
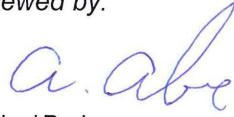


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Products

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Auftraggeber: <i>Client:</i>	CATEYE Co., Ltd. 2-8-25, Kuwazu, Higashi-Sumiyoshi-Ku, Osaka, 546-0041 Japan		
Gegenstand der Prüfung: <i>Test Item:</i>	Speed Cadence Sensor		
Bezeichnung: <i>Identification:</i>	ISC-12	Serien-Nr.: <i>Serial No.:</i>	Refer to section 4.3
Wareneingangs-Nr.: <i>Receipt No.:</i>	A000608321	Eingangsdatum: <i>Date of Receipt:</i>	2017-08-09
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of Test Item at Delivery:</i>	Good		
Prüfört: <i>Testing Location:</i>	TÜV Rheinland Japan Ltd. – Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan		
Prüfgrundlage: <i>Test Specification:</i>	FCC 47 CFR Part 15, Subpart C, Section 15.249 (October 1, 2016) RSS-210 (Issue 9): 2016 RSS-Gen (Issue 4): 2014 ANSI C63.10-2013		
Prüfergebnis: <i>Test Result:</i>	Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n). <i>The test item passed the test specification(s).</i>		
Prüflaboratorium: <i>Testing Laboratory:</i>	TÜV Rheinland Japan Ltd. – Global Technology Assessment Center 4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan		
geprüft/ tested by:	kontrolliert/ reviewed by:		
			
2017-10-06 P. Zhang / Inspector	2017-10-06 A. Abe / Reviewer		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>
			Name/Stellung <i>Name/Position</i>
			Unterschrift <i>Signature</i>
Sonstiges / Other Aspects:			
Abkürzungen:	P(ass) = entspricht Prüfgrundlage	Abbreviations:	P(ass) = passed
	F(ail) = entspricht nicht Prüfgrundlage		F(ail) = failed
	N/A = nicht anwendbar		N/A = not applicable
	N/T = nicht getestet		N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.</i>			

TEST SUMMARY

5.1.1 SUPPLY VOLTAGE REQUIREMENTS

RESULT: PASS

5.1.2 ANTENNA REQUIREMENTS

RESULT: PASS

5.1.3 RESTRICTED BANDS OF OPERATION

RESULT: PASS

5.2.1 CONDUCTED OUTPUT POWER

5.3.1 DUTY CYCLE

5.3.2 20dB BANDWIDTH

RESULT: PASS

5.3.3 99% BANDWIDTH

5.3.4 FIELD STRENGTH OF FUNDAMENTAL

RESULT: Pass

5.3.5 RADIATED SPURIOUS EMISSIONS OF TRANSMITTER

RESULT: PASS

5.4.1 AC POWER LINE CONDUCTED EMISSION OF TRANSMITTER

RESULT: N/A

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1. General Remarks

1.1 Complementary Materials

There is no attachment to this test report.

2. Test Sites

2.1 Test Facilities

TÜV Rheinland Japan Ltd. – Global Technology Assessment Center
4-25-2 Kita-Yamata, Tsuzuki-ku, Yokohama 224-0021, Japan

The used test equipment is in accordance with CISPR 16 for measurement of radio interference.

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 299054.

Innovation, Science and Economic Development Canada has reviewed the technical characteristics of the radiated and conducted emission facilities and has found these test sites to be in compliance with Canadian requirements. The description of the test facility is listed under OATS filing number 3466B-1.

The test facility is accredited by VLAC (member of ILAC) under number VLAC-017 according to ISO/IEC 17025:2005.



TÜV Rheinland Japan Ltd. is accredited by the Federal Communications Commission as a Conformity Assessment Body under Designation Number JP0017 and Test Firm Registration Number 386498.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
For Antenna Port Conducted Emission							
RF Power Meter	Agilent	N1911A	MY451017 37	RF-0393	1 year	2016-10-14	2017-10-14
RF Peak Power Sensor	Agilent	N1921A	MY452422 28	RF-0394	1 year	2016-10-14	2017-10-14
For Radiated Emission							
Radiated Emission Measurement Soft-ware (below 30MHz)	Toyo Corporation	EP5/ME	Ver. 5.0.10	RF-0172	1 year	2017-03-31	2018-03-31
Radiated Emission Measurement Soft-ware (above 30MHz)	Toyo Corporation	EP7/RE	Ver. 5.0.2	RF-0026	1 year	2017-03-31	2018-03-31
Receiver	Rohde & Schwarz	ESU 8	100025	RF-0020	1 year	2017-07-11	2018-07-11
Receiver	Rohde & Schwarz	ESU 40	100029	RF-0021	1 year	2017-07-03	2018-07-03
RF Selector (10m Chamber)	Toyo Corporation	NS4900	0703-182	RF-0029	1 year	2017-03-31	2018-03-31
Loop Antenna with Amplifier, 9kHz-30MHz	Rohde & Schwarz	HFH2-Z2	100139	RF-0048	1 year	2017-05-29	2018-05-29
Trilog Antenna No. 2, 30-1000MHz	Schwarzbeck	VULB 9168	9168-475	RF-0462	1 year	2017-04-04	2018-04-04
5dB Attenuator	Pasternack	PE7047-5	-	RF-0731	1 year	2017-03-01	2018-03-01
Low Noise Preamplifier, 9kHz-1GHz	T SJ	MLA-10K01-B01-35	1370750	RF-0253	1 year	2017-01-18	2018-01-18
Low Pass Filter, DC-1GHz	R&K	LP1000CH 3	12104001	RF-0515	1 year	2017-01-18	2018-01-18
Horn Antenna, 1-8GHz	Schwarzbeck	BBHA 9120 D	1059	RF-0553	1 year	2017-06-20	2018-06-20
Microwave Preamplifier, 1-8GHz	Toyo Corporation	TPA0108-40	0634	RF-0052	1 year	2017-01-25	2018-01-25
Band Reject Filter, 1-8GHz	Nitsuki	NF-49BT	027	RF-0131	1 year	2017-01-26	2018-01-26
Horn Antenna with Preamplifier, 8-18GHz	Toyo Corporation	HAP06-18W	00000025	RF-0065	1 year	2017-06-20	2018-06-20
High Pass Filter, 8-18GHz	Micro-Tronics	HPM50107	006	RF-0334	1 year	2017-06-20	2018-06-20
Horn Antenna with Preamplifier, 18-26.5GHz	Toyo Corporation	HAP18-26N	00000010	RF-0070	1 year	2017-06-21	2018-06-21

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Kind of Equipment	Manufacturer	Model Name	Serial Number	Equip. ID	Cal. Interval	Cal. Date	Next Cal.
Constant Voltage Constant Frequency Stabilizers and Power Accessories							
DC Power Supply	Agilent	E3646A	MY503500 07	RF-0412	N/A	N/A	N/A
True RMS Multimeter	Fluke	87V	97680445	RF-0281	1 year	2017-02-02	2018-02-02

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.

