

 Test report No.
 : 13282403S-A-R1

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 Issued date
 : June 10, 2020

 FCC ID
 : BBQ-GSWH1000

SAR TEST REPORT

Test Report No.: 13282403S-A-R1

Applicant	:	CASIO COMPUTER CO., LTD.
Type of EUT	:	Wireless Module
Model Number of EUT	:	GSW-H1000 (*. It was installed into a limited host device as listed in below.)
FCC ID	:	BBQ-GSWH1000
Test Standard	:	FCC 47CFR §2.1093
Test Result	:	Complied (Refer to Section 3.5)

RF Exposure	Platfor	Platform Highes			est Reported SAR Value		Remarks			Output power (average)	
Condition	Туре	Model	Туре	Tune-up value	Limit	Band	Frequency	Mode	Measured	Maximum	
Extremity (Wrist)	Smort Watch	GSW- H1000	SAR (10g)	<0.10 W/kg	4	DTS	2437 MHz	11b (1Mbps)	16.73 dBm	17.15 dBm	
Next-to-Mouth	Smart watch		SAR (1g)	<0.10 W/kg	1.6	DTS	2437 MHz	11b (1Mbps)	16.73 dBm	17.15 dBm	

*. 11b: IEEE 802.11b

*. Highest reported SAR across all exposure conditions and on this platform is "<0.10 W/kg (10g, Wrist)" and "<0.10 W/kg (1g, Next-of-mouth)".

*. This Wireless Module: GSW-H1000 was only installed into the Smart Watch which were listed in above.

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.

2. The results in this report apply only to the sample tested.

3. This sample tested is in compliance with the limits of the above regulation.

4. The test results in this test report are traceable to the national or international standards.

5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.

6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.

8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.

9. The information provided from the customer for this report is identified in SECTION 1.

10. This report (-R1) is a revised version of 13282403S-A. 13282403S-A reports are replaced with this report.

Date of test:

May 14 and 15, 2020

Test engineer:

aku

Hiroshi Naka Engineer, Consumer Technology Division

Approved by:

Toyokazu Imamura Leader, Consumer Technology Division



The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.

There is no testing item of "Non-accreditation".

UL Japan, Inc. Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN Telephone: +81 463 50 6400 / Facsimile: +81 463 50 6401

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FCC ID : BBQ-GSWH1000

REVISION HISTORY

Revision	Test report No.	Date	Page revised	Contents			
Original	13282403S-A	June 1, 2020	-				
-R1	-R1 13282403S-A-R1 June 10, 2020 p1 p1(in table, comment); Corrected a mistake. (was: GSW-H10000 > GSW-H1000)						
*. By issue of new revision report, the report of an old revision becomes invalid.							

AZIA The American Association for Laboratory Accessitation IF Intermediate Expressery AC Alternating Current ILAC Intermediate Expressery ACH Adaptive Expression for Laboratory Accessitation Conference APH Acaptities LAD Intermediate Organization for Sandballization AMI Amplifies LAD Laboratory Information Management System ANSI Antenian National Sandballisation LOS Management System ANSI Antenian National Sandballisation LOS Management System AP Access Point MCS Modulation and Coding Scheme AP Access Point MCA Matual Recognition Antengement System Atta, ATT Attenator NA No A management Atta, ATT Attenator NA No A management AV Average NSA Nominal Institute O'Sandballisation Program BR Blaecodth Bisse Rate NSA Normalized Sind Attenuation BT Blaecodth Bisse Rate NSA Normalized Sind Attenuation BR Blaecodth Bisse	Reference : Ab	breviations (Including words undescribed in this repo	rt) (radio_r0v03_20	00214)
ACAlequé represerve l'hopringILACInstruction y Accreditation ConferenceAPHAdapté represerve l'hopringISEDInstruction y Accreditation of ConferenceAMAnginale MachalanISOInstruction of Consolve Development CanadaAMAmpinale MachalanISOInstruction Robot and Consolve Development CanadaANSAmerican National Standards InstituteLNNLocal Area NetworkANAAntenanAntenanINSLaboratory Information Management SystemANAntenanNGAMachalan and Coding SchemeANAAntenanNANA A AppäsableAtten, ATTAttenantNANA A AppäsableAtten, ATTAttenantNANo signal detectBRBlacoft Biase RateNSANo signal detectBTBlacoft Biase RateNSANo signal detectBTBlacoft Biase RateNSANo signal detectBTBlacoft Biase RateNSANo signal detectBTBlacoft ConstructionPMOccupied Biad WathBTLEBlacoft Diase RatePMPower meterCCKComplement Code KeyingPEBPacter RateCLCollinet Classification InstruitPAMPower meterCLConstructionaus WavePKPadaDBFSDifferential BPSKPower Special DoraDCKCorrelet Termational Special des Perturbations RadiocterriquesPKDBFSDifferential BPSKPower Special DoraDCKCorrelet Termatio	A2LA	The American Association for Laboratory Accreditation	IF	Intermediate Frequency
AFH Adaptive Trequercy Hopping ISD Invotation, Science and Economic Development Canada AM Ampitude Modulation ISO Invotation, Science and Economic Development Canada ANP Ampitude Modulation IAB Ispen Accretionion Board ANSI Amorizani National Standards Institute LAN Loonatory Information Management System AP Access Point MCS Modulation on and Coding Scheme AP Access Point MCS Modulation on and Coding Scheme ARA Ampitude Sulf Keying NRA Mutual Recognition Amorgenent Atta, ATT Attenuator NA Nedapticable AV Average NIST National Institute of Standards and Technology BR Bluctooth Dissies Rate NSA Normalized Site Attenuation BTT Bluctooth Dissies Rate NSA Normalized Site Attenuation BTT Bluctooth Dissies Rate OFDM Ordinagement BTUE Bluctooth Dissies Rate OFDM Ordinagement BT Bluctooth Dissies Rate OFDM Ordinagement BT Bluctooth Dissies Rate OFDM Ordinagement Coll Car Calibration Interval OFDM Ordinagement Coll Car Calibration Interval<	AC	Alternating Current	ILAC	International Laboratory Accreditation Conference
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ASK Amplitude Stiff Keying MRA Matual Recognition Arrangement Atten, ATT Attenuator N/A Not Applicable AV Average NIST National Institute of Standards and Technology BPSK Binny Phase-Shiff Keying NS No signal decct. BR Blactooth Basic Rate NS No signal decct. BT Blatotooth Low Energy OBW Occupied Basic Rate BT Blatotooth Low Energy OBW Occupied Basic Rate CL Callart OHBY Ordported Width BW Band/Width OFDM Ordported Frequency Division Multiplexing CL Callart Callart PM Proceed Width CK Complementary Code Keying PCB Pinted Circuit Board CL Connol PR Pask Darad CW Continuous Wave PK Peak DBPSK Differential BPSK PN Pscudo-Pandom Bit Sequence DC Direct Current PBS Pasudo-Pandom Bit Sequence DC Direct Current PSB Pasudo-Pandom Bit Sequence DC Direct Current PSB Pasudo-Pandom Bit Sequence DFS Dynamic Frequency Selection QAM	AP	Access Point	MCS	Modulation and Coding Scheme
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Driver and backTrickTrickDCDirect CurrentPRBSPseudo-Random Bit SequenceD-factorDistance factorPSDPower Spectral DensityDFSDynamic Frequency SelectionQAMQuadrature Amplitude ModulationDQPSKDifferential (PSKQPQuasi-PeakDUTDevice Under TestRBWResolution Band WidthEDREnhanced Data RateRDSRadio Data SystemEIRP, ei.r.p.Equivalent Isotropically Radiated PowerRERadio Data SystemEMCElectroMagnetic InterferenceRMSRodio Mean SquareENEuropean NormRSSRadio Standards SpecificationsERP, er.p.Effective Radiated PowerRxReceivingEUEuropean NormRSSRadio Standards SpecificationsERP, er.p.Effective Radiated PowerRxReceivingEUEuropean NormRSSRadio Standards SpecificationsERP, er.p.Effective Radiated PowerRxReceivingEUEuropean NormRSSRadio Standards SpecificationsERP, er.p.Effective Radiated PowerSA, S/ASpectrum AnalyzerEUTEquipment Under TestSARSpecific Absorption RateFac.FactorSGSignal GeneratorFCCFederal Communications CommissionTXTransmittingFreq.Frequency ModulationTXTransmittingFreq.Frequency Shift KeyingVert.VerticalGNSSGlobal Navigation Sa	DBPSK	Differential BPSK	PN	Pseudo random Noise
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DockDevice Under TestQuickQui	DSSS	Direct Sequence Spread Spectrum	OPSK	Quadrature Phase Shift Keving
DOTDot of the resultEDREnhanced Data RateRDSRadio Data SystemEIRP, e.i.rp.Equivalent Isotropically Radiated PowerRERadio Data SystemEMCElectroMagnetic CompatibilityRFRadio Tata SystemEM1ElectroMagnetic InterferenceRMSRoot Mean SquareENEuropean NormRSSRadio Standards SpecificationsERP, er.p.Effective Radiated PowerRxReceivingEUEuropean UnionSA, S/ASpectrum AnalyzerEUTEquipment Under TestSARSpecific Absorption RateFac.FactorSGSignal GeneratorFCCFederal Communications CommissionSVSWRSite-Voltage Standing Wave RatioFHSSFrequency Hopping Spread SpectrumTRTest ReceiverFMFrequency ModulationTxTransmittingFreq.Frequency Shift KeyingVert.VeticalGNSSGlobal Navigation Statellite SystemGrSSGlobal Navigation StandardGPSGlobal Navigation StandardEuropean StandardEuropean StandardHori.HorizontalHorizontalHorizontalICESInterference-Causing Equipment StandardEuropean StandardIECInterference-Causing Equipment StandardEuropean StandardIECInterference-Causing Equipment StandardEuropean StandardIECInterference-Causing Equipment StandardEuropean StandardIECInterference-Causing Equipment StandardEuropean Standard	DUT	Device Under Test	RBW	Resolution Band Width
LinkIndexNobEIRR, e.ir.p.Equivalent isotropically Radiated PowerRERadio EquipmentEMCElectroMagnetic CompatibilityRFRadio EquipmentEMIElectroMagnetic InterferenceRMSRoot Mean SquareENEuropean NomRSSRadio Standards SpecificationsERP, er.p.Effective Radiated PowerRxReceivingEUEuropean UnionSA, S/ASpectrum AnalyzerEUTEquipment Under TestSARSpectrum AnalyzerEUTEquipment Under TestSGSignal GeneratorFACFederal Communications CommissionSVSWRSite-Voltage Standing Wave RatioFHSSFrequency Hopping Spread SpectrumTRTest ReceiverFMFrequency ModulationTxTransmittingFreq.Frequency Shift KeyingVert.VeticalGFSKGlobal Navigation Satellite SystemGFSKGlobal Navigation Satellite SystemHori.HorizontalHorizontalIterference-Causing Equipment StandardIECInterference-Causing Equipment StandardEEIECInterference-Causing Engineers EngineersEE	FDR	Enhanced Data Rate	RDS	Radio Data System
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EMC ElectroMagnetic Interference RMS Roto Mean Square EN European Norm RSS Radio Standards Specifications ERP, exp. Effective Radiated Power Rx Receiving EU European Union SA, S/A Spectrum Analyzer EU European Union SA, S/A Spectrum Analyzer EUT Equipment Under Test SAR Specific Absorption Rate Fac. Factor SG Signal Generator FCC Federal Communications Commission SVSWR Site-Voltage Standing Wave Ratio FHSS Frequency Hopping Spread Spectrum TR Test Receiver FM Frequency Modulation Tx Transmitting Freq. Frequency Modulation Tx Transmitting FrsK Frequency Shift Keying Vert. Vertical GFSK Global Navigation Satellite System GPS Global Positioning System Hori. Horizontal ICES Interference-Causing Equipment Standard IEC Interference-Clausing Enginement Standard E IEC Interference-Clausing Enginement Standard E	EMC EMC	ElectroMagnetic Compatibility	RE	Radio Equipment
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IFF Institute of Electrical and Electronics Engineers	IEC	International Electrotechnical Commission		
	IFFE	Institute of Electrical and Electronics Engineers		

