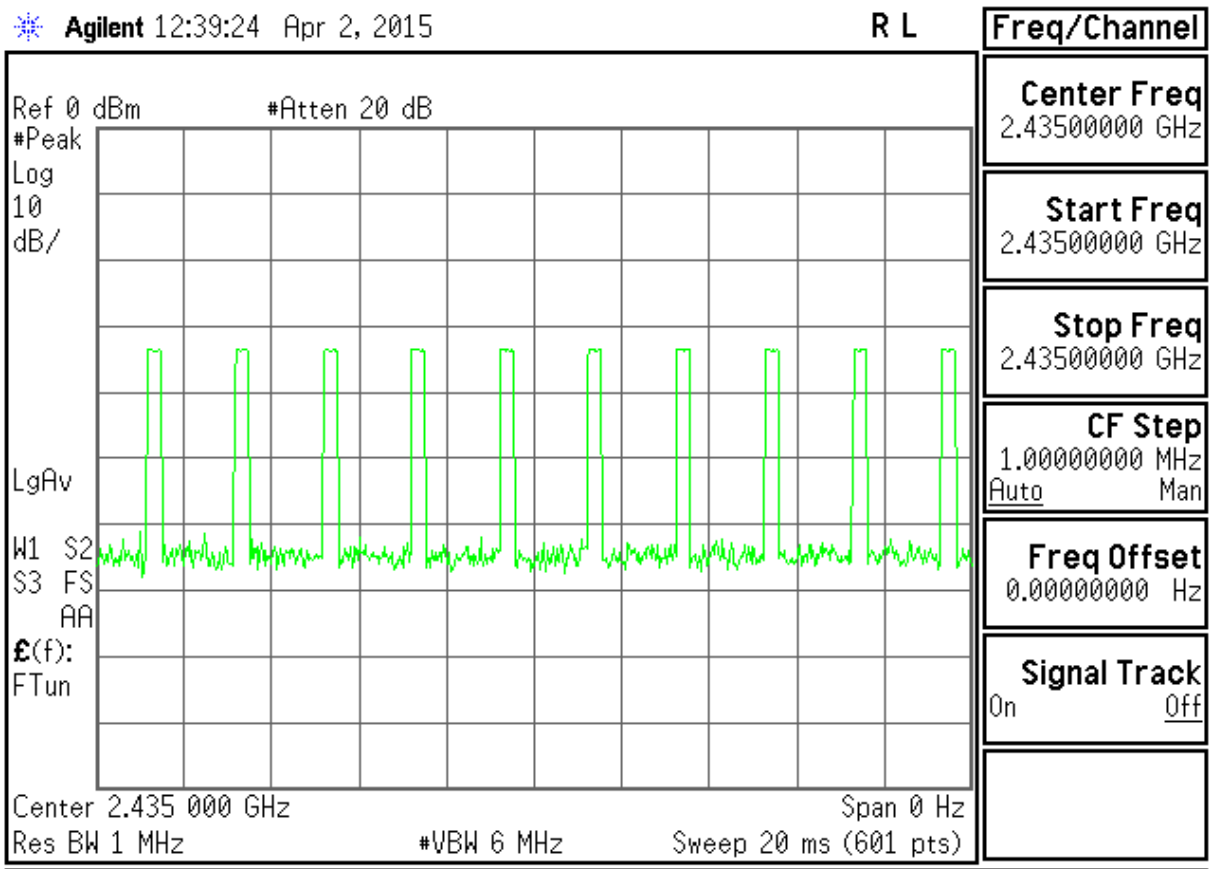
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor For Average Measurements (FCC 15.35) (dB)
2.4GHz Band					
ECG	0.280	2.020	0.139	13.86%	-17.16

DUTY CYCLE PLOT – wECG

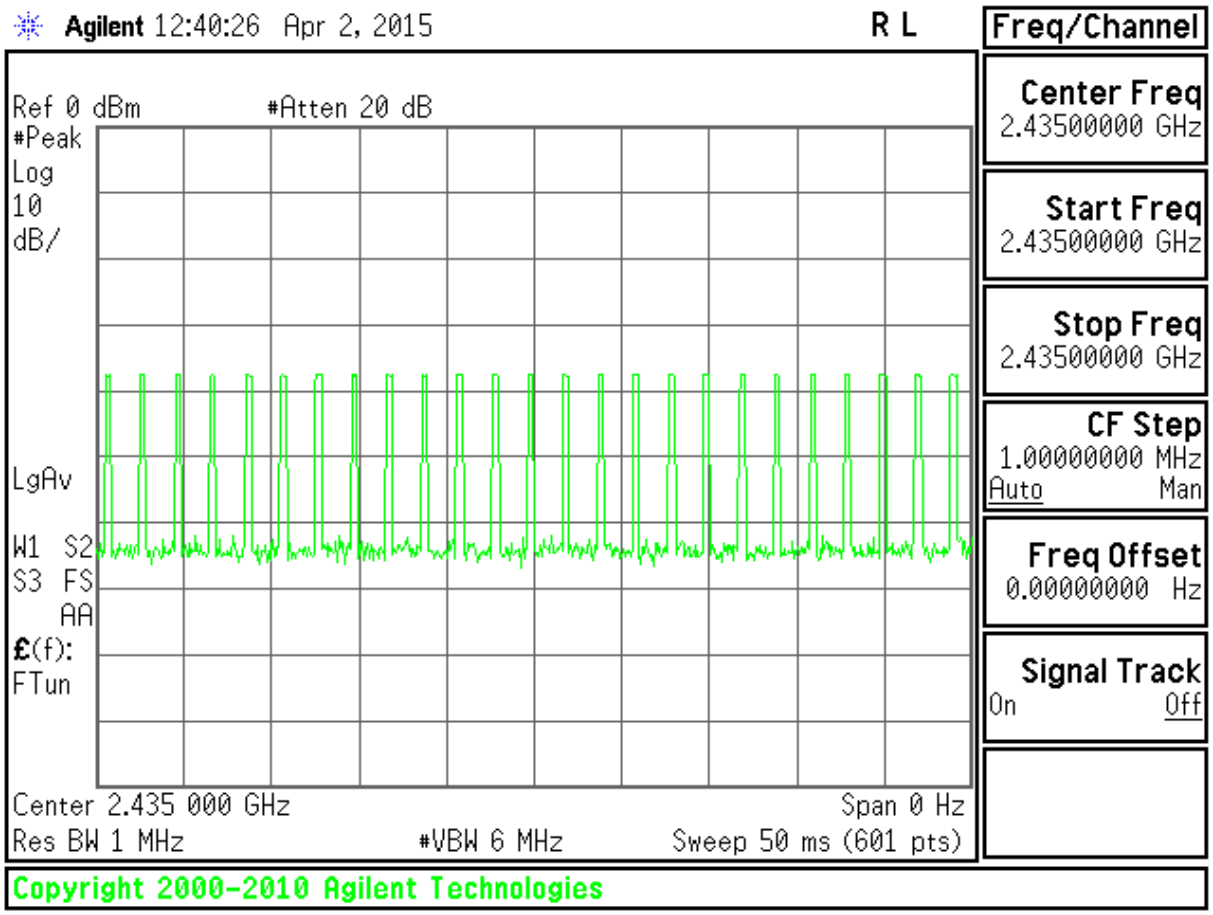


20 log (280us/2020us) = -17.16 dB

DUTY CYCLE PLOT OVER 20 msec – wECG



DUTY CYCLE PLOT OVER 50 msec – wECG



7.3. RADIATED EMISSIONS

LIMIT

IC RSS-210, A2.9
FCC 15.249

Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ, and 24.0–24.25 GHz.
(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