2.3 Measurement Uncertainty

Table 2: Emission Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	20Hz - 40GHz	±1.5dB
Radiated Emission	150kHz - 30MHz	±4.7dB
	30MHz - 1GHz	±4.7dB
	> 1GHz	±4.7dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) model ISC-12 is a speed cadence sensor with Bluetooth Low Energy wireless communication feature. It is intended to be used by a driver of a bicycle and is attached on a frame of the bicycle to monitor driving a speed and a cadence. The EUT can communicate with a CATEYE's cyclocomputer.

3.2 System Details

Radio standard:	Bluetooth 4.0 Low Energy
Measured output power:	+3.56dBm (Conducted, Peak)
Antenna gain:	-2.59dBi
Antenna type:	Pattern antenna
Antenna mounting type:	Internal
Frequency range:	2402-2480MHz
Number of channels:	40 (f= 2402MHz +k*2MHz, where k=0, 1,....., 39)
Channel spacing:	2MHz
Modulation type:	GFSK
FCC classification:	DTS
IC classification:	Bluetooth Device
Emission designator:	1M27F1D

Rated voltage:	DC 3.0V (Li coin cell)
Rated current:	Max. 1.0mA
Protection class:	III

Test voltage:	DC 3.0V
---------------	---------

3.3 Clock Frequencies

The highest frequency generated or used by the EUT is 16MHz for the radio portion, and is 4MHz for the digital interface portion.

3.4 Noise Suppressing Parts

Refer to schematics.

4. Test Set-up and Operation Modes

4.1 Test Methodology

The test methodology used is based on the requirements of 47 CFR Part 15, Sections 15.31, 15.33, 15.35, 15.205, 15.207, 15.209 and 15.249.

The test methods, which have been used, are based on ANSI C63.10 and RSS-Gen. For details, see under each test item.

4.2 Operation Modes

Testing was performed at the lowest operating frequency (2402MHz), at the operating frequency in the middle of the specified frequency band (2442MHz) and at the highest operating frequency (2480MHz).

The basic operation modes used for testing are:

- A. EUT transmits (TX mode), with full power, at lowest channel (2402MHz), a continuous modulated signal streaming with the maximum duty cycle.
- B. EUT transmits (TX mode), with full power, at middle channel (2442MHz), a continuous modulated signal streaming with the maximum duty cycle.
- C. EUT transmits (TX mode), with full power, at highest channel (2480MHz), a continuous modulated signal streaming with the maximum duty cycle.

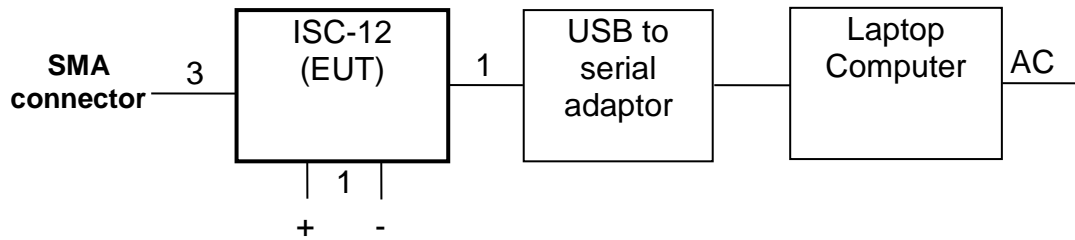
4.3 Physical Configuration for Testing

The test system was configured in a typical fashion (as a customer would normally use it).

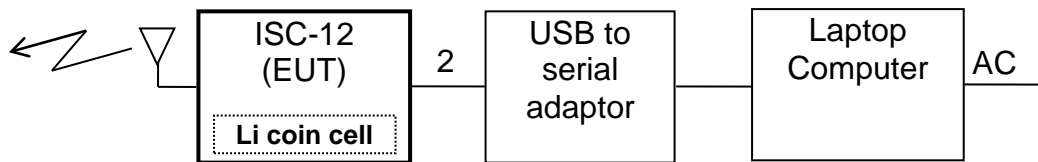
The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10.

Figure 1: Block Diagram

1) Test Setup of Conducted Radio Testing



2) Test Setup of Radiated Testing



Note: A laptop computer and USB to serial adaptor were only used for an initial setup of radio operation. They were disconnected to the EUT during conducted and radiated radio testing.

Table 3: Interfaces present on the EUT

No.	Interface	Cable Length for Testing, Shielding	Interface Classification
1.	Signal line	8cm, Un-Shielded	DC Input Power and Signal Port
2.	(Between the EUT and Serial Adaptor)	4cm, Un-Shielded	
3.	RF Cable (Conducted Radio test only)	6cm, Shielded	RF Port

Note:

The EUT does not have any user accessible interface ports. However, above-mentioned interface ports were used for testing purpose.

The following test samples were available;

- Sample No. 121 was used for antenna conducted radio measurements,
- Sample No. 122 was used for radiated radio measurements

For more details, refer to section: Photographs of the Test Set-Up.

4.4 Test Software

The EUT was provided by the manufacturer with suitable software to allow operation in all the required modes.

Software used for testing: nRFgo Studio version 1.16.1.3119 by Nordic Semiconductor ASA.

Before starting radio testing, special software mentioned above was running on a laptop computer connected to the EUT through a converter for an initial setting purpose. It was used to enable the test operation modes listed in section 4.2 as appropriate.