UL Japan, Inc. Shonan EMC Lab. 1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN Telephone: +81 463 50 6400 / Facsimile: +81 463 50 6401

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SECTION 1: Customer information

Company Name	CASIO COMPUTER CO., LTD.
Address	2-1, Sakaecho 3-chome, Hamura-shi, Tokyo, 205-8555 Japan
Telephone Number	+81-42-579-7249
Contact Person	Munetaka Seo

The information provided from the customer is as follows;

Applicant, Type of EUT, Model Number of EUT, FCC ID, on the cover and other relevant pages

Operating/Test Mode(s) (Mode(s)) on all the relevant pages

SECTION 1: Customer information

SECTION 2: Equipment under test (EUT)

SECTION 4: Operation of EUT during testing

Appendix 1: The part of Antenna location information, Description of EUT and Support Equipment _

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2, SECTION 4 and Appendix 1.

SECTION 2: Equipment under test (EUT)

2.1 **Identification of EUT**

	EUT	Platform				
Type of EUT and Platform	Wireless Module	Smart Watch				
Model Number	GSW-H1000 GSW-H1000 (*1)					
Serial Number	237	237				
Condition of FLIT	Production prototype	Production prototype				
Condition of EO I	*. Not for sale: These samples are equivalent to mass-produced iter	ns.				
	April 20, 2020 (*. EUT for power measurement.) *. N	No modification by the Lab.				
Receipt Date of Sample	May 11, 2020 (*. EUT for SAR test.) *. No modification by the Lab.					
receipe 2 me er sampre	(*. After power measurement, the EUT was returned to the customer, and the RF wiring was changed to the					
	original antenna line from the antenna conducted power i	measurement line by the customer.)				
Country of Mass-production	Japan, Thailand					
Category Identified	Portable device					
	Model number: GSW-H1000 (referred to as the EUT in this report) is a Wireless Module which					
Feature of FLIT	installs into the Smart Watch (Wristwatch, Model number: GSW-H1000).					
	This platform: GSW-H1000 supports some operations and functions (e.g. responding to mail and SMS messages, etc.) by					
using the voice command.						
	Removable wrist band: non-metallic.					
SAR Accessory (Platform)	*. For the SAR test, the wrist band was removed to make the back of wristwatch touch to the flat phantom directly. (Refer to					
	Appendix 1-1 for more detail.)					

*.1 The platform (model number: GSW-H1000) has alternative name as "S001." Model number: GSW-H1000 was used for distinction in this report.

2.2 Product Description (EUT: Wireless Module, model No.: GSW-H1000)

Equipment type	Transceiver								
Operation mode		W	∕i-Fi		Bluetooth (Ver. 4.2 with EDR function)				
Frequency of operation		(2412~2462)	MHz (b, g, n20)	(2402~2480) MHz (BDR (Basic Data Rate), EDR (Enhanced Data Rate), BLE (Low Energy mode))					
Channel spacing		51	MHz		1MHz (I	BDR, EE	DR), 2MH	łz(BLE)	
Bandwidth		20 MHz	z (b, g, n20)			79N	/IHz		
Type of modulation	(g, n	(b) DSSS: DBPSK, DQPSK, CCK (g, n20)) OFDM: BPSK, QPSK, 16QAM, 64QAM				FHSS: GFSK (*. EDR: GFSK+π/4-DQPSK, GFSK+8DPSK)			
	Mod	le b	g	n(20HT)	BDR	E)R	BLE	
Transmit typical power	Typic	al n/a	n/a	n/a	n/a	n	n/a n/a		
and maximum tune-up	Maximu	n 17.15 dBm	13.41 dBm	12.04 dBm	9.26 dBm	6.53	dBm	7.36 dBm	
tolerance limit	Remar	KS -	-	-	-				
	*. The measured Tx output power (conducted) refers to section 6 in this report.								
Quantity of Antenna	1 piece	Antenna model	TX-50	1ANT	Antenna connect	or type	Solderin	ıg	
Antenna gain (peak)	-3.70 dBi Antenna type Inverted F						lF		

bi IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT) The EUT do not use the special transmitting technique such as "beam-forming" and "time-space code diversity." Since Wi-Fi and Bluetooth are used a same antenna, Wi-Fi and Bluetooth do not transmit simultaneously.

