



STC Test Report

Date: 2015-01-07

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No.: DM116520

Applicant: VOLFONI R&D
29 rue Jean Jacques Rousseau, 75001 Paris, France

Manufacturer: VOLFONI R&D
29 rue Jean Jacques Rousseau, 75001 Paris, France

Description of Sample(s): Submitted sample(s) said to be
Product: ActivHub RF50 RF emitter
Brand Name: Volfoni
Model Number: VPES-04100
FCC ID: 2AD3Q-VPES04

Date Sample(s) Received: 2014-08-12

Date Tested: 2014-12-24 to 2014-12-26

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2014 and ANSI C63.4: 2009 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): ---



LONG Yun Jian, Along
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
STC (Dongguan) Company Limited

STC (Dongguan) Company Limited

68 Fumin Nan Road, Dalang, Dongguan, China. (Zip Code : 523 770)

Tel : (86 769) 8111 9888 Fax : (86 769) 8111 6222 E-mail : dgstc@dgstc.org Homepage : www.dgstc.org

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1.0 General Details

1.1 Equipment Under Test [EUT] Description of Sample(s)

Product:	ActivHub RF50 RF emitter
Manufacturer:	VOLFONI R&D
Brand Name:	Volfoni
Model Number:	VPES-04100
Rating:	5.0Vd.c. (Powered by PC USB port)

1.2 Description of EUT Operation

The Equipment Under Test (EUT) is a ActivHub RF50 RF emitter of VOLFONI R&D. The transceiver operating in the 2.4GHz ISM frequency band. The RF signal was modulated by IC, the type of modulation used is FSK.

1.3 Date of Order

2014-08-12

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2014-12-24 to 2014-12-26

1.6 Country of Origin

China

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2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2014 Regulations and ANSI C63.4:2009 for FCC Certification.

2.2 Test Standards and Results Summary Tables

EMISSION Results Summary						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Fail	N/A
Field Strength of Fundamental & Harmonics Emissions	FCC 47CFR 15.249	ANSI C63.4:2009	N/A	☒	☐	☐
Radiated Emissions	FCC 47CFR 15.209	ANSI C63.4:2009	N/A	☒	☐	☐
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.4:2009	N/A	☒	☐	☐

Note: N/A - Not Applicable

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3.0 Test Results

3.1 Emission

3.1.1 Radiated Emissions

Test Requirement:	FCC 47CFR 15.249 & FCC 47CFR 15.209
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-26
Mode of Operation:	Communication mode

Test Method:

The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*: Semi-anechoic chamber located on the STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

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Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)

RBW: 10kHz
VBW: 30kHz
Sweep: Auto
Span: Fully capture the emissions being measured
Trace: Max. hold

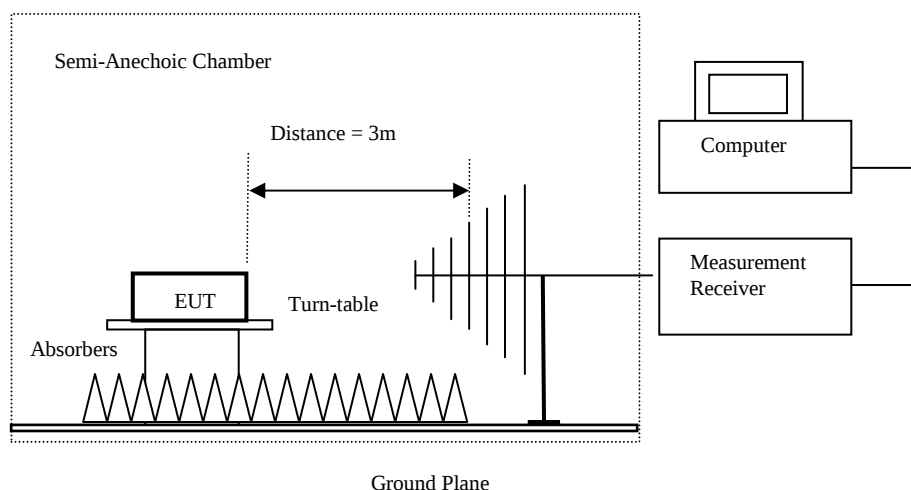
30MHz – 1GHz (QP)

RBW: 120kHz
VBW: 120kHz
Sweep: Auto
Span: Fully capture the emissions being measured
Trace: Max. hold

Above 1GHz (Pk & Av)

RBW: 3MHz
VBW: 3MHz
Sweep: Auto
Span: Fully capture the emissions being measured
Trace: Max. hold

Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used, 9kHz to 30MHz loop antennas are used.

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Limits for Field Strength of Fundamental & Harmonics Emissions [FCC 47CFR 15.249]:

Frequency Range of Fundamental [MHz]	Field Strength of Fundamental Emission [microvolts/meter]	Field Strength of Harmonics Emission [microvolts/meter]
902-928	500,000 [Quasi-Peak]	500 [Average]
2400-2483.5	50,000 [Average]	500 [Average]

Results of Tx mode (Lowest Frequency Channel): Pass

Field Strength of Fundamental Emissions Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2401.50	57.6	36.8	94.4	52,480.7	500,000	Vertical

Field Strength of Fundamental Emissions Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2401.50	45.9	36.8	82.7	13,645.8	50,000	Vertical

Field Strength of Harmonics Emission Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
4803.0	14.1	41.5	55.6	602.6	5,000	Vertical
4803.0	12.2	42.4	54.6	537.0	5,000	Horizontal
7204.5	10.4	45.1	55.5	595.7	5,000	Vertical
7204.5	9.0	46.2	55.2	575.4	5,000	Horizontal
9606.0	7.1	48.0	55.1	568.9	5,000	Vertical
9606.0	6.5	48.8	55.3	582.1	5,000	Horizontal
12007.5	4.2	51.5	55.7	609.5	5,000	Vertical
12007.5	4.1	52.4	56.5	668.3	5,000	Horizontal

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Field Strength of Harmonics Emission						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
4803.0	0.5	41.5	42.0	125.9	500	Vertical
4803.0	-1.3	42.4	41.1	113.5	500	Horizontal
7204.5	-5.4	45.1	39.7	96.6	500	Vertical
7204.5	-5.7	46.2	40.5	105.9	500	Horizontal
9606.0	-7.6	48.0	40.4	104.7	500	Vertical
9606.0	-6.6	48.8	42.2	128.8	500	Horizontal
12007.5	-11	51.5	40.5	105.9	500	Vertical
12007.5	-9.9	52.4	42.5	133.4	500	Horizontal

