

FCC - TEST REPORT

Report Number	: 68.910.19.0055.01	Date of Issue: <u>September 04, 2019</u>
Model	: R5025	
Product Type	: HEATED INSOLE REMOTE	
Applicant	: Implus Footcare LLC	
Address	: 2001 TW ALEXANDER DRIVE DURHAM, North Carolina 27709-3925 USA	
Production Facility	: Shenzhen Cosinno Technology Co., Ltd.	
Address	: 2nd Floor, A Building, Diwei 1st Road, DongFang Block, Songgang, Bao'an District, 518125 Shenzhen City, PEOPLE'S REPUBLIC OF CHINA	
Test Result	: <input checked="" type="checkbox"/> Positive <input type="checkbox"/> Negative	
Total pages including Appendices	: <u>23</u>	

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052,
P. R. China

FCC Registration Number: 514049

ISED#: 10320A

CAB identifier: CN0077

Telephone: 86 755 8828 6998
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3 Description of the Equipment Under Test

Description of the Equipment Under Test

Product: HEATED INSOLE REMOTE

Model no.: R5025

FCC ID: 2AUDI-R5025

Options and accessories: NIL

Ratings: 12VDC

RF Transmission Frequency: 2452MHz-2468MHz

Channel Numbers 2

Modulation: GFSK

Antenna Type: PCB

Antenna Gain: 4dBi

Description of the EUT: NIL

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	RATINGS	MODEL NO.(SHIELD)
---	---	---	---

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2018 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to ANSI C63.10-2013.

5 Summary of Test Results

Technical Requirements						
FCC Part 15 Subpart C 15.249		Pages	Test Site	Test Result		
Test Condition				Pass	Fail	N/A
§15.207 Conducted emission AC power port	---	---		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.205(a), §15.209(a), §15.249(a), §15.249(c) Field strength of emissions and Restricted bands	9	Site 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.249(d) Out of band emissions	14	Site 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.215(c) 20dB bandwidth	19	Site 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203 Antenna requirement	See note 1			<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remark 1: N/A- Not Applicable for battery operated device.

Note 1: The EUT used an integral PCB antenna, which gain is 4dBi. According to §15.203, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID:2AUDI-R5025 complies with Section 15.205, 15.209, 15.249 of the FCC Part 15, Subpart C Rules.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed

- **Not** Performed

The Equipment Under Test

- **Fulfills** the general approval requirements.

- **Does not** fulfill the general approval requirements.

Sample Received Date: August 16, 2019

Testing Start Date: August 20, 2019

Testing End Date: September 03, 2019

- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch -

Reviewed by:

Prepared by:

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Laurent Yuan
EMC Project Manager



