

Vpatch Cardio Pty Ltd.

TEST REPORT

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Radio Spectrum TEST REPORT

Applicant:	Vpatch Cardio Pty Ltd. Level 1, 1221 Toorak Road, Camberwell, Victoria, 3124, Australia.
Product:	ECG Remote Event Monitor
Model No.:	301
Brand Name:	3G Vcell
FCC ID:	2ARNZ-1002
Test Method/ Standard:	47 CFR FCC Part 15.249 & ANSI C63.10 2013
Test By:	Intertek Testing Services Taiwan Ltd., Hsinchu Laboratory No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan



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Revision History

Report No.	Issue Date	Revision Summary
180800266TWN-001	Feb. 22, 2019	Original report

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Summary of Tests

Test	Reference	Results
20dB Bandwidth	15.215(c)	Pass
Radiated Emission test	15.249(c), 15.209	Pass
Emission on the Band Edge	15.249(d)	Pass
Conducted Emission of AC Power	15.207	Pass
Antenna Requirement	15.203	Pass

1. General Information

1.1 Identification of the EUT

Product:	ECG Remote Event Monitor
Model No.:	301
Operating Frequency:	Single channel
Channel Number:	2466MHz
Rated Power:	DC 4.2V from adapter
Power Cord:	N/A
Sample receiving date:	Aug. 20, 2018
Sample condition:	Workable
Test Date(s):	Oct. 08, 2018 ~ Jan. 24, 2019
Note:	2.4GHz ISM Band and WWAN cannot transmit simultaneously

1.2 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Model no.	Specification
Adapter 1	Type 2200	I/P: 100-240Vac, 50-60Hz O/P: 4.2V, 1.3A

1.3 Antenna description

Antenna Type: PCB printed F-type antenna

Antenna Gain: 0.0dBi

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Paragraph 15.249 for non-spread spectrum devices.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

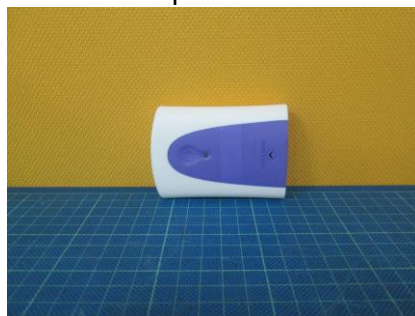
2.2 Operation mode

TX mode: EUT Press the button entering test mode.

The signal is maximized through rotation and placement in the three orthogonal axes.



X axis



Y axis



Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at Z axis. The final test data was executed under this configuration.

3. 20dB Bandwidth test

3.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure:	1008	hPa

3.2 Test setup & procedure

Step 1: The 20dB bandwidth was measured using a 50 ohm spectrum analyzer

Step 2: The span range for the SA display shall be between two times and five times the OBW.

Step 3: The nominal IF filter bandwidth (3 dB RBW) should be approximately 1 % to 5 % of the OBW, unless otherwise specified, depending on the applicable requirement.

Step 4: The test was performed at 1 channel. The maximum 20dB modulation bandwidth is in the following Table.

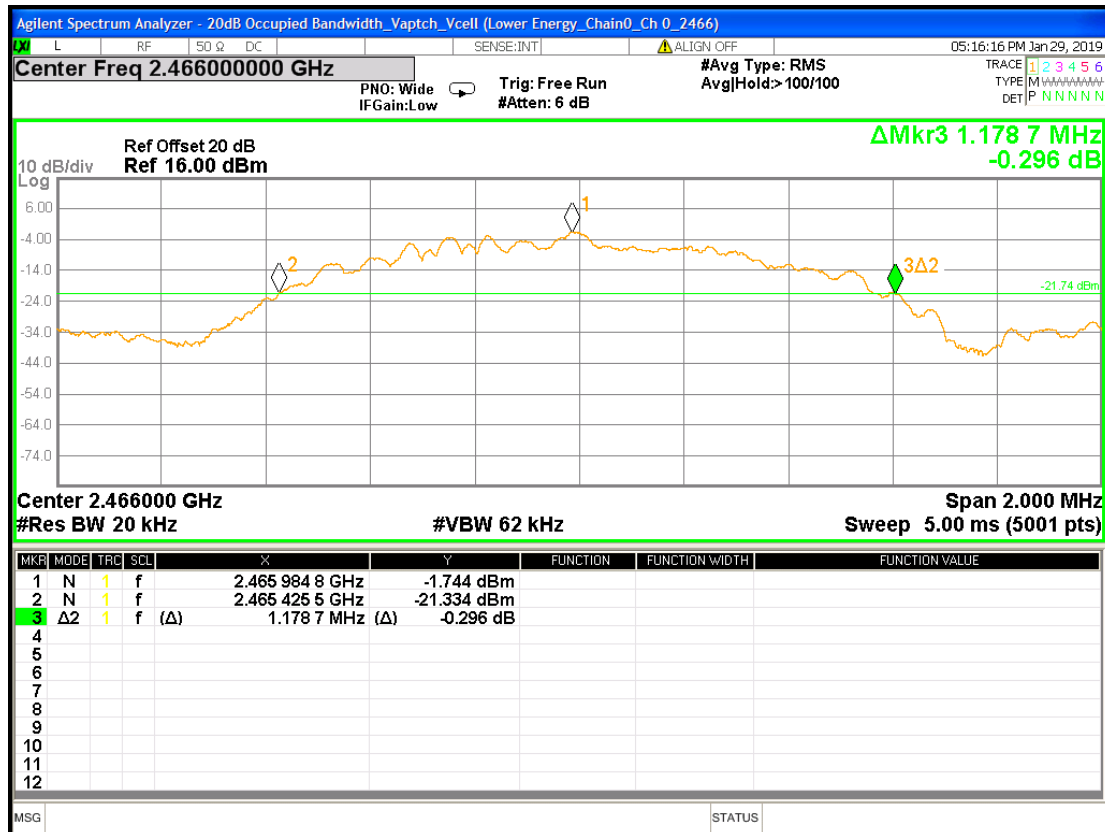
3.3 Measured data of modulated bandwidth test results

