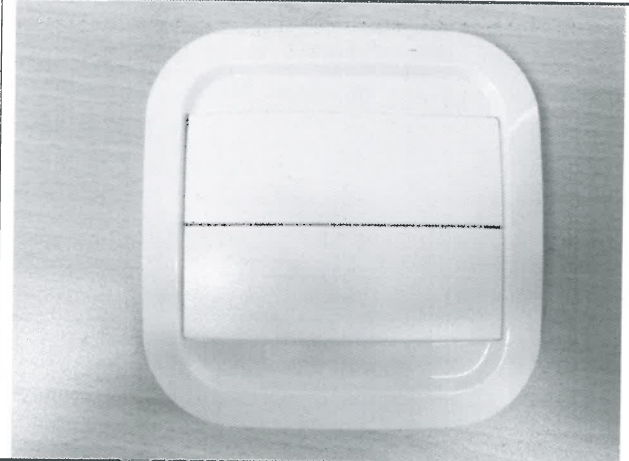


Prüfbericht-Nr.: <i>Test Report No.:</i>	50048016 001	Auftrags-Nr.: <i>Order No.:</i>	154157285	Seite 1 von 22 <i>Page 1 of 22</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	639393	Auftragsdatum: <i>Order date:</i>	2016.04.03	
Auftraggeber: <i>Client:</i>	ID-RF SAS 121 RUE DES HETRES, ST CYR EN VAL, France			
Prüfgegenstand: <i>Test item:</i>	Z-Wave Controller			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	CWS-3US-1 FCC ID: 2A1HGCWS-3US-1 IC: 21504-CWS3US1			
Auftrags-Inhalt: <i>Order content:</i>	Complete test			
Prüfgrundlage: <i>Test specification:</i>	FCC CFR47 Part 15, Subpart C Section 15.249 ANSI C63.10: 2013 RSS-Gen Issue 4, November 2014 RSS-210 Issue 8, December 2010			
Wareneingangsdatum: <i>Date of receipt:</i>	2016.03.30			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000351921-003			
Prüfzeitraum: <i>Testing period:</i>	2016.04.07 to 2016.04.10			
Ort der Prüfung: <i>Place of testing:</i>	MRT Technology(Suzhou) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
2016.12.19 Elliot Zhang <i>[Signature]</i> Datum Name / Stellung Unterschrift Date Name / Position Signature		2016.12.20 Shi Li / Section Manager <i>[Signature]</i> Datum Name / Stellung Unterschrift Date Name / Position Signature		
Sonstiges / Other				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) Legend: 1 = very good 2 = good 3 = satisfactory P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s)		4 = ausreichend 5 = mangelhaft N/A = nicht anwendbar N/T = nicht getestet 4 = sufficient 5 = poor N/A = not applicable N/T = not tested		
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

V04

TEST SUMMARY

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 FIELD STRENGTH OF FUNDAMENTAL EMISSIONS

RESULT: Pass

5.1.3 RADIATED EMISSIONS

RESULT: Pass

5.1.4 20dB BANDWIDTH AND 99% BANDWIDTH

RESULT: Pass

5.1.5 RF EXPOSURE STATEMENT

RESULT: Pass

Contents

1.	GENERAL REMARKS	4
1.1	COMPLEMENTARY MATERIALS	4
2.	TEST SITES	4
2.1	TEST FACILITIES	4
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS	5
2.3	TRACEABILITY	6
2.4	CALIBRATION	6
2.5	MEASUREMENT UNCERTAINTY	6
3.	GENERAL PRODUCT INFORMATION	7
3.1	PRODUCT FUNCTION AND INTENDED USE	7
3.2	RATINGS AND SYSTEM DETAILS	7
3.3	INDEPENDENT OPERATION MODES	7
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS	7
3.5	SUBMITTED DOCUMENTS	7
4.	TEST SET-UP AND OPERATION MODES	8
4.1	PRINCIPLE OF CONFIGURATION SELECTION	8
4.2	TEST OPERATION AND TEST SOFTWARE	8
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	8
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE	8
5.	TEST RESULTS	9
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	9
5.1.1	Antenna Requirement	9
5.1.2	Field Strength of Fundamental Emissions	11
5.1.3	Radiated Emissions	17
5.1.4	20dB Bandwidth and 99% Bandwidth	19
5.1.5	RF Exposure Statement	20
6.	LIST OF TABLES	22
7.	LIST OF FIGURES	22

1. General Remarks

1.1 Complementary Materials

Null.