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EMC Project Manager

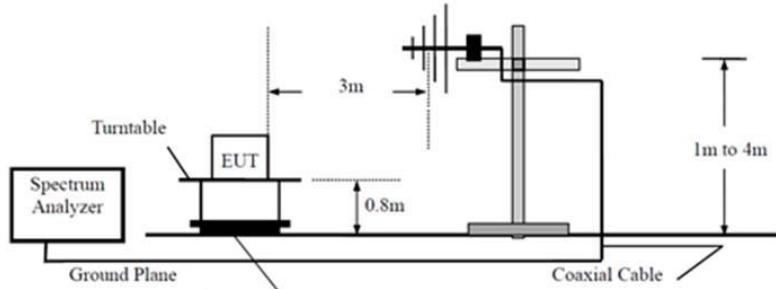


Tree Zhan
EMC Senior Test Engineer

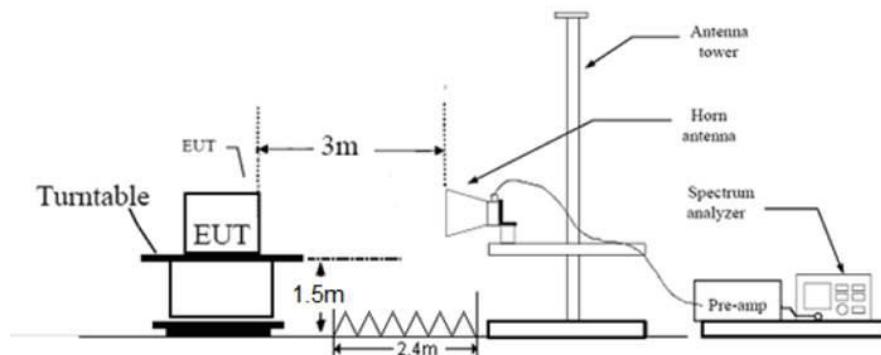
7 Test setups

7.1 Radiated test setups

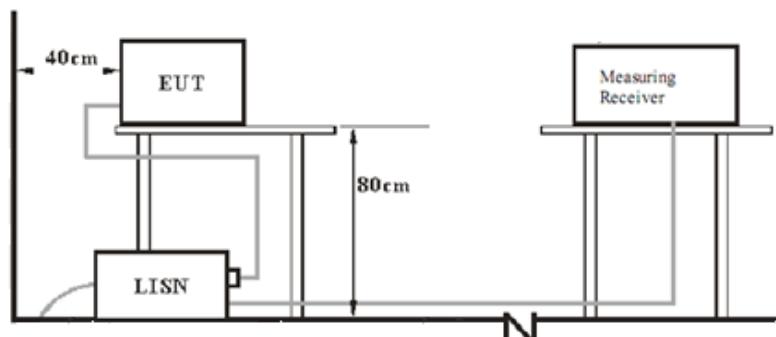
Below 1GHz



Above 1GHz



7.2 AC Power Line Conducted Emission test setups



9 Technical Requirement

9.1 Field strength of emissions and Restricted bands

Test Method

- 1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3-meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Above 1GHz

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 1MHz, VBW \geq RBW for peak measurement and VBW = 10Hz for average
 measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 100 KHz, VBW \geq RBW for peak measurement, Sweep = auto, Detector function
 = peak, Trace = max hold.

Note:

- 1: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2: The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
- 3: If the emission is pulsed modify the unit for continuous operation: use the settings shown above, then correct the reading by subcontracting the peak to average duty cycle correction factor 20log (duty cycle),, derived from the appropriate duty cycle calculation.

Limits

According to §15.249 (a), 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

According to §15.249 (c), Field strength limits are specified at a distance of 3 meters.

According to §15.249 (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.

According to §15.205, Unwanted emissions falling into restricted bands in §15.205 (a)Table 7 shall comply with the limits specified in §15.209.

Frequency MHz	Field Strength uV/m	Field Strength dB μ V/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Field strength of emissions and Restricted bands

EUT: HEATED INSOLE REMOTE

M/N: R5025

Operating Condition: Tx; 2452MHz

For Peak& QP Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB	PK Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
For Below 1GHz								
QP	882.2528	H	48.50	-15.8	32.70	40.00	13.30	Spurious
QP	839.7344	V	49.29	-16.5	32.79	40.00	13.21	Spurious
For Above 1GHz								
PK	2452.0000	H	87.78	-5.6	82.18	114.00	31.82	Fundamental
PK	2452.0000	V	89.56	-5.6	83.96	114.00	30.04	Fundamental
PK	7357.0312	H	60.72	5.5	66.22	74.00	7.78	Spurious
PK	7357.0312	V	52.25	5.5	57.75	74.00	16.25	Spurious
-	-	-	-	-	-	-	-	-

For AV Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	PK Emission dB μ V/m	Average Factor dB	AV Emission dB μ V/m	AV Limit dB μ V/m	Margin dBm	Emission Type
AV	2452.0000	H	82.18	-13.03	69.15	94.00	24.85	Fundamental
AV	2452.0000	V	83.96	-13.03	70.93	94.00	23.07	Fundamental
AV	7357.0312	H	66.22	-13.03	53.19	54.00	0.81	Spurious
AV	7357.0312	V	57.75	-13.03	44.72	54.00	9.28	Spurious
-	-	-	-	-	-	-	-	-

Average Peak to average duty cycle correction factor = $20\log(\text{dutycycle})$, dutycycle=22.3%

Remark:

1: Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.