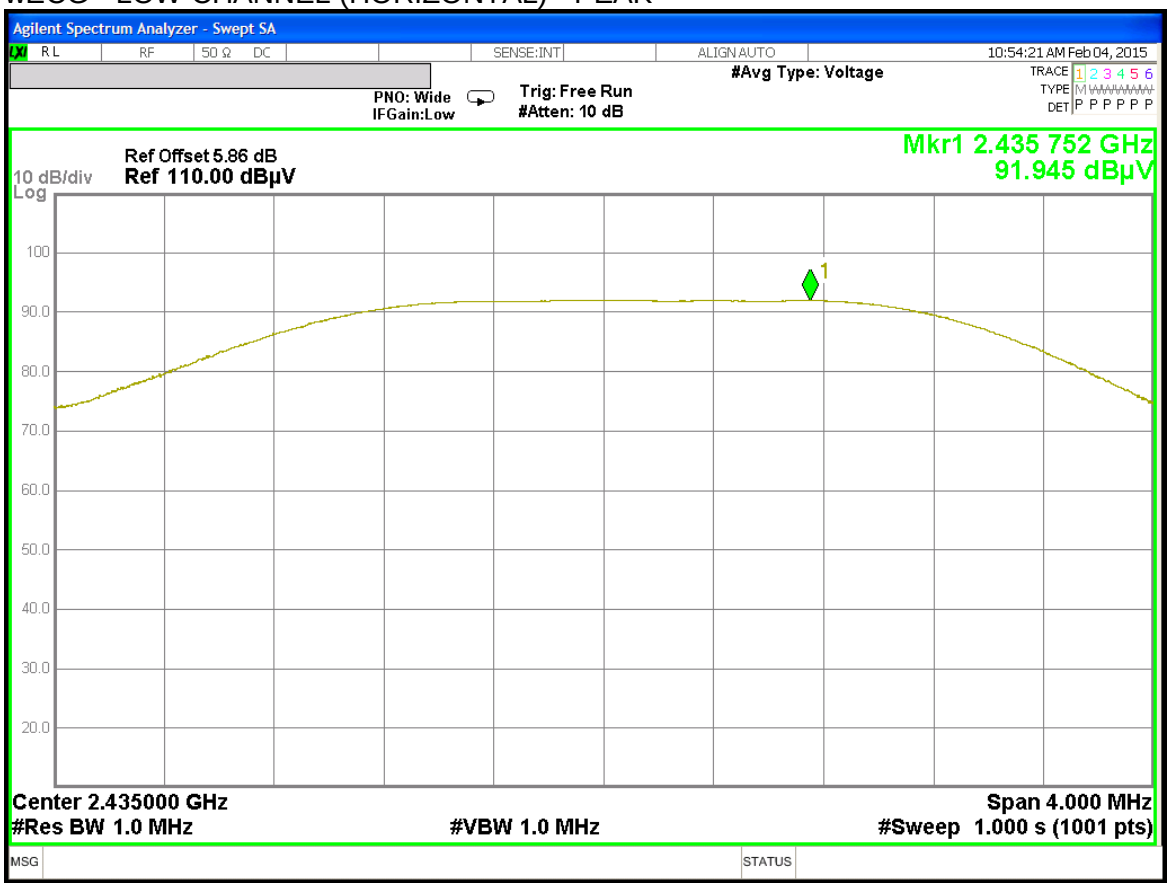
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

RESULTS

7.3.1. FUNDAMENTAL FREQUENCY RADIATED EMISSION

wECG - LOW CHANNEL (HORIZONTAL) - PEAK

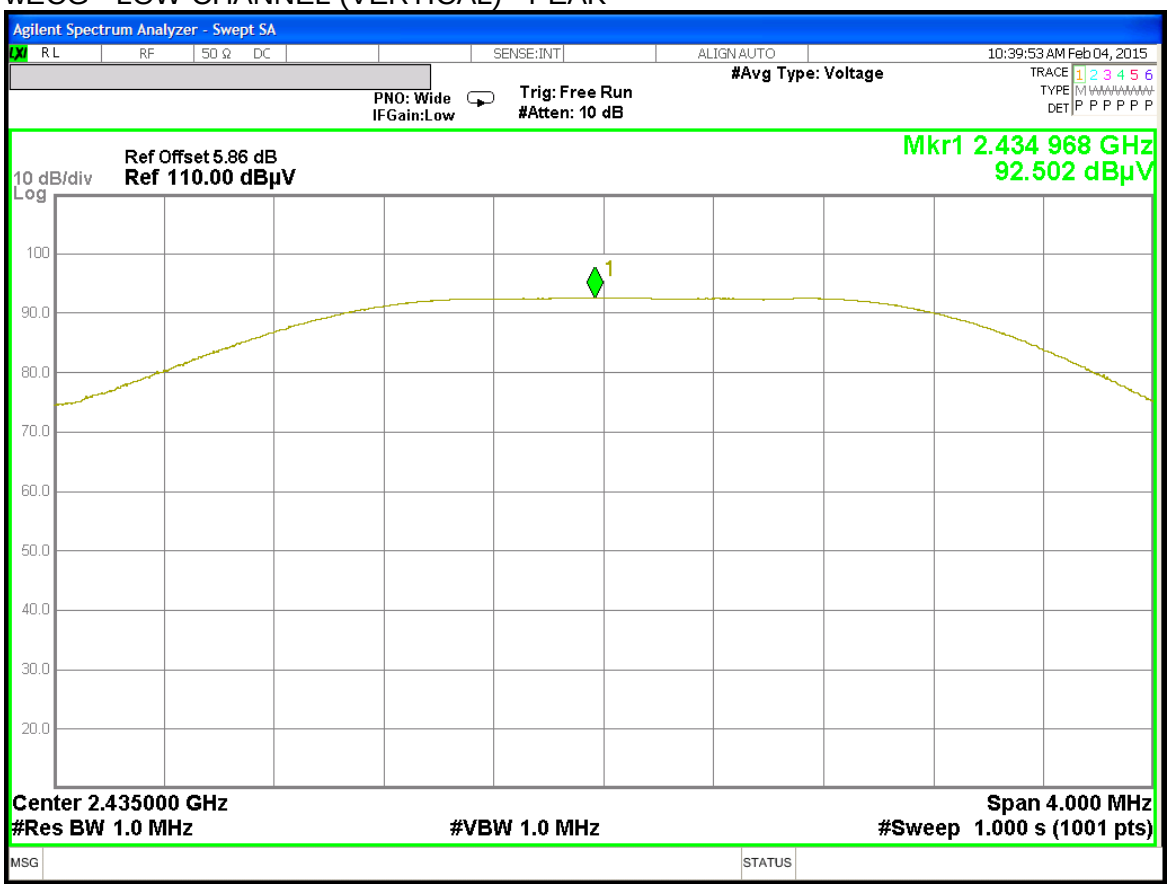


AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 91.95 dBuV/m – 17.16 dB = 74.79 dBuV/m

wECG - LOW CHANNEL (VERTICAL) - PEAK

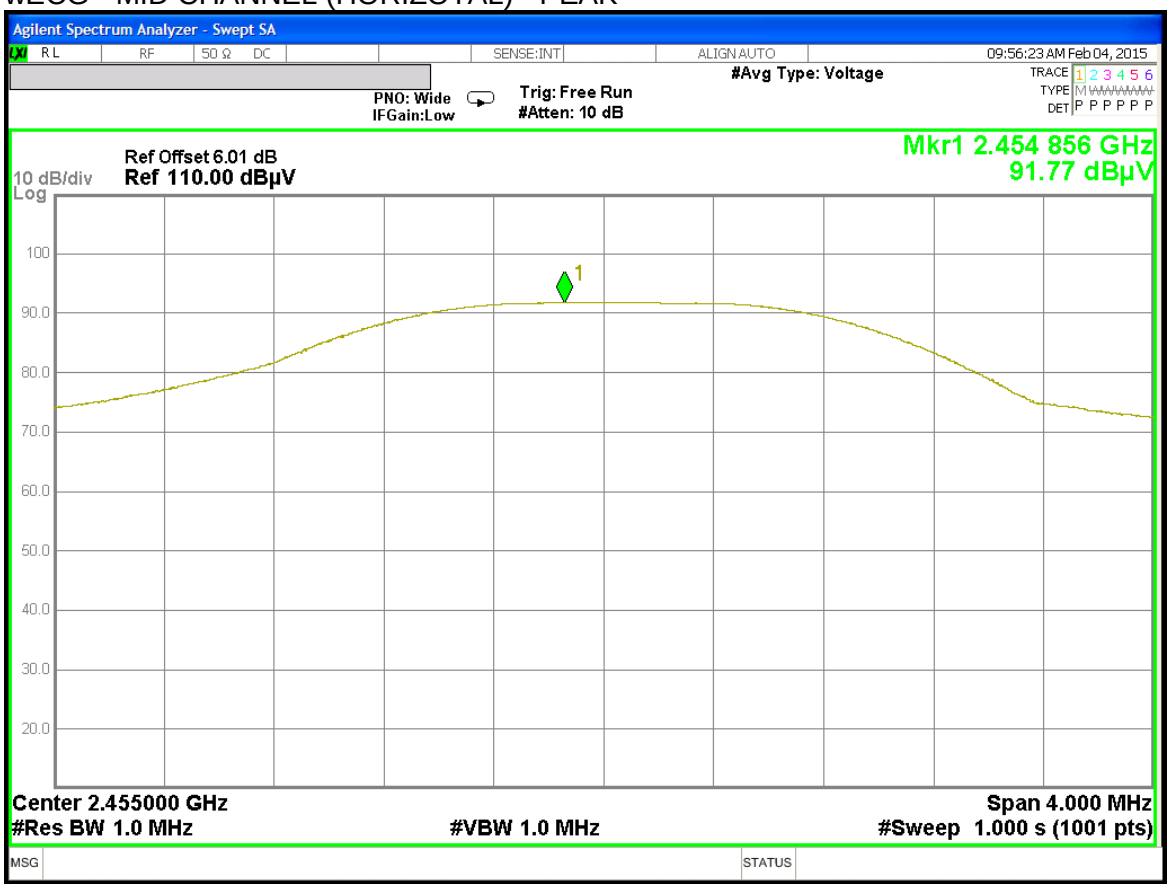


AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 92.5 dBuV/m – 17.16 dB = 75.34 dBuV/m

