MOTOROLA SOLUTIONS

MS ISO/IEC 17025
TESTING

SAMM No.0826

DECLARATION OF COMPLIANCE: MPE ASSESSMENT

Motorola Solutions, Inc.
EME Test Laboratory
Motorola Solutions Malaysia Sdn Bhd (Innoplex)
Plot 2A, Medan Bayan Lepas,
Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia.

Date of Report: 31/7/2018
Report Revision: C

Responsible Engineer:	Tiong Nguk Ing
Report Author:	Tiong Nguk Ing
Assessment Date(s)	3/15/2018
Manufacturer:	Motorola Israel
DUT Description:	MC-EDGE CPU MODULEAPX4000 UHF2, LoRA and LTE B4&B13
Test TX mode(s):	FM, LoRA and LTE
Max. Power output:	**Baseline**: APX4000 UHF2 band **Module LoRA**: (FCC ID: SQG-1001) **Module LTE**: (FCC ID: N7NHL7588); For full description of max powers for each transmission mode refer to Table 4.
Tx Frequency Bands:	**Baseline**: 450-520 MHz **Module LoRA** (FCC ID: SQG-1001): 923-927.5 MHz **Module LTE** (FCC ID: N7NHL7588): LTE B4, LTE B13 For full description of specific transmit frequencies, refer to Table 4.
Model(s) Tested:	F0016A (VA00712AA, VA00715AA, VA00726AA)
Model(s) Certified:	F0016A (VA00712AA, VA00715AA, VA00726AA), F0016A (VA00712AA), F0016A (VA00712AA, VA00715AA), F0016A (VA00712AA, VA00726AA)
Classification:	Occupational / Controlled Environment
FCC ID:	AZ492FT7114 – Include modules FCC ID: SQG-1001 and N7NHL7588
IC:	109U-92FT7114 – Include modules IC: 2417C-HL7588 and 3147A-1001

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 4.0 of this report. This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc. EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements.
This reporting format is consistent with the suggested guidelines of the TIA TSB-159 April 2006
The results and statements contained in this report pertain only to the device(s) evaluated herein.

Tiong Nguk Ing
Digitally signed by Tiong Nguk Ing
Date: 2018.07.31 21:32:14 +08'00'

Tiong Nguk Ing
Deputy Technical Manager (Approved Signatory)
Approval Date: 31/7/2018

Table of Contents

1.0 Introduction 3
2.0 Abbreviations / Definitions 3
3.0 Referenced Standards and Guidelines 3
4.0 Power Density Limits 4
5.0 Product and System Description 6
6.0 Assessment Method 7
7.0 MPE Assessment 7
8.0 Conclusion 8

Report Revision History

Date	Revision	Comments
4/23/2018	A	Initial release
6/7/2018	B	Update models at cover page.
31/7/2018	C	Update typo at section 5.0

1.0 Introduction

This report contains calculated Maximum Permissible Exposure (MPE) results for product model F0016A (VA00712AA, VA00715AA, VA00726AA). This product contains modules FCC ID: N7NHL7588 and SQG-1001.

2.0 Abbreviations / Definitions

DUT: Device Under Test
EME: Electromagnetic Energy
LTE: Long Term Evolution
MPE: Maximum Permissible Exposure

3.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 1.1310, § 2.1091 (d) and § 2.1093 for RF Exposure, where applicable.
- Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65 (Edition 97-01), FCC, Washington, D.C.: August 1997.
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1999
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992. Specific to FCC rules and regulations.
- Institute of Electrical and Electronics Engineers (IEEE) C95.3-2002
- Ministry of Health (Canada) Safety Code 6 (2015), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- RSS-102 (Issue 5) – Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
- FCC KDB – 447498 D01 General RF Exposure Guidance v06
- FCC KDB – 865664 D02 RF Exposure Reporting v01r02

4.0 Power Density Limits

Table 2 – Occupational / Controlled Exposure Limits

Frequency Range (MHz)	FCC OET Bulletin 65 mW/cm^2	ICNIRP W/m^2	IEEE C95.1 1992/1999 mW/cm^2	IEEE C95.1 2005 W/m^2	RSS-102 Issue 5 2015 W/m^2
10 – 20					10.0
20 – 48					$44.72 / f^{0.5}$
30 – 300	1.0				
48 – 100					6.455
10 – 400		10.0			
100 – 300			1.0	10.0	
100 – 6,000					$0.6455 f^{0.5}$
300 – 1,500	f/300				
300 – 3,000			f/300	f/30	
400 – 2,000		f/40			
1,500 – 15,000					
1,500 – 100,000	5.0				
2,000 – 300,000		50.0			
3,000 – 300,000			10.0	100.0	
6,000 – 15,000					50.0
15000 – 150,000					50.0
150000 –300,000					$3.33\times10^{-4} f$

Table 3 – General Population / Uncontrolled Exposure Limits

Frequency Range (MHz)	FCC OET Bulletin 65 mW/cm^2	ICNIRP W/m^2	IEEE C95.1 1992/1999 mW/cm^2	IEEE C95.1 2005 W/m^2	RSS-102 Issue 5 2015 W/m^2
10 – 20					2.0
20 – 48					$8.944 / f^{0.5}$
30 – 300	0.2				
48 – 300					1.291
10 – 400		2.0			
100 – 300			0.2		
100 – 400				2.0	
300 – 1,500	f/1,500				
300 – 6000					$0.02619 f^{0.6834}$
400 – 2,000		f/200		f/200	
300 – 15,000			f/1,500		
1,500 – 15,000					
1,500 – 100,000	1.0				
2,000 – 100,000				10.0	
2,000 – 300,000		10.0			
6,000 – 15,000					10.0
15,000 – 150,000					10.0
150,000 – 300,000					6.67×10-5 f

5.0 Product and System Description

Model F0016A (VA00712AA, VA00715AA, VA00726AA) is Remote Terminal Unit (RTU) used in Supervisory Control and Data Acquisition systems to monitoring and controlling/local processing of data in the industries such as water/waste management, oil/gas utilization, electricity and radio communication.