4.5 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

1. Product: Laptop Computer
Manufacturer: Panasonic
Model: CF-T9JWFCPS
Rated Voltage: DC 16V
Protection Class: III
Serial Number: 0DKSA02735

2. Product: AC Adapter for Laptop Computer
Manufacturer: Panasonic
Model: CF-AA6372A M3
Rated Voltage: AC 100V-240V
Input Current: 1.5A
Frequency: 50-60Hz
Protection Class: II
Serial Number: 6372AM310201996J

3. Product: USB to Serial Adapter
Manufacturer: IO DATA
Model: USB-RSAQ3
Rated Voltage: 5V (USB bus powered)
Protection Class: III
Serial Number: V1E0035358BT

4.6 Countermeasures to achieve Compliance

No additional measures were employed to achieve compliance.

5. Test Results RADIO

5.1 Technical Requirements

5.1.1 Supply Voltage Requirements

RESULT: **PASS**

Requirements:

FCC 15.31(e)

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Verdict:

The EUT is battery operated and it was tested with a new battery. Hence it complies with the supply voltage requirements.

5.1.2 Antenna Requirements

RESULT: **PASS**

Requirements:

FCC 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Verdict:

The EUT has an internal antenna which is not user accessible. Hence it complies with the antenna requirements.

5.1.3 Restricted Bands of Operation

RESULT:

PASS

Requirements:

FCC 15.205 and RSS-Gen §8.10

Only spurious emissions are permitted in any of the restricted frequency bands, unless otherwise specified.

Verdict:

The EUT operation frequency range is 2402 - 2480MHz. Therefore only spurious emissions may be found in the restricted bands of operation and the EUT complies with the restricted frequency band requirement.

5.2 Conducted Measurements at Antenna Port

5.2.1 Conducted Output Power

Date of testing: 2017-09-20

Ambient temperature: 24°C
Relative humidity: 48%
Atmospheric pressure: 1000hPa

Requirements:

N/A

(This test item was performed for RF exposure evaluation.)

Test procedure:

RSS-Gen (Issue 4) §6.12

The maximum Peak Output Power (conducted) was measured at the antenna connector with a power meter.

Table 4: Conducted Output Power

Operating Frequency [MHz]	Peak Output Power	
	[dBm]	[mW]
2402	3.33	2.153
2442	3.48	2.228
2480	3.56	2.270

Note: Grey shading area shows the highest power in the test result.

5.3 Radiated Measurements

5.3.1 Duty Cycle

Date of testing: 2017-08-18

Ambient temperature: 20°C
 Relative humidity: 53%
 Atmospheric pressure: 1006hPa

Requirements:
 N/A (This test item was performed as reference.)

Test procedure:
 ANSI C63.10-2013

Table 5: Duty Cycle

Operating Frequency [MHz]	On Time Duration [us]	Period of the Pulse Train [us]	Total On Time [%]
2402	134.615385	625.000000	21.5
2442	136.184615	620.158974	22.0
2480	140.512821	627.692308	22.4

Figure 2: Duty Cycle, Mode A (2402MHz)

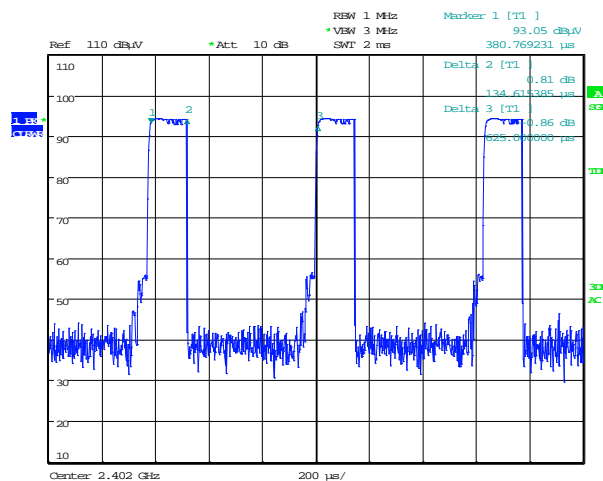
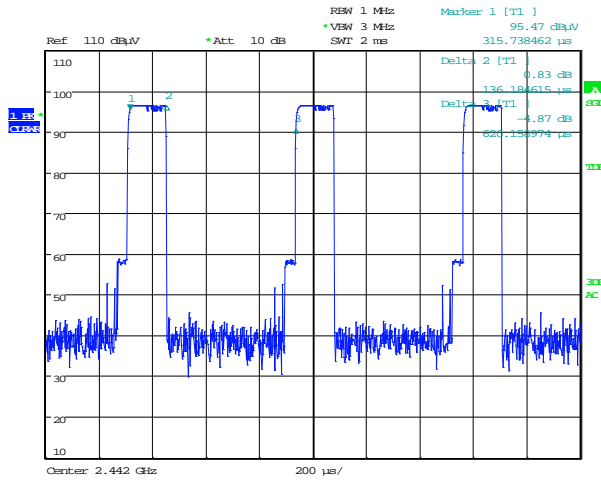
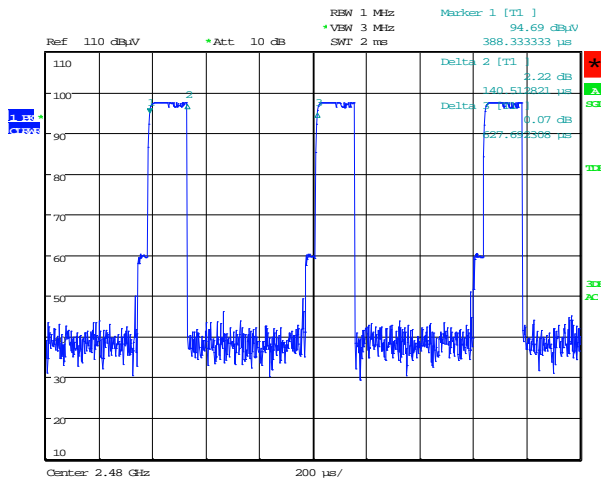


Figure 3: Duty Cycle, Mode B (2442MHz)



Date: 18.AUG.2017 17:23:21

Figure 4: Duty Cycle, Mode C (2480MHz)



Date: 18.AUG.2017 16:04:04

5.3.2 20dB Bandwidth

RESULT:

PASS

Date of testing: 2017-08-18

Ambient temperature: 20°C

Relative humidity: 53%

Atmospheric pressure: 1006hPa

Requirements:

FCC 15.215(c) and FCC 15.249

The 20dB bandwidth of the emission shall be contained within the frequency band designated in the rule section under which the equipment is operated.