wECG - MID CHANNEL (HORIZOTAL) - PEAK

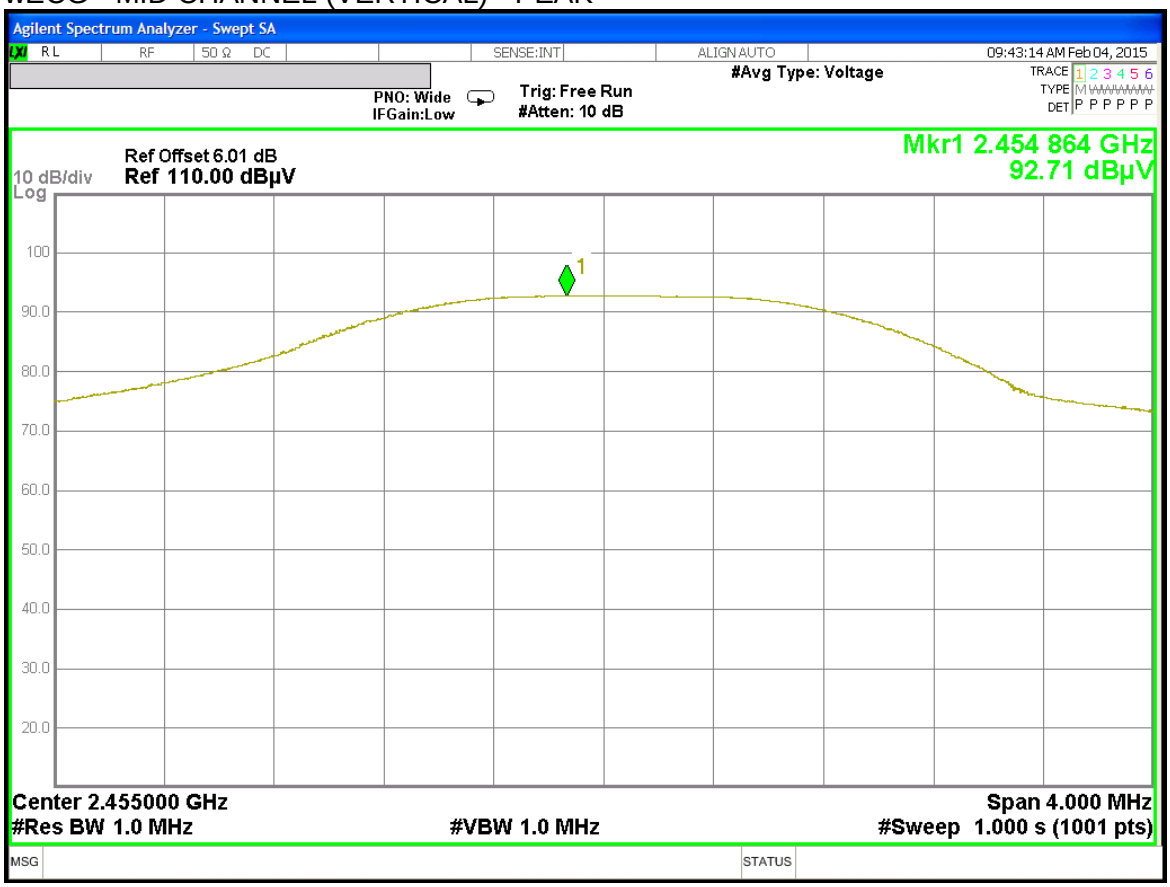


AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 91.77 dBuV/m – 17.16 dB = 74.61 dBuV/m

wECG - MID CHANNEL (VERTICAL) - PEAK

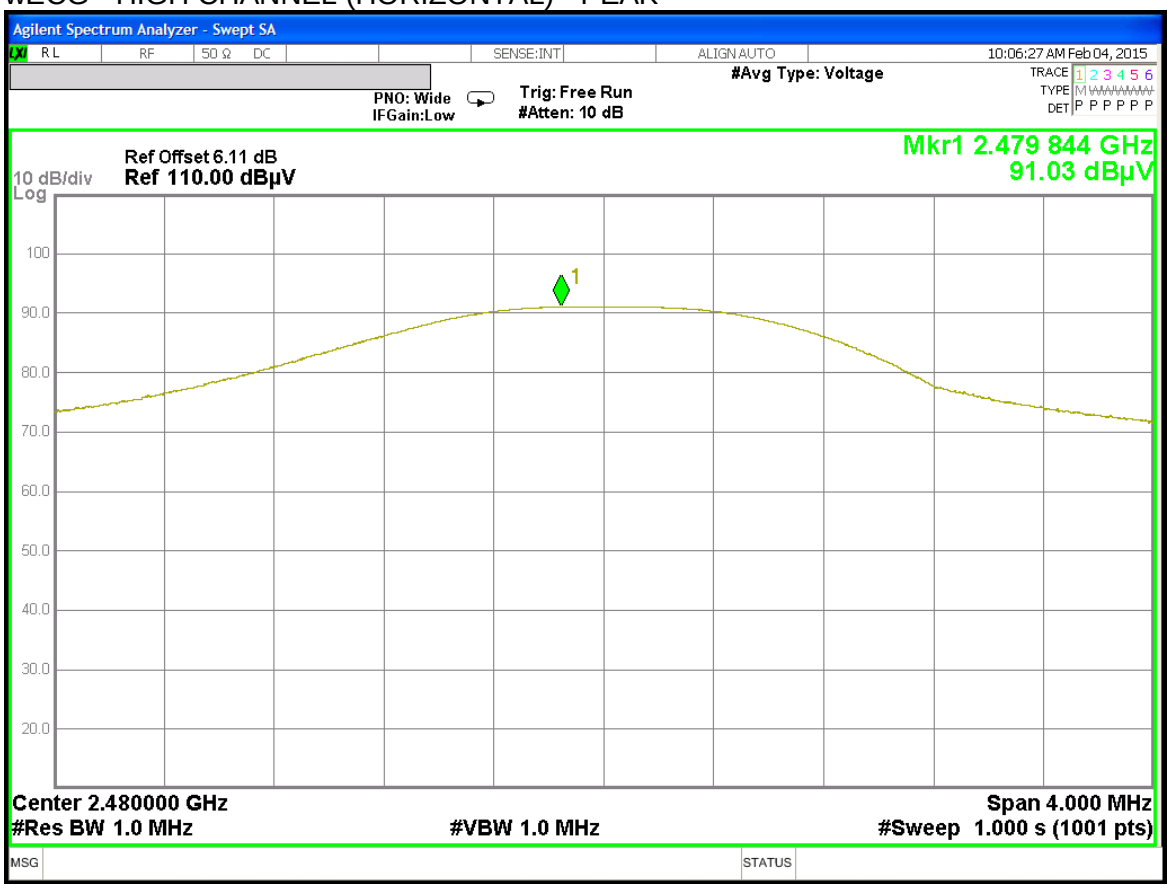


AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 92.71 dBuV/m – 17.16 dB = 75.55 dBuV/m