The RTU collects data from on-site sensors, adds data from off-site sources, and uses this data aggregate to make decisions regarding how the system's process is operating.

This device consists of UHF2 band, modules RG191-M2 (FCC ID: SQG-1001) and HL7588 (FCC ID: N7NHL7588) which supports LoRA and LTE. Simultaneous transmission is possible between UHF2 band, LoRA and LTE (only one LTE band at any given time).

Table 4 below summarizes the technologies, bands, maximum duty cycles and maximum output powers. Maximum output powers are defined as upper limit of the production line final test station.

Table 4

Technologies	Transmit Bands (MHz)	Duty Cycle (%)	Max Power (W)
Baseline:			
FM	450-520	100	5.60
Module RG191-M2 (FCC ID: SQG-1001):			
LoRA	923.3-927.5 MHz	100	0.589
Module HL7588 (FCC ID: N7NHL7588):			
LTE B4	1710-1755	100	0.259
LTE B13	777-787	100	0.220

6.0 Assessment Method

MPE calculation was used to determine the RF exposure for this device. According to FCC's OET Bulletin 65 Edition 97-01 Section 2, calculations can be made to predict RF field strength and power density levels around typical RF sources.

Equation 1:

$$S = \frac{P_t\, G}{4\pi d^2}\text{F}$$

Equation (1) accounts for the maximum duty cycle of the signal, and the factor, F, to provide a worst-case prediction of power density per FCC OET Bulletin 65, Edition 97-01 1997.

Where: S = power density (mW/cm^2)
P_t = maximum output power scaled by the maximum duty cycle of the signal (mW)
G = Gain of antenna in linear scale
d = distance from antenna (cm)
F = Enhancement factor for predicting ground-level field strength (2.56)

7.0 MPE Assessment

Table 5 summarized the highest MPE calculation for each standalone transmitter bands.

Table 5

Antenna #	Max Power (mW)	Duty Cycle (%)	Tx Frequency (MHz)	Antenna Gain (dBi)	Dist., d (cm)	Enhance Factor, F	Max Calc. MPE (mW/cm^2)	FCC Limit (mW/cm^2)	% To FCC Limit	ISED limit (mW/cm2)	% To ISED Limit
FM (450-520 MHz)											
MWU4002S	5600	100	450.0	0.00	90	2.56	0.141	0.30	**46.9**	0.17	**82.7**
	5600	100	485.0	0.00	90	2.56	0.141	0.32	43.6	0.18	78.6
	5600	100	520.0	0.00	90	2.56	0.141	0.35	40.6	0.19	74.9
LoRA (923.3-927.5 MHz)											
BMLPVMBLTENGP-VP	589	100	923.3	3.00	90	2.56	0.030	0.62	**4.8**	0.28	**10.6**
	589	100	925.4	3.00	90	2.56	0.030	0.62	4.8	0.28	10.6
	589	100	927.5	3.00	90	2.56	0.030	0.62	4.8	0.28	10.6
LTE 4 (1710-1755 MHz)											
BMLPVMBLTENGP-VP	259	100	1710.0	3.00	90	2.56	0.013	1.00	**1.3**	0.42	**3.1**
	259	100	1732.5	3.00	90	2.56	0.013	1.00	1.3	0.43	3.0
	259	100	1755.0	3.00	90	2.56	0.013	1.00	1.3	0.43	3.0
LTE 13 (777-787 MHz)											
BMLPVMBLTENGP-VP	220	100	777.0	3.00	90	2.56	0.011	0.52	**2.1**	0.25	**4.5**
	220	100	782.0	3.00	90	2.56	0.011	0.52	2.1	0.25	4.4
	220	100	787.0	3.00	90	2.56	0.011	0.52	2.1	0.25	4.4

Per KDB 447498 D01, simultaneous transmission MPE test exclusion applies when the sum of MPE ratios for all simultaneous transmitting antennas incorporated in a host device is ≤ 1.0, according to calculated/estimated, numerically modeled, or measured field strengths or power density.

The evaluation here considers FM UHF2 band, LoRA and LTE transmitter are transmitting simultaneously. The sum of MPE percentage to the limit is calculated as follows:

Table 6: FCC, US

Simultaneous Transmission Scenario	Highest % to FCC limit				Sum of MPE percentage to the FCC limit
	FM	LoRA	LTE B4	LTE B13	
	46.9%	4.8%	1.3%	2.1%	
FM + LoRA + LTE B4	x	x	x		53.0%
FM + LoRA + LTE B13	x	x		x	53.8%

Table 7: ISED, Canada

Simultaneous Transmission Scenario	Highest % to ISED limit				Sum of MPE percentage to the ISED limit
	FM	LoRA	LTE B4	LTE B13	
	82.7%	10.6%	3.1%	4.5%	
FM + LoRA + LTE B4	x	x	x		96.4%
FM + LoRA + LTE B13	x	x		x	97.8%

8.0 Conclusion

The MPE assessment presented in this report concludes that model F0016A (VA00712AA, VA00715AA, VA00726AA) when transmitting either in standalone or simultaneously at minimum separation distance 90 cm from antennas, are compliant to the FCC and ISED General Population/Uncontrolled RF exposure limits.