

SAR TEST REPORT

Applicant Name: JVC KENWOOD CORPORATION 1-16-2 Hakusan Midori-ku Yokohama-shi Kanagawa 226-8525 Japan	Date of Issue: 12. 20, 2018 Test Report No.: HCT-SR-1812-FI001 Test Site: HCT CO., LTD.
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FCC ID:
IC ID:

K44502500
282F-502500

Equipment Type:	800/900 MHz DIGITAL TRANSCEIVER
Application Type	Certification
FCC Rule Part(s):	47CFR §2.1093
IC Rule Part(s):	RSS-102 Issue 5; Health Canada Safety Code 6
FCC Model Name:	NX-3400-K3, NX-3420-K3, NX-3420-M3, NX-3420-M
ISED/HVIN/PMN Name:	NX-3400-K3, NX-3420-K3
Date of Test:	12/17/2018 ~ 12/19/2018

This device has been shown to be capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in FCC KDB procedures and had been tested in accordance with the measurement procedures specified in FCC KDB procedures.

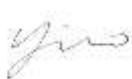
I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested By



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Reviewed By



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DOCUMENT HISTORY

Rev.	DATE	DESCRIPTION
HCT-SR-1812-FI001	12. 20, 2018	First Approval Report

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1. Attestation of Test Result of Device Under Test

Test Laboratory	
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Attestation of SAR test result	
Applicant Name:	JVC KENWOOD CORPORATION
FCC ID:	K44502500
IC ID:	282F-502500
FCC Model:	NX-3400-K3, NX-3420-K3, NX-3420-M3, NX-3420-M
ISED/HVIN/PMN Model:	NX-3400-K3, NX-3420-K3
EUT Type:	800/900 MHz DIGITAL TRANSCEIVER
Application Type:	Certification

The Highest Reported SAR for FCC						
Band	Tx. Frequency	Equipment Class	Reported 1g SAR (W/kg)			
	(MHz)		Hand-held to Face	Body-Worn Belt clip		
800/900 MHz	806-824, 851-869, 896-901, 935-940, 901-902, 940-941	TNF	3.79	6.29		
Bluetooth	2 402 ~ 2 480	DSS	N/A			
Simultaneous SAR per KDB 690783 D01v01r03			6.40			
Date(s) of Tests:	12/17/2018 ~ 12/19/2018					
The Highest Reported SAR for IC						
Band	Tx. Frequency	Equipment Class	Reported 1g SAR (W/kg)			
	(MHz)		Hand-held to Face	Body-Worn Belt clip		
800/900 MHz	806-824, 851-869, 896-901, 935-940, 901-902, 940-941	TNF	3.79	6.29		
Bluetooth	2 402 ~ 2 480	DSS	N/A			
Simultaneous SAR per KDB 690783 D01v01r03			6.54			
Date(s) of Tests:	12/17/2018 ~ 12/19/2018					

Note : The Duty Cycle of PTT was 50% applied.

2. Test Methodology and Procedures

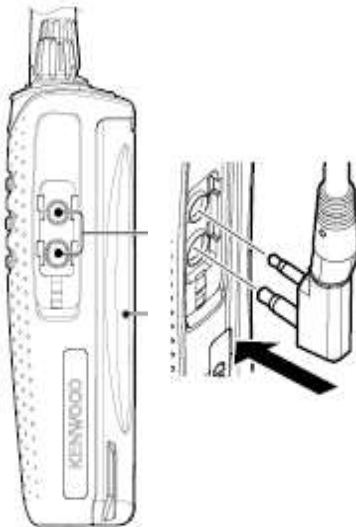
The tests documented in this report were performed in accordance with IEEE Standard 1528-2013 & IEEE 1528-2005 and the following published KDB procedures.

- RSS-102 issue 5
- Health Canada Safety Code 6
- IEC 62209-2:2010
- IEEE 1528:2013
- FCC KDB Publication 447498 D01 General SAR Guidance v06
- FCC KDB Publication 648474 D04 Handset SAR v01r03
- FCC KDB Publication 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
- FCC KDB Publication 865664 D02 SAR Reporting v01r02
- FCC KDB Publication 643646 D01 SAR Test for PTT Radios v01r03