Test procedure:

ANSI C63.10 §6.9.2

The EUT was placed on a nonconductive turntable 1.5m above the ground plane in a semi-anechoic chamber.

The 20dB bandwidth was measured with a horn antenna connected to a spectrum analyzer using a peak detector.

Final measurements were performed using a spectrum analyzer with the resolution bandwidth (RBW) set to in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately $3 \times$ RBW. Markers were placed at the lowest and highest intersections of the trace with a 20dBc line to obtain the value of the emission bandwidth.

Table 6: 20dB Bandwidth Edge Frequencies

20dB Bandwidth Edge Side	Operating Frequency [MHz]	Edge Frequency [MHz]	Limit [MHz]	Margin [MHz]
Lower freq.	2402MHz	2401.423128	2400.0	1.423128
Upper freq.	2480MHz	2480.512871	2483.5	2.987129

Note: EUT / Antenna Orientation was Y / V.

Table 7: 20dB Bandwidth

Operating Frequency [MHz]	EUT / Antenna Orient.	20dB Bandwidth [MHz]
2402	Y / V	1.258012821
2442	Y / V	1.049679487
2480	Y / V	1.057692308

Note: Grey shading area shows the widest bandwidth in this test result.

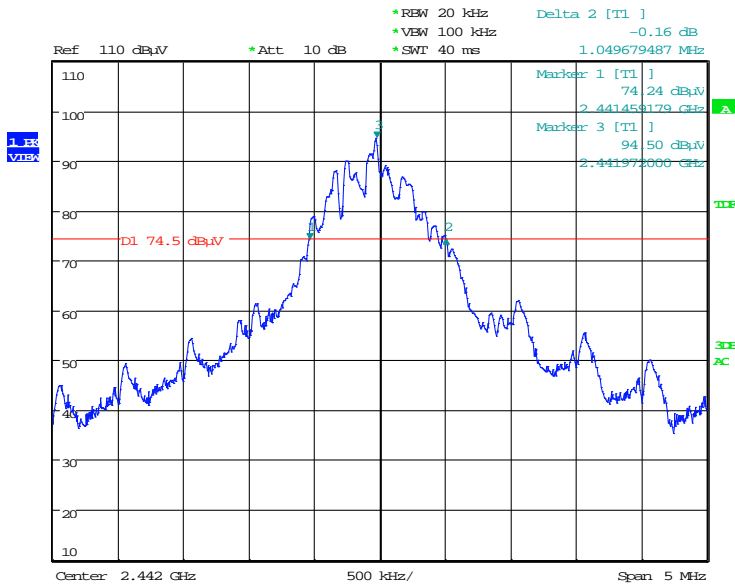
Figure 5: 20dB Bandwidth, Mode A (2402MHz)



Date: 18.AUG.2017 17:56:39

Note: RBW was set to 1.59% of the observed OBW. $(20 \text{ kHz} / 1258 \text{ kHz}) \times 100 = 1.59 \%$

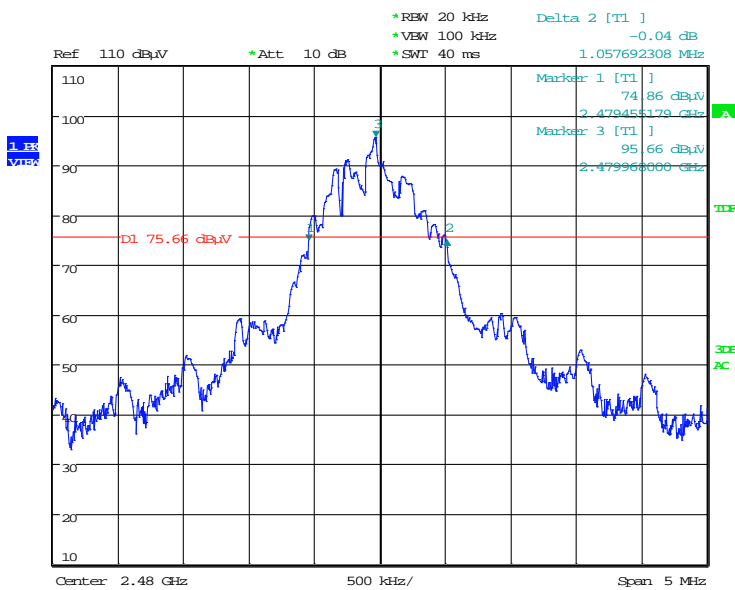
Figure 6: 20dB Bandwidth, Mode B (2442MHz)



Date: 18.AUG.2017 17:19:18

Note: RBW was set to 1.90% of the observed OBW. $(20 \text{ kHz} / 1050 \text{ kHz}) \times 100 = 1.90 \%$

Figure 7: 20dB Bandwidth, Mode C (2480MHz)



Date: 18.AUG.2017 15:54:24

Note: Frequency of the marker 2 is calculated. $2479.455179 + 1.057692308 = 2480.512871 \text{ MHz}$
RBW was set to 1.89% of the observed OBW. $(20 \text{ kHz} / 1058 \text{ kHz}) \times 100 = 1.89 \%$

5.3.3 99% Bandwidth

Date of testing: 2017-08-18

Ambient temperature: 20°C
Relative humidity: 53%
Atmospheric pressure: 1006hPa

Requirements:

RSS-Gen §6.6 and 8.11

The 99% bandwidth shall be reported and shall lie entirely outside the restricted bands and the prohibited TV bands of 54-72MHz, 76-88MHz, 174-216MHz, 470-608MHz and 614-806MHz.