*.

Test specification, procedures and results SECTION 3:

3.1 **Test specification**

FCC47CFR §2.1093: Radiofrequency radiation exposure evaluation: portable devices.

The US Federal Communications Commission has released the report and order "Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992. The device should be evaluated at maximum output power (radiated from the antenna) under "worst-case" conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling in accordance with the following measurement procedures.

The tests documented in this report were performed in accordance with FCC 47 CFR Parts 2, IEEE Std.1528-2013 (latest), the following FCC Published RF exposure KDB procedures, and TCB workshop updates.

KDB 447498 D01 (v06):	General RF exposure guidance
KDB 248227 D01 (v02r02):	SAR Guidance for IEEE 802.11 (Wi-Fi) transmitters
KDB 865664 D01 (v01r04):	SAR measurement 100MHz to 6GHz
IFFF Std 1528 2013.	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the
TELE Stu. 1520-2015.	Human Head from Wireless Communications Devices: Measurement Techniques.

3.2 **Exposure** limit

Environments of exposure limit	Whole-Body (averaged over the entire body)	Partial-Body (averaged over any 1g of tissue)	Hands, Wrists, Feet and Ankles (averaged over any 10g of tissue)
(A) Limits for Occupational /Controlled Exposure (W/kg)	0.4	8.0	20.0
(B) Limits for General population /Uncontrolled Exposure (W/kg)	0.08	1.6	4.0

*. Occupational/Controlled Environments:

are defined as locations where there is exposure that may be incurred by people who are aware of the potential for

exposure.

exposure, (i.e. as a result of employment or occupation). *. General Population/Uncontrolled Environments: are defined as locations where there is the exposure of individuals who have no knowledge or control of their

The limit applied in this test report is;

General population / uncontrolled exposure, Extremity (averaged over any 10g of tissue) limit: 4 W/kg (Wrist) General population / uncontrolled exposure, Partial-Body (averaged over any 1g of tissue) limit: 1.6 W/kg (Next-to-Mouth)

*. Tested platform is a wristwatch which support the voice command.

3.3 Addition, deviation and exclusion to the test procedure

No addition, exclusion nor deviation has been made from the test procedure.

3.4 **Test Location**

UL Japan, Inc., Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN

Telephone number: +81 463 50 6400 / Facsimile number: +81 463 50 6401

A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Used?	Place	Width x Depth x Height (m)	Size of reference ground plane (m)/ horizontal conducting plane	Maximum measurement distance
	No.1 Semi-anechoic chamber	20.6×11.3×7.65	20.6 × 11.3	10 m
	No.2 Semi-anechoic chamber	$20.6 \times 11.3 \times 7.65$	20.6×11.3	10 m
	No.3 Semi-anechoic chamber	$12.7 \times 7.7 \times 5.35$	12.7×7.7	5 m
	No.4 Semi-anechoic chamber	$8.1 \times 5.1 \times 3.55$	8.1×5.1	-
	No.1 Shielded room	$6.8 \times 4.1 \times 2.7$	6.8×4.1	-
	No.2 Shielded room	$6.8 \times 4.1 \times 2.7$	6.8×4.1	-
	No.3 Shielded room	$6.3 \times 4.7 \times 2.7$	6.3×4.7	-
	No.4 Shielded room	$4.4 \times 4.7 \times 2.7$	4.4×4.7	-
	No.5 Shielded room	$7.8 \times 6.4 \times 2.7$	7.8×6.4	-
	No.6 Shielded room	$7.8 \times 6.4 \times 2.7$	7.8×6.4	-
X	No.7 Shielded room	2.76 × 3.76 × 2.4	2.76×3.76	-
	No.8 Shielded room	$3.45 \times 5.5 \times 2.4$	3.45 × 5.5	-
	No.1 Measurement room	$2.55 \times 4.1 \times 2.5$	2.55×4.1	-

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3.5 **Procedures and Results**

Test Descelario	GAD	· KDD 447400 KD		EE 9: 11529				
Test Procedure	SAR measurement; KDB 44 /498, KDB 24822 /, KDB 865664, IEEE Std.1528							
Category		FCC 47CFR §2.1093 (Portable device)						
Platform / model		Smart Watch (Model	number: GSW-H10	00)				
RF Exposure condition	Extrem	ity (Wrist)	Partial-bod	y (Next-to-Mouth)				
Limit	4 W/kg ((SAR(10g))	1.6 W/	kg (SAR(1g))				
	Bluetooth	Wi-Fi	Bluetooth	Wi-Fi				
Results	Complied (*. lower power, SAR test was exempt.)	Complied (*. Refer to Section 7)	Complied (*. lower power, SAR test was exempt.)	Complied (*. Refer to Section 7)				
Reported SAR value (*. Scaled)	N/A	0.058 W/kg	N/A	0.053 W/kg				
Measured SAR value	N/A	0.052 W/kg	N/A	0.048 W/kg				
Liquid type	N/A	Body	N/A	Head				
Setup (separation distance)	N/A	0 mm	N/A	10 mm				
Operation mode, channel	-	11b (1Mbps, DSSS), 2437 MHz (6ch)	-	11b (1Mbps, DSSS), 2437 MHz (6ch)				
Duty cycle (duty cycle factor)	- 99.1 %(×1.01)		-	99.1 % (×1.01)				
Power measured / max. power [dBm]	-	16.73/max.17.15	-	16.73/max.17.15				
Power scaled factor		×1.10		×1.10				

Note: UL Japan's SAR Work Procedures No.13-EM-W0429 and 13-EM-W0430. No addition, deviation nor exclusion has been made from standards

(mode) b: IEEE 802.11b, max.:maximum, n/a: not applied.

(ince Biuetooth and Wii-Fi are used a same antenna, Bluetooth and Wi-Fi do not transmit simultaneously. (Calculating formula) Corrected SAR to max.power(as Reported SAR) (W/kg) = (Measured SAR (W/kg)) × (Duty scaled factor) × (Tune-up factor) where; Tune-up factor [-] = $1/(10^{-(4)} \text{max} (\text{max.power} - \text{burst average power}, dB''/10)$), Duty scaled factor [-] = 100(%)/(duty cycle, %)*

Test outline: Where the EUT is built into a platform, it was verified whether multi-platform conditions can be suited in according with section 2) of 5.2.2 in KDB447498 D01 (v06).

Consideration of the	The highest reported SAR (1g) and SAR (10g) of this platform was kept; \leq 0.4 W/kg.
test results:	Since highest reported SAR (1g) on this EUTs platform obtained in accordance with KDB447498 D01 (v06) was kept under 0.4 W/kg, this
	EUT was approved to operate multi-platform (limited to use the specified model in listed above table.).

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for partial body (next-to-mouth), 4.0 W/kg for extremity (wrist) specified in FCC 47 CFR part 2 (2.1093), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

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3.6 SAR measurement procedure

3.6.1 Normal SAR measurement procedure

Step 1: Confirmation before SAR testing

Before SAR test, the RF wiring for the sample had been switched to the antenna conducted power measurement line from the antenna line and the average power was measured. The SAR test reference power measurement and the SAR test were proceeded with the lowest data rate (which has the higher time-based average power typically) on each operation mode. Therefore, the average output power was measured on the lower, middle (or near middle), upper and specified channels with the lowest data rate of each operation mode. The power of other data rate was also measured to confirm the time-base average power and when it's required. The power measurement result is shown in Section 6.