Results of Tx mode (Middle Frequency Channel): Pass

Field Strength of Fundamental Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2419.40	56.9	36.8	93.7	48,417.2	500,000	Vertical

Field Strength of Fundamental Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
2419.40	45.3	36.8	82.1	12,735.0	50,000	Vertical

Field Strength of Harmonics Emission						
Peak Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
4838.8	13.3	41.6	54.9	555.9	5,000	Vertical
4838.8	12.8	42.5	55.3	582.1	5,000	Horizontal
7258.2	10.3	45.2	55.5	595.7	5,000	Vertical
7258.2	8.9	46.3	55.2	575.4	5,000	Horizontal
9677.6	7.0	48.1	55.1	568.9	5,000	Vertical
9677.6	6.3	48.9	55.2	575.4	5,000	Horizontal
12097.0	2.8	51.6	54.4	524.8	5,000	Vertical
12097.0	4.0	52.5	56.5	668.3	5,000	Horizontal

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Field Strength of Harmonics Emission Average Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
4838.8	-1.1	41.6	40.5	105.9	500	Vertical
4838.8	-1.4	42.5	41.1	113.5	500	Horizontal
7258.2	-5.2	45.2	40.0	100.0	500	Vertical
7258.2	-6.7	46.3	39.6	95.5	500	Horizontal
9677.6	-6.8	48.1	41.3	116.1	500	Vertical
9677.6	-8.9	48.9	40.0	100.0	500	Horizontal
12097.0	-11.3	51.6	40.3	103.5	500	Vertical
12097.0	-11.0	52.5	41.5	118.9	500	Horizontal

Results of Tx mode (Highest Frequency Channel): Pass

Field Strength of Fundamental Emissions Quasi-Peak						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2438.60	56.7	36.8	93.5	47,315.1	500,000	Vertical

Field Strength of Fundamental Emissions Average Value						
Frequency MHz	Measured Level @3m dB μ V/m	Correction Factor dB μ V/m	Field Strength dB μ V/m	Field Strength μ V/m	Limit @3m μ V/m	E-Field Polarity
2438.60	45.0	36.8	81.8	12,302.7	50,000	Vertical

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Field Strength of Harmonics Emission						
Average Value						
Frequency MHz	Measured Level @3m dBμV/m	Correction Factor dBμV/m	Field Strength dBμV/m	Field Strength μV/m	Limit @3m μV/m	E-Field Polarity
4877.2	-0.4	41.4	41.0	112.2	500	Vertical
4877.2	-1.1	42.7	41.6	120.2	500	Horizontal
7315.8	-5.3	45.6	40.3	103.5	500	Vertical
7315.8	-4.5	46.5	42.0	125.9	500	Horizontal
9754.4	-8.9	48.6	39.7	96.6	500	Vertical
9754.4	-10.1	49.7	39.6	95.5	500	Horizontal
12193.0	-9.9	51.7	41.8	123.0	500	Vertical
12193.0	-12.3	52.7	40.4	104.7	500	Horizontal

No additional spurious emissions found between lowest internal used/generated frequency and 30 MHz

Calculated measurement uncertainty	(9kHz - 30MHz): 3.3dB
	(30MHz – 1GHz): 4.6dB
	(1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [$\mu\text{V/m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

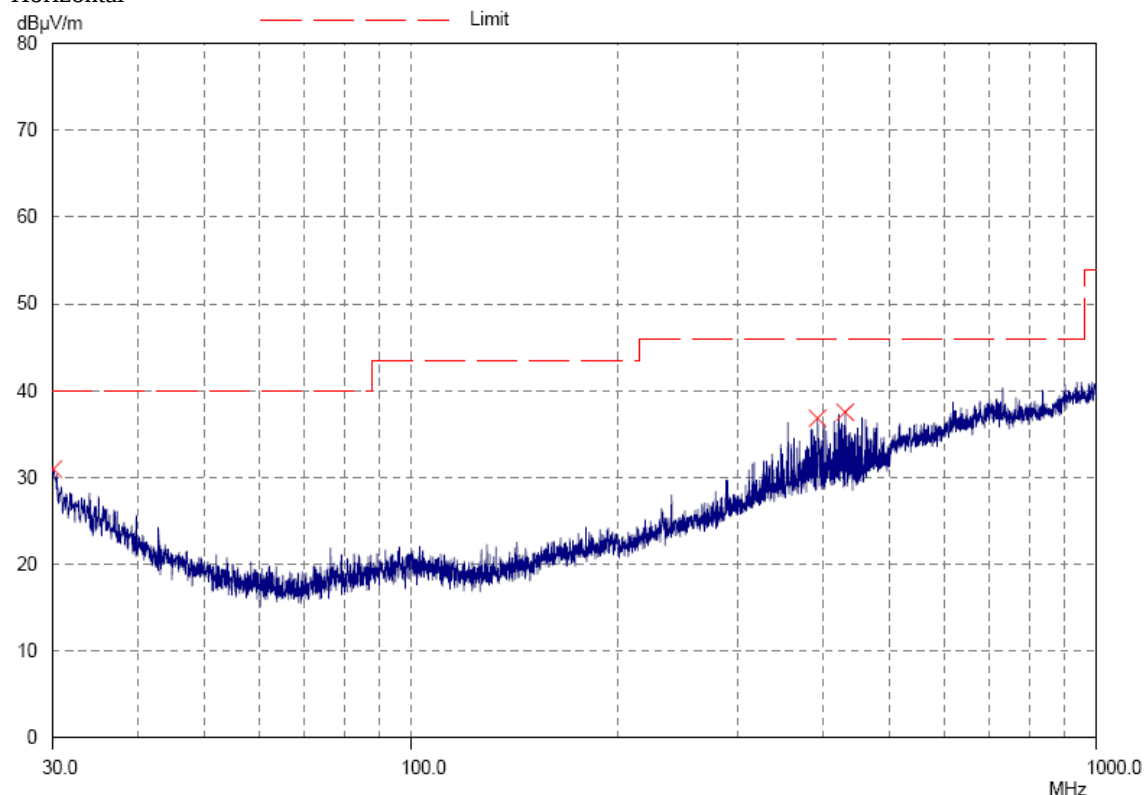
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Results of Communication mode (9kHz – 30MHz): PASS