Test procedure:

ANSI C63.10 §6.9.3 and RSS-Gen §6.6

The EUT was placed on a nonconductive turntable 1.5m above the ground plane in a semi-anechoic chamber.

Final measurements were performed using a spectrum analyzer with the resolution bandwidth (RBW) set to in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately $3 \times$ RBW. The 99% bandwidth was measured by using the OBW function of the analyzer with a 99% coverage setting. Sample detector was used at this test item.

Table 8: 99% Bandwidth Edge Frequencies

99% Bandwidth Edge Side	Operating Frequency [MHz]	Edge Frequency [MHz]	Limit [MHz]	Margin [MHz]
Lower freq.	2402MHz	2401.400000	2390	11.400000
Upper freq.	2480MHz	2480.472000	2655	174.528000

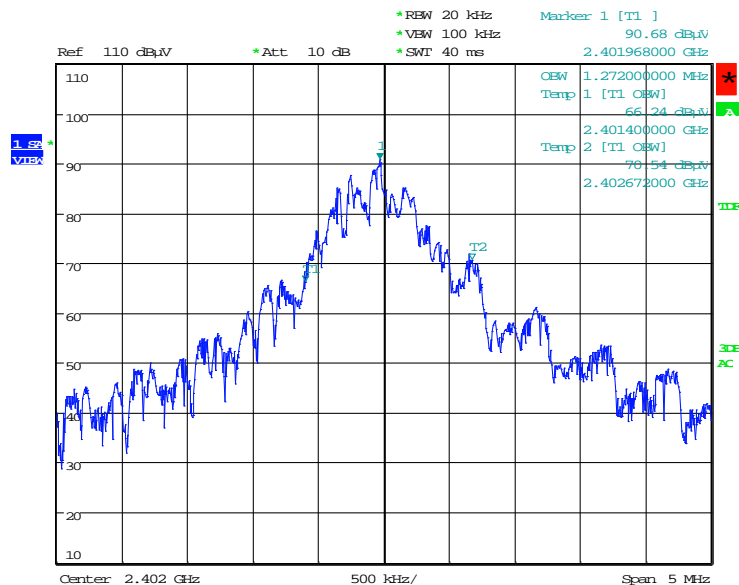
Note: EUT / Antenna Orientation was Y / V.

Table 9: 99% Bandwidth

Operating Frequency [MHz]	EUT / Antenna Orient.	99% Bandwidth [MHz]
2402	Y / V	1.272
2442	Y / V	1.036
2480	Y / V	0.996

Note: Grey shading area shows the widest bandwidth in this test result.

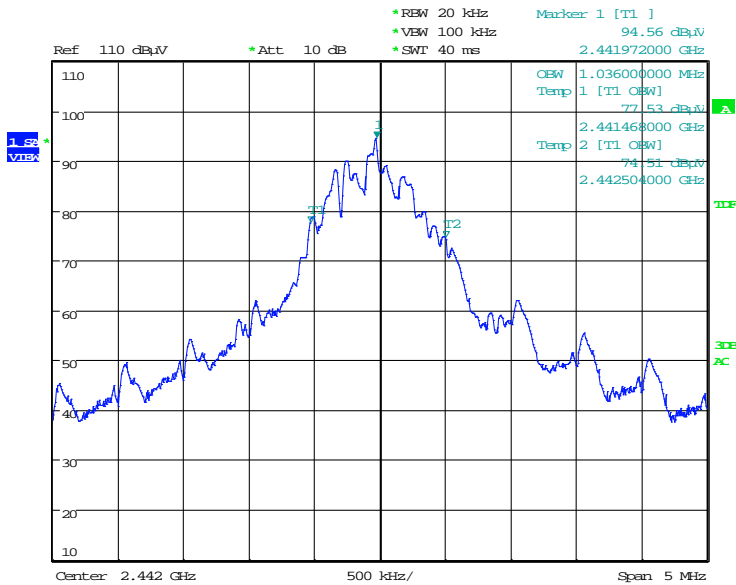
Figure 8: 99% Bandwidth, Mode A (2402MHz)



Date: 18.AUG.2017 18:01:06

Note: RBW was set to 1.57% of the observed OBW. $(20 \text{ kHz} / 1272 \text{ kHz}) \times 100 = 1.57 \%$

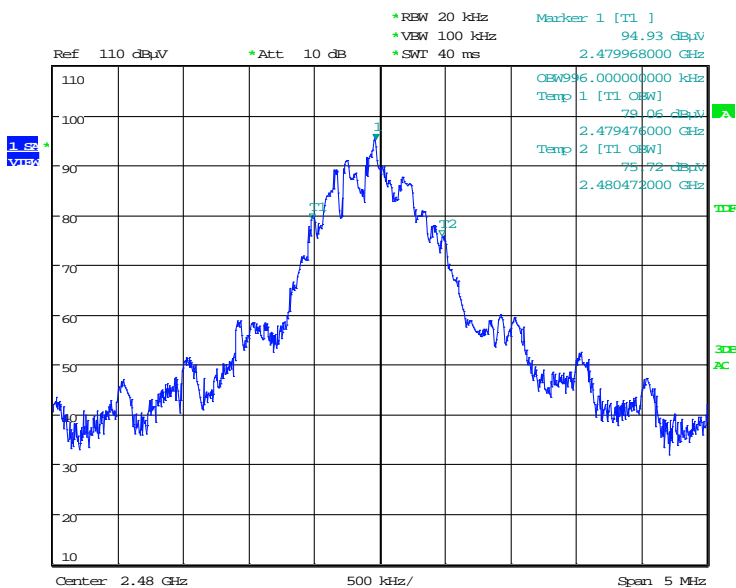
Figure 9: 99% Bandwidth, Mode B (2442MHz)



Date: 18.AUG.2017 17:15:04

Note: RBW was set to 1.93% of the observed OBW. $(20 \text{ kHz} / 1036 \text{ kHz}) \times 100 = 1.93 \%$

Figure 10: 99% Bandwidth, Mode C (2480MHz)



Date: 18.AUG.2017 15:57:07

Note: RBW was set to 2.00% of the observed OBW. $(20 \text{ kHz} / 996 \text{ kHz}) \times 100 = 2.00 \%$

5.3.4 Field Strength of Fundamental

RESULT:

Pass

Date of testing: 2017-08-16, 2017-08-17, 2017-08-18

Ambient temperature: 20, 20, 20°C

Relative humidity: 51, 53, 53%

Atmospheric pressure: 1003, 1006, 1006hPa

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

FCC 15.249 (a) (c) (e) and RSS-210 §B.10 (a)

The field strength of fundamental shall not exceed the level specified in FCC 15.249 (a) (e) and RSS-210 §B.10 (a).