The EUT transmission power was verified that it was within 2dB lower than the maximum tune-up tolerance limit when it was set the rated power. (Clause 4.1, KDB447498 D01 (v06))

Step 2: Power reference measurement

Measurement of the E-field at a fixed location above the central position of flat phantom (or/and furthermore an interpolated peak SAR location of area scan in step 2) was used as a reference value for assessing the power drop.

Step 3: Area Scan (Area scan parameters: KDB 865664 D01 (v01r04).)

The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the antenna of EUT and suitable horizontal grid spacing of EUT. Based on these data, the area of the maximum absorption was determined by splines interpolation.

	\leq 3 GHz	> 3 GHz			
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5\pm1~\mathrm{mm}$	$\sin\delta\ln(2)\pm0.5~mm$			
Maximum probe angle from probe axis to phantom surface normal at the measurement location	arrement point $\leq 3 \text{ GH2}$ appendix phantom surface $5 \pm 1 \text{ mm}$ $\frac{1}{2}, 6^{2}$ is to phantom surface $30^{6} \pm 1^{6}$ $30^{6} \pm 1^{6}$ is to phantom $30^{6} \pm 1^{6}$ $3-4$ is 2 GHz; $\leq 15 \text{ mm}$ $3-4$ i: $\Delta X_{Ares}, \Delta y_{Ares}$ When the x or y dimension of the test a measurement plane orientation, is small measurement point on the test device with measurement point on the test device.	$20^{\circ} \pm 1^{\circ}$			
	$\leq 2~GHz_1 \leq 15~mm \\ 2-3~GHz_2 \leq 12~mm$	$\begin{array}{l} 3-4 \ GHz \leq 12 \ mm \\ 4-6 \ GHz \leq 10 \ mm \end{array}$			
Maximum area scan spatial resolution: $\Delta x_{\rm Area}, \Delta y_{\rm Area}$	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be \leq the corresponding x or y dimension of the test device with at least one measurement point on the test device.				

Step 4: Zoom Scan and post-processing (Zoom scan parameters: KDB 865664 D01 (v01r04).)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The Zoom Scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure.

A volume of 30 mm (X) × 30 mm (Y) × 30 mm (Z) (or more) was assessed by measuring $7\times7\times7$ points (or more), \leq 3GHz. A volume of 28 mm (X) × 28 mm (Y) × 24mm (Z) (or more) was assessed by measuring $8\times8\times7$ points (or more) (by "Ratio step" method (*1)), > 3 GHz. When the SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are proceeded for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR. If the zoom scan measured as defined above complies with both of the following criteria. or if the peak spatial-average SAR is below 0.1 W/kg, no additional measurements are needed.
 The smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both x and y directions and recorded.
 The ratio of the SAR at the second measured point to the SAR at the closest measured point at the x-y location of the measured maximum SAR value shall be at least 30% and recorded.

				f ≤ 3 GHz	3 GHz < f ≤ 8 GHz
1	Maximum ze resolution: A	1aximum zoom scan spatial asolution: Δx _{zoom} , Δy _{zoom} uniform grid: Δz _{zoom} (n) 1aximum born scan batter patial between 1st two points closest to		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
2	Maximum zoom scan spatial resolution, normal to phantom surface	Uniform s	grid: ∆z _{žoom} (n)	≤5mm	3 – 4 GHz; ≤ 4 mm 4 – 5 GHz; ≤ 3 mm 5 – 6 GHz; ≤ 2 mm
3		graded	Δz _{zoom} (1): between 1 st two points closest to phantom surface	≤4mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
4		rface grid between subsequent points		≤ 1.5·∆z _{žo}	_{om} (n-1) mm
5	Minimum zoomscan x, y, z volume		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	

corresponding variable and fixed parameters given in IEC 62209-1:2016 and IEC 62209-2:2010/AMD1:2019

Step 5: Power drift measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the last Power Reference Measurement. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 2. It was checked that the power drift is within ±5% in the evaluation procedure of SAR testing. The verification of power drift during the SAR test is that DASY system calculates the power drift by measuring the e-filed at the same location at beginning and the end of the scan measurement for each test position. The result is shown in SAR plot data of APPENDIX 2.

- DASY system calculation Power drift value[dB] =20log(Ea)/(Eb) (where, Before SAR testing: Eb[V/m] / After SAR testing: Ea[V/m]) Limit of power drift[W] = $\pm 5\%$; Power drift limit (X) [dB] = $10log(P_drift)=10log(1.05/1)=10log(1.05)-10log(1)=0.21dB$
 - from E-filed relations with power; $S=E\times H=E^2/\eta=P/(4\times\pi\times r^2)$ (η : Space impedance) $\rightarrow P=(E^2\times 4\times\pi\times r^2)/\eta$

 - Therefore, The correlation of power and the E-filed Power drift limit (X) dB=10log(P_drift) = 10log(E_drift)^2=20log(E_drift)

From the above mentioned, the calculated power drift of DASY system must be the less than (±) 0.21dB.

Step 6: Z-Scan

The Z Scan measures points along a vertical straight line. The line runs along the Z-axis of a one-dimensional grid. In order to get a reasonable extrapolation the extrapolated distance should not be larger than the step size in Z-direction.

- The all SAR tests were conservatively performed with test separation distance 0 mm. The phantom bottom thickness is approx. 2mm. Typical distance from probe tip to dipole centers is 1mm. The distance between the SAR probe tip to the surface of test device which is touched the bottom surface of the phantom is approx. 3 mm for 2.4GHz band and 2.4 mm for 5GHz band.
- *1. "Ratio step" method parameters used; the first measurement point: "1.4mm" from the phantom surface, the initial z grid separation: "1.4mm", subsequent graded grid ratio: "1.4". These parameters comply with the requirement of KDB 865664 D01 and recommended by Schmid & Partner Engineering AG (DASY5 manual).

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SECTION 4: Operation of EUT during testing

4.1 Operation mode for SAR testing

The EUT has Bluetooth (BDR/EDR/BT-LE) and IEEE 802.11b, IEEE 802.11g, IEEE 802.11n(20HT) continuous transmitting modes. The frequency and the modulation used in the SAR testing are shown as a following.

Operation mode		BDR	E	DR	B	T-LE	b	b		g	n20
Tx f	requency band		(2402~24	80) MHz					(241	2~2462) MF	łz
Mavin	Maximum power [dBm]		6.53	6.53	7	7.36	171	5		13.41	12.04
тлали			(*. lo	wer power than H	BDR.)		17.1	5		(*. lower pov	ver than 11b mode)
(Head)	Frequency [MHz]	n/a (lo	ower power, SAF	test was exempt	t.)(*2)		2437	(*1)		n/a	n/a
SAR tested	Modulation	GFSK	GFSK+π/4- DQPSK	GFSK +8DPSK	G	FSK	DSSS		OFDM		OFDM
condition	Data rate [Mbps]	1	2	3		1	1 (*. lowest modulation)		6 (*. lowest modulation)		MCS0 (*. lowest modulation)
SAR	tested/reduced?	Reduced (*2)	Reduced (*2)	Reduced (*2)	Redu	duced (*2) Tested		Reduced (*1)		Reduced (*1)	
(Wrist)	Frequency [MHz]	n/a (le	n/a (lower power, SAR test was exempt.				2437 (*1)		n/a		n/a
SAR tested	Modulation	GFSK	GFSK+π/4- DQPSK	GFSK +8DPSK	G	FSK	DSS	DSSS		OFDM	OFDM
condition	Data rate [Mbps]	1	2	3		1	1 (*. lowest n	nodulation)	6 (*. lowest modulation		MCS0 (*. lowest modulation)
SAR	tested/reduced?	Reduced (*2)	Reduced (*2)	Reduced (*2)	Redu	1ced (*2)	Test	ed	Rec	luced (*1)	Reduced (*1)
Central			Software name		Version		Date		Storage location		
Controll	Power measureme	ent, (Wi-Fi)666	5241 CY WLTI	EST (*3)		7.45.98.3	0	2020/04/	24	Memory of platform (firmware)	
soltwal	SAR	(Bluetooth)	BCM4343A1.	hcd (*3)		001	2020/04/2		24	4 Memory of platform (firmware)	

*. (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT); BT-LE: Bluetooth Low Energy; BDR: Basic Data Rate; EDR: Enhanced Data Rate; n/a: not applied.
 *. Any output power reducing for channel 1 and 11 to meet restricted band requirements was not observed.