wECG - HIGH CHANNEL (HORIZONTAL) - PEAK

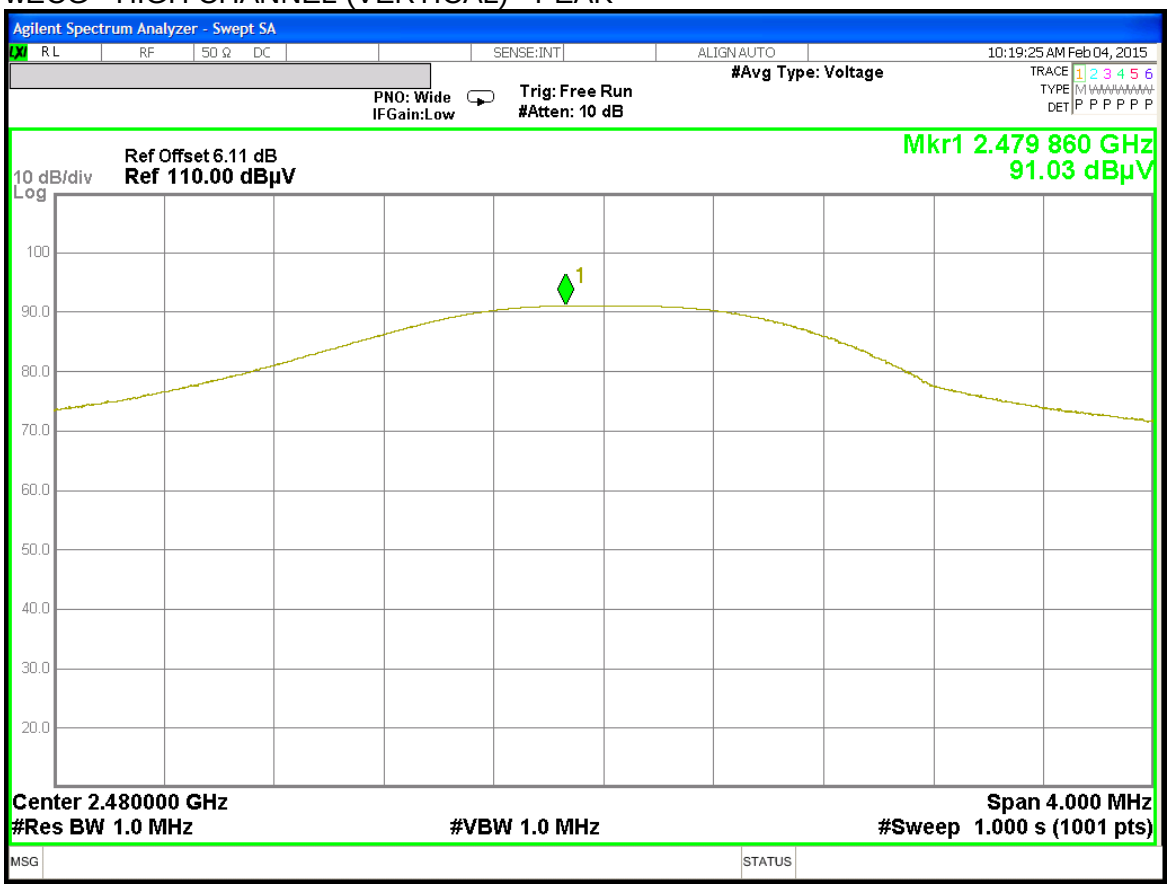


AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 91.03 dBuV/m – 17.16 dB = 73.87 dBuV/m

wECG - HIGH CHANNEL (VERTICAL) - PEAK



AVERAGE MEASUREMENT

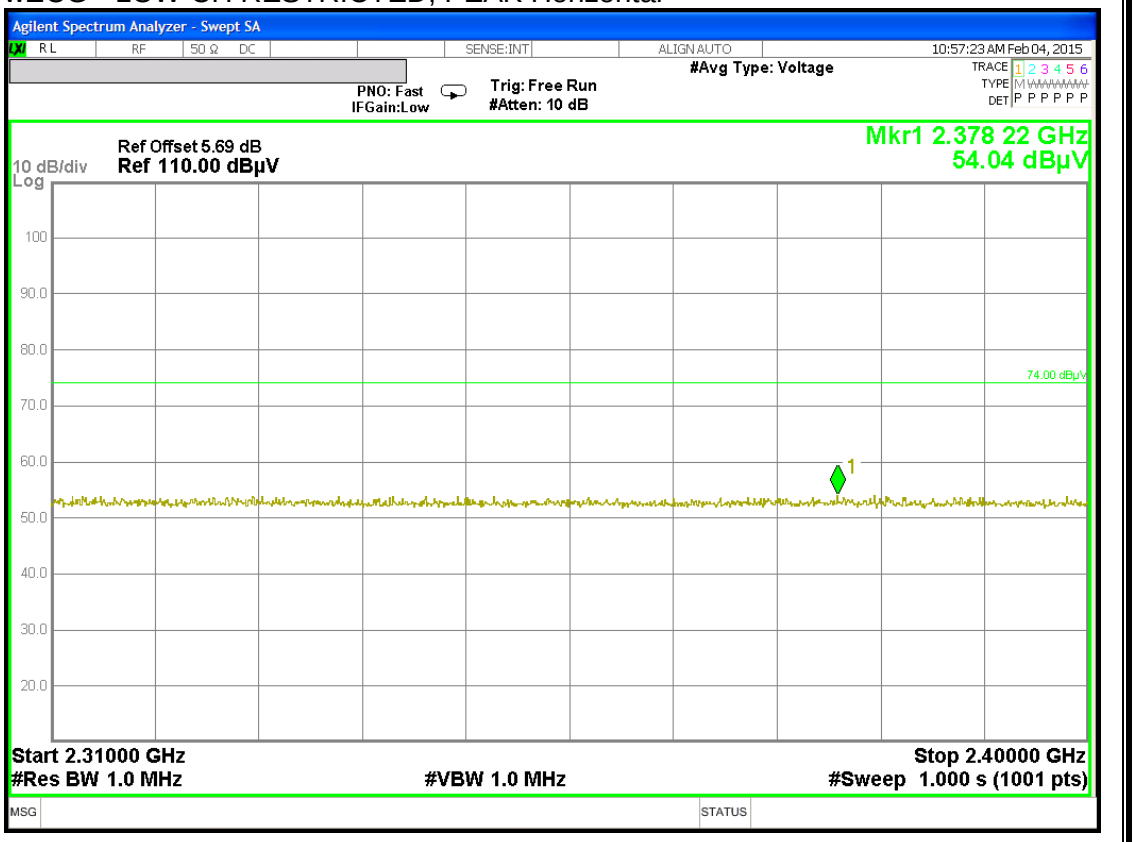
Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 91.03 dBuV/m – 17.16 dB = 73.87 dBuV/m

7.3.2. TRANSMITTER RESTRICTED BAND EDGES

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

wECG - LOW CH RESTRICTED, PEAK Horizontal



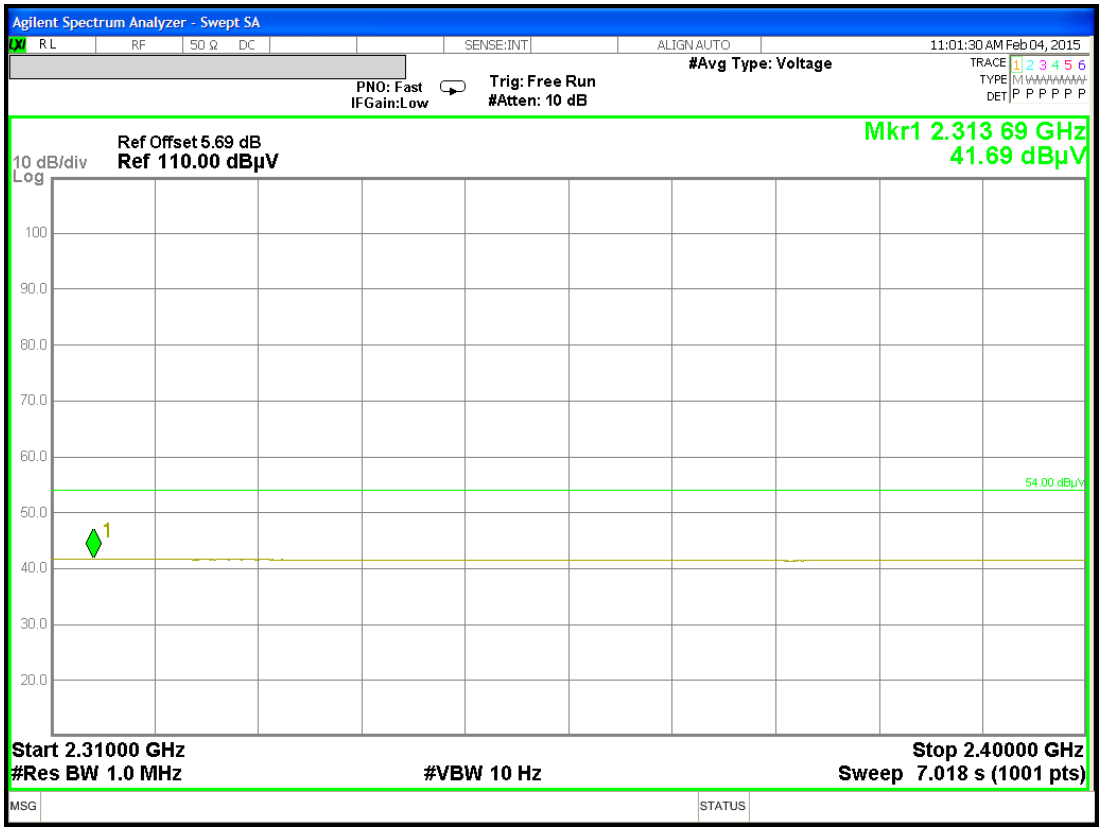
wECG - LOW CH RESTRICTED, AVG, Horizontal

AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

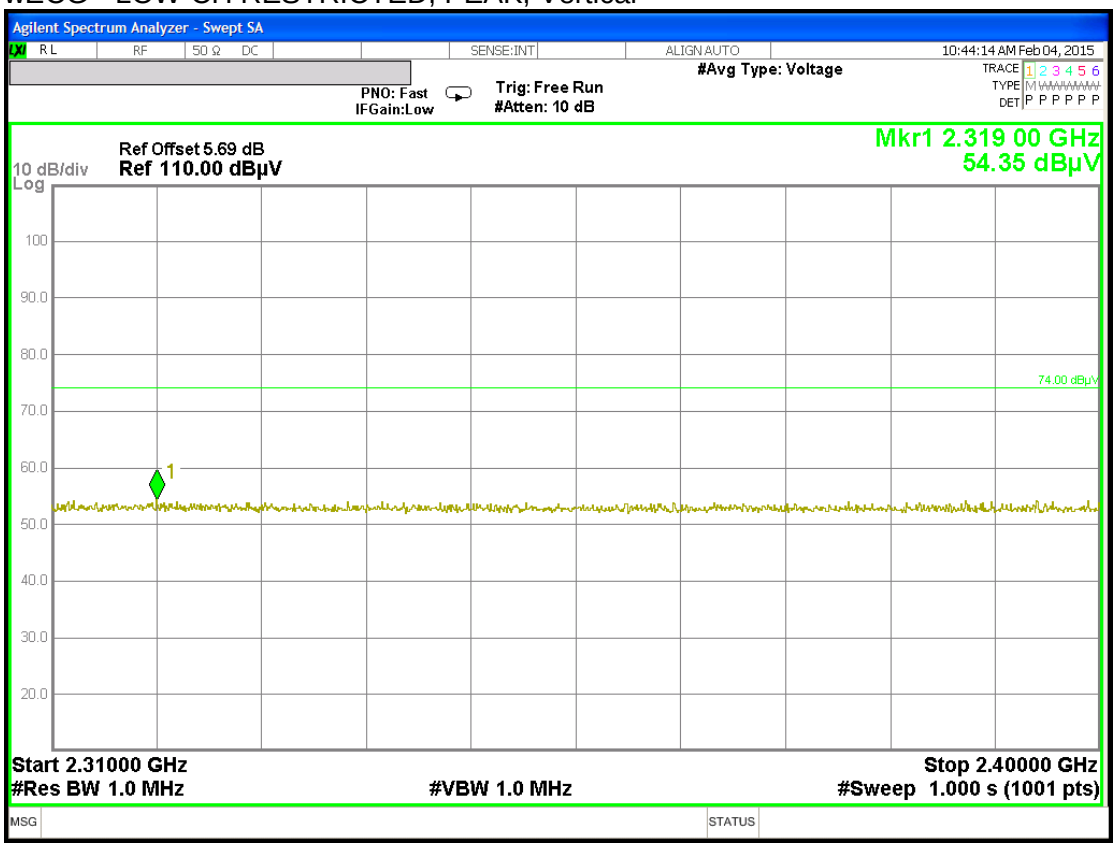
Average E-field = Peak – 17.16dB = 54.04 dBuV/m – 17.16 dB = 36.88 dBuV/m

Additionally, a reduced video bandwidth scan was performed to show no emissions were below the noise floor that is not related to the fundamental.



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

wECG - LOW CH RESTRICTED, PEAK, Vertical



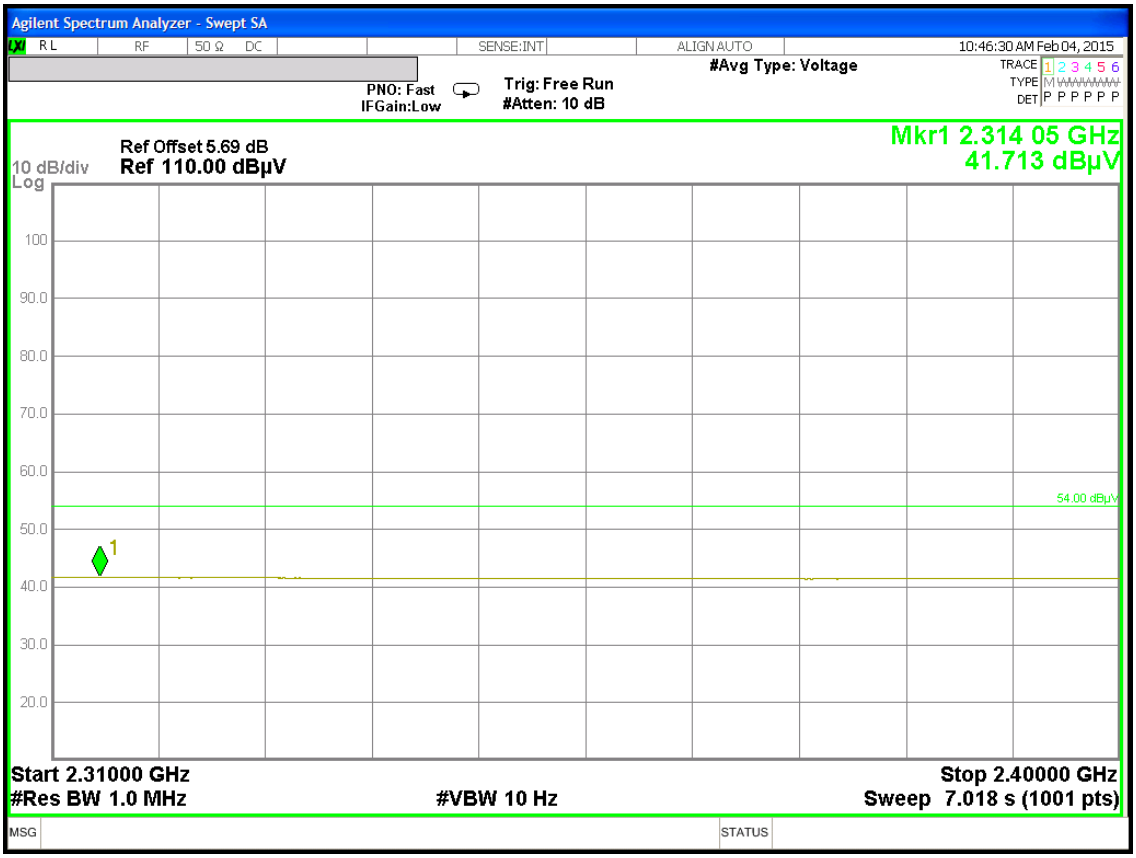
wECG - LOW CH RESTRICTED, AVG, Vertical

AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

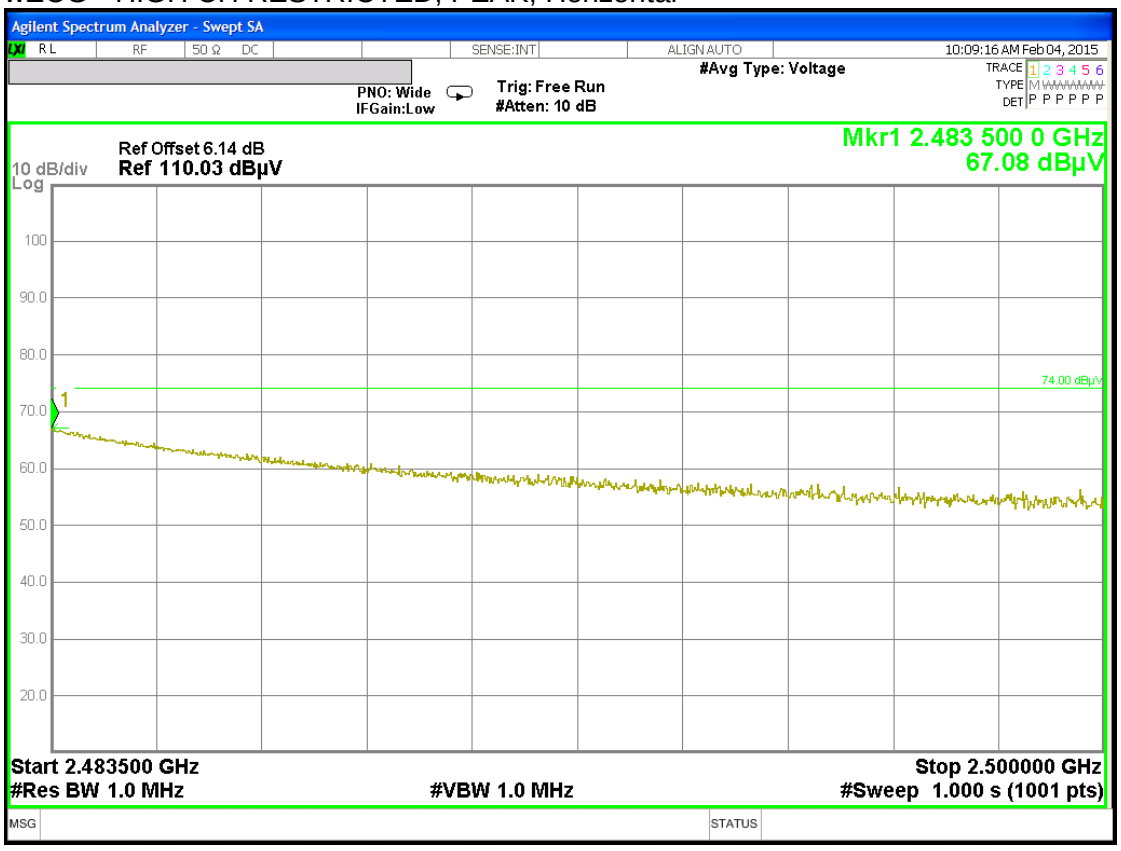
Average E-field = Peak – 17.16dB = 54.35 dBuV/m – 17.16 dB = 37.19 dBuV/m

Additionally, a reduced video bandwidth scan was performed to show no emissions were below the noise floor that is not related to the fundamental.