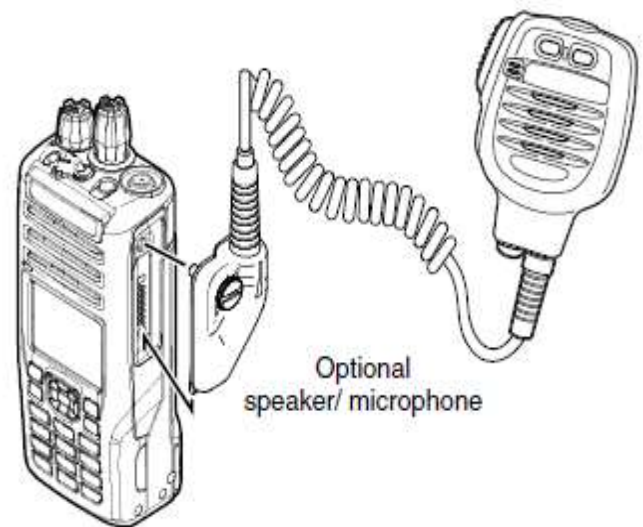
Model Name	NX-3400-K3	NX-3420-K3 (NX-3420-M3)	NX-3420-M
Mic Jack type	Universal type	2 pin	2 pin
Key type	Full	Full	Basic



2 pin type



Universal type



3. Output Power Specifications.

3.1 Nominal and Maximum Output Power Specifications

This device operates using the following maximum output power specifications. SAR values were scaled to the maximum allowed power to determine compliance per KDB publication 447498 D01v06.

3.2 Maximum Output Power

Band	Frequency	Power
800/900 MHz	806 MHz - 824 MHz 851 MHz - 869 MHz 896 MHz - 901 MHz 935 MHz - 940 MHz 901 MHz - 902 MHz 940 MHz - 941 MHz	3.3 W
Bluetooth 4.0	2 402 MHz ~ 2 480 MHz	2.5 mW

.3 Output Average Conducted Power

800/900 MHz		
Frequency (MHz)	Channel	Power (dBm)
806.050	1	34.83
823.950	3	34.94
851.050	4	35.01
868.950	6	34.97
898.550	8	34.77
901.550	10	34.75
937.550	12	34.57
940.550	14	34.58

:

Per KDB 447498 D01 v05r01 Page 7 section 6) pages 7-8, the number of channels required to be tested is as follows.

$F_{high} = 940.550$ MHz

$F_c = 873.300$ MHz

$F_{Low} = 806.050$ MHz

$N_c = \text{Round} \{ [100(f_{high} - f_{low}) / f_c]^{0.5} \times (f_c / 100)^{0.2} \} = \text{Round} \{ [100(940.550 - 806.050) / 873.300]^{0.5} \times (873.300 / 100)^{0.2} \} = 6$

Therefore, for the frequency band from 806.050MHz to 940.550MHz channels are required for testing.

3.4 SAR Summation Scenario

According to FCC KDB 447498 D01v06, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the EUT are shown below paths and are mode in same rectangle to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.



Simultaneous transmission paths

This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneous transmission analysis according to FCC KDB 447498 D01v06.

Simultaneous Transmission Scenarios	
Applicable Combination	Body-Worn
800/900 MHz + 2.4 GHz Bluetooth	Yes

3.5 SAR Test Exclusions Applied

(A) Bluetooth for FCC

Per FCC KDB 447498 D01v06, The SAR exclusion threshold for distance < 50mm is defined by the following equation:

$$\frac{\text{Max Power of Channel(mW)}}{\text{Test Separation Distance (mm)}} * \sqrt{\text{Frequency(GHz)}} \leq 3.0 \text{ for } 1 - \text{g SAR}$$

Mode	Frequency [MHz]	Maximum Allowed Power [mW]	Separation Distance [mm]	≤ 3.0 for 1g SAR
Bluetooth	2 480	2.5	5	0.8

Based on the maximum conducted power of Bluetooth and antenna to use separation distance, Bluetooth SAR was not required $[(2.5/5)*\sqrt{2.480}] = 0.8 < 3.0$.

This device contains transmitters that may operate simultaneously. Therefore simultaneous transmission analysis is required. Per FCC KDB 447498 D01v06 IV.C.1iii, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the simultaneous transmitting antennas in a specific a physical test configuration is ≤ 1.6W/kg. When standalone SAR is not required to be measured per FCC KDB 447498 D01v06 4.3.22, the following equation must be used to estimate the standalone 1-g SAR and 10g SAR for simultaneous transmission assessment involving that transmitter.

$$\text{Estimated SAR} = \frac{\sqrt{f(\text{GHz})}}{7.5} * \frac{(\text{Max Power of channel mW})}{\text{Min Separation Distance}}$$

Estimated 1-g SAR

Mode	Frequency [MHz]	Maximum Allowed Power [mW]	Separation Distance (Body) [mm]	Estimated 1g SAR (Body) [W/kg]
Bluetooth	2 480	2.5	5	0.105

Note:

Held-to ear configurations are not applicable to Bluetooth operations and therefore were not considered for simultaneous transmission. The Estimated SAR results were determined according to FCC KDB447498 D01v06.