*1. (KDB248227 D01 (v02r02)) Since the reported SAR of the highest measured maximum output power channel of DSSS mode was \leq 0.8 W/kg, the SAR testing for other channels of DSSS mode and SAR test of OFDM modes were omitted.

*2. For Bluetooth mode, since it was enough lower power, SAR test for this mode was exempt.

*3. This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.

4.2 Test setup

Antenna separation distances in each test setup plan are shown as follows.

		Mode->	Wi-Fi	Bluetooth	
Setup plan	Explanation of SAR test setup plan (*. Refer to Appendix 1 for test setup photographs which had been tested.)	D [mm]	SAR Tested /Reduced	SAR Tested /Reduced	SAR type (*4)
Back	The back flat-surface of watch is touched to the Flat phantom.	3.95	Tested	Reduced	Wrist-touch (*4)
Front	The front surface of watch is set parallel to the Flat phantom with 10mm separation gap.	11.26 (*. 21.26, including 10 mm gap)	Tested	Reduced	Next-to-Mouth (*4)
Bezel-left	The left side of bezel of watch is touched to the Flat phantom.	10.9	Reduced	Reduced	
Near side	The near side of bezel of watch is touched to the Flat phantom.	16.2	Reduced	Reduced	Not amplied (*4)
Far side	The far side of bezel of watch is touched to the Flat phantom.	37.22	Reduced	Reduced	not applied (*4)
Bezel-right	The right side of bezel of watch is touched to the Flat phantom.	42.8	Reduced	Reduced	

*. D: Antenna separation distance. It is the distance from the EUT antenna inside a platform to the outer surface of platform which an operator may touch.

. Size of platform: round shape, 65.54 mm (length) \times 56.28 mm (width) \times 19.41 mm (thickness) (. excluding wrist band.)

*4. It was applied the SAR test procedure "KDB447498 D01 (v06), Clause 6.2. Wrist watch and wrist-worn transmitters", because this platform which has EUT built-in is a wristwatch and the voice command is supported. According to KDB447498 D01 (v06), Clause 6.2. Wrist watch and wrist-worn transmitters;

Transmitters that are built-in within a wrist watch or similar wrist-worn devices typically operate in speaker mode for voice communication, with the device worn on the wrist and positioned next to the mouth. <u>Next to the mouth exposure requires 1-g SAR and the wrist-worn condition</u> requires 10-g extremity <u>SAR</u>. The 10-g extremity and 1-g SAR test exclusions may be applied to the wrist and face exposure conditions. <u>When</u> <u>SAR evaluation is required, next to the mouth use is evaluated with the front of the device positioned at 10 mm from a flat phantom filled with head tissue-equivalent medium. The wrist bands should be strapped together to represent normal use conditions. SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled with body tissue-equivalent medium. The wrist bands should be unstrapped and touching the phantom. The space introduced by the watch or wrist bands and the phantom must be representative of actual use conditions; otherwise, if applicable, the neck or a curved head region of the SAM phantom may be used, provided the device positioning and SAR probe access issues have been addressed through a KDB inquiry. When other device positioning and SAR measurement considerations are necessary, a KDB inquiry is also required for the test results to be acceptable; for example, devices with rigid wrist bands or electronic circuitry and/or antenna(s) incorporated in the wrist bands. These test configurations are applicable only to devices that are worn on the wrist and cannot support other use conditions; therefore, the operating restrictions must be fully demonstrated in both the test reports and user manuals.</u>

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4.3 SAR test exclusion considerations accordance to KDB 447498 D01

The following is based on KDB447498D01;

- Step 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances \leq 50 mm are determined by: [(max.power of channel, including tune-up tolerance, mW)/(min.test separation distance, mm)]×[\sqrt{f} (GHz)] \leq 3.0 (for SAR(1g), 7.5(for SAR(10g)) formula (1) If power is calculated from the upper formula (1); [SAR(1g) test exclusion thresholds, mW]=3×[test separation distance, mm]/[\sqrt{f} (GHz)] formula (2)
 - 1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
 - 2. Power and distance are rounded to the nearest mW and mm before calculation
 - 3. The result is rounded to one decimal place for comparison
 - 4. The test exclusions are applicable only when the minimum test separation distance is ≤50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is <5 mm, a distance of 5 mm is applied to determine SAR test exclusion.</p>

When the calculated threshold value by a numerical formula above-mentioned in the following table is 3.0 or less, SAR test can be excluded.

- Step 2) At 1500 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following,
 - [test exclusion thresholds, mW] = [(Power allowed at numeric threshold for 50mm in formula (1))] + [(test separation distance, mm) (50mm)] × 10 ······· formula (3) 1. The upper frequency of the frequency band was used in order to calculate standalone SAR test exclusion considerations.
 - Power and distance are rounded to the nearest mW and mm before calculation
- When output power is less than the calculated threshold value by a numerical formula above-mentioned in the following table, SAR test is excluded.

[Table 1: SAR exclusion calculations]

					Step 1) SAR exclusion calculations for antenna \leq 50mm from the user.							
							Cal	lculated threshold va	alue			
Band T			Max	imum	Setup	Back	Fr	Front		Near-side	Far-side	Bezel-right
	Ty mode	Opper	output	output power SAR type		ype SAR(10g), wrist SAR(1g), head		SAR(1g), head		-	-	-
	1 A HIOLO	[MHz]			Limit	≤7.5	\leq	3.0	-	-	-	-
		2462	[dBm]	[mW]	D[mm]	≤5 (4)	11	21 (*. including 10 mm separation gap)	11	16	37	43
2.4GHz	b	2462	17.15	52	Judge	16.3, Measure	7.4, Measure	3.9, Measure	Reduce	KDB 4474	98 D01, C	lause 6.2
2.4GHz	g	2462	13.41	22	Judge	6.9, Reduce	3.1, Measure	1.6, Reduce	Reduce	KDB 4474	98 D01, C	lause 6.2
2.4GHz	n20	2462	12.04	16	Judge	5.0, Reduce	2.3, Reduce	1.23, Reduce	Reduce, KDB 447498 D01, Clause 6.2			
2.4GHz	BDR	2480	9.26	8	Judge	2.5, Reduce	1.1, Reduce	0.6, Reduce	Reduce, KDB 447498 D01, Clause 6.2		lause 6.2	
2.4GHz	BT-LE	2480	7.36	5	Judge	1.6, Reduce	0.7, Reduce	0.4, Reduce	Reduce	KDB 4474	98 D01, C	lause 6.2
2.4GHz	EDR	2480	6.53	4	Judge	1.3. Reduce	0.6. Reduce	0.3. Reduce	Reduce.	KDB 4474	98 D01, C	lause 6.2

*. D: Antenna separation distance, (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT); BT-LE: Bluetooth Low Energy; BDR: Basic Data Rate; EDR: Enhanced Data Rate.

Notes: 1. Power and distance are rounded to the nearest mW and mm before calculation.

<Conclusion for consideration for SAR test reduction>

Tested platform is a wristwatch with the watch-wristband. This platform is usually wom on the wrist. Since the platform has sound responsive function, the platform is used in front of the mouth when a voice input is operated.

1) For Wi-Fi operation, "Back" setup is considered extremity (wrist) SAR (touch) and is applied the SAR test in body-liquid.

- 2) For Wi-Fi operation, "Front" setup is considered partial body SAR (next-to-mouth, 10 mm separation gap) and is applied the SAR test in headliquid.
- The SAR test of other SAR setups (side edge of platform) are reduced, because they are not operator accessible area for long time continuously in normal use. (KDB 447498 D01, Clause 6.2)
- 4) For Bluetooth operation, the SAR test was reduced, because the SAR test exclusion judge was "test can be reduced". (Refer to table 1)
- 5) The all SAR tests were conservatively performed with test separation distance 0mm.