Single TX

Mode	Frequency (MHz)	20dB Occupied Bandwidth (MHz)
ANT+	2466	1.1787

Please see the plot below.

Vcell_20dB Bandwidth @ ANT+ 2466MHz



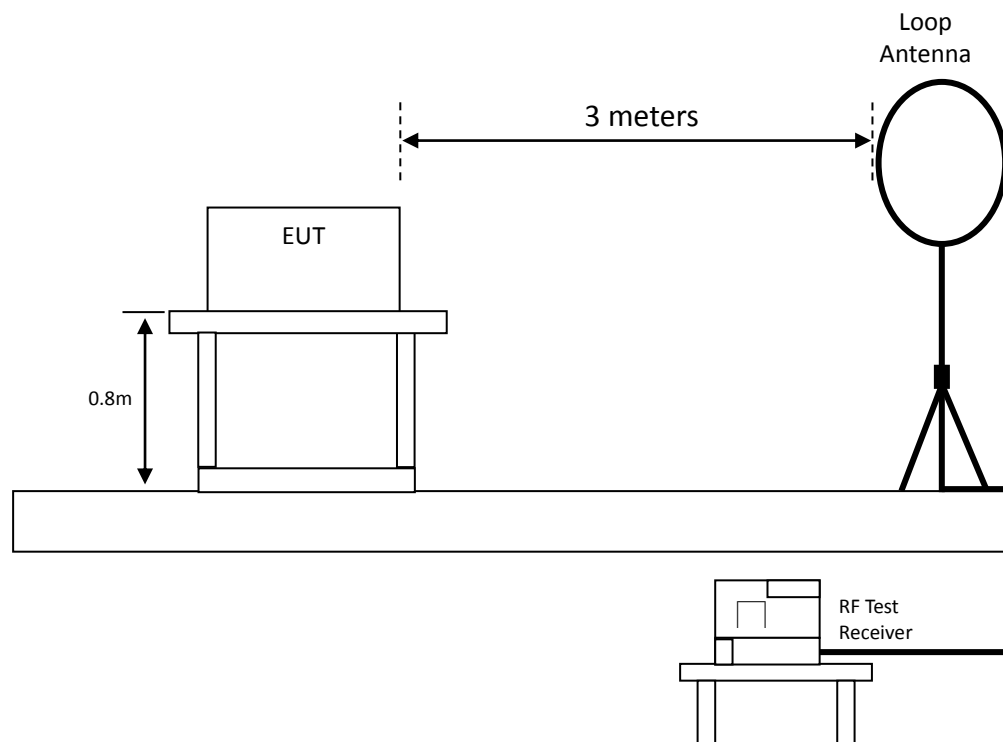
4. Radiated emission test FCC 15.249 (C)