Emissions detected are more than 20 dB below the FCC Limits

Results of Communication mode: PASS

Horizontal



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Results of Communication mode: PASS

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dB μ V/m	Limit @3m dB μ V/m	Level @3m μ V/m	Limit @3m μ V/m
30.1	Horizontal	30.9	40.0	35.1	100
392.1	Horizontal	36.8	46.0	69.2	200
430.1	Horizontal	37.5	46.0	75.0	200

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Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [$\mu\text{V/m}$]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

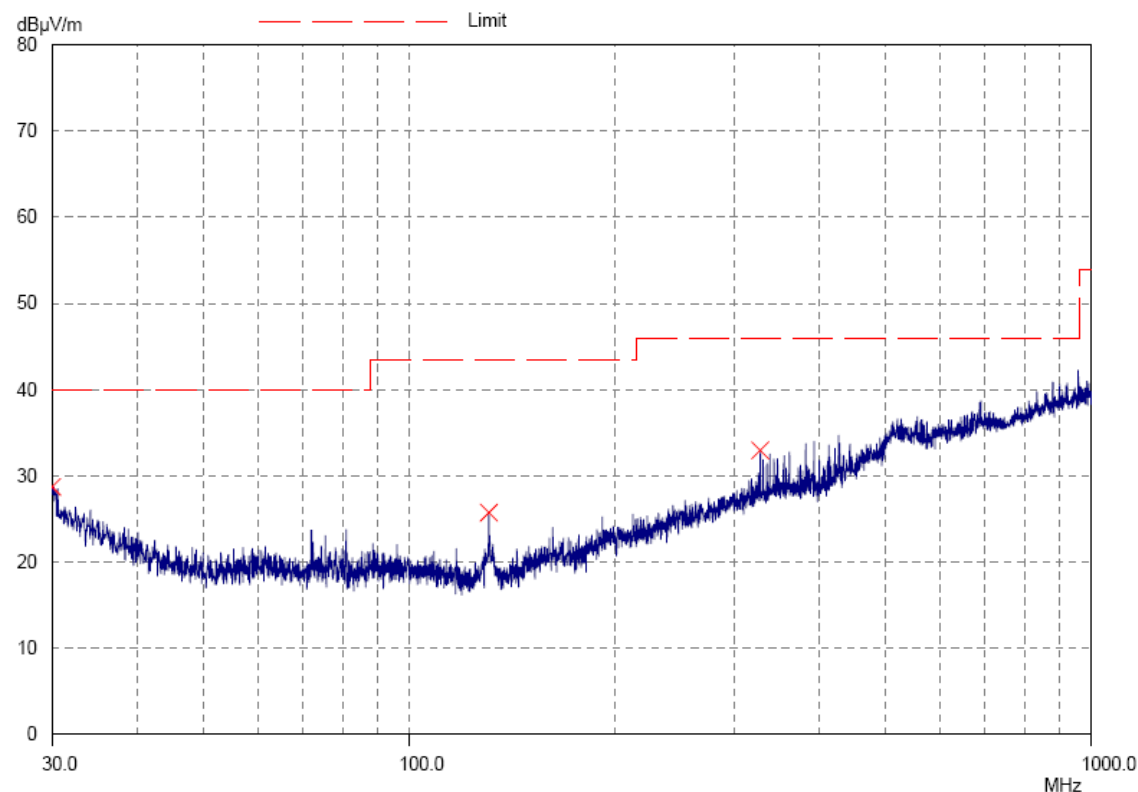
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Results of Communication mode (9kHz – 30MHz): PASS

Emissions detected are more than 20 dB below the FCC Limits

Results of Communication mode: PASS

Vertical



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Results of Communication mode: PASS

Radiated Emissions Quasi-Peak					
Emission Frequency MHz	E-Field Polarity	Level @3m dB μ V/m	Limit @3m dB μ V/m	Level @3m μ V/m	Limit @3m μ V/m
30.0	Vertical	28.7	40.0	27.2	100
130.9	Vertical	25.7	43.5	19.3	150
327.1	Vertical	32.9	46.0	44.2	200

Remarks:

Calculated measurement uncertainty (9kHz - 30MHz): 3.3dB
 (30MHz – 1GHz): 4.6dB
 (1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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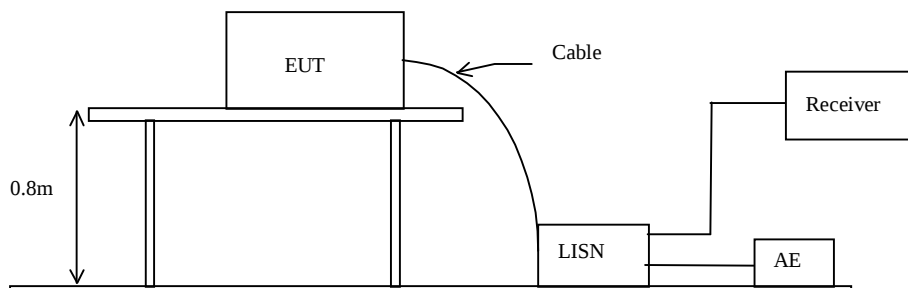
3.1.2 AC Mains Conducted Emissions (0.15MHz to 30MHz)

Test Requirement:	FCC 47CFR 15.207
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-26
Mode of Operation:	Charge mode
Test Voltage:	120Va.c. 60Hz

Test Method:

The test was performed in accordance with ANSI C63.4: 2009, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



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Limit for Conducted Emissions (FCC 47 CFR 15.207):