By the determined test setup shown above, the SAR test was applied in the following procedures.

	(KDB 447498 D01, Clause 6.2)
Ste	p Measure extremity SAR(10g) (wrist) of DSSS mode on "Back" setup with a maximum power channel by using body liquid;
1	Determine the highest reported SAR(10g) of DSSS mode by changing the channels, if it is necessary.
	(*. In addition, change the operation mode, if it is necessary.)
	(KDB 447498 D01, Clause 6.2)
Ste	p Measure partial body SAR(1g) (next-to-mouth) of DSSS mode on "Front" setup with 10 mm separation gap by using head liquid;
2	Determine the highest reported SAR(1g) of DSSS mode by changing the channels, if it is necessary.
	(*. In addition, change the operation mode, if it is necessary.)
*.	During SAR test, the radiated power is always monitored by Spectrum Analyzer.

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SECTION 5: Uncertainty Assessment (SAR measurement/Daily check)

*. Although this standard determines only the limit value of uncertainty, there is no applicable rule of uncertainty in this. Therefore, the following results are derived depending on whether or not laboratory uncertainty is applied.

ι	Uncertainty of SAR measurement (2.4GHz~6GHz) (*.ε&σ:≤±5%, DAK3.5, Tx:≈100% duty cycle) (v09) 1g SAR 10g SAR									
	Combined measurement unce	rtainty of the me	asurement system (l	x=1)		±	13.0 %	±12.9 %		
	Expande	d uncertainty (k=	=2)			±	26.0 %	±25.8 %		
	Error Description (2.4-6GHz)	Uncertainty Value	Probability distribution	Divisor	ci(lg)	ci(10g)	ui (1g)	ui (10g)	Vi, veff	
A	Measurement System (DASY5)						(std. uncertainty)	(std. uncertainty)		
1	Probe Calibration Error	±6.55 %	Normal	1	1	1	±6.55%	±6.55%	8	
2	Axial isotropy Error	±4.7 %	Rectangular	√3	√0.5	√0.5	±1.9 %	±1.9 %	80	
3	Hemispherical isotropy Error	±9.6 %	Rectangular	$\sqrt{3}$	√0.5	√0.5	±3.9 %	±3.9 %	8	
4	Linearity Error	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	8	
5	Probe modulation response (v09)	±5.5 %	Rectangular	√3	1	1	±3.2 %	±3.2 %	8	
6	Sensitivity Error (detection limit)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	80	
7	Boundary effects Error	±4.3%	Rectangular	√3	1	1	±2.5 %	±2.5 %	00	
8	Readout Electronics Error(DAE)	±0.3 %	Rectangular	√3	1	1	±0.3 %	±0.3 %	80	
- 9	Response Time Error	±0.8 %	Normal	1	1	1	±0.8 %	±0.8 %	00	
10	Integration Time Error (≈100% duty cycle)	±0 %	Rectangular	√3	1	1	0%	0%	00	
11	RF ambient conditions-noise (v09)	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	00	
12	RF ambient conditions-reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	00	
13	Probe positioner mechanical tolerance	±3.3 %	Rectangular	√3	1	1	±1.9 %	±1.9 %	00	
14	Probe Positioning with respect to phantom shell	±6.7 %	Rectangular	√3	1	1	±3.9 %	±3.9 %	00	
15	Max. SAR evaluation (Post-processing)	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	00	
B	Test Sample Related									
16	Device Holder or Positioner Tolerance (v09)	±3.2 %	Normal	1	1	1	±3.2 %	±3.2 %	5	
17	Test Sample Positioning Error (v09)	±2.1 %	Normal	1	1	1	±2.1 %	±2.1 %	10	
18	Power scaling	±0%	Rectangular	√3	1	1	±0 %	±0 %	00	
19	Drift of output power (measured, <0.2dB)	±2.3%	Rectangular	√3	1	1	±2.9 %	±2.9 %	80	
C	Phantom and Setup									
20	Phantom uncertainty (shape, thickness tolerances)	±7.5 %	Rectangular	√3	1	1	±4.3 %	±4.3 %	00	
21	Algorithm for correcting SAR (e',σ: ≤5%)	±1.2 %	Normal	1	1	0.84	±1.2 %	±0.97 %	00	
22	Measurement Liquid Conductivity Error (DAK3.5)	±3.0 %	Normal	1	0.78	0.71	±2.3 %	±2.1 %	7	
23	Measurement Liquid Permittivity Error (DAK3.5)	±3.1 %	Normal	1	0.23	0.26	±0.7 %	± 0.8 %	7	
24	Liquid Conductivity-temp.uncertainty (<2deg.C.)	±5.3 %	Rectangular	√3	0.78	0.71	±2.4 %	±2.2 %	00	
25	Liquid Permittivity-temp.uncertainty (<2deg.C.)	±0.9 %	Rectangular	$\sqrt{3}$	0.23	0.26	±0.1 %	±0.1 %	00	
	Combined Standard Uncertainty (v09)						± 13.0 %	±12.9 %	945	
	Expanded Uncertainty (k=2) (v09)						$\pm 26.0\%$	± 25.8 %		

This measurement uncertainty budget is suggested by IEEE Std.1528(2013) and determined by Schmid & Partner Engineering AG (DASY5 Uncertainty Budget). Per KDB 865664 D01 (v01r04) SAR Measurement 100 MHz to 6 GHz, Section 2.8.1., when the highest measured SAR(1g) within a frequency band is < 1.5W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std.1528 (2013) is not required in SAR reports submitted for equipment approval.

	Uncertainty of daily check (2.4G	Hz~6GHz) (*.ε&σ	tolerance: ≤±5%, DAK3.5	i, CW) (v08	5)		1g SAR	10g SAR	
	Combined measurement unce	rtainty of the mea	asurement system (k	(=1)		±	:11.0 %	±10.9 %	ĺ
	Expande	d uncertainty (k=	=2)			÷	22.1 %	±21.8 %	1
	Error Description (v08)	Uncertainty Value	Probability distribution	Divisor	ci(lg)	ci (10g)	ui(lg)	ui (10g)	Vi, veff
Α	Measurement System (DASY5)						(std. uncertainty)	(std. uncertainty)	
1	Probe Calibration Error	±6.55 %	Normal	1	1	1	±6.55 %	±6.55 %	00
2	Axial isotropy error	±4.7 %	Rectangular	√3	√0.5	√0.5	±1.9%	±1.9 %	00
3	Hemispherical isotropy error	±9.6 %	Rectangular	√3	0	0	0%	0%	00
4	Probe linearity	±4.7 %	Rectangular	√3	1	1	±2.7 %	±2.7 %	00
5	Probe modulation response (CW)	±0.0 %	Rectangular	√3	1	1	0%	0%	00
6	System detection limit	±1.0 %	Rectangular	√3	1	1	±0.6 %	±0.6 %	00
7	Boundary effects	±4.8 %	Rectangular	√3	1	1	±2.8 %	±2.8 %	00
8	System readout electronics (DAE)	±0.3 %	Normal	1	1	1	±0.3 %	±0.3 %	00
9	Response Time Error (<5ms/100ms wait)	±0.0 %	Rectangular	√3	1	1	0%	0%	00
10	Integration Time Error (CW)	±0.0 %	Rectangular	√3	1	1	0%	0%	00
11	RF ambient conditions-noise	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	00
12	RF ambient conditions-reflections	±3.0 %	Rectangular	√3	1	1	±1.7 %	±1.7 %	00
13	Probe positioner mechanical tolerance	±3.3 %	Rectangular	√3	1	1	±1.9%	±1.9%	00
14	Probe positioning with respect to phantom shell	±6.7 %	Rectangular	√3	1	1	±3.9%	±3.9%	00
15	Max. SAR evaluation (Post-processing)	±4.0 %	Rectangular	√3	1	1	±2.3 %	±2.3 %	00
B	Test Sample Related								
16	Deviation of the experimental source	±3.5 %	Normal	1	1	1	±3.5 %	±3.5 %	00
17	Dipole to liquid distance (10mm±0.2mm,<2deg.)	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2 %	00
18	Drift of output power (measured, <0.2dB)	±2.3 %	Rectangular	√3	1	1	±1.3 %	±1.3 %	00
С	Phantom and Setup								
19	Phantom uncertainty	±2.0 %	Rectangular	√3	1	1	±1.2 %	±1.2%	00
20	Algorithm for correcting SAR (e',σ: ≤5%)	±1.2 %	Normal	1	1	0.84	±1.2 %	±0.97 %	00
21	Liquid conductivity (meas.) (DAK3.5)	±3.0 %	Normal	1	0.78	0.71	±2.3 %	±2.1 %	00
22	Liquid permittivity (meas.) (DAK3.5)	±3.1 %	Normal	1	0.23	0.26	±0.7 %	±0.8 %	00
23	Liquid Conductivity-temp.uncertainty (S2deg.C.)	±5.3 %	Rectangular	√3	0.78	0.71	±2.4 %	±2.2 %	00
24	Liquid Permittivity-temp.uncertainty (<2deg.C.)	±0.9 %	Rectangular	√3	0.23	0.26	±0.1 %	±0.1 %	00
	Combined Standard Uncertainty						±11.0%	±10.9 %	
	Expanded Uncertainty (k=2)						±22.1 %	±21.8%	
*.	This measurement uncertainty budget is suggested by I	EEE Std. 1528(2013)	and determined by Schn	nid & Partr	er Engine	ering AG (I	DASY5 Uncertain	nty Budget).	