2: “**” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

3: AV Emission Level= PK emission Level + $20\log(\text{dutycycle})$

4: PK Emission = Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss (For Below 1GHz)

Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain (For Above 1GHz)

(The Reading Level is recorded by software which is not shown in the sheet)

Field strength of emissions and Restricted bands

EUT: HEATED INSOLE REMOTE

M/N: R5025

Operating Condition: Tx; 2468MHz

For Peak& QP Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	Reading Level dB μ V/m	Correction Factor dB	PK Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
For Below 1GHz								
QP	882.2528	H	48.50	-15.8	32.70	40.00	13.30	Spurious
QP	839.7344	V	49.29	-16.5	32.79	40.00	13.21	Spurious
For Above 1GHz								
PK	2468.0000	H	88.78	-5.4	83.38	114.00	30.62	Fundamental
PK	2468.0000	V	90.41	-5.4	85.01	114.00	28.99	Fundamental
PK	7404.8437	H	60.18	5.9	66.08	74.00	7.92	Spurious
PK	7404.3750	V	52.33	5.9	58.23	74.00	15.77	Spurious
-	-	-	-	-	-	-	-	-

For AV Value

Radiated Emission								
Value	Emissions Frequency MHz	E-Field Polarity	PK Level dB μ V/m	Average Factor dB	AV Emission dB μ V/m	Limit dB μ V/m	Margin dBm	Emission Type
AV	2468.0000	H	83.38	-13.03	66.22	94.00	27.78	Fundamental
AV	2468.0000	V	85.01	-13.03	71.98	94.00	22.02	Fundamental
AV	7404.8437	H	66.08	-13.03	53.05	54.00	0.95	Spurious
AV	7404.3750	V	58.23	-13.03	45.2	54.00	8.8	Spurious
-	-	-	-	-	-	-	-	-