4.1 Operating environment

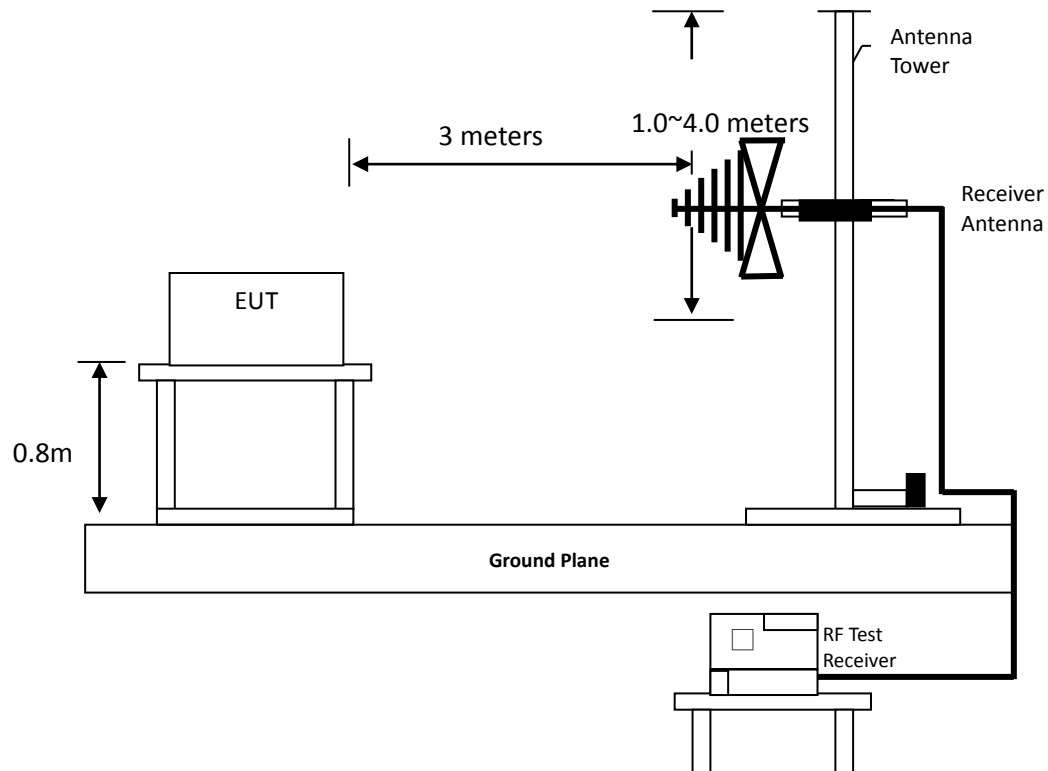
Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure:	1008	hPa

4.2 Test setup & procedure

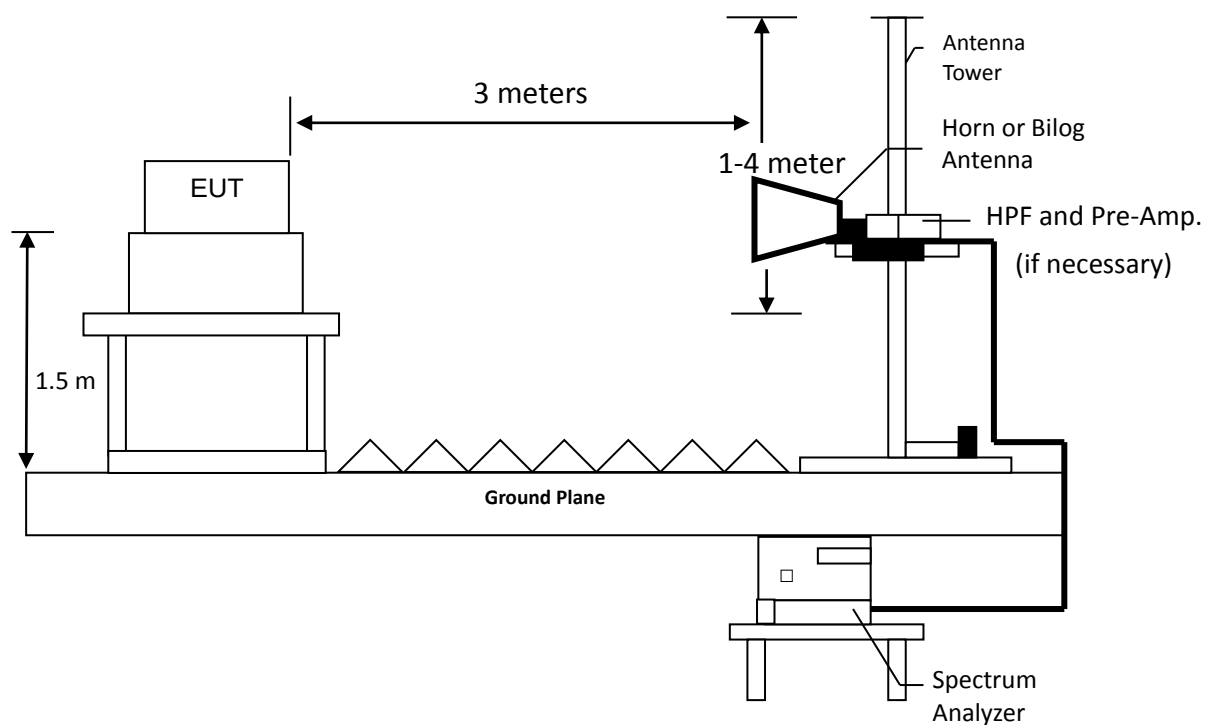
Radiated emission from 9kHz to 30MHz uses Loop Antenna:



Radiated emission below 1GHz using Bilog Antenna



Radiated emission above 1GHz using Horn Antenna



Radiated emissions were investigated cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1 MHz RBW/ 3 MHz VBW) recorded also on the report.