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

wECG - HIGH CH RESTRICTED, PEAK, Horizontal



wECG - HIGH CH RESTRICTED, AVG, Horizontal

AVERAGE MEASUREMENT

Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 67.08 dBuV/m – 17.16 dB = 49.92 dBuV/m

Additionally, a reduced video bandwidth scan was performed to show no emissions were below the noise floor that is not related to the fundamental.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

wECG - HIGH CH RESTRICTED, PEAK, Vertical

wECG - HIGH CH RESTRICTED, AVG, Vertical

AVERAGE MEASUREMENT

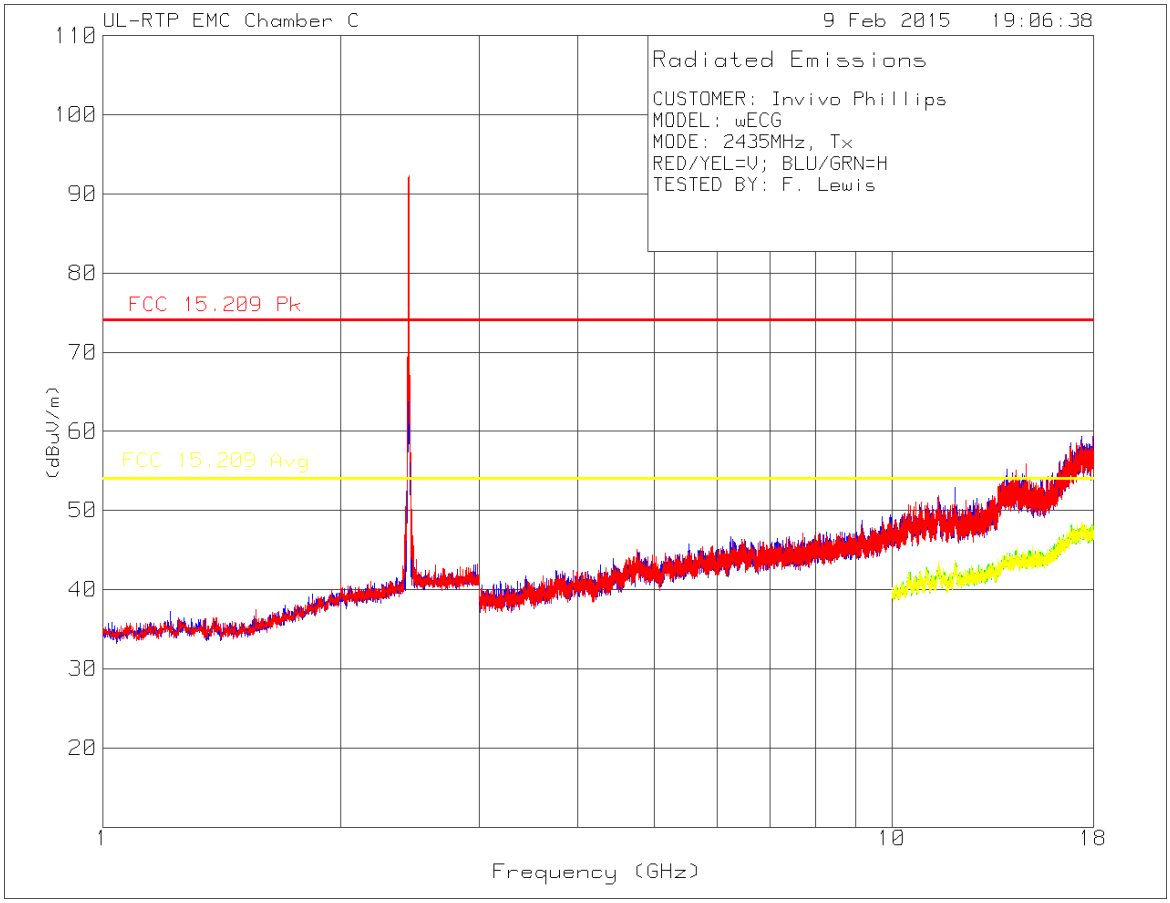
Note: Using a measured duration of 280 us versus a measured period of 2.020 ms, a Duty cycle correction (DCC) was calculated for Average measurements per FCC Part 15.35(c) = 20*log(0.280/2.020)= -17.16dB

Average E-field = Peak – 17.16dB = 66.52 dBuV/m – 17.16 dB = 49.36 dBuV/m

Additionally, a reduced video bandwidth scan was performed to show no emissions were below the noise floor that is not related to the fundamental.

7.3.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1GHz

wECG LOW CHANNEL - PLOT



The yellow/green trace represents a reduced video bandwidth trace (10Hz) to show no emissions present.

wECG LOW CHANNEL – DATA

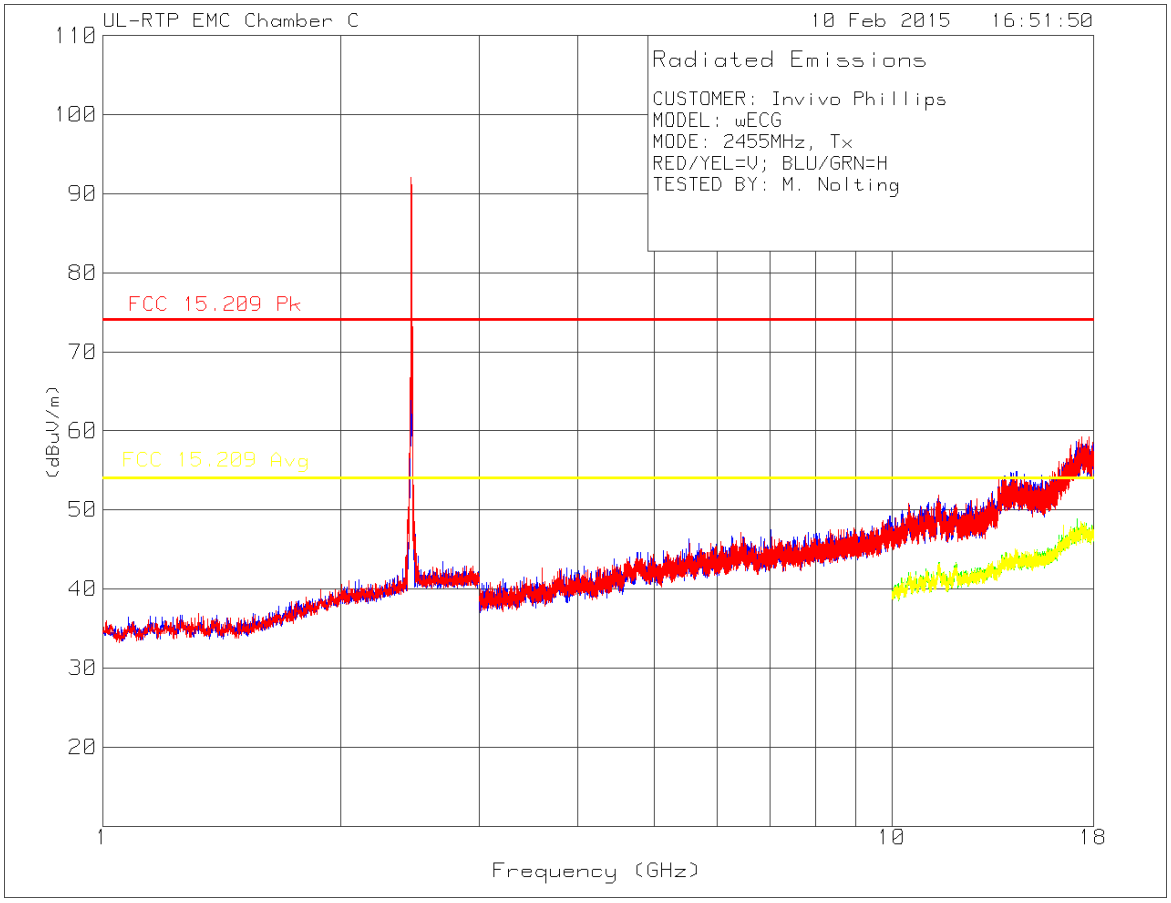
CUSTOMER: Invivo Phillips
MODEL: wECG
MODE: 2435MHz, Tx
RED/YEL=V; BLU/GRN=H
TESTED BY: F. Lewis