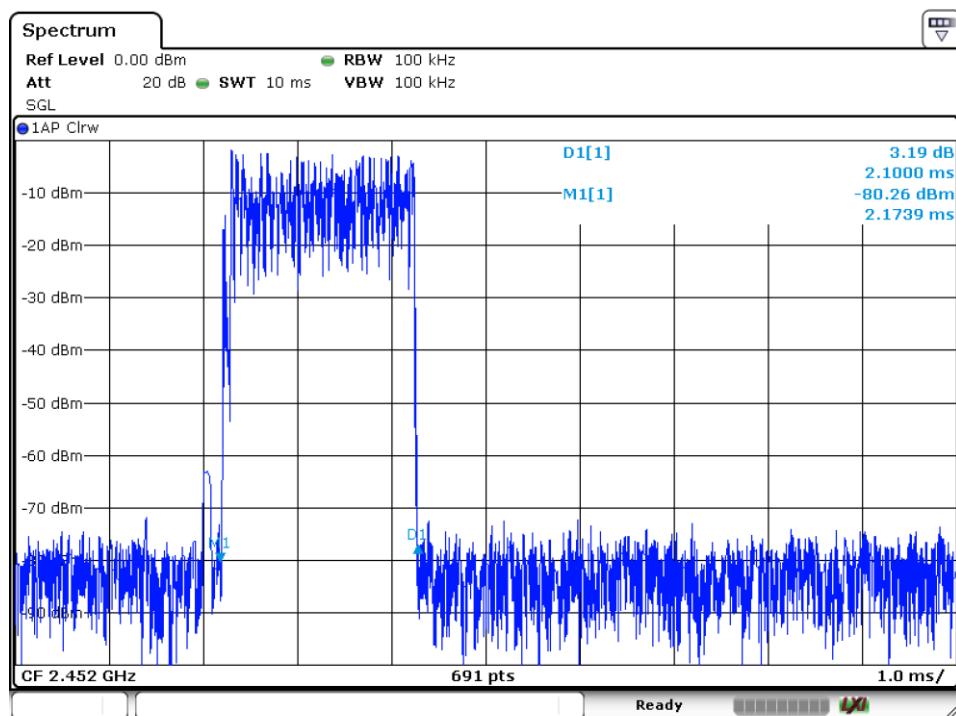
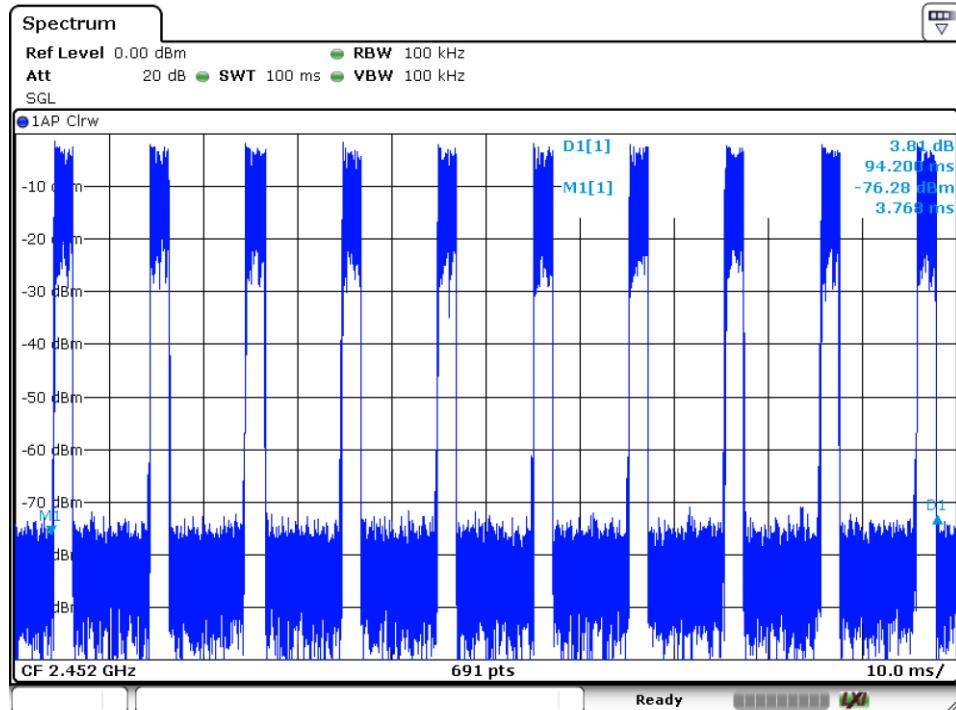
Peak to average duty cycle correction factor = $20\log(\text{dutycycle})$, dutycycle=22.3%

Remark:

- 1: Data of measurement within this frequency range shown “-” in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- 2: “**” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- 3: AV Emission Level= PK emission Level + $20\log(\text{dutycycle})$
- 4: PK Emission = Reading Level + Correction Factor

Correction Factor=Antenna Factor + Cable Loss (For Below 1GHz)
 Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain (For Above 1GHz)
 (The Reading Level is recorded by software which is not shown in the sheet)

Duty cycle:



Duty cycle=(10x2.1)/94.2=22.3%

9.2 Out of Band Emissions

Test Method

- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold.
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section.

Limits

According to §15.249(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.