*. Table of uncertainties are listed for ISO/IEC 17025.

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SECTION 6: Confirmation before testing

6.1 SAR reference power measurement (*. Antenna terminal conducted average power)

			Data	Power	Duty	Duty Duty	Duty	Μ	easuren	ient Res	sult]	Power	correcti	on	D	Domontra
Mode	Frequ	ency	rate	Setting	cycle	factor	scaled	Time a	verage	Burst	nower	Typical	Max.	Δ from	Tune-up	tuning	*. Antenna gain (peak):
	D 01 1			(software)	50 (7	r 103	Tactor	pov	ver	F ID 3		power	power	max.	Tactor	applied?	-3.70 dBi
	[MHz]	CH	[Mbps]	[-]	[%]		[-]	[dBm]	[mW]	[dBm]	[mW]	[dBm]	[dBm]	[dB]	[-]		
	2402	0	1(DH5)	fix	78.1	1.07	1.28	7.79	6.01	8.86	7.69		9.26	-0.40	1.10	n/a (fix)	-
BDR	2441	39	1(DH5)	fix	78.1	1.07	1.28	7.60	5.75	8.67	7.36		9.26	-0.59	1.15	n/a (fix)	-
	2480	78	1(DH5)	fix	78.1	1.07	1.28	7.31	5.38	8.38	6.89	-	9.26	-0.88	1.22	n/a (fix)	-
	2402	0	2(2DH5)	fix	78.1	1.07	1.28	4.25	2.66	5.32	3.40		6.53	-1.21	1.32	n/a (fix)	-
EDR	2441	39	2(2DH5)	fix	78.1	1.07	1.28	4.27	2.67	5.34	3.42	-	6.53	-1.19	1.32	n/a(fix)	
	2480	78	2(2DH5)	fix	78.1	1.07	1.28	4.86	3.06	<mark>5.93</mark>	3.92	-	6.53	-0.60	1.15	n/a (fix)	-
	2402	0	3(3DH5)	fix	78.1	1.07	1.28	4.26	2.67	5.33	3.41	-	6.53	-1.20	1.32	n/a (fix)	-
EDR	2441	39	3(3DH5)	fix	78.1	1.07	1.28	4.27	2.67	5.34	3.42		6.53	-1.19	1.32	n/a(fix)	-
	2480	78	3(3DH5)	fix	78.1	1.07	1.28	4.88	3.08	5.95	3.94		6.53	-0.58	1.14	n/a(fix)	-
	2402	0	1	fix	60.5	2.18	1.65	4.67	2.93	6.85	4.84	-	7.36	-0.51	1.12	n/a (fix)	-
BT-LE	2440	19	1	fix	60.5	2.18	1.65	4.52	2.83	6.70	4.68		7.36	-0.66	1.16	n/a (fix)	
	2480	39	1	fix	60.5	2.18	1.65	4.40	2.75	6.58	4.55		7.36	-0.78	1.20	n/a (fix)	
	2412	1	1	fix	99.1	0.04	1.01	16.53	44.98	16.57	45.39	-	17.15	-0.58	1.14	n/a (fix)	-
h	2437	6	1	fix	99.1	0.04	1.01	16.69	46.67	16.73	47.10	-	17.15	-0.42	1.10	n/a(fix)	
Ŭ	2462	11	· · · i · · ·	fix	99.1	0.04	1.01	16.54	45.08	16.58	45.50		17.15	-0.57	1.14	n/a (fix)	
	2412	1	6	fix	93.7	0.28	1.07	12.54	17.95	12.82	19.14	-	13.41	-0.59	1.15	n/a (fix)	_
σ	2437	6	6	fix	93.7	0.28	1.07	12.53	17.91	12.81	19.10		13.41	-0.60	1.15	n/a (fix)	
ь	2462	- <u>i</u> i -	6	fix	93.7	0.28	107	12.54	17.95	12.82	19 14		13.41	-0.59	1 15	n/a (fix)	
	2412	1	MCS0	fix	93.3	0.30	1.07	11.06	12.76	11.36	13.68	-	12.04	-0.68	1.15	n/a (fix)	-
n20	2437	6	MCS0	fiv	03.2	0.30	1.07	11.06	12.76	11.36	13.68		12.04	-0.68	1 17	n/a (fix)	
1120	2462	11	MCS0	fiv	03.3	0.30	1.07	10.08	12.70	11 28	13.00		12.04	-0.76	1 10	n/a(fix)	
<u> </u>	2402	11	WIC50	шл	<i>J</i> 3.5	0.30	1.07	10.96	12.33	11.20	15.45	-	12.04	-0.70	1.19		-

: SAR test was applied.; *. xx.xx highlight is shown the maximum measured output power in each mode.; CH: channel, max: maximum, n/a: not applied.

The SAR test power was not more than 2dB lower than maximum tune-up power (KDB 447498 D01 (v06) requirement). *.

*

For Wi-Fi mode, the lowest data rate (lowest modulation) mode was selected for the SAR test which had the highest duty cycle. (KDB 447498 D01 (v06)) CH: channel, Max. power: Maximum tune-up power, n/a: not applicable, (mode) b: IEEE 802.11b, g: IEEE 802.11g, n20: IEEE 802.11n(20HT), BT-LE: Bluetooth Low Energy; BDR: Basic Data Rate; EDR: Enhanced Data Rate.

*. The measured duty cycle number of BDR/EDR/BT-LE was nearly equal to highest theory duty cycle.

*. Calculating formula: Result-Time average power (dBm) = (P/M Reading, dBm) + (Cable loss, dB) + (Attenuator, dB)

Result-Burst power (dBm) (*.equal to 100% duty cycle) = (P/M Reading, dBm)+(Cable loss, dB)+(Attenuator, dB)+(duty factor, dB) The table point (during (during (during to the second during (during to the second during the second during the second during (during the second during the $\Delta \text{ form max. } (dB) = (\text{Results-Burst power (average, dBm)}) - (\text{Max-specification output power (average, dBm)})$

Date measured: April 24, 2020/Measured by: H. Naka/Place: Preparation room of No. 7 shield room. (23 deg.C./ 45 %RH)

Uncertainty of antenna port conducted test; (±) 0.98 dB (Average power), (±) 0.262 % (duty cycle).