(B) Bluetooth for IC

Per RSS102 Issue 5, 2.5.1 Exemption Limits for Routine Evaluation

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance^{4,5}

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW			

4. Manufacturer's Accessory List

Part No.	Description	Accessory Type	Accessory
KRA-32	700/800 MHz WHIP Antenna	Antennas	1
KRA-36	700/800 MHz Stubby Antenna		2
KRA-38	800/900 MHz WHIP Antenna		3
KRA-39	700/800 MHz Stubby Antenna		4
KNB-55L	Li-Ion Battery Pack (1480mA)	Battery	1
KNB-56N	Ni-MH Battery Pack (1400mA)		2
KNB-57L	Li-Ion Battery Pack (2000mA)		3
KBP-5	AA Alkaline Battery Pack		4
KNB-78L	Li-Ion Battery Pack (2860mAh)		5
KNB-79LC	Li-Ion Battery Pack (2860mAh)		6
KWR-1	Water Resistance Bag	Body-worn	1
KBH-11	Belt Clip		2
KLH-207K	Nylon Case (non Display)		3
KLH-207K3	Nylon Case (Full Keypad)		4
KLH-206K	Leather Case (non Display)		5
KLH-206K3	Leather Case (Full Keypad)		6
KLH-208P	Leather Case (non Display)		7
KLH-208P3	Leather Case (Full Keypad)		8
KBH-13DS	Leather swivel belt loop		9
KLH-140SW	Swivel Belt Loop With D Ring		10
KLH-37BT	Leather Belt		11
KLH-38ST	Shoulder Strap		12

KHS-35F	Headset	Microphones Audio Accessory	27
EMC-12	Clip Microphone with Earphone		28
KMC-54WD	Speaker Phone		29
KMC-25	MIL-SPEC, Noise canceling Speaker mic		30
KMC-25S	MIL-SPEC, Noise canceling Speaker mic		31
KMC-41	MIL-SPEC, IP54/55 Noise-canceling Speaker Mic		32
KMC-41D	MIL-SPEC, IP54/55 Noise-canceling Speaker Mic		33
KMC-42W	MIL-SPEC, IP67 (Immersion) Noise-canceling Speaker Mic		34
KMC-42WD	MIL-SPEC, IP67 (Immersion) Noise-canceling Speaker Mic		35
KEP-1	3.5mm earphone kit		36
KCT-51	Hirose 6-pin Adapter (adapts KVL/aftermarket audio acc. to portable connector)		37
KHS-11BE	2-wire palm mic w/earphone, universal connector (Beige)		38
KHS-11BL	2-wire palm mic w/earphone, universal connector (Black)		39
KHS-12BE	3-wire mini lapel mic w/earphone, universal connector (Beige)		40
KHS-12BL	3-wire mini lapel mic w/earphone, universal connector (Black)		41
KHS-14	Lt. Wt. Single muff headset w/boom mic & In-line PTT		42
KHS-15-BH	Hvy-duty noise reduction behind-the-headset w/noise cancelling boom mic & in-line PTT		43
KHS-15-OH	Hvy-duty noise reduction over-the-headset w/noise cancelling boom mic & in-line PTT		44
KMC-40	Speaker Mic. with Antenna Connector		45
KMC-46EX	Speaker Microphone		46
KMC-51D	Speaker Microphone		47
KMC-52	Speaker Microphone		48
KMC-52D	Speaker Microphone		49
KCT-48VU	External Vibration Unit		50

*** Note:** Battery Dimensions

No.	Battery Model	description	Size (mm)
1	KNB-55L	Li-Ion Battery Pack (1480mA)	WHD 56.0 x 100.5 x 15.5
2	KNB-56N	Ni-MH Battery Pack (1400mA)	WHD 56.0 x 100.5 x 20.2
3	KNB-57L	Li-Ion Battery Pack (2000mA)	WHD 56.0 x 100.5 x 20.2
4	KBP-5	AA Alkaline Battery Pack	WHD 56.0 x 100.5 x 21.5
5	KNB-78L	Li-Ion Battery Pack (2860mAh)	WHD 56.0 x 100.5 x 23.7
6	KNB-79LC	Li-Ion Battery Pack (2860mAh)	WHD 56.0 x 100.5 x 23.7

This SAR report is the result of a change test for the addition of a battery Since the additional battery has the biggest capacity of the battery, the Head Face SAR test were performed the Full SAR test and the body worn SAR were evaluated under the worst case condition of the original SAR report.