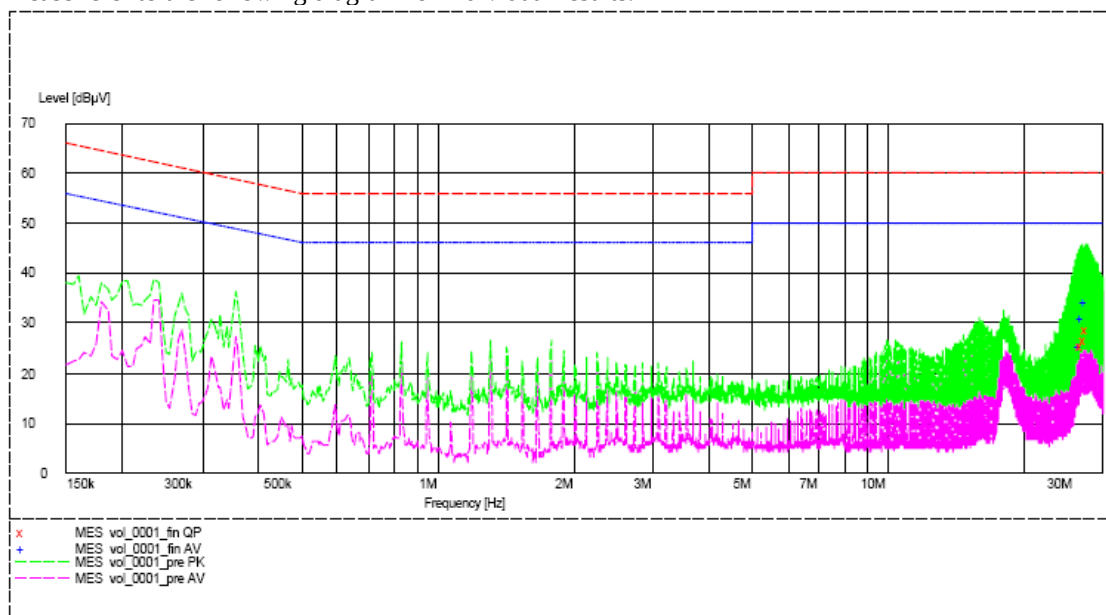
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Result of Communication mode(EUT Connected to PC, PC Mains) (L): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Live	26.910	25.5	60.0	-*-	-*-
Live	27.515	26.5	60.0	-*-	-*-
Live	27.635	28.5	60.0	-*-	-*-
Live	26.790	-*-	-*-	25.5	50.0
Live	26.910	-*-	-*-	31.1	50.0
Live	27.395	-*-	-*-	34.3	50.0

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Limit for Conducted Emissions (FCC 47 CFR 15.207):

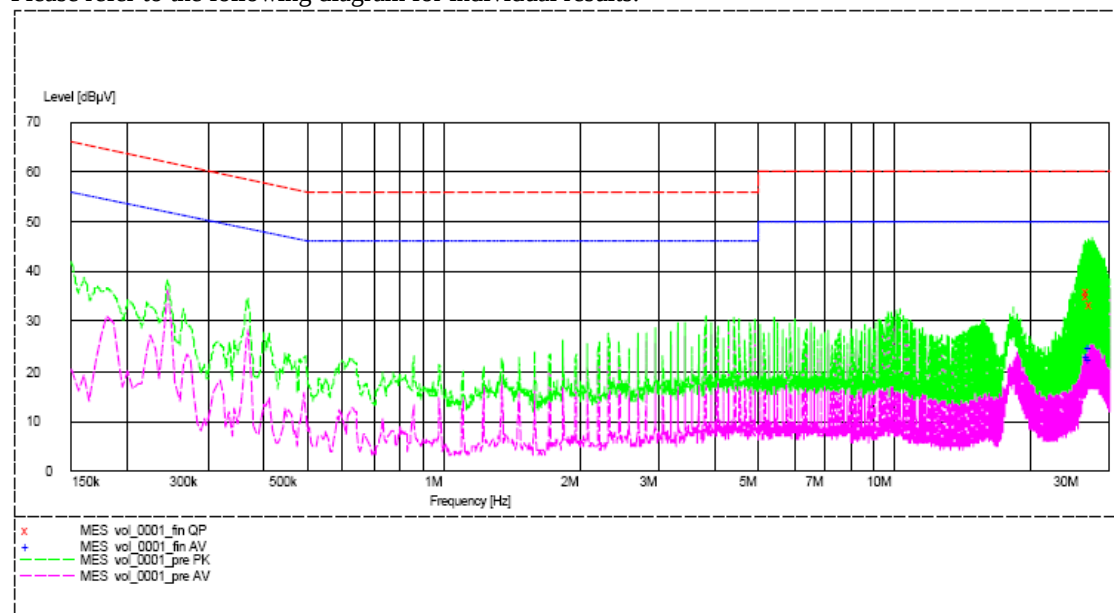
Frequency Range [MHz]	Quasi-Peak Limits [dBμV]	Average [dBμV]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Result of Communication mode(EUT Connected to PC, PC Mains) (N): PASS

Please refer to the following diagram for individual results.



Conductor Live or Neutral	Frequency MHz	Quasi-peak		Average	
		Level dBμV	Limit dBμV	Level dBμV	Limit dBμV
Neutral	26.810	35.1	60.0	-*-	-*-
Neutral	26.935	36.1	60.0	-*-	-*-
Neutral	27.430	33.5	60.0	-*-	-*-
Neutral	26.935	-*-	-*-	23.1	50.0
Neutral	27.060	-*-	-*-	22.3	50.0
Neutral	27.305	-*-	-*-	24.7	50.0

Remarks:

Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB

-*- Emission(s) that is far below the corresponding limit line.

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3.2 20dB Bandwidth of Fundamental Emission

Test Requirement:	FCC 47 CFR 15.249
Test Method:	ANSI C63.4:2009
Test Date:	2014-12-20
Mode of Operation:	Tx mode