The EUT for testing is arranged on a turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

4.3 Emission limit

4.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
2400-2483.5	50	94	500	54

4.3.2 General radiated emission limits

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

Frequency MHz	15.209 Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

4.4 Radiated spurious emission test data

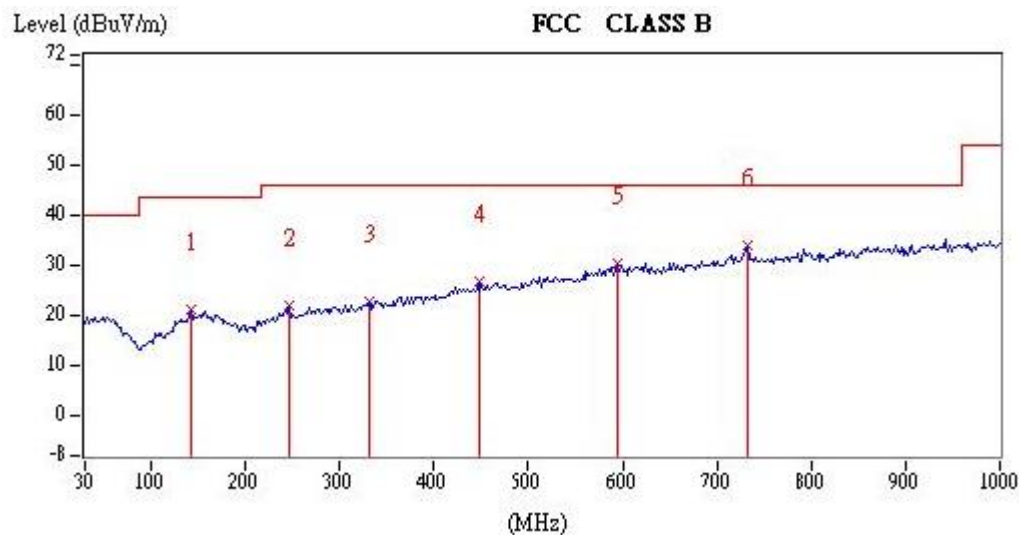
4.4.2 Measurement results: frequencies equal to or less than 1 GHz

Polarity: Vertical

Frequency	Factor	Reading	Emission	Limit	Margin
MHz	dB	dBμV	dBμV/m	dBμV/m	dB
142.52	19.89	1.18	21.08	43.50	-22.42
247.28	20.31	1.60	21.91	46.00	-24.09
330.70	22.17	0.53	22.70	46.00	-23.30
447.10	25.30	1.48	26.78	46.00	-19.22
594.54	28.18	2.12	30.30	46.00	-15.70
732.28	30.45	3.36	33.80	46.00	-12.20

Remark:

1. Factor = Antenna Factor (dB/m) + Cable Loss (dB)
2. Emission (dBμV/m) = Factor (dB) + Reading (dBμV)
3. Margin (dB) = Emission (dB μ V/m) – Limit (dB μ V/m)