Radio Face Test (Hand-held to Face)

Battery 1			
Ant. 1	Ant. 2	Ant. 3	Ant. 4
Yes	Yes	Yes	Yes
Battery 2			
Ant. 1	Ant. 2	Ant. 3	Ant. 4
Yes	Yes	Yes	Yes
Battery 3			
Ant. 1	Ant. 2	Ant. 3	Ant. 4
Yes	Yes	Yes	Yes
Battery 4			
Ant. 1	Ant. 2	Ant. 3	Ant. 4
Yes	Yes	Yes	Yes
Battery 5			
Ant. 1	Ant. 2	Ant. 3	Ant. 4
Yes	Yes	Yes	Yes
Battery 6			
Ant. 1	Ant. 2	Ant. 3	Ant. 4
Yes	Yes	Yes	Yes

Radio Body Test (Body-Worn)

Audio Accessory	Battery					
	1	2	3	4	5	6
1	No	No	No	No	No	No
2	Yes	Yes	Yes	Yes	Yes	Yes
3	No	No	No	No	No	No
4	No	No	No	No	No	No
5	No	No	No	No	No	No
6	No	No	No	No	No	No
7	No	No	No	No	No	No
8	No	No	No	No	No	No
9	No	No	No	No	No	No
10	No	No	No	No	No	No
11	No	No	No	No	No	No
12	No	No	No	No	No	No
13	No	No	No	No	No	No
14	No	No	No	No	No	No
15	No	No	No	No	No	No
16	No	No	No	No	No	No
17	No	No	No	No	No	No
18	No	No	No	No	No	No
19	No	No	No	No	No	No
20	No	No	No	No	No	No
21	No	No	No	No	No	No
22	No	No	No	No	No	No
23						

*** Manufacture's disclosed accessory listing information provided by Kenwood corporation.**

*** Note:**

Audio Accessory KMC-45 and KMC-54WD was chosen for the testing body worn radio configuration.

5. INTRODUCTION

The FCC has adopted the guidelines for evaluating the environmental effects of radio frequency radiation in ET Docket 93-62 on Aug. 6, 1996 to protect the public and workers from the potential hazards of RF emissions due to FCC-regulated portable devices.

The safety limits used for the environmental evaluation measurements are based on the criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (SAR) in IEEE/ANSI C95.1-2005 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York 10017. The measurement procedure described in IEEE/ANSI C95.3-1992 Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave is used for guidance in measuring SAR due to the RF radiation exposure from the Equipment Under Test (EUT). These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields," NCRP Report No. 86 NCRP, 1986, Bethesda, MD 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards.

SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative of the incremental electromagnetic energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (r). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body.

$$SAR = \frac{d}{dt} \left(\frac{dU}{dm} \right)$$

Figure 1. SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg)

$$SAR = \sigma E^2 / \rho$$

Where:

σ = conductivity of the tissue-simulant material (S/m)
 ρ = mass density of the tissue-simulant material (kg/m³)
 E = Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation

6. DESCRIPTION OF TEST EQUIPMENT

6.1 SAR MEASUREMENT SETUP

These measurements are performed using the DASY4 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Staubli), robot controller, Pentium III computer, near-field probe, probe alignment sensor, and the generic twin phantom containing the brain equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF) (see Figure.2).

A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The PC with Windows XP or Windows 7 is working with SAR Measurement system DASY4 & DASY5, A/D interface card, monitor, mouse, and keyboard. The Staubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

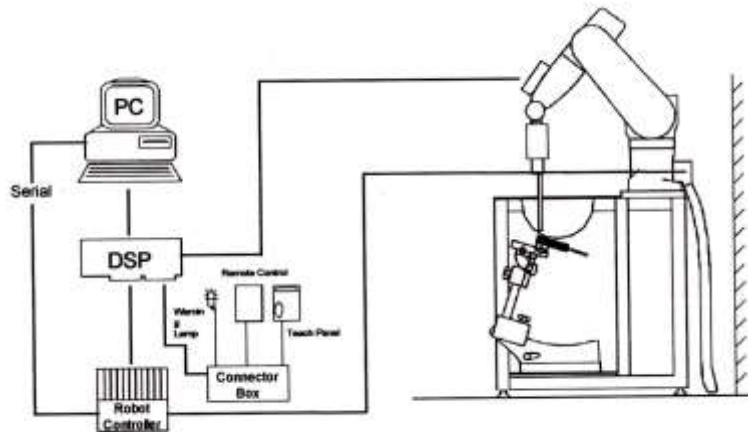


Figure 2. HCT SAR Lab. Test Measurement Set-up

The DAE consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer. The system is described in detail in.

6.2 Phantom

• ELI Phantom

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG diametric probes and dipoles.



Figure 6.1 ELI Phantom

Shell Thickness	$2.0 \pm 0.2\text{mm}$
Filling Volume	approx. 30 liters
Dimensions	Major axis: 600 mm, Minor axis: 400 mm

6.3 Device Holder for Transmitters

Device Holder – Mounting Device

In combination with the SAM Phantom, the Mounting Device enables the rotation of the mounted transmitter in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatably positioned according to the EN 50360:2001/A:2001 and FCC KDB specifications. The device holder can be locked at different phantom locations (left head, right head, flat phantom).

Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations. To produce the Worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.