2. Test Sites

2.1 Test Facilities

MRT Technology (Suzhou) Co., Ltd.

D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China

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

The Federal Communications Commission has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance with the requirements of section 2.948 of the FCC rules. The description of the test facility is listed under FCC registration number 809388.

The Industry Canada has reviewed the technical characteristics of the radiated and conducted emission facility, and has found these test facilities to be in compliance. The description of the test facility is listed under chambers filing number 11384A.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment
Conducted Emissions

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESR7	101209	2016.11.03
Two-Line V-Network	R&S	ENV216	101683	2016.11.03
Two-Line V-Network	R&S	ENV216	101684	2016.11.03
Temperature/Humidity Meter	Yuhuaze	N/A	N/A	2016.12.20

Radiated Emission

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	E4447A	MY45300136	2016.12.08
EMI Test Receiver	R&S	ESR7	101209	2016.11.03
Preamplifier	Schwarzbeck	BBV 9721	9721-008	2017.04.16
Preamplifier	Agilent	83017A	MY53270040	2017.03.29
Loop Antenna	Schwarzbeck	FMZB1519	1519-041	2016.12.14
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	2016.11.07
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	2016.11.07
Broadband Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170549	2017.01.04
Digital Thermometer & Hygrometer	Minggao	N/A	N/A	2016.11.30

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MY52090106	2017.05.08
USB Wideband Power Sensor	Boonton	55006	8911	2017.05.08
Temperature/Humidity Meter	Yuhuaze	N/A	N/A	2016.12.20

Software	Version	Function
e3	V8.3.5	EMI Test Software

2.3 Traceability

All measurement equipment calibrations are traceable to NIST or where calibration is performed outside the United States, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

Table 2: Measurement Uncertainty

Measurement Type	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	±0.39dB
	> 1GHz	±0.68dB
Radiated Emission	30MHz - 1GHz	±5.34dB
	> 1GHz	±5.40dB

3. General Product Information

3.1 Product Function and Intended Use

The EUT (Equipment Under Test) is a Z-Wave Controllers.
For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Kind of Equipment	: Z-Wave Controller
Type Designation	: CWS-3US-1
Operating Frequency	: 908.42 MHz
Modulation Type	: FSK
Operation Voltage	: DC 3.3V (by Battery)
Antenna Type	: PCB Antenna

3.3 Independent Operation Modes

The basic operation modes are:

- A. On
 - 1. Transmitting
 - 2. Receiving
- B. Standby
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram.

3.5 Submitted Documents

- | | |
|--------------------|----------------------|
| - Bill of Material | - Circuit Diagram |
| - PCB Layout | - Instruction Manual |
| - Photo Document | - Rating Label |

4. Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

4.3 Special Accessories and Auxiliary Equipment

Null.

4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Constructional Data Form or the Technical Construction File. No additional measures were employed to achieve compliance.

5. Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass

Table 3: Antenna Requirement

FCC 15.203 – Antenna Requirement 1	
Requirement:	No antenna other than that furnished by the responsible party shall be used with the device. ☒ Use of a permanently attached antenna, or ☐ Use an antenna that uses a unique coupling to the intentional radiator.
Results:	Antenna type: PCB Antenna
Verdict:	PASS

FCC 15.204 – Antenna Requirement 2	
Requirement:	An intentional radiator may be operated only with the antenna with which it is authorized. If an antenna is marketed with the intentional radiator, it shall be of a type which is authorized with the intentional radiator.
Results:	Only one integral antenna can be used
Verdict:	PASS

RSS-Gen 6.3 – External Control	
Requirement:	The device shall not have any external controls accessible to the user that enable it to be adjusted, selected or programmed to operate in violation of the limits prescribed in the applicable RSS.
Results:	The device does not have any transmitter external controls accessible to the user that can be adjusted and operated in violation of the limits of this standard.
Verdict:	PASS