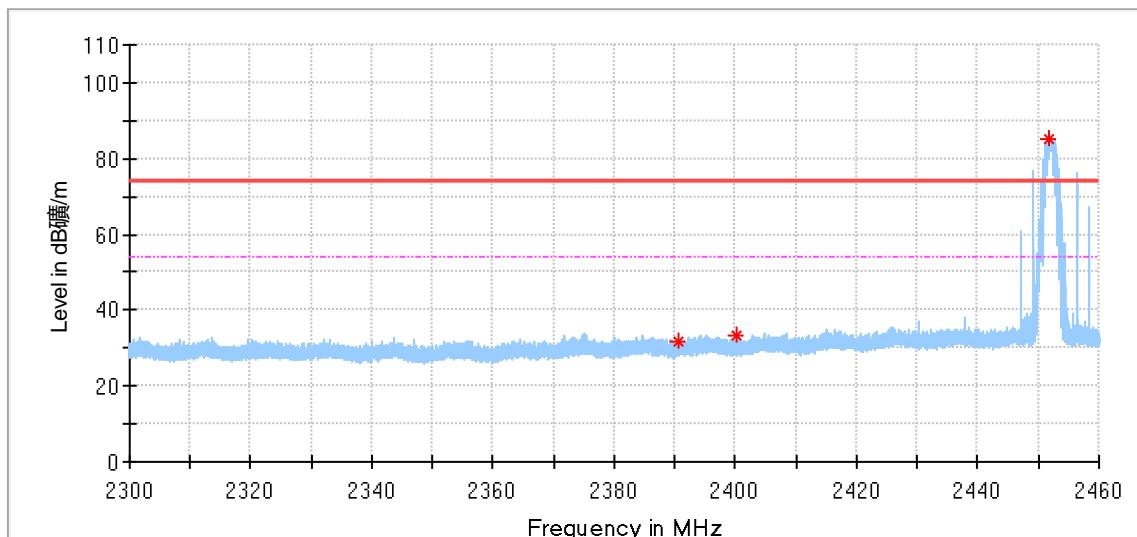
Out of Band Emissions

EUT: HEATED INSOLE REMOTE

M/N: R5025

Operating Condition: Tx; 2452Hz

Polarization: Horizontal



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV /m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.550000	31.82	74.00	42.18	---	---	154.0	H	358.0	-6.0
2400.290000	33.07	74.00	40.93	---	---	154.0	H	330.0	-6.0
2451.610000	85.37	74.00	-11.37	---	---	154.0	H	55.0	-5.6