7. SAR MEASUREMENT PROCEDURE

The evaluation was performed with the following procedure:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no more than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the DUT's head and body area and the horizontal grid resolution was depending on the FCC KDB 865664 D01v01r04 table 4-1 & IEEE 1528-2013.
2. Based on step, the area of the maximum absorption was determined by sophisticated interpolations routines implemented in DASY software. When an Area Scan has measured all reachable point. DASY system computes the field maximal found in the scanned are, within a range of the maximum. SAR at this fixed point was measured and used as a reference value.
3. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB 865664 D01v01r04 table 4-1 and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (reference from the DASY manual.)
 - a. The data at the surface were extrapolated, since the center of the dipoles is no more than 2.7 mm away from the tip of the probe (it is different from the probe type) and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
 - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions. The volume was integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan. If the value changed by more than 5 %, the SAR evaluation and drift measurements were repeated.

Area scan and zoom scan resolution setting follow KDB 865664 D01v01r04 quoted below.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	$\frac{1}{2} \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan Spatial resolution: $\Delta x_{Area}, \Delta y_{Area}$			≤ 2 GHz: ≤ 15 mm $2-3$ GHz: ≤ 12 mm	$3-4$ GHz: ≤ 12 mm $4-6$ GHz: ≤ 10 mm
			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.	
Maximum zoom scan Spatial resolution: $\Delta x_{zoom}, \Delta y_{zoom}$			≤ 2 GHz: ≤ 8 mm $2-3$ GHz: ≤ 5 mm*	$3-4$ GHz: ≤ 5 mm* $4-6$ GHz: ≤ 4 mm*
Maximum zoom scan Spatial resolution normal to phantom surface	uniform grid: $\Delta z_{zoom}(n)$		≤ 5 mm	$3-4$ GHz: ≤ 4 mm $4-5$ GHz: ≤ 3 mm $5-6$ GHz: ≤ 2 mm
	graded grid	$\Delta z_{zoom}(1)$: between 1 st two Points closest to phantom surface	≤ 4 mm	$3-4$

8. DESCRIPTION OF TEST POSITION

8.1 Body Holster/Belt Clip Configurations

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. A device with a headset output is tested with a headset connected to the device. Body dielectric parameters are used.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with each accessory. If multiple accessory share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some Devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used.

Since this EUT does not supply any body worn accessory to the end user a distance of 0 cm from the EUT back surface to the liquid interface is configured for the generic test.

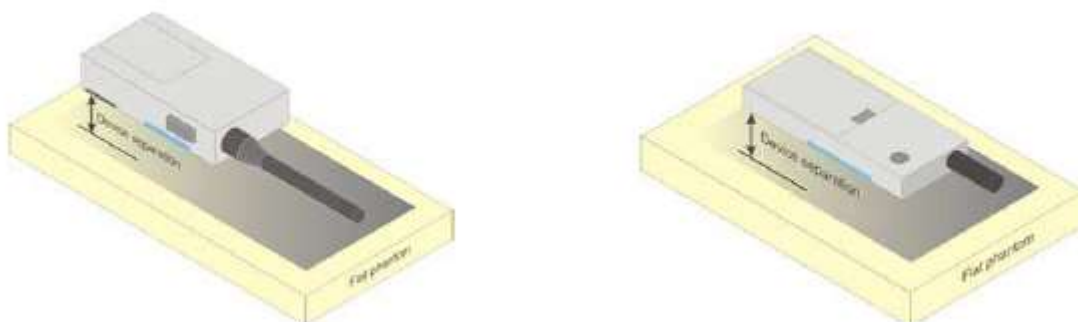
"See the Test SET-UP Photo"

Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessory(ies), including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

In all cases SAR measurements are performed to investigate the worst-case positioning. Worst case positioning is then documented and used to perform Body SAR testing.

8.2 Hand-held to Face device

A typical example of a front-of-face device is a two-way radio that is held at a distance from the face of the user when transmitting. In these cases the device under test shall be positioned at the distance to the phantom surface that corresponds to the intended use as specified by the manufacturer in the user instructions. If the intended use is not specified, a separation distance of 25 mm⁵ between the phantom surface and the device shall be used.



9. RF EXPOSURE LIMITS

HUMAN EXPOSURE	UNCONTROLLED ENVIRONMENT General Population	CONTROLLED ENVIRONMENT Occupational
	(W/kg) or (mW/g)	(W/kg) or (mW/g)
SPATIAL PEAK SAR * (Brain)	1.60	8.00
SPATIAL AVERAGE SAR ** (Whole Body)	0.08	0.40
SPATIAL PEAK SAR *** (Hands / Feet / Ankle / Wrist)	4.00	20.00

Table 8.1 Safety Limits for Partial Body Exposure

NOTES:

* The Spatial Peak value of the SAR averaged over any 1 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

** The Spatial Average value of the SAR averaged over the whole-body.

*** The Spatial Peak value of the SAR averaged over any 10 g of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

10. SYSTEM VERIFICATION

10.1 Tissue Verification

The Head/ body simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity.