Test procedure:

ANSI C63.10 §6.3 and 6.6 and RSS-Gen §8.1

The EUT was placed on a nonconductive turntable 1.5m above the ground plane. Measurements were made at 3m distance. The EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level.

Measurements were taken using both horizontal and vertical antenna polarizations for 3 EUT orientations (X, Y and Z).

Measurements were performed using a spectrum analyzer with a suitable span to encompass the peak of the fundamental and using the following settings: Peak: RBW = 1MHz, VBW = 3MHz. Average: RBW = 1MHz, VBW = 3MHz.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. In the spectra here below, the upper trace corresponds to the peak measurement and the lower trace corresponds to the average measurement.

Table 10: Field Strength of Fundamental

Operating Frequency [MHz]	EUT / Antenna Orient.	Average Level [dBµV/m]	Peak Level [dBµV/m]	Average Limit [dBµV/m]	Peak Limit [dBµV/m]	Average Margin [dB]	Peak Margin [dB]
2402	Y / V	81.36	94.52	94	114	12.64	19.48
2442	Y / V	83.41	96.52	94	114	10.59	17.48
2480	Y / V	84.60	97.66	94	114	9.40	16.34

Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
 Average limit in dBµV/m is calculated as follows: Average limit = 20 x Log₁₀ (50000µV/m).
 Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

Figure 11: Field Strength of Fundamental, Spectral Diagram, Mode A (2402MHz)

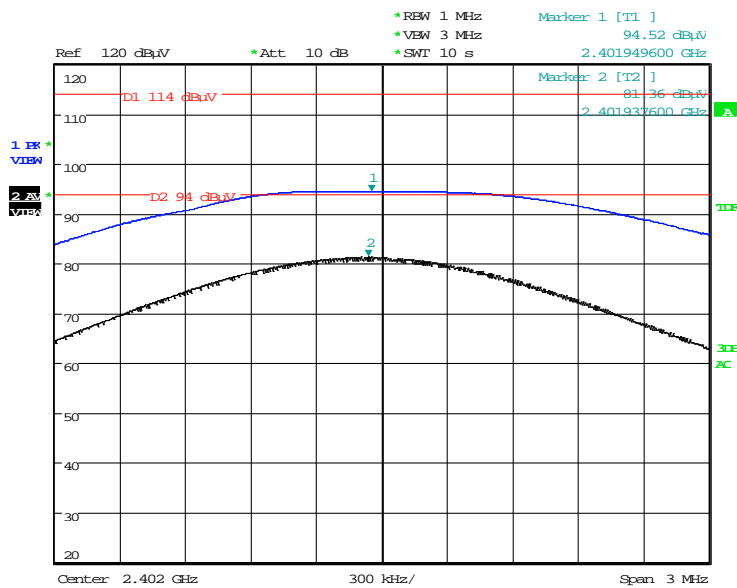
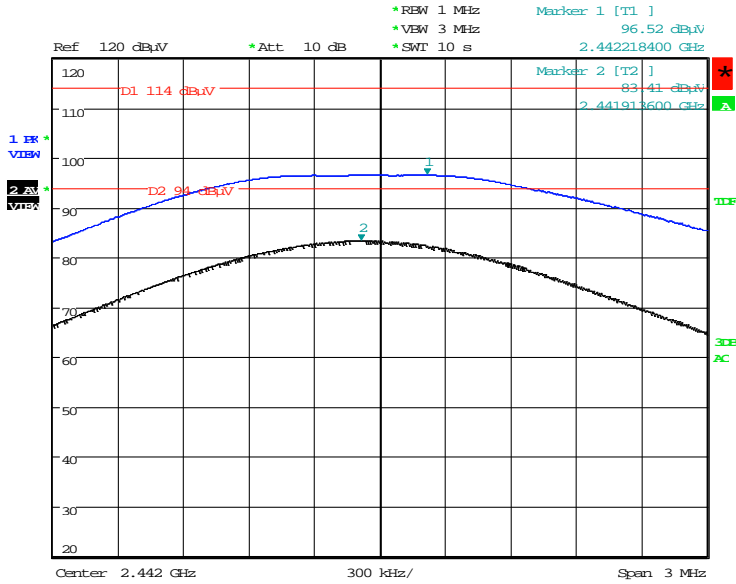
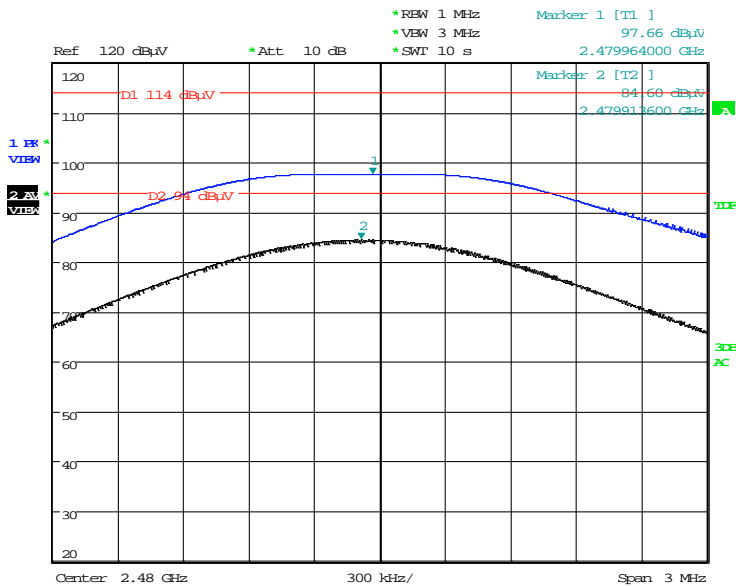