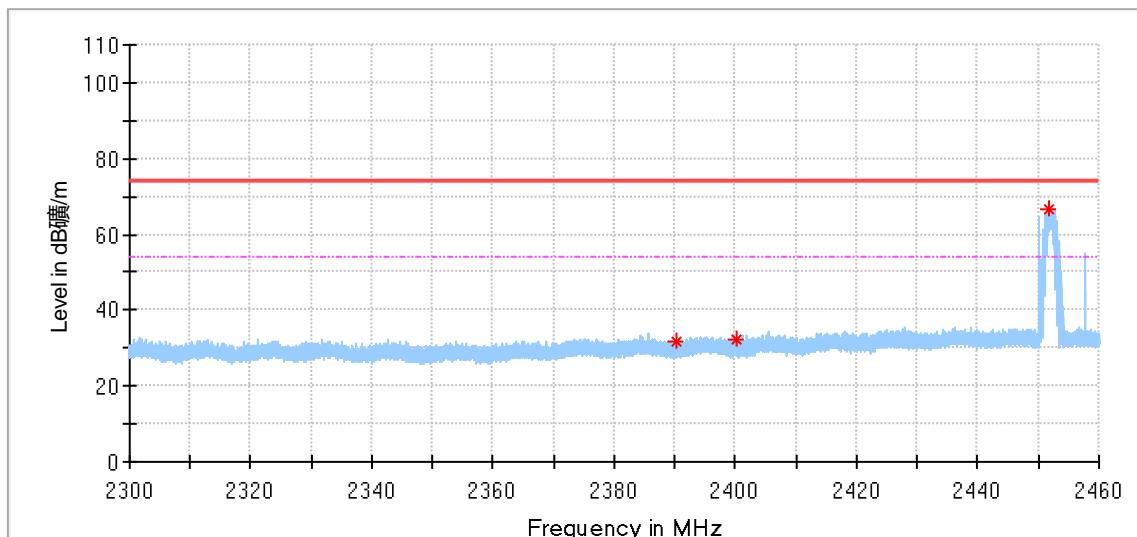
Out of Band Emissions

EUT: HEATED INSOLE REMOTE

M/N: R5025

Operating Condition: Tx; 2452MHz

Polarization: Vertical



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV /m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2390.195000	31.52	74.00	42.48	---	---	154.0	V	173.0	-6.0
2400.145000	32.07	74.00	41.93	---	---	154.0	V	4.0	-6.0
2451.670000	66.43	74.00	7.57	---	---	154.0	V	283.0	-5.6

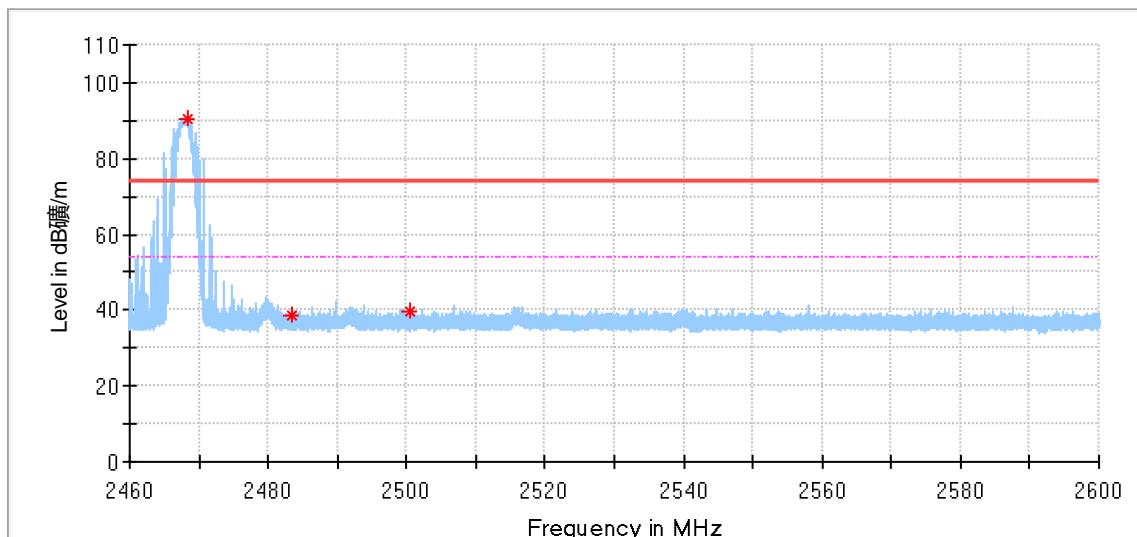
Out of Band Emissions

EUT: HEATED INSOLE REMOTE

M/N: R5025

Operating Condition: Tx; 2468MHz

Polarization: Horizontal



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV /m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2468.295000	90.41	74.00	-16.41	---	---	154.0	H	123.0	-5.4
2483.511250	38.43	74.00	35.57	---	---	154.0	H	214.0	-5.2
2500.551875	39.40	74.00	34.60	---	---	154.0	H	359.0	-5.1

