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RF EXPOSURE EVALUATION
(MAXIMUM PERMISSIBLE EXPOSURE)

Applicant Name:
SmartSynch Inc.
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USA

Date of Testing:
January 4-5, 2012
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0Y1111282057.QHC

FCC ID:	**QHC-SGRCWZ**
APPLICANT:	**SmartSynch Inc.**

EUT Type:	Smart Grid Communications Hub
FCC Rule Part(s):	FCC Part 1 (§1.1310) and Part 2 (§2.1091)
FCC Classification:	PCS Licensed Transmitter (PCB)
Test Procedure:	OET Bulletin 65

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in FCC OET Bulletin 65 (See Test Report). These measurements were performed with no deviation from the standards. Test results reported herein relate only to the item(s) tested.

I authorize and 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.

PCTEST certifies that no party to this application has been subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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1.0 RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 Introduction

This document is prepared on behalf of SmartSynch Inc. to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations and RSS-102 of Industry Canada.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310 and RSS-102: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits For Occupational / Control Exposures (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	…	…	f/300	6
1500-100,000	…	…	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	…	…	f/1500	30
1500-100,000	…	…	1.0	30

Table 1-1. Limits for Maximum Permissible Exposure (MPE)

1.2 EUT Description

The Smartsynch FCC ID: QHC-SGRCWZ is a Smart Grid Communications Hub. Its device capabilities are 850/1900 GSM/GPRS/EDGE, 850/1900 WCDMA, 802.11b/g WLAN, and Zigbee. For this MPE evaluation the device is set to transmit from the antenna of each transmitter and the RF exposure of each transmitter is evaluated individually. The GridRouter CWZ will be deployed standard with external antennas for the GSM, WCDMA, WLAN, and Zigbee modules. The external WLAN/Zigbee antennas are connected via a reverse SMA connector. The antennas listed below will be the only antennas deployed with the EUT.

EUT:

Model:	GridRouter CWZ		
Grantee:	SmartSynch Inc.		
FCC ID:	QHC-SGRCWZ		
Antennas:	**Model**	**Frequency Range**	**Gain**
	Skywave 15-1017-C	Cellular/PCS Band	1.4 dBi / 4 dBi
	Skywave 11-1080-C	WLAN / Zigbee Band	5 dBi

1.3 MPE Requirements Overview

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable and are defined as follows:

- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.

- **Mobile Devices:** a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.

- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR§2.1093).

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational/ Controlled Exposure and General Population/Uncontrolled Exposure. These two categories are defined as follows:

- **Occupational/Controlled Exposure:** 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. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.

- **General Population/Uncontrolled 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. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

The Smartsynch Smart Grid Communications Hub FCC ID: QHC-SGRCWZ is a fixed installation device normally mounted on utility poles, however the MPE is evaluated to the Mobile Devices requirements and is considered a device to be used by the General Population/Uncontrolled Exposure.

1.4 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements.

The power generated by each transmitter used in this product was initially measured by a power meter and the powers were recorded. Through use of the Friis transmission formula, the power density level is calculated at a distance of 20cm. The power density for the Zigbee transmitter in the 2.4GHz band was calculated using the maximum peak power.

In Table 1-2 and 1-3 below, a tolerance is added to the highest measured ERP and EIRP to yield Max ERP and Max EIRP Power (P). The value of the tolerance is based on the difference between the measured conducted power and the listed maximum power with maximum tolerances from the operational description document. Adding this tolerance to the ERP and EIRP gives the worst case maximum radiated powers.

For the Cellular band, since GPRS source based time averaging is applicable, 2 slot GPRS represented the highest power. Since 2 slot GPRS, with conducted power within 0.1 dBm of 1 slot GPRS, has a duty cycle of ¼, then 10 * log(1/4) = -6.0 dBm. This value is added to the Max ERP Power to yield the Source Based Time Averaged Power which was used to calculate Power Density (S) for Cellular Band.