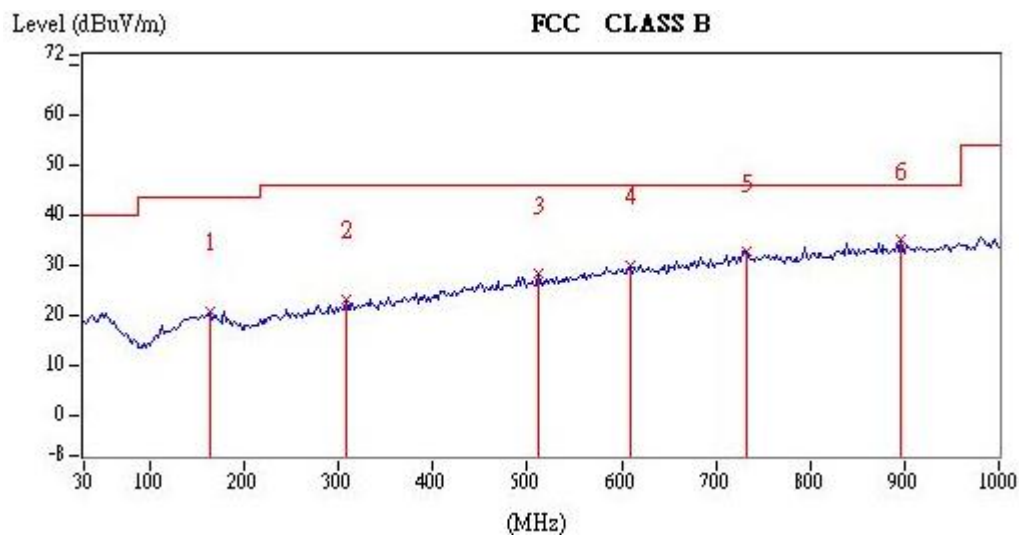


Polarity: Horizontal

Frequency	Factor	Reading	Emission	Limit	Margin
MHz	dB	dB μ V	dB μ V/m	dB μ V/m	dB
163.86	20.29	0.52	20.80	43.50	-22.70
307.42	21.63	1.71	23.33	46.00	-22.67
511.12	26.27	1.99	28.26	46.00	-17.74
610.06	28.46	1.55	30.01	46.00	-15.99
732.28	30.45	2.31	32.76	46.00	-13.24
895.24	32.51	2.65	35.17	46.00	-10.83

Remark:

- Factor = Antenna Factor (dB/m) + Cable Loss (dB)
- Emission (dB μ V/m) = Factor (dB) + Reading (dB μ V)
- Margin (dB) = Emission (dB μ V/m) – Limit (dB μ V/m)



4.4.3 Measurement results: frequency above 1GHz

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
ANT+	4932	PK	V	6.34	47.43	53.77	74.00	-20.23
	4932	AV	V	6.34	33.35	39.69	54.00	-14.31
	7398	PK	V	14.75	33.66	48.41	74.00	-25.59
	4932	PK	H	6.34	48.15	54.49	74.00	-19.51
	4932	AV	H	6.34	33.44	39.78	54.00	-14.22
	7398	PK	H	14.75	50.01	64.76	74.00	-9.24
	9864	PK	H	17.26	48.66	65.92	74.00	-8.08

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre_Amplifier Gain

4.4.4 Measurement results: Fundamental

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
ANT+	2466	PK	V	34.36	47.25	81.61	114.00	-32.39
	2466	AV	V	34.36	33.27	67.63	94.00	-26.37
	2466	PK	H	34.36	49.42	83.78	114.00	-30.22
	2466	AV	H	34.36	35.44	69.80	94.00	-24.20

Remark: Correction Factor = Antenna Factor + Cable Loss

5. Radiated emission on the band edge FCC 15.249(d)

5.1 Operating environment

Temperature:	25	°C
Relative Humidity:	50	%
Atmospheric Pressure:	1008	hPa

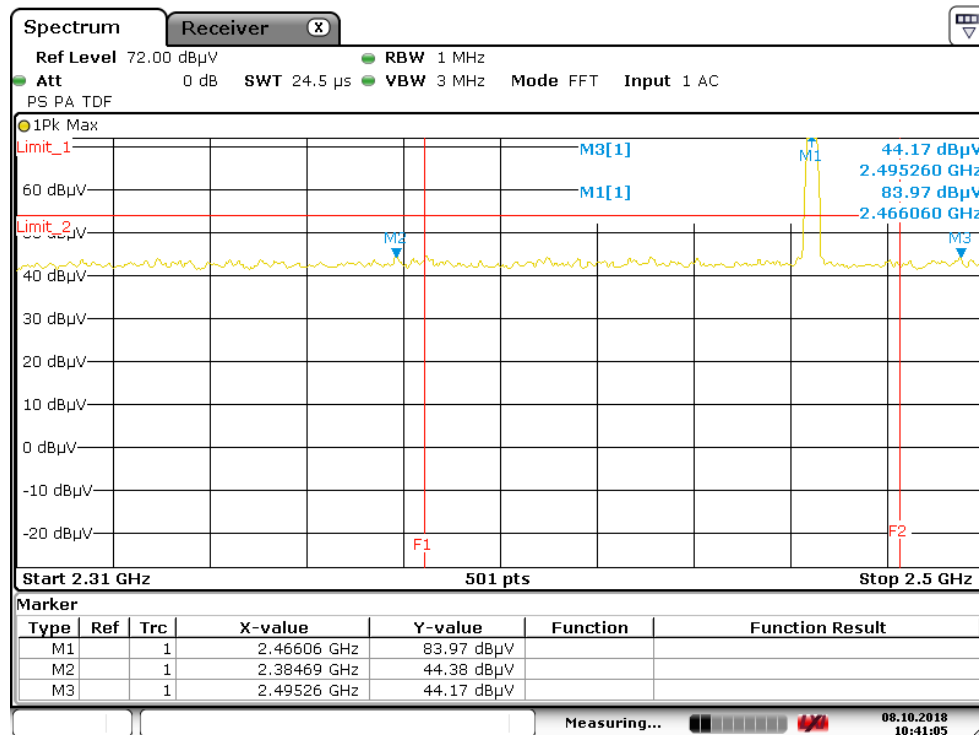
5.2 Radiated emission on the band edge test data