Figure 12: Field Strength of Fundamental, Spectral Diagram, Mode B (2442MHz)



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Figure 13: Field Strength of Fundamental, Spectral Diagram, Mode C (2480MHz)



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5.3.5 Radiated Spurious Emissions of Transmitter

RESULT:

PASS

Date of testing: 2017-08-17, 2017-08-18, 2017-08-20

Ambient temperature: 20, 20, 19°C

Relative humidity: 53, 54, 41%

Atmospheric pressure: 1006, 1006, 1008hPa

Frequency range: 9kHz - 25GHz

Measurement distance: 3m

Kind of test site: Semi Anechoic Chamber

Requirements:

FCC 15.209, FCC 15.249(a)(c)(d)(e), RSS-Gen §8.9 and 8.10 and RSS-210 §B.10(a)(b)

Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209, FCC 15.249(a)(d)(e), RSS-Gen §8.9 (tables 4 and 5) and RSS-210 §B.10(a)(b).

Test procedure:

ANSI C63.10 §6.3, 6.4, 6.5, 6.6, 6.10 and RSS-Gen §6.13 and 8.1

The EUT was placed on a nonconductive turntable. The table height was 0.8m for measurements below 1GHz and 1.5m for measurements above 1GHz. Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y and Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 9kHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° in order to determine the emission's maximum level. For frequencies above 30MHz, the antenna was raised and lowered from 1 to 4m and measurements were taken using both horizontal and vertical antenna polarizations.

For emissions between 30MHz and 1GHz, measurements were performed with a test receiver operating in the CISPR quasi-peak detection mode with a 6dB bandwidth set to 120kHz. For emissions above 1GHz, measurements were performed with a spectrum analyzer using the following settings: for peak field strength: RBW = 1MHz & VBW ≥ 1MHz; for average field strength: RBW = 1MHz & VBW = 10Hz.

Absorbers have been placed on the floor between the EUT and the measuring antenna for testing above 1GHz.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Emissions other than those mentioned are small or not detectable.

No spurious emission was found in the following ranges. 9kHz - 30MHz, 8 – 18GHz and 18 – 25GHz.

Table 11: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)

Frequency [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
66.210	X/V	33.6	-22.2	11.4	40.0	28.6	100	7
163.586	X/H	30.1	-20.5	9.6	43.5	33.9	175	313
857.510	X/V	31.2	-8.6	22.6	46.0	23.4	170	172
958.823	X/H	30.4	-6.4	24.0	46.0	22.0	170	104

Note: Level QP = Reading QP + Factor

Table 12: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode B (2442MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
44.242	X/V	34.0	-21.3	12.7	40.0	27.3	140	167
167.812	X/H	30.0	-20.7	9.3	43.5	34.2	331	344
951.774	X/H	30.8	-6.6	24.2	46.0	21.8	290	84
972.108	X/V	30.4	-6.0	24.4	54.0	29.6	117	303

Note: Level QP = Reading QP + Factor

Table 13: Radiated Emissions, Quasi Peak Data, 30MHz - 1GHz, Horizontal and Vertical Antenna Orientations, Mode C (2480MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading QP [dBµV]	Factor [dB(1/m)]	Level QP [dBµV/m]	Limit [dBµV/m]	Margin QP [dB]	Height [cm]	Angle [°]
66.280	X/V	33.5	-22.2	11.3	40.0	28.7	100	354
164.226	X/H	30.2	-20.5	9.7	43.5	33.8	186	97
364.110	X/V	29.6	-17.0	12.6	46.0	33.4	383	95
832.496	X/H	31.0	-8.8	22.2	46.0	23.8	244	70

Note: Level QP = Reading QP + Factor

Table 14: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2318.453	Z/H	40.1	-14.4	25.7	54.0	28.3	176	182
2375.314	Z/H	39.9	-14.6	25.3	54.0	28.7	168	9
2436.804	Z/H	40.5	-14.9	25.6	54.0	28.4	138	25
4803.876	Z/V	40.7	-8.4	32.3	54.0	21.7	162	180
7523.020	Z/H	38.8	-1.9	36.9	54.0	17.1	143	313

Note: Level AV = Reading AV + Factor

Table 15: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode A (2402MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2318.453	Z/H	69.5	-14.4	55.1	74.0	18.9	176	182
2375.314	Z/H	69.4	-14.6	54.8	74.0	19.2	168	9
2436.804	Z/H	71.9	-14.9	57.0	74.0	17.0	138	25
4803.876	Z/V	58.5	-8.4	50.1	74.0	23.9	162	180
7523.020	Z/H	53.1	-1.9	51.2	74.0	22.8	143	313

Note: Level PK = Reading PK + Factor

Table 16: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2442MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
2497.263	Z/H	40.2	-15.1	25.1	54.0	28.9	177	0
2572.011	Z/H	40.0	-15.0	25.0	54.0	29.0	187	180
4883.911	Z/V	39.6	-8.6	31.0	54.0	23.0	147	197
7140.489	Z/H	39.2	-2.0	37.2	54.0	16.8	193	276

Note: Level AV = Reading AV + Factor

Table 17: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode B (2442MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
2497.263	Z/H	74.0	-15.1	58.9	74.0	15.1	177	0
2572.011	Z/H	73.8	-15.0	58.8	74.0	15.2	187	180
4883.911	Z/V	57.3	-8.6	48.7	74.0	25.3	147	197
7140.489	Z/H	53.4	-2.0	51.4	74.0	22.6	193	276

Note: Level PK = Reading PK + Factor

Table 18: Radiated Emissions, Average Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode C (2480MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading AV [dBµV]	Factor [dB(1/m)]	Level AV [dBµV/m]	Limit [dBµV/m]	Margin AV [dB]	Height [cm]	Angle [°]
1499.965	Z/V	39.2	-16.4	22.8	54.0	31.2	202	111
2435.917	Z/H	40.1	-14.9	25.2	54.0	28.8	100	38
2571.757	Z/H	40.0	-15.0	25.0	54.0	29.0	184	179
7284.493	Z/V	38.6	-1.5	37.1	54.0	16.9	181	205
7942.664	Z/H	38.7	-0.7	38.0	54.0	16.0	112	248