Test Method:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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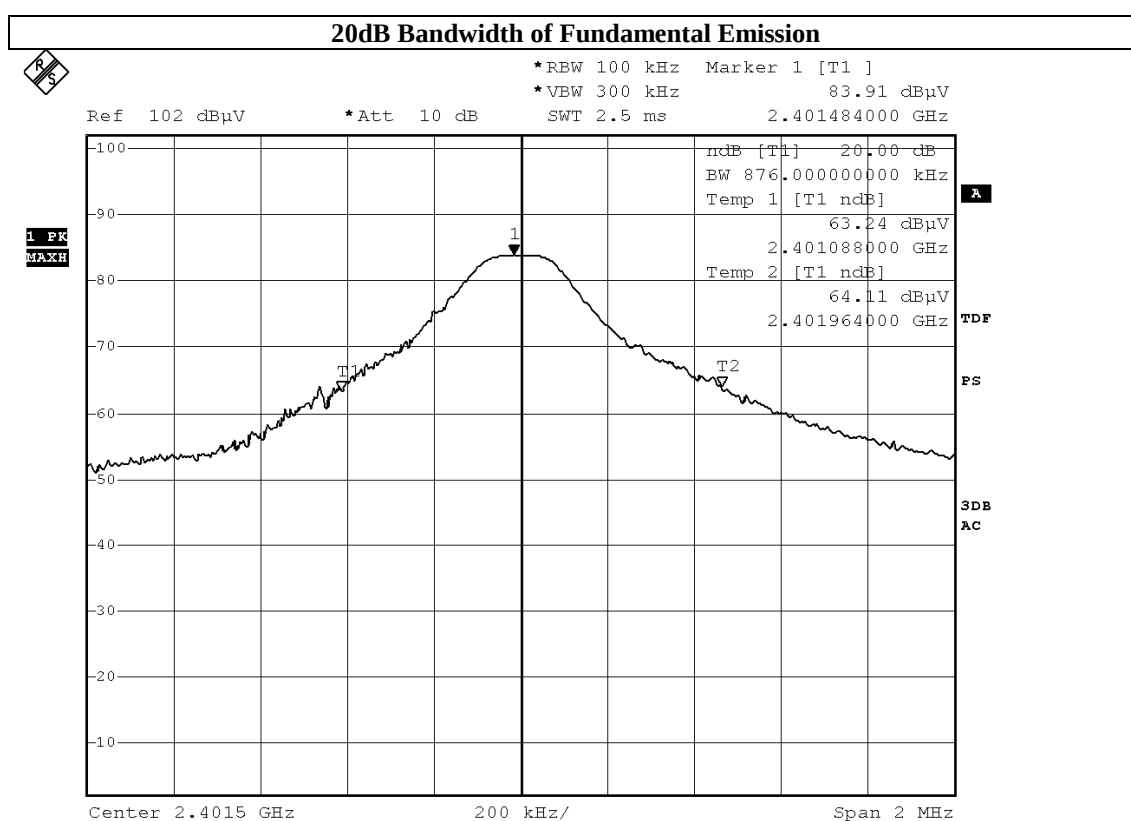
Date: 2015-01-07

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Limits for 20dB Bandwidth of Fundamental Emission (Low Frequency Channel):

Frequency Range [MHz]	20dB Bandwidth [kHz]
2401.5	876



Date: 20.DEC.2014 15:09:24

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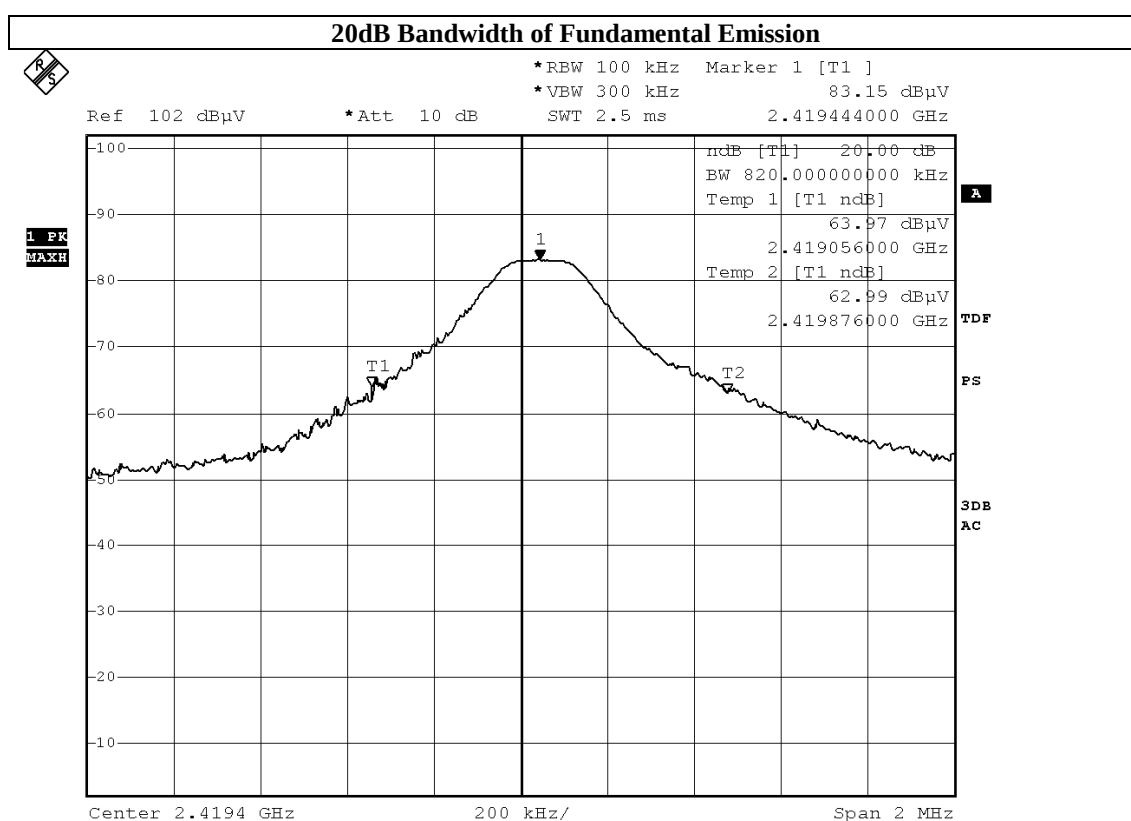
Date: 2015-01-07

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Limits for 20dB Bandwidth of Fundamental Emission (Middle Frequency Channel):