Table for Head Tissue Verification

Date of Tests	Tissue Temp. (°C)	Tissue Type	Freq. (MHz)	Measured Conductivity σ (S/m)	Measured Dielectric Constant, ϵ	Target Conductivity σ (S/m)	Target Dielectric Constant, ϵ	% dev σ	% dev ϵ
12/17/2018	20.3	900H	800	0.878	43.601	0.897	41.680	-2.12%	4.61%
			900	0.980	42.822	0.970	41.500	1.03%	3.19%
			920	0.999	42.490	0.982	41.490	1.73%	2.41%

Table for Body Tissue Verification

Date of Tests	Tissue Temp. (°C)	Tissue Type	Freq. (MHz)	Measured Conductivity σ (S/m)	Measured Dielectric Constant, ϵ	Target Conductivity σ (S/m)	Target Dielectric Constant, ϵ	% dev σ	% dev ϵ
12/19/2018	21.0	900B	800	0.928	54.602	0.967	55.34	-4.03%	-1.33%
			900	1.033					

10.3 System Verification Procedure

SAR measurement was prior to assessment, the system is verified to the $\pm 10\%$ of the specifications at each frequency band by using the system Verification kit. (Graphic Plots Attached)

- Cabling the system, using the Verification kit equipments.
- Generate about 50 mW Input Level from the Signal generator to the Dipole Antenna.
- Dipole Antenna was placed below the Flat phantom.
- The measured one-gram SAR at the surface of the phantom above the dipole feed-point should be within 10 % of the target reference value.
- The results are normalized to 1 W input power.

NOTE;

SAR Verification was performed according to the FCC KDB 865664 D01v01r04.

11. SAR TEST DATA SUMMARY

11.1 Measurement Results (Hand-held to Face SAR)

Model Name	Antenna	Frequency (MHz)	Ch.	Tune- Up Limit (dBm)	Conducted Power (dBm)	Power Drift (dB)	Battery	Separation Distance (mm)	Measure d SAR (mW/g)	SAR 50% Duty (mW/g)	Reported SAR (mW/g)	Plot No.
NX-3400-M3	KRA-32	851.05	4	35.19	35.01	-0.95	KNB-78L	25	1.63	0.815	1.060	-
	KRA-38	851.05	4	35.19	35.01	-1.21	KNB-78L	25	3.18	1.590	2.190	-
	KRA-36	851.05	4	35.19	35.01	-0.38	KNB-78L	25	6.21	3.105	3.530	-
	KRA-36	868.95	6	35.19	34.97	-0.50	KNB-78L	25	5.32	2.660	3.140	-
	KRA-39	901.55	10	35.19	34.75	-0.27	KNB-78L	25	3.12	1.560	1.820	-
	KRA-36	851.05	4	35.19	35.01	-0.32	KNB-79LC	25	5.91	2.955	3.320	-
	KRA-36	851.05	4	35.19	35.01	-0.35	KNB-55L					

11.2 Measurement Results (Body-worn Belt clip SAR)

Model	Antenna	Frequency	Ch.	Tune-Up Limit	Conducted Power	Power Drift	Battery	Separation Distance	Measured SAR	SAR 50% Duty	Reported SAR	Plot No.
		(MHz)		(dBm)	(dBm)	(dB)		(mm)	(mW/g)	(mW/g)	(mW/g)	
NX-3400-M3	KRA-32	851.05	4	35.19	35.01	-0.43	KNB-55L	0	1.09	0.545	0.630	-
	KRA-38	851.05	4	35.19	35.01	-0.69	KNB-55L	0	1.76	0.880	1.080	-
	KRA-36	851.05	4	35.19	35.01	-0.24	KNB-55L	0	10.7	5.350	5.890	2
	KRA-36	868.95	6	35.19	34.97	-0.65	KNB-55L	0	10.3	5.150	6.292	3
	KRA-36	823.95	3	35.19	34.94	-0.65	KNB-55L	0	6.49	3.245	3.990	-
	KRA-36	806.05	1	35.19	34.83	-0.28	KNB-55L	0	6.52	3.260	3.778	-
	KRA-39											

12. Simultaneous SAR Analysis

12.1 Simultaneous Transmission Summation for Body-Worn FCC

Simultaneous Transmission Summation Scenario with Bluetooth				
Exposure condition	Band	Max SAR	Bluetooth SAR	Σ 1-g SAR
		(W/kg)	(W/kg)	(W/kg)
Body-worn	Body-worn Belt clip	6.292	0.105	6.397

Note: Bluetooth SAR was not required to be measured per FCC KDB 447498 D01v06. Estimated SAR results were used for SAR summation for body-worn back side at 5 mm to determine simultaneous transmission SAR test exclusion.