Note: Level AV = Reading AV + Factor

Table 19: Radiated Emissions, Peak Data, 1 - 25GHz, Horizontal and Vertical Antenna Orientations, Mode C (2480MHz)

Freq. [MHz]	EUT / Antenna Orientation	Reading PK [dBµV]	Factor [dB(1/m)]	Level PK [dBµV/m]	Limit [dBµV/m]	Margin PK [dB]	Height [cm]	Angle [°]
1499.965	Z/V	54.1	-16.4	37.7	74.0	36.3	202	111
2435.917	Z/H	72.0	-14.9	57.1	74.0	16.9	100	38
2571.757	Z/H	74.7	-15.0	59.7	74.0	14.3	184	179
7284.493	Z/V	53.1	-1.5	51.6	74.0	22.4	181	205
7942.664	Z/H	52.8	-0.7	52.1	74.0	21.9	112	248

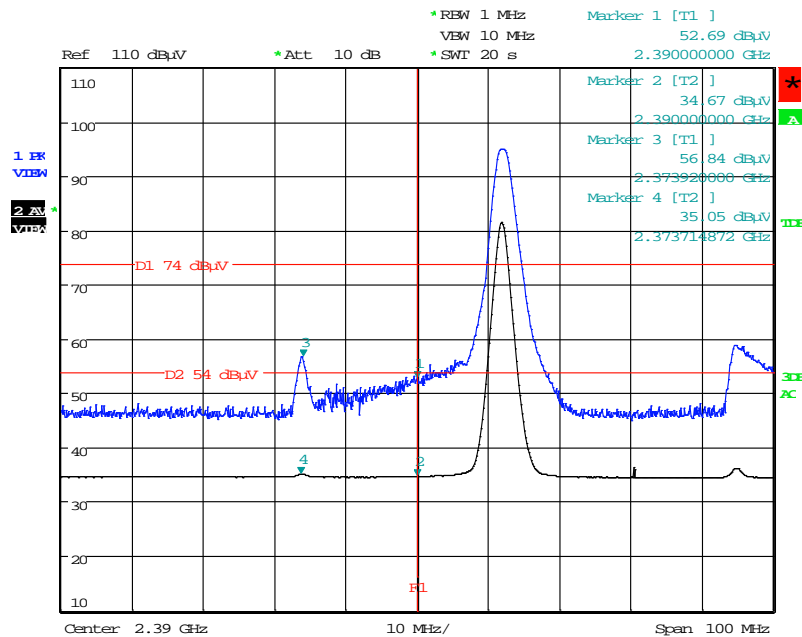
Note: Level PK = Reading PK + Factor

Table 20: Radiated Emissions at Band Edge, Average and Peak Data, Horizontal and Vertical Antenna Orientations, Modes A (2402MHz) and C (2480MHz)

Operating Frequency [MHz]	EUT / Antenna Orientation	Level AV [dBµV/m]	Level PK [dBµV/m]	Limit AV [dBµV/m]	Limit PK [dBµV/m]	Margin AV [dB]	Margin PK [dB]
2402	V / Y	35.05	56.84	54.0	74.0	18.95	17.16
2480	V / Y	41.34	63.62	54.0	74.0	12.66	10.38

Notes: All correction factors (antenna, cable, pre-amplifier) are included in the measurement values.
 Average limit in dBµV/m is calculated as follows: Average limit = 20 x Log₁₀(500µV/m).
 Peak limit in dBµV/m is calculated as follows: Peak limit = Average limit + 20dB.

Figure 14: Radiated Emissions at Band Edge, Spectral Diagram, Mode A (2402MHz)



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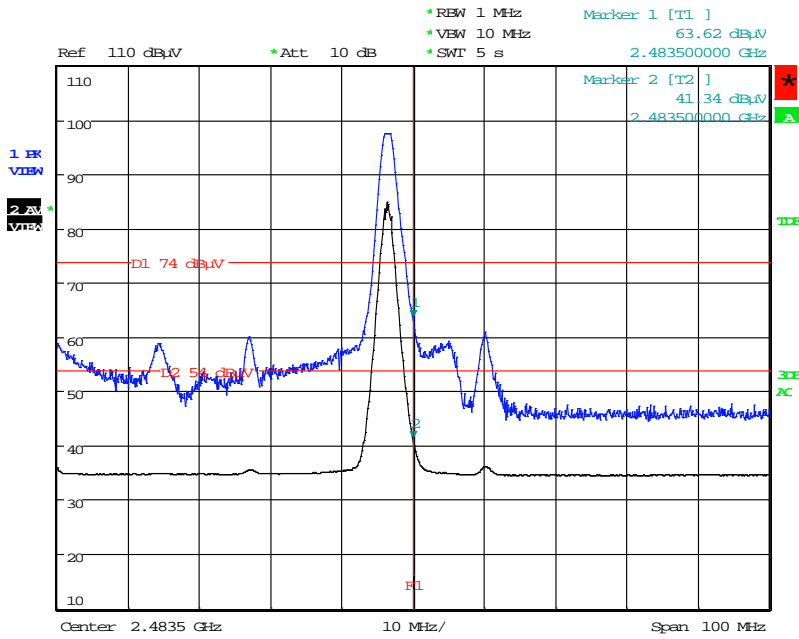
Note: The upper trace shows the peak value and the lower trace shows the average value.

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Figure 15: Radiated Emissions at Band Edge, Spectral Diagram, Mode C (2480MHz)



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Note: The upper trace shows the peak value and the lower trace shows the average value.

5.4 AC Power Line Conducted Measurements

5.4.1 AC Power Line Conducted Emission of Transmitter

RESULT: **N/A**

Frequency range: 0.15 - 30MHz

Requirements:

FCC 15.207 and RSS-Gen 8.8

The AC power line conducted emission on any frequency within the band 150kHz to 30MHz shall not exceed the limits specified in FCC 15.207 and RSS-Gen 8.8 (Table 3).

Test procedure:

ANSI C63.10-2013

Note:

It is not applicable since the EUT is battery operated.

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