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 (2470MHz) or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
ANT+	2384.69	PK	V	34.37	10.01	44.38	74	-29.62	2310~2390
	2382.04	AV	V	34.37	-3.52	30.85	54	-23.15	
	2495.26	PK	V	34.35	9.82	44.17	74	-29.83	2483.5~2500
	2499.81	AV	V	34.35	-3.16	31.19	54	-22.81	

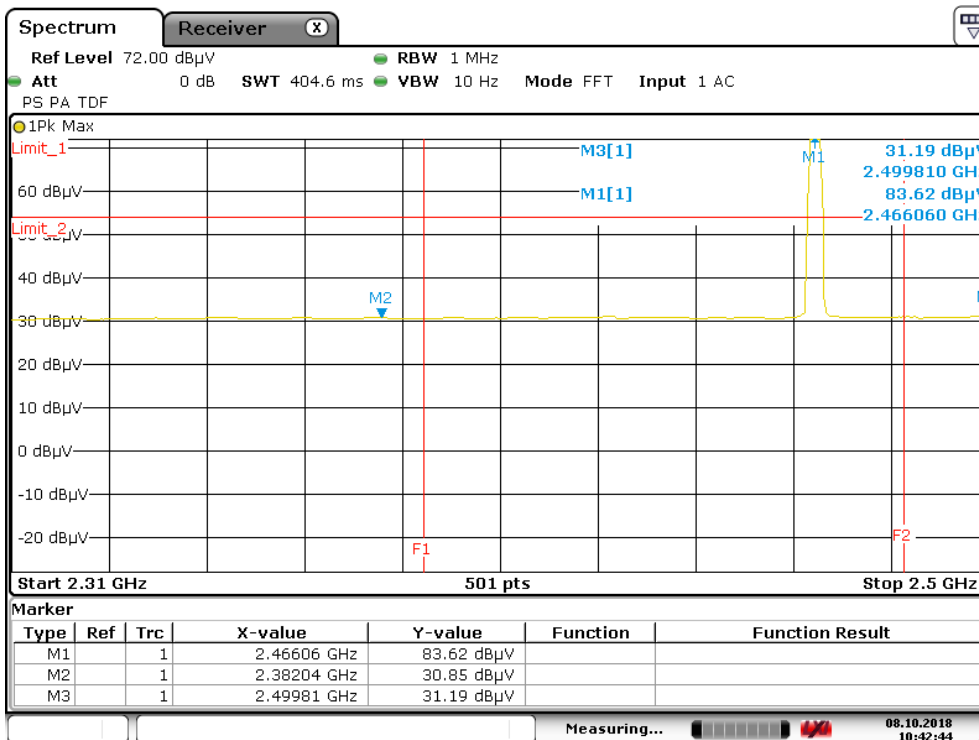
Remark: Correction Factor = Antenna Factor + Cable Loss

Vcell_Bandedge @ mode ANT+ 2466MHz Peak



Date: 8.OCT.2018 10:41:05

Vcell_Bandedge @ mode ANT+ 2466MHz Average



Date: 8.OCT.2018 10:42:44

6. AC Power Line Conducted Emission

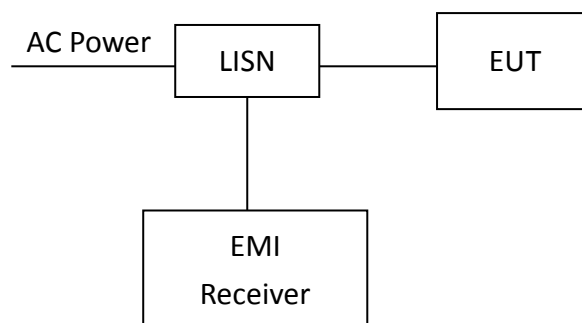
6.1 Measuring instrument setting

Receiver Function	Setting
Detector	QP
Start frequency	0.15MHz
Stop frequency	30MHz
IF bandwidth	9 kHz
Attenuation	10dB

6.2 Test Procedure

Step 1	Configure the EUT according to ANSI C63.10:2013. The EUT or host of EHT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
Step 2	Connect EUT or host of EUT to the power mains through a line impedance stabilization network.
Step 3	All the companion devices are connected to the other LISN. The LISN should provide 50Uh/50ohms coupling impedance.
Step 4	The frequency range from 150 kHz to 30MHz was searched.
Step 5	Set the test-receiver system to peak detector and specified bandwidth with maximum hold mode.
Step 6	The measurement has to be done between each power line and ground at the power terminal.