The simultaneous transmission summation is applied only for body-worn case according to user condition. Bluetooth transmission is using for Bluetooth headset when DUT is on the body-worn case.

12.2 Simultaneous Transmission Summation for Body-Worn IC

Simultaneous Transmission Summation Scenario with Bluetooth For IC				
Exposure condition	Band	Max SAR	Bluetooth SAR	Σ 1-g SAR
		(W/kg)	(W/kg)	(W/kg)
Body-worn	Body-worn Belt clip	6.292	0.250	6.542

Note: Bluetooth SAR was not required to be measured per RSS102:Issue 5 .Estimated SAR results were used for SAR summation for body-worn back side at 5 mm to determine simultaneous transmission SAR test exclusion.

The simultaneous transmission summation is applied only for body-worn case according to user condition. Bluetooth transmission is using for Bluetooth headset when DUT is on the body-worn case.

12.3 Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the

13. MEASUREMENT UNCERTAINTY

Measurement Uncertainty for DUT SAR test								
a	c	d	e	f	g	$h = c \times f / e$	$i = c \times g / e$	k
Source of uncertainty	Uncertainty $\pm \%$	Probability distribution	Div.	c_i	c_i	Standard Uncertainty $\pm \%$ (1 g)	Standard Uncertainty $\pm \%$ (10 g)	v_i or v_{eff}
Measurement system								
Probe calibration	6.65	N	1	1	1	6.65	6.65	∞
Axial isotropy	4.70	R	1.73	0.71	0.71	1.92	1.92	∞
Hemispherical isotropy	9.60	R	1.73	0.71	0.71	3.92	3.92	∞
Boundary effect	2.00	R	1.73	1	1	1.15	1.15	∞
Linearity	4.70	R	1.73	1	1	2.71	2.71	∞
Detection limits	1.00	R	1.73	1	1	0.58	0.58	∞
Readout electronics	0.30	N	1	1	1	0.30	0.30	∞
Response time	0.80	R	1.73	1	1	0.46	0.46	

14. SAR TEST EQUIPMENT

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	ELI Phantom	-	N/A	N/A	N/A
HP	SAR System Control PC	-	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F13/5R4XF1/C/01	N/A	N/A	N/A
Staubli	TX90 XLSpeag	F13/5R4XF1/A/01	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-1338 1332	N/A	N/A	N/A
SPEAG	DAE4	648	05/25/2018	Annual	05/25/2019
SPEAG	DAE3	446	08/10/2018	Annual	08/10/2019
SPEAG	E-Field Probe ES3DV3	3076	07/26/2018	Annual	07/26/2019
SPEAG	E-Field Probe EX3DV4	3968	09/25/2018	Annual	09/25/2019
SPEAG	Dipole D900V2	1d069	05/30/2018	Annual	05/30/2019
Agilent	Power Meter E4419B	MY40511244	04/25/2018	Annual	04/25/2019
Agilent	Power Meter N1911A	MY45101406	09/06/2018	Annual	09/06/2019
Agilent	Power Sensor 8481A	SG1091286	10/11/2018	Annual	10/11/2019
Agilent	Power Sensor 8481A	MY41090873	10/11/2018	Annual	10/11/2019
Agilent	Power Sensor N1921A				

15. CONCLUSION

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the ANSI/IEEE C95.1- 2005.

These measurements are taken to simulate the RF effects exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests.

The SAR measurement indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested.

- [20] IEC 62209-1, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation and procedures – Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz), Feb. 2005.
- [21] IEC 62209-2, Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz) Mar. 2010.
- [22] Industry Canada RSS-102 Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Band) Issue 5, March 2015.
- [23] Health Canada Safety Code 6 Limits of Human Exposure to Radio Frequency Electromagnetic Fields in the Frequency Range from 3 kHz – 300 GHz, 2009
- [24] FCC SAR Test procedures for 2G-3G Devices, Mobile Hotspot and UMPC Device KDB 941225 D01.
- [25] SAR Measurement Guidance for IEEE 802.11 transmitters, KDB 248227 D01v02r02
- [26] SAR Evaluation of Handsets with Multiple Transmitters and Antennas KDB 648474 D03, D04.
- [27] SAR Evaluation for Laptop, Notebook, Netbook and Tablet computers KDB 616217 D04.
- [28] SAR Measurement and Reporting Requirements for 100 MHz – 6 GHz, KDB 865664 D01, D02.
- [29] FCC General RF Exposure Guidance and SAR procedures for Dongles, KDB 447498 D01,D02.