Frequency Range [MHz]	20dB Bandwidth [kHz]
2419.4	820



Date: 20.DEC.2014 14:54:32

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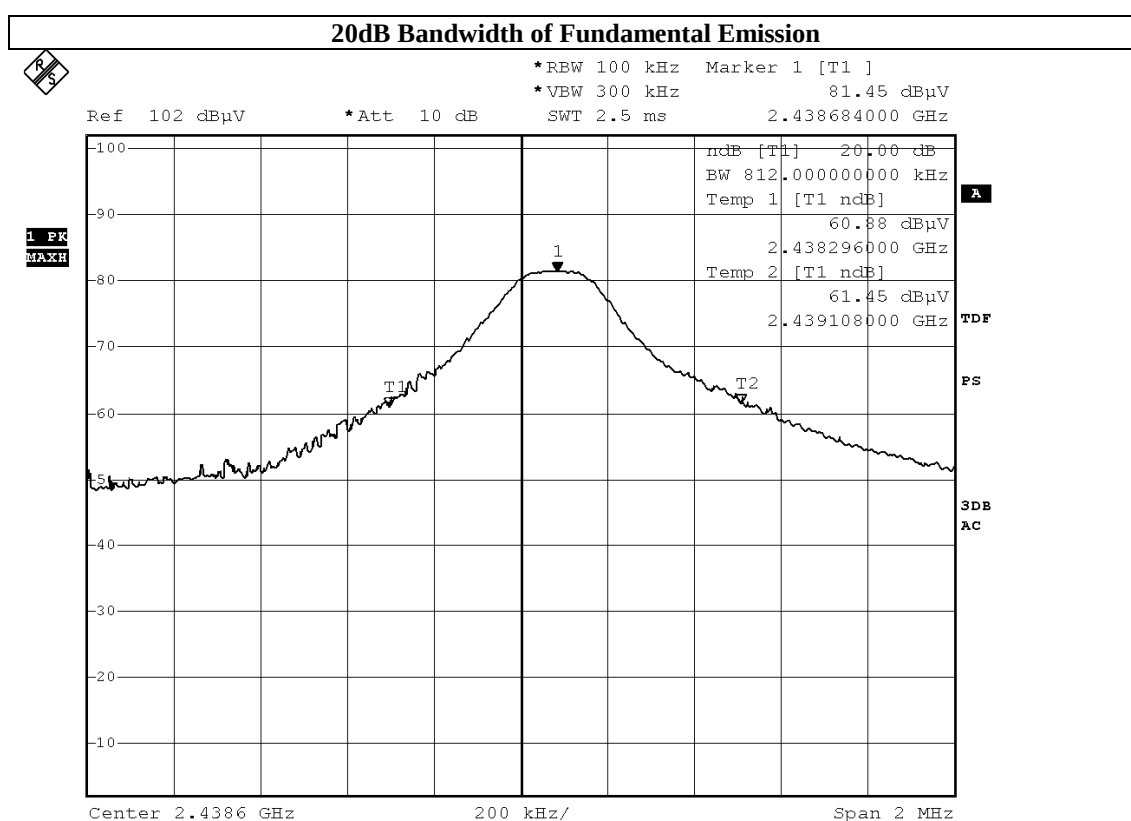
Date: 2015-01-07

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Limits for 20dB Bandwidth of Fundamental Emission (High Frequency Channel):

Frequency Range [MHz]	20dB Bandwidth [kHz]
2438.6	812



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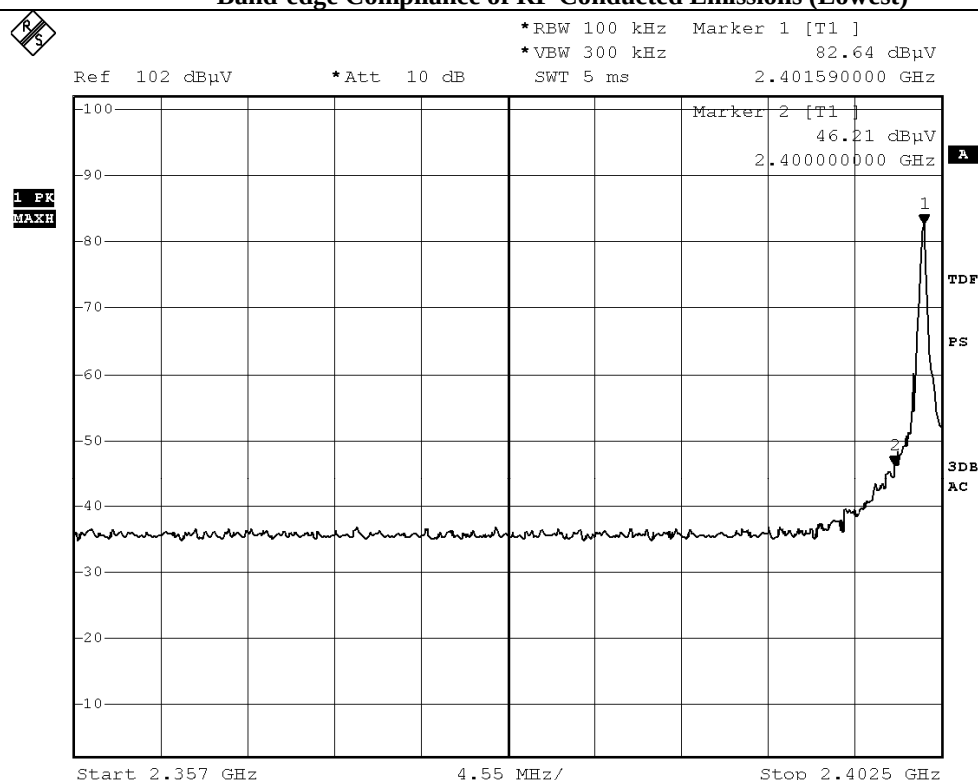
Band-edge Compliance of RF Conducted Emissions Measurement:

Limit :

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
2400 – Lowest Fundamental (2401.5)	36.43

Band-edge Compliance of RF Conducted Emissions (Lowest)