Freq (GHz)	Meter Reading [dBuV]	Detector	Antenna Factor [dB/m]	Gain/Loss [dB]	DCCF (dB)	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Average Limit [dBuV/m]	Margin [dB]	Antenna Polarity
4.867	41.9	Pk	35.0	-32.8	0.0	44.1	74.0	-29.9	54.0	-9.9	H
9.156	38.9	Pk	37.0	-27.1	0.0	48.8	74.0	-25.2	-	-	H
9.156	38.9	AvCalc	37.0	-27.1	-17.2	31.6	-	-	54.0	-22.4	H
9.960	39.7	Pk	37.8	-26.3	0.0	51.2	74.0	-22.8	-	-	H
9.960	39.7	AvCalc	37.8	-26.3	-17.2	34.1	-	-	54.0	-19.9	H
9.727	38.9	Pk	37.5	-26.5	0.0	49.9	74.0	-24.2	-	-	H
9.727	38.9	AvCalc	37.5	-26.5	-17.2	32.7	-	-	54.0	-21.3	H
12.010	38.6	Pk	39.3	-25.0	0.0	52.9	74.0	-21.1	-	-	H
12.010	38.6	AvCalc	39.3	-25.0	-17.2	35.7	-	-	54.0	-18.3	H
4.747	43.3	Pk	35.3	-33.5	0.0	45.1	74.0	-29.0	54.0	-9.0	V

*Pk = Peak

AvCalc: Average Field Strength computed as follows for the above harmonics: PK + DCCF, where DCCF = 20*log(T_on/Period)

wECG MID CHANNEL - PLOT



The yellow/green trace represents a reduced video bandwidth trace (10Hz) to show no emissions present.

wECG MID CHANNEL - DATA

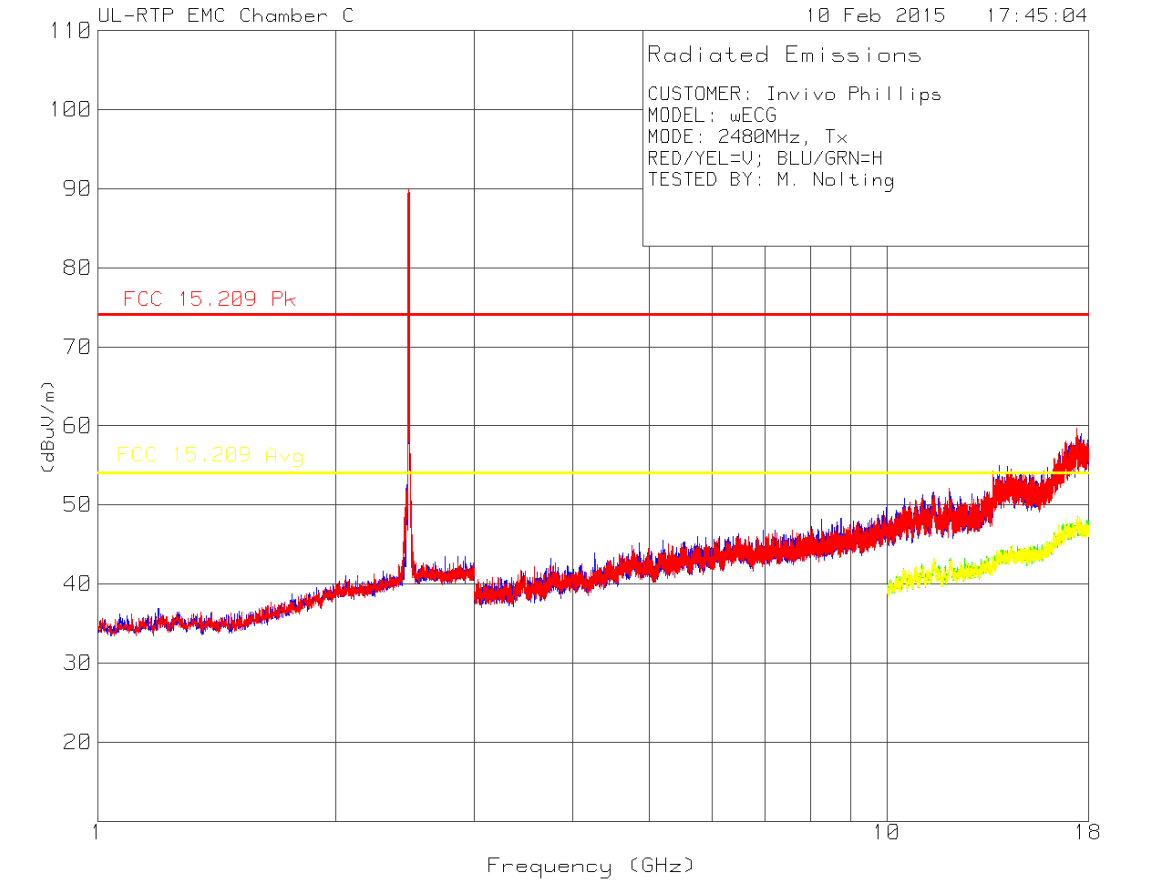
CUSTOMER: Invivo Phillips
MODEL: wECG
MODE: 2455MHz, Tx
RED/YEL=V; BLU/GRN=H
TESTED BY: M. Nolting

Freq (GHz)	Meter Reading [dBuV]	Detector	Antenna Factor [dB/m]	Gain/Loss [dB]	DCCF (dB)	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Average Limit [dBuV/m]	Margin [dB]	Antenna Polarity
5.533	41.0	Pk	35.9	-30.5	0.0	46.4	74.0	-27.6	54.0	-7.6	H
7.019	40.0	Pk	36.0	-28.4	0.0	47.6	74.0	-26.5	54.0	-6.5	H
11.298	37.3	Pk	38.8	-25.6	0.0	50.5	74.0	-23.5	-	-	H
11.298	37.3	AvCalc	38.8	-25.6	-17.2	33.3	-	-	54.0	-20.7	H
3.606	43.4	Pk	33.2	-34.0	0.0	42.6	74.0	-31.4	54.0	-11.4	V
6.439	39.7	Pk	36.3	-28.8	0.0	47.2	74.0	-26.8	54.0	-6.8	V
10.495	37.4	Pk	38.3	-24.5	0.0	51.2	74.0	-22.8	-	-	V
10.495	37.4	AvCalc	38.3	-24.5	-17.2	34.0	-	-	54.0	-20.0	V

*Pk = Peak

AvCalc: Average Field Strength computed as follows for the above harmonics: PK + DCCF, where DCCF = 20*log(T_on/Period)

wECG HIGH CHANNEL - PLOT



The yellow/green trace represents a reduced video bandwidth trace (10Hz) to show no emissions present.

wECG HIGH CHANNEL - DATA

CUSTOMER: Invivo Phillips
MODEL: wECG
MODE: 2480MHz, Tx
RED/YEL=V; BLU/GRN=H
TESTED BY: M. Nolting

Freq (GHz)	Meter Reading [dBuV]	Detector	Antenna Factor [dB/m]	Gain/Loss [dB]	DCCF (dB)	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Average Limit [dBuV/m]	Margin [dB]	Antenna Polarity
2.756	46.7	Pk	32.7	-36.0	0.0	43.4	74.0	-30.6	54.0	-10.6	H
8.263	38.0	Pk	36.3	-27.5	0.0	46.8	74.0	-27.2	-	-	H
8.263	38.0	AvCalc	36.3	-27.5	-17.2	29.6	-	-	54.0	-24.4	H
10.519	37.3	Pk	38.3	-24.4	0.0	51.2	74.0	-22.8	-	-	H
10.519	37.3	AvCalc	38.3	-24.4	-17.2	34.1	-	-	54.0	-20.0	H
4.756	42.9	Pk	35.3	-33.4	0.0	44.8	74.0	-29.2	54.0	-9.2	V
11.997	38.2	Pk	39.3	-25.1	0.0	52.4	74.0	-21.6	-	-	V
11.997	38.2	AvCalc	39.3	-25.1	-17.2	35.3	-	-	54.0	-18.8	V
17.393	37.1	Pk	42.1	-19.5	0.0	59.7	74.0	-14.3	-	-	V
17.393	37.1	AvCalc	42.1	-19.5	-17.2	42.6	-	-	54.0	-11.4	V