Attachment 1. – SAR Test Plots

Attachment 2. – Dipole Verification Plots

Attachment 3. – Probe Calibration Data

EX3DV4 – SN:3968

September 25, 2018

Probe EX3DV4

SN:3968

Manufactured:	September 30, 2013
Repaired:	September 13, 2018
Calibrated:	September 25, 2018

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

EX3DV4- SN:3968

September 25, 2018

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3968

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.56	0.57	0.56	± 10.1 %
DCP (mV) ^B	98.0	99.0	97.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	171.6	±2.7 %
		Y	0.0	0.0	1.0		161.8	
		Z	0.0	0.0	1.0		178.8	

Note: For details on UID parameters see Appendix.

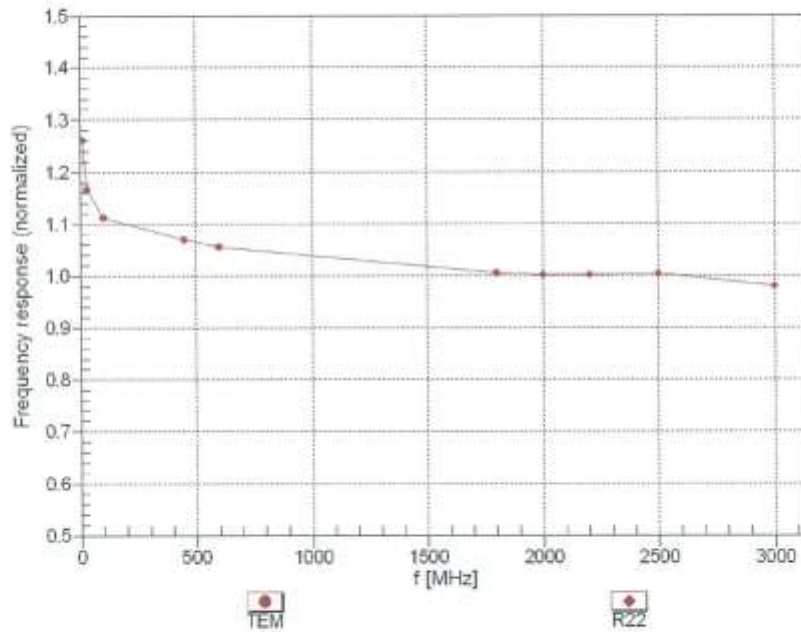
Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $\text{ms}\cdot\text{V}^{-2}$	T2 $\text{ms}\cdot\text{V}^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
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EX3DV4- SN:3968

September 25, 2018

Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)

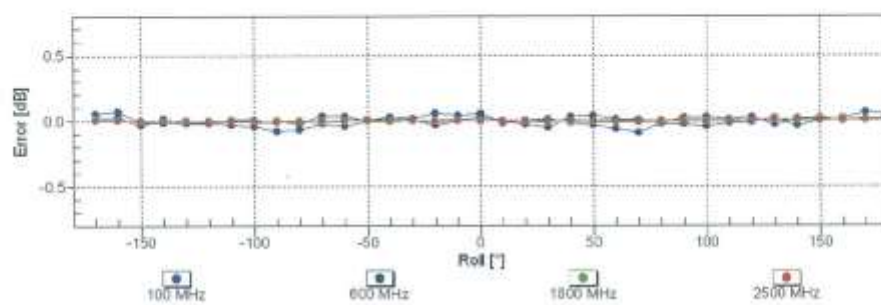
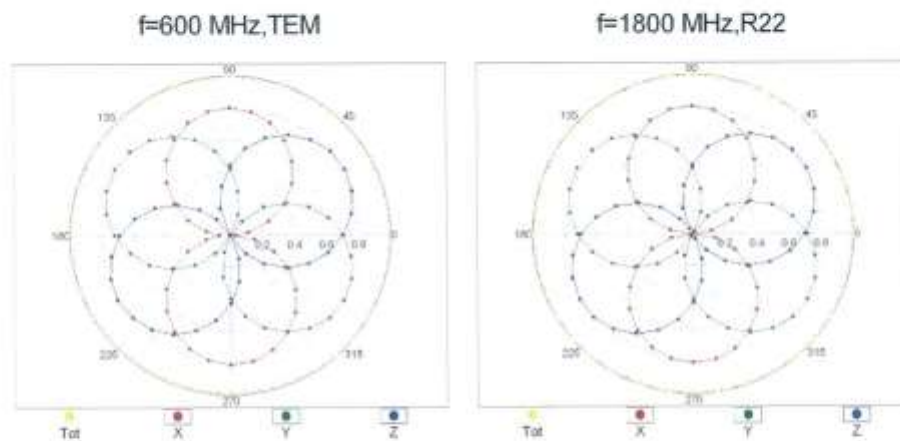


Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

EX3DV4-SN:3968

September 25, 2018

Receiving Pattern (ϕ), $\theta = 0^\circ$



Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

EX3DV4- SN:3968

September 25, 2018

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3968**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	89.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