6.3 Test Diagram



6.4 Limit

Frequency (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56	56 – 46
0.50~5.00	56	46
5.00~30.0	60	50

6.5 Operating Environment Condition

Temperature (°C) :	26
Relative Humidity (%) :	68
Atmospheric Pressure (hPa) :	1010

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6.6 Test Results

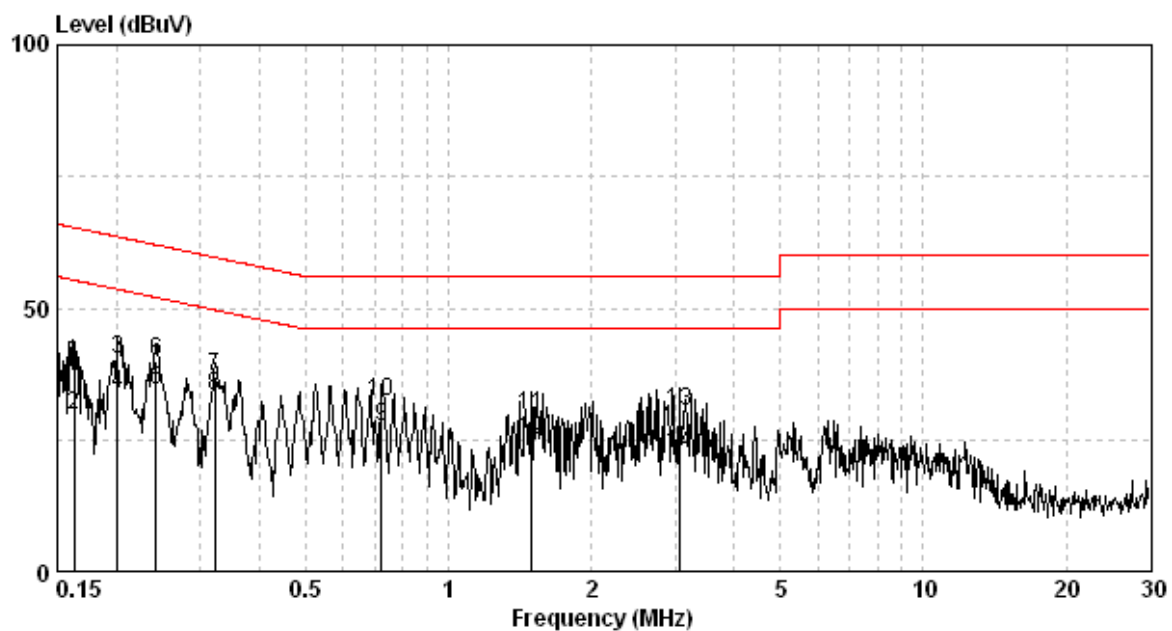
Phase: Live Line

Test Condition: Tx mode

Frequency (MHz)	Corr. Factor (dB)	Reading QP (dBuV)	Level QP (dBuV)	Limit QP (dBuV)	Reading AV (dBuV)	Level AV (dBuV)	Limit AV (dBuV)	Margin (dB)	
								QP	AV
0.162	9.69	29.99	39.68	65.34	20.15	29.83	55.34	-25.66	-25.51
0.201	9.68	30.57	40.25	63.58	24.10	33.78	53.58	-23.33	-19.80
0.242	9.68	30.20	39.89	62.04	24.64	34.32	52.04	-22.15	-17.72
0.322	9.69	27.13	36.81	59.66	23.75	33.44	49.66	-22.85	-16.23
0.724	9.71	22.41	32.12	56.00	17.80	27.50	46.00	-23.88	-18.50
1.487	9.75	19.96	29.72	56.00	15.30	25.06	46.00	-26.28	-20.94
3.058	9.80	20.68	30.48	56.00	12.40	22.21	46.00	-25.52	-23.79

Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



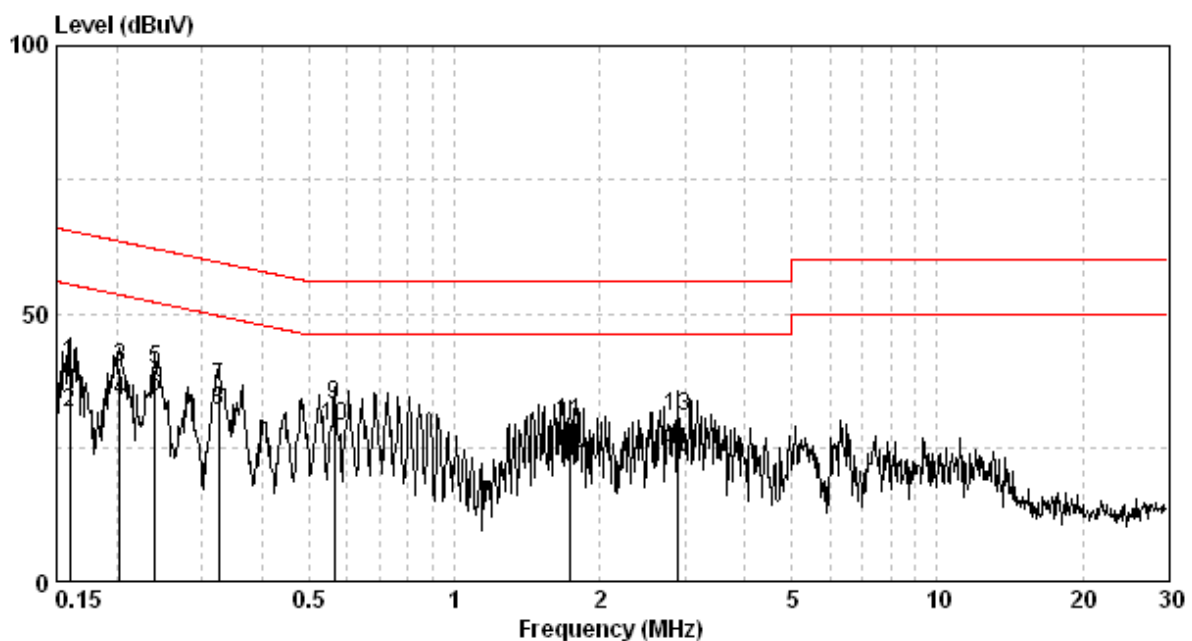
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Phase: Neutral Line
Test Condition: Tx mode