*

• •	Duty	Cycle U	omonnau		lowestu	iala Ialc	on cach	operan	JIIIIOC	e were si	OWILL	I ule de	iow ci	lan.						
	I	3T-LE, ((1.135(on)	/1.875(1cy	cle)ms*	100=60	.5%, duty	/ factor=	2.18dB			BDR	(DH5),	(2.929(on	n)/3.751(1cycle)r	ns*100=78	3.1%, du	ty factor	=1.07d	В
Ref Ø	dBm			Atten 10 d	В		-			-0.68 dB	Ref 10	dBm		Ĥ	tten 20 dB					-0.46 dB
#Peak											#Peak									
L09 10											LOG 10									
dBZ											dB/									
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	_A ships	41 4 <u>1</u>				47	-		Contrativity of			allyticationally be		-			- IM	da ya 1 da shekiri di	nina.	
LgAv	<u> </u>	5 I.						1		_	LgAv			_						
	-										01 00			-						-
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Center	2.44	0 000 GH	lz							Span 0 Hz	Center	2.441 0	00 GHZ	2				~		Span @ HZ
Res Bl	48 MI	z			+VBW 50 h	MHz		Sweep	2.4 ms (8001 pts)	Kes BM	8 MHZ			■VDW 50	MHZ		Sweep	5 ms (8001 pts)
Mark	er	Trace	Type	Х	Ĥxis		Amplit	ude			Mark 10	er Tra	ice	Type	X Axis 407 E ····		Amplitu	ide ID-		
1R		(3)	Tine	22	23.2 µs		-66.63	dBn			1.0	6	K .	Time	407.5 µs 2 929 mo		-56.25 (8.86	dB		
10		(3)	Time	1.	135 ms		-4.82	dB			28	G	ő –	Time	467.5 us		-56.23	IBm		
28		(3)	Tine	1.	23.2 με 875 ms		-66.63 -0.68	dBn IdB			2۵	Ċ	Ď.	Time	3.751 ms		-0.46	dB		

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FCC ID : BBQ-GSWH1000

SECTION 7: SAR Measurement results

Measurement date: May 14 and 15, 2020

Measurement by:

Hiroshi Naka

Issued date

[Liquid measurement]

E		Liquid parameters (*a)												cients(*b)			
[MHz]	Liquid	P	Permittivi	ity (&r) [-]		Conductivity [S/m]				Tama	Denth	ΔSAR		Constant	Data mangunad		
	type	Towart	Mea	sured	T imit	Townst	Measured		T innit	Temp.	Depui	1g	10g	Correction	Date measureu		
(Cnannei)		Target	Meas.	$\Delta \epsilon r [\%]$	Linin Target	Meas.	Δσ[%]	Lunu	[deg.C.]	luuul	[%]	[%]	requireu:				
2437 (6)	Head	39.22	38.29	-2.4	±5	1.788	1.846	+3.2	±5	24.0	150	+2.09	+1.22	not required.	May 14, 2020, before SAR test		
2437(6)	Body	52.72	50.60	-4.0	±5	1.938	1.954	+0.9	±5	22.9	149	+1.32 +0.86 not required.		not required.	1. May 15, 2020, before SAR test		

SAR measurement results]

				SAR me	asuren	nent	results				Reported SAR [W/kg]							
Tes	Test setup			F	Data	SAR [W/kg]			SAR	Duty cycle		Output burst average		Tune-up				
Position	C	c	Mode	Frequency	rate		Max.value	of multi-	of multi-peak		correction		power correction		SAR	Limit	Domonla	
	Gap [mm]	power	wouc	(Channel)	[Mbps] or	SAR	Моок	ΔSAR	ΔSAR	Appendix	dix Duty Duty		Meas. Max. Tune-up		Corrected	[W/kg]	ixemai ks	
	[]	F=			[Index]	type	ivicas.	sign	corrected	2-2	[%]	scaled	[dBm].	[dBm]	factor	(*c)		
Step 1: Worst partial head SAR(1g) (next-to-mouth) in Head liquid																		
Front	10	Battery	b	2437(6)	1	1g	0.048	Positive	n/a (*b)	Plot 1-1	99.1	1.01	16.73	17.15	1.10	0.053	1.6	-
Step 2: W	Step 2: Worst extremity SAR(10g) (wrist) in Body liquid																	
Deals	0	D. #	1	2427(0)	1	10	0.052	D	/ (91)	$D1 \neq 0.1$	00.1	1.01	16 72	1715	1.10	0.050	4	

 Back
 0
 Battery
 b
 2437(6)
 1
 10g
 0.052
 Positive
 n/a (*b)
 Plot 2-1
 99.1
 1.01
 16.73
 17.15
 1.10
 0.058
 4

 Notes:
 *.
 (mode) b: IEEE 802.11b; Max.: maximum.; Meas.: Measured.; n/a: not applied.
 n/a: not applied.
 100
 10.058
 4
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*.

Gap: It is the separation distance between the nearest position of platform outer surface and the bottom outer surface of phantom; During test, the platform was operated by full-charged build-in rechargeable Li-ion battery.

Calibration frequency of the SAR measurement probe (and used conversion factors)

Liquid	SAR test frequency	Probe calibration frequency	Validity	Conversion factor	Uncertainty								
Head	2437 MHz	2450 MHz	within ±50MHz of calibration frequency	7.26	±12.0%								
Body 2437 MHz 2450 MHz within ±50 MHz of calibration frequency 7.49													
*. The u	. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.												

*a. The target value is a parameter defined in Appendix A of KDB 865664 D01 (v01r04), the dielectric parameters suggested are given at 2000, 2450, 3000MHz. Parameters for the frequencies between 2000 and 3000 MHz were obtained using linear interpolation.

*b. Calculating formula: $\Delta SAR(1g) = Cer \times \Delta er + C\sigma \times \Delta \sigma, Cer = -7.854E - 4xf^3 + 9.402E - 3xf^2 - 2.742E - 2xf - 0.2026 / C\sigma = 9.804E - 3xf^3 - 8.661E - 2xf^2 + 2.981E - 2xf + 0.7829 /$

*c. Since the calculated Δ SAR values of the tested liquid had shown positive correction, the measured SAR was not converted by Δ SAR correction.

Calculating formula: Δ SAR corrected SAR (W/kg) = (Meas. SAR (W/kg)) × (100 - (Δ SAR(%)) / 100

*d. Calculating formula:

Reported SAR (W/kg) = (Measured SAR (W/kg)) × (Duty scaled) × (Tune-up factor) Duty scaled = Duty scaled factor: Duty cycle correction factor for obtained SAR value, Duty scaled factor [-] = 100(%)/(duty cycle, %)Tune-up factor: Power tune-up factor for obtained SAR value, Tune-up factor $[-] = 1/(10^{("Deviation from max., dB"/10)})$

(Clause 5.2, 2.4GHz SAR Procedures, in KDB248227 D01 (v02r02))

5.2.1 802.11b DSSS SAR Test Requirements

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 5.2.2 2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3, including sub-sections). SAR is not required for the following 2.4 GHz OFDM conditions.

1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.

When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg. 2)

SAR test of OEDM mode was reduced because the estimate reported SAR of OEDM mode was < 1.2 W/kg by using the highest reported SAR of DSSS mode

. 5/10		Divi mode w	as reduced	i, occause uk	countaic report	a or n	COLOT DIVITIN		.2 W/Kg Uy u	sing the menest reported	1 DI II OI DE	bb mode.
OFDM	M	aximum tune-	up toleranc	e limit	OFDM scaled		DSSS report	ted SAR vol	110	Estimated SAD unhar	Exclusion	Standalone
mode	DSSS		OFDM		factor [-]		D3551401	icu SAIC Va	ue	OFDM [W/kg]	limit	SAR test
[dBm] [mW] (a) [dBm] [mW] (b)					(b)/(a)×100	S	SAR type	Setup	[W/kg]	OrDivi[w/kg]	[W/kg]	require?
11g	17.15	52	13.41	22	0.423	lg	lg Next-to-		0.053	0.022	≤1.2	No
n(20HT)	17.15	52	12.04	16	0.301	1g	mouse	Front	0.053	0.016	≤1.2	No
11g	17.15	52	13.41	22	0.423	10g	Weint	Back	0.058	0.025	≤1.2	No
n(20HT)	17.15	52	12.04	16	0.301	10g	wnst	Back	0.058	0.017	≤1.2	No