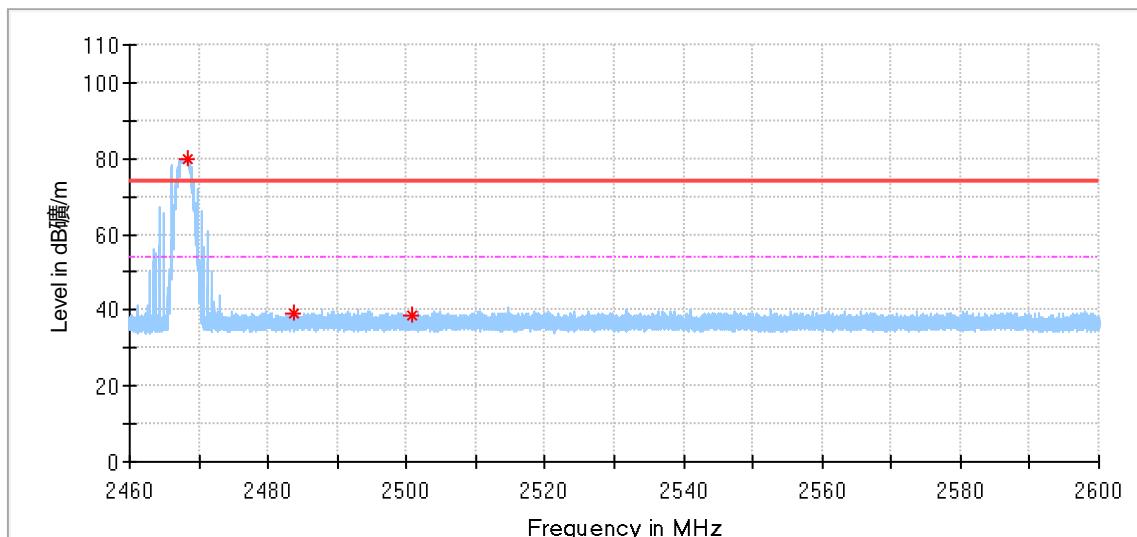
Out of Band Emissions

EUT: HEATED INSOLE REMOTE

M/N: R5025

Operating Condition: Tx; 2468MHz

Polarization: Vertical



Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V /m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2468.347500	80.01	74.00	-6.01	---	---	154.0	V	202.0	-5.4
2483.668750	39.23	74.00	34.77	---	---	154.0	V	194.0	-5.2
2500.796875	38.59	74.00	35.41	---	---	154.0	V	288.0	-5.1

9.3 20dB Bandwidth

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

Limits:

According to §15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through §15.257 and in Subpart E of this part, must be designed to ensure that the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

20dB Bandwidth

Frequency	20dB Bandwidth	Limit
MHz	MHz	kHz
2452	1.7080	--



Date: 20.AUG.2019 22:01:25

20dB Bandwidth

Frequency	20dB Bandwidth	Limit
MHz	MHz	kHz
2468	1.5770	--



Date: 20.AUG.2019 22:02:54

10 Test equipment lists

List of Test Instruments

Site 2

Radiated Emission Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	R&S	ESU8	100316	Oct. 12, 2018	1 Year
Spectrum analyzer	Agilent	E4447A	MY50180031	Jun. 25, 2019	1 Year
Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	Nov. 09, 2018	1 Year
Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	Oct. 20, 2018	1 Year
Double Ridged Horn Antenna	R&S	HF907	100276	Nov. 16, 2018	1 Year
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	790	Oct. 25, 2018	1 Year
Pre-amplifier	A.H.	PAM-0118	360	Oct. 12, 2018	1 Year
Pre-amplifier	TERA-MW	TRLA-0040G35	101303	Oct. 12, 2018	1 Year
RF Cable	HUBSER	CP-X2+ CP-X1	W11.03+ W12.02	Oct. 21, 2018	1 Year
RF Cable	N/A	SMAJ-SMAJ-1M+ 11M	17070133+17070131	Nov. 08, 2018	1 Year
MI Cable	HUBSER	C10-01-01-1M	1091629	Oct. 21, 2018	1 Year
Test software	Audix	E3	V 6.11111b	N/A	N/A

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Site 2:

Test Item	Uncertainty
Bandwidth	1.1%
Temperature	0.4 °C
Humidity	2 %
Uncertainty for Radiation Emission test (30 MHz-1 GHz)	4.70 dB (Antenna Polarize: V) 4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1 GHz-40 GHz)	4.10 dB (1-6 GHz) 4.40 dB (6 GHz-18 GHz) 3.54dB (18GHz-26 GHz) 4.30 dB (26 GHz-40 GHz)

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