For the PCS band, 3 slot GPRS represented the highest output power. Since 3 slot GPRS, with conducted power within 0.1 dBm of 1 slot GPRS, has a duty cycle of 3/8, then 10 * log(3/8) = -4.26 dBm. This value is added to the Max EIRP Power to yield the Source Based Time Averaged Power which was used to calculate Power Density (S) for PCS Band.

Also, evaluation of co-located transmitters was performed to ensure that the effective multiple transmitters do not exceed 100% of the total power density limit.

Friis Transmission Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4\pi r^2)$

Where,

P_d = Power Density (mW/cm^2) π = 3.1416
P_{out} = output power to antenna (mW) r = distance between observation point and center of the radiator (cm)
G = gain of antenna in linear scale

MPE Calculations

Frequency	824.2	MHz	
Limit	0.549	mW/cm^2	
Distance (cm), R =	20	cm	
ERP Power (dBm) =	33.92	dBm	2466.04 mW
Tolerance (dB) =	1.67	dB	
Max ERP Power (dBm), P =	35.59	dBm	3622.43 mW
Source Based Time Averaged Power (dBm) =	29.57	dBm	905.61 mW
Power Density (S) =	**0.180**	mW/cm^2	(at 20cm)
Minimum Distance =	**11.5**	cm	

Table 1-2. Calculated MPE Data for Cellular Band

Frequency	1880	MHz	
Limit	1.000	mW/cm^2	
Distance (cm), R =	20	cm	
EIRP Power (dBm) =	28.85	dBm	767.36 mW
Tolerance (dB) =	1.89	dBm	
Max EIRP Power (dBm), P =	30.74	dBi	1185.77 mW
Source Based Time Averaged Power (dBm) =	26.48	dBm	444.66 mW
Power Density (S) =	**0.088**	mW/cm^2	(at 20cm)
Minimum Distance =	**5.9**	cm	

Table 1-3. Calculated MPE Data for PCS Band

Frequency	2462	MHz	
Limit	1.000	mW/cm^2	
Distance (cm), R =	20	cm	
Power (dBm), P =	15.13	dBm	32.58 mW
TX Ant Gain (dB), G =	5	dBi	
Power Density (S) =	**0.020**	mW/cm^2	(at 20cm)
Minimum Distance =	**2.9**	cm	

Table 1-4. Calculated MPE Data for 2.4GHz WLAN

Frequency	2440	MHz	
Limit	1.000	mW/cm^2	
Distance (cm), R =	20	cm	
Power (dBm), P =	10.24	dBm	10.57 mW
TX Ant Gain (dB), G =	5	dBi	
Power Density (S) =	**0.007**	mW/cm^2	(at 20cm)
Minimum Distance =	**1.6**	cm	

Table 1-5. Calculated MPE Data for 2.4GHz Zigbee

1.5 Summary of Results

Frequency Band [MHz]	MPE @ 20cm [mW/cm^2]	Test Result
824.7 – 848.31	0.180	PASS
1851.25 – 1908.75	0.088	PASS
2412 - 2462	0.020	PASS
2405 – 2475	0.007	PASS

Table 1-6. Maximum Permissible Exposure Summary Table

	Power Density (mW/cm^2)	Limit (mW/cm^2)	Percent MPE Used (%)
Transmitter #1 - Cellular	0.180	0.549	32.76
Transmitter #2 - WLAN	0.020	1.000	2.00
Transmitter #3 - Zigbee	0.007	1.000	0.70
Total			35.46

Table 1-7. Maximum Permissible Exposure Co-location Table

Note: On Table 1-7, since Cellular and PCS bands will not be operating simultaneously, the worst case co-location calculations are based on the Cellular Band MPE.

2.0 CONCLUSION

The device meets the mobile RF exposure limit at a 20cm separation distance as specified in §2.1091 of the FCC Rules and Regulations and Health Canada Safety Code 6. An appropriate RF exposure compliance statement will be placed in the user's manual.