Frequency (MHz)	Corr. Factor (dB)	Reading QP (dBuV)	Level QP (dBuV)	Limit QP (dBuV)	Reading AV (dBuV)	Level AV (dBuV)	Limit AV (dBuV)	Margin (dB)	
								QP	AV
0.160	9.69	30.88	40.57	65.47	21.63	31.32	55.47	-24.90	-24.15
0.203	9.68	30.12	39.80	63.49	24.19	33.87	53.49	-23.70	-19.62
0.240	9.68	29.74	39.42	62.08	24.66	34.34	52.08	-22.66	-17.75
0.325	9.68	26.75	36.42	59.57	22.22	31.90	49.57	-23.15	-17.67
0.564	9.69	23.17	32.86	56.00	19.19	28.88	46.00	-23.14	-17.12
1.734	9.77	20.08	29.85	56.00	14.07	23.84	46.00	-26.15	-22.16
2.900	9.80	20.87	30.68	56.00	12.45	22.25	46.00	-25.32	-23.75

Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



Appendix A: Test equipment list

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2018/11/14	2019/11/13
Spectrum Analyzer	Rohde & Schwarz	FSP30	100245	2018/02/23	2019/02/22
Horn Antenna (1-18G)	SHWARZBECK	BBHA 9120 D	9120D-456	2018/01/23	2019/01/22
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2017/09/04	2020/09/02
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2018/04/23	2019/04/22
Pre-Amplifier	EMC Co.	EMC12635SE	980205	2018/12/10	2019/12/09
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2018/08/28	2019/08/27
Power Meter	Anritsu	ML2495A	0844001	2018/10/29	2019/10/28
Power Sensor	Anritsu	MA2411B	0738452	2018/10/29	2019/10/28
Signal Analyzer	Agilent	N9030A	MY51380492	2018/08/24	2019/08/23
966-2(A) Cable 9kHz~26.5GHz	SUHNER	SMA / EX 100	N/A	2018/08/07	2019/08/06
966-2(B) Cable 9kHz~26.5GHz	SUHNER	SUCOFLEX 104P	CB0005	2018/08/07	2019/08/06
RF Cable 9kHz~26.5GHz	SUHNER	SUCOFLEX 102	CB0006	2018/05/03	2019/05/02
966-2_3m Semi-Anechoic Chamber	966_2	CEM-966_2	N/A	2018/03/05	2019/03/04
High Pass Filter	Wainwright	WHKX3.0/18G-12SS	N/A	2018/06/01	2019/05/31
Active Loop Antenna	SCHWARZBECK MESS-ELEKTRONIC	FMZB1519	1519-067	2018/04/17	2019/04/16

Note: No Calibration Required (NCR)

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	R&S	ESR7	101822	2018/06/12	2019/06/11
Two-Line V-Network	R&S	ENV216	101160	2018/07/24	2019/07/23
Two-Line -V-Network	R&S	ESH3-Z5	838979/014	2018/09/03	2019/09/02
CON-2 Shielded Room	N/A	N/A	N/A	NCR	NCR
CON-2 Cable	SUHNER	EMCCFD300-BM- NM-6000	170502	2018/05/07	2019/05/06
Test software	Audix	e3	4.20040112L	NCR	NCR

Note: No Calibration Required (NCR).

Appendix B: Measurement Uncertainty

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k=2$.

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.14 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.22 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.64 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.64 dB
Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	2.68 dB
Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	2.68 dB
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.54 dB
Emission on the Band Edge Test	3.64 dB
20dB Bandwidth	1.22 dB
AC Power Line Conducted Emission	2.48 dB