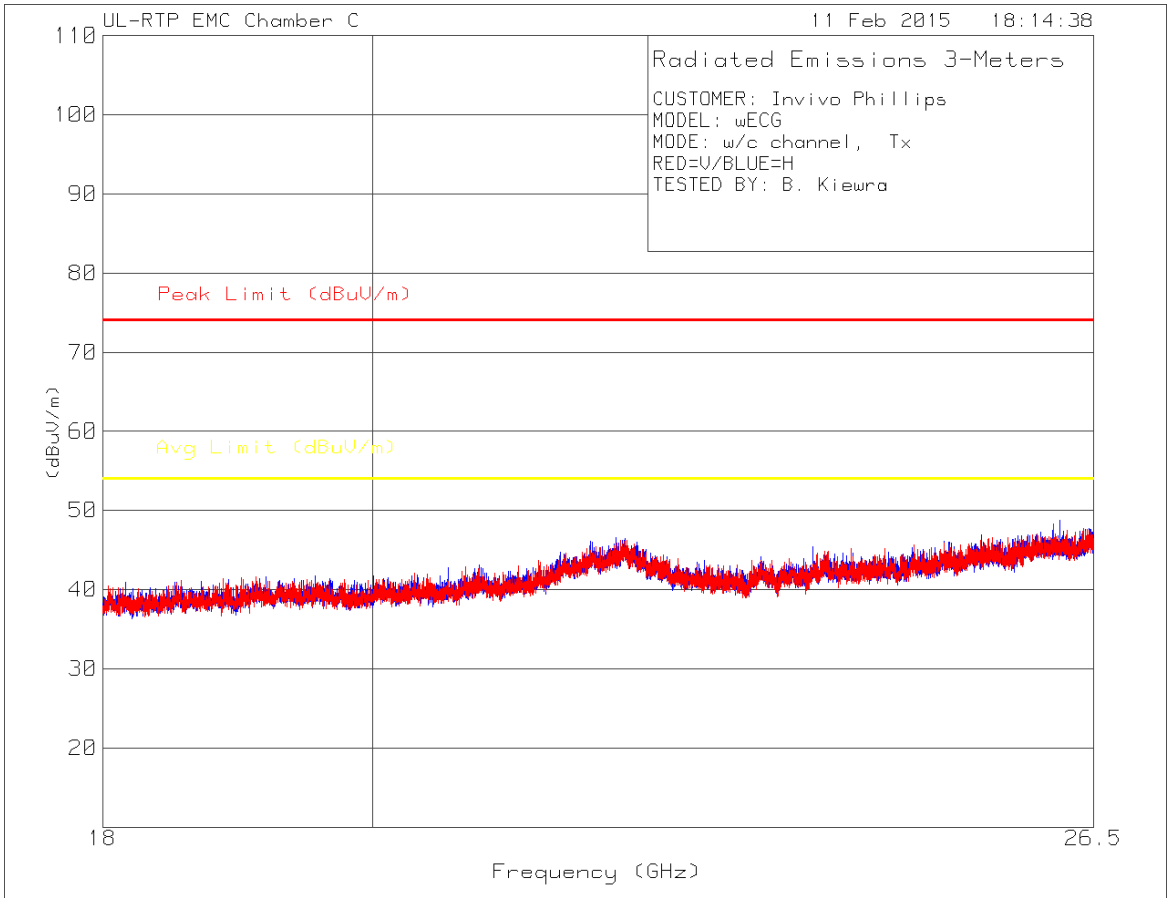
*Pk = Peak

AvCalc: Average Field Strength computed as follows for the above harmonics: PK + DCCF, where DCCF = 20*log(T_on/Period)

7.3.4. WORST-CASE ABOVE 1 GHz (18-26 GHz)

SPURIOUS EMISSIONS 18 TO 26 GHz

wECG - PLOT



wECG - DATA

CUSTOMER: Invivo Phillips
MODEL: wECG
MODE: w/c channel, Tx
RED=V/BLUE=H
TESTED BY: B. Kiewra

Freq (GHz)	Meter Reading [dBuV]	Detector	Antenna Factor [dB/m]	Gain/Loss [dB]	DCCF (dB)	Field Strength [dBuV/m]	Peak Limit [dBuV/m]	Margin [dB]	Average Limit [dBuV/m]	Margin [dB]	Antenna Polarity
20.600	42.1	Pk	33.0	-32.4	0.0	42.7	74.0	-31.2	54.0	-11.2	H
21.992	41.9	Pk	36.9	-32.3	0.0	46.5	74.0	-27.4	54.0	-7.4	H
26.154	42.7	Pk	34.1	-28.4	0.0	48.4	74.0	-25.6	-	-	H
26.154	42.7	AvCalc	34.1	-28.4	-17.2	31.2	-	-	54.0	-22.8	H
20.736	42.2	Pk	33.1	-32.5	0.0	42.8	74.0	-31.1	54.0	-11.1	V
22.090	41.5	Pk	36.8	-32.1	0.0	46.2	74.0	-27.7	54.0	-7.7	V
26.093	42.5	Pk	34.0	-28.2	0.0	48.3	74.0	-25.7	-	-	V
26.093	42.5	AvCalc	34.0	-28.2	-17.2	31.2	-	-	54.0	-22.9	V

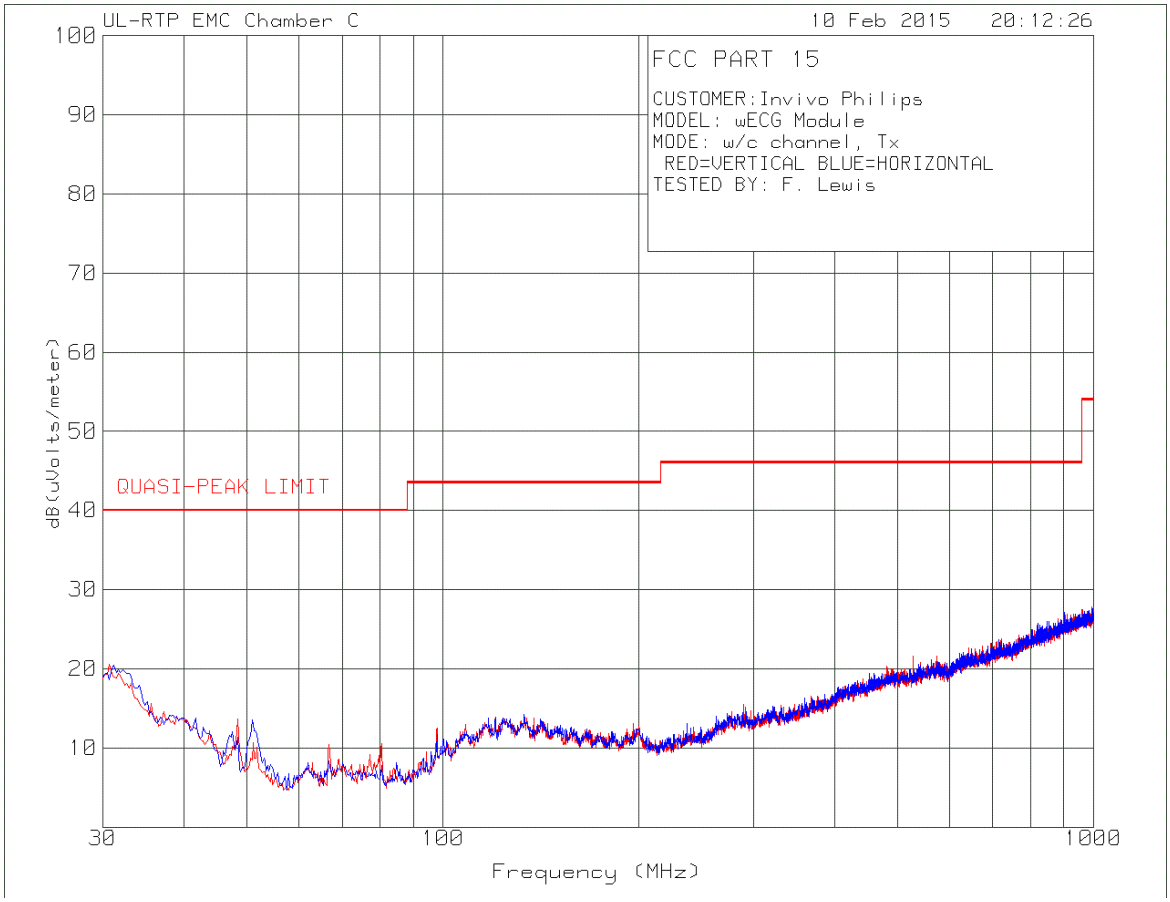
*Pk = Peak

AvCalc: Average Field Strength computed as follows for the above harmonics: PK + DCCF, where DCCF = 20*log(T_on/Period)

7.3.5. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (HORIZONTAL)

wECG - PLOT



wECG - DATA
CUSTOMER:Invivo Philips
MODEL: wECG Module
MODE: w/c channel, Tx
RED=VERTICAL BLUE=HORIZONTAL
TESTED BY: F. Lewis

Test Frequency [MHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	QP Limit [dBuV/m]	Margin [dB]	Polarity
30.727	30.9	Pk	21.2	-31.6	20.5	40.0	-19.5	V
48.425	36.6	Pk	8.5	-31.4	13.7	40.0	-26.3	V
80.427	34.3	Pk	7.4	-31.1	10.6	40.0	-29.5	V
527.727	32.8	Pk	17.9	-29.0	21.7	46.0	-24.4	V
31.212	31.1	Pk	20.9	-31.6	20.4	40.0	-19.6	H
50.850	37.5	Pk	7.5	-31.4	13.6	40.0	-26.5	H
*Pk = Peak, Qp = Quasi-Peak, AV = Average.								

END OF REPORT