Date: 20.DEC.2014 15:35:32

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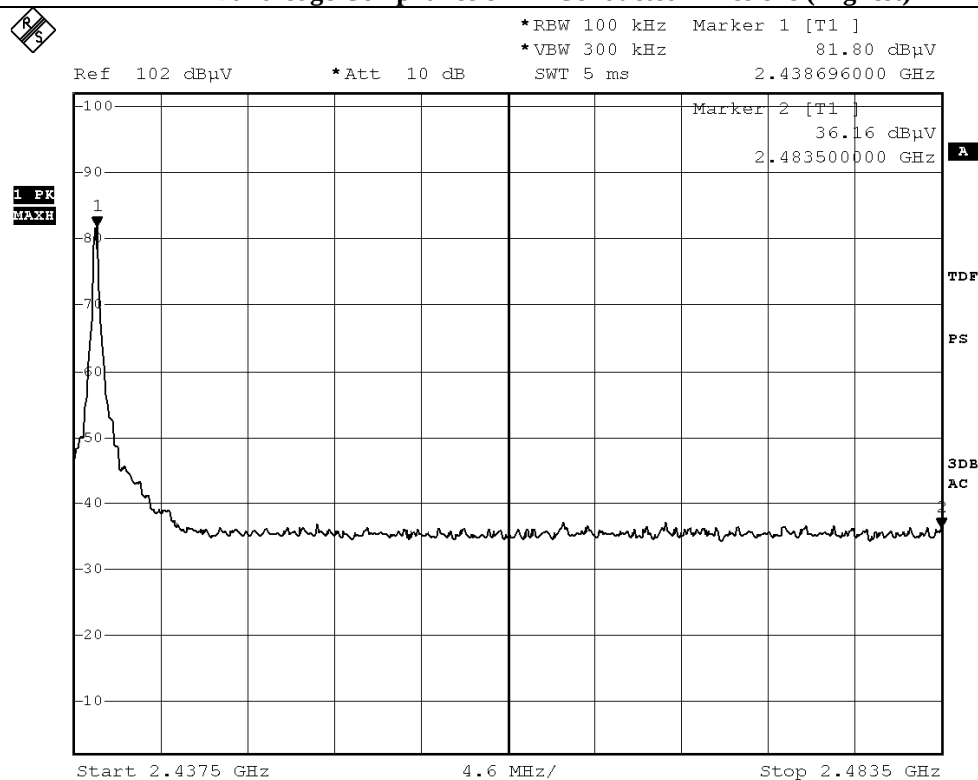
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Band-edge Compliance of RF Conducted Emissions Measurement:

Frequency Range	Radiated Emission Attenuated below the Fundamental
[MHz]	[dB]
Highest Fundamental (2438.6) - 2483.5	45.64

Band-edge Compliance of RF Conducted Emissions (Highest)



Date: 20.DEC.2014 15:31:27

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Band-edge Compliance of RF Radiated Emissions Measurement:

Limit :

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 5.205(c)).

Result: Band-edge Compliance of RF Radiated Emissions (Lowest)

Field Strength of Band-edge Compliance Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB μ V/m	
2400.0	11.7	36.8	48.5	74.0	25.5	Vertical

Field Strength of Band-edge Compliance Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB μ V/m	
2400.0	1.3	36.8	38.1	54.0	15.9	Vertical

Result: Band-edge Compliance of RF Radiated Emissions (Highest)

Field Strength of Band-edge Compliance Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB μ V/m	
2483.5	10.4	36.4	46.8	74.0	27.2	Horizontal

Field Strength of Band-edge Compliance Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dB μ V	dB/m	dB μ V/m	dB μ V/m	dB μ V/m	
2483.5	1.2	36.4	37.6	54.0	16.4	Horizontal

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Appendix A

List of Measurement Equipment

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EMD004	LISN	ROHDE & SCHWARZ	ESH3-Z5	100102	2014.03.21	2015.03.21
EMD022	EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100314	2014.03.21	2015.03.21
EMD035	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	100441	2014.06.10	2015.06.10
EMD036	EMI Test Receiver	ROHDE & SCHWARZ	ESIB 26	100388	2014.06.10	2015.06.10
EMD041	TWO-LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	100261	2014.03.21	2015.03.21
EMD061	Biconilog Antenna	ETS.LINDGREN	3142C	00060439	2014.11.29	2016.11.29
EMD062	Double-Ridged Waveguide (1GHz – 18GHz)	ETS.LINDGREN	3117	00075933	2014.11.15	2015.11.15
EMD084	MULTI-DVICE CONTROLLER	ETS.LINDGREN	2090	00060107	N/A	N/A
EMD088	Video Contol Unit	ETS.LINDGREN	Y21953A	2601073	N/A	N/A
EMD093	Monitor	ViewSonic	VA9036	Q8X064201876	N/A	N/A
EMD102	Intelligent Frequency	Ainuo Instrument Co., Ltd	AN97005SS	79707454	N/A	N/A
EMD103	Intelligent Frequency	Ainuo Instrument Co., Ltd	AN97005SS	79707455	N/A	N/A
EMD105	FACT-3 EMC Chamber	ETS.LINDGREN	FACT-3	3803	N/A	N/A
EMD106	Shielding Room #1	ETS.LINDGREN	RFD-100	3802	N/A	N/A
	100V Insertion Unit	ROHDE & SCHWARZ	URV5-Z4	100464	2014.03.21	2015.03.21
EMD113	Pre-Amplifier	ROHDE & SCHWARZ	N/A	1129588	2014.03.21	2015.03.21
EMD124	Loop Antenna	ETS-Lindgren	6502	00104905	2014.04.28	2016.04.28
EMD131	Standard Gain Horn Antenna (18GHz – 26.5GHz)	Chengdu AINFO Inc.	JXTXLB-42-15-C-KF	J2021100721001	2013.04.09	2015.04.09

Remarks:-

N/A Not Applicable or Not Available

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Appendix B

Photographs of EUT

Front View of the product



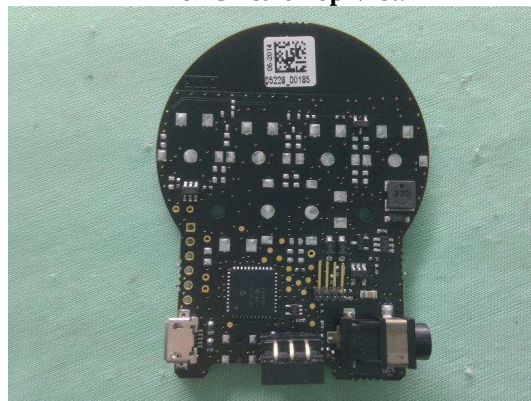
Rear View of the product



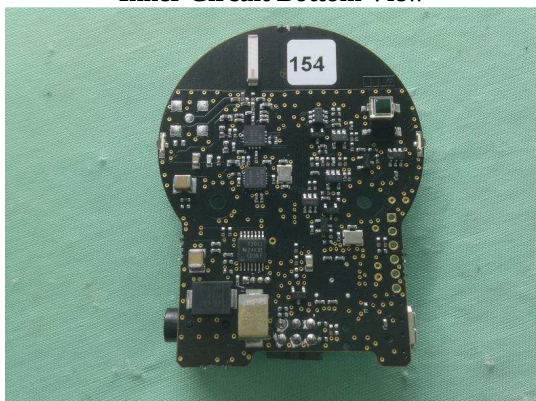
Inside View of the product



Inner Circuit Top View



Inner Circuit Bottom View



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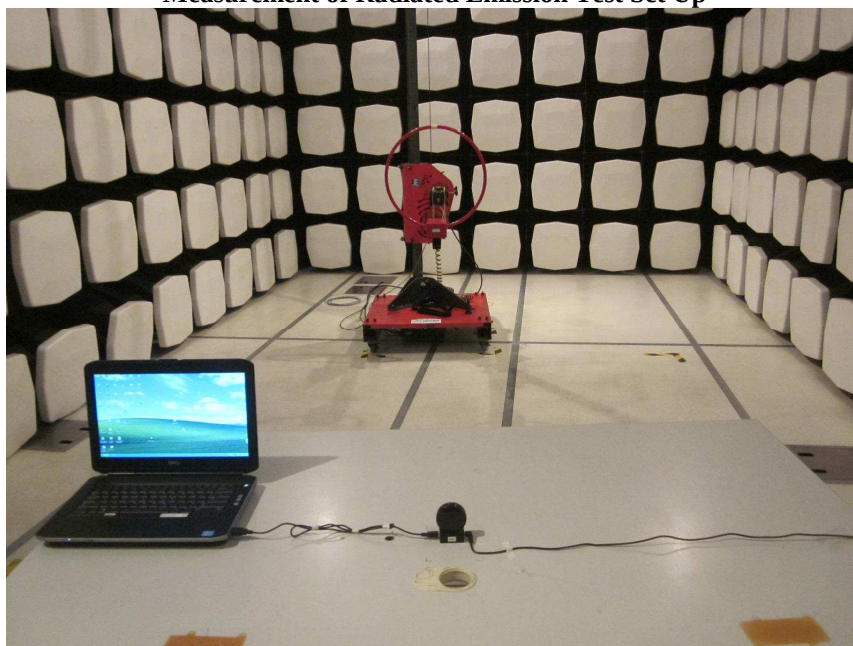
Date: 2015-01-07

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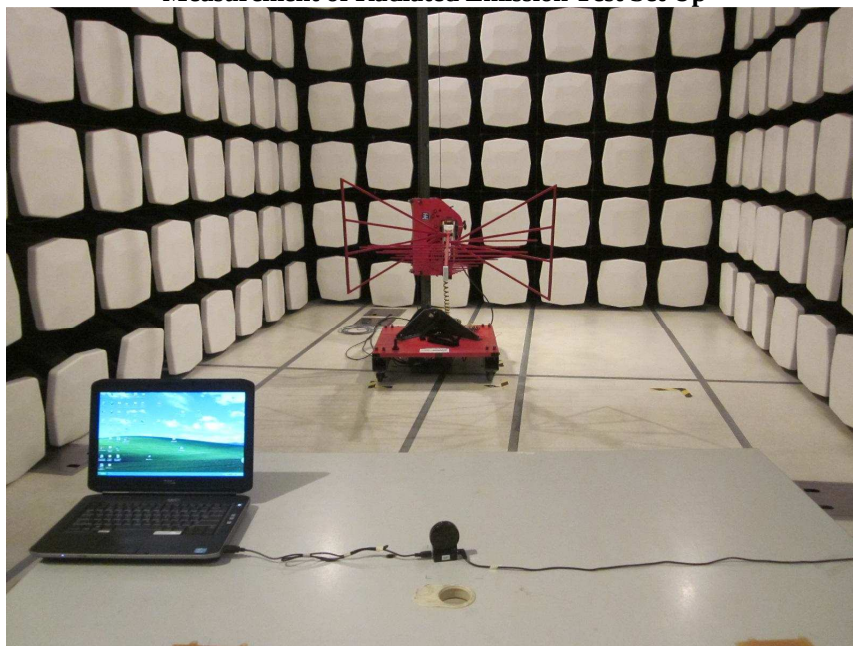
No.: DM116520

Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Radiated Emission Test Set Up



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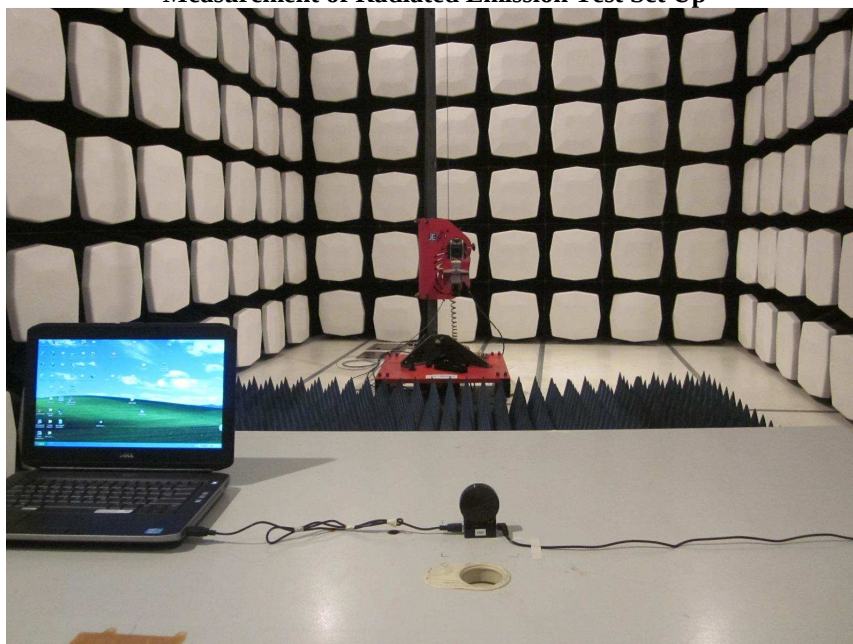
Date: 2015-01-07

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Photographs of EUT

Measurement of Radiated Emission Test Set Up



Measurement of Conducted Emission Test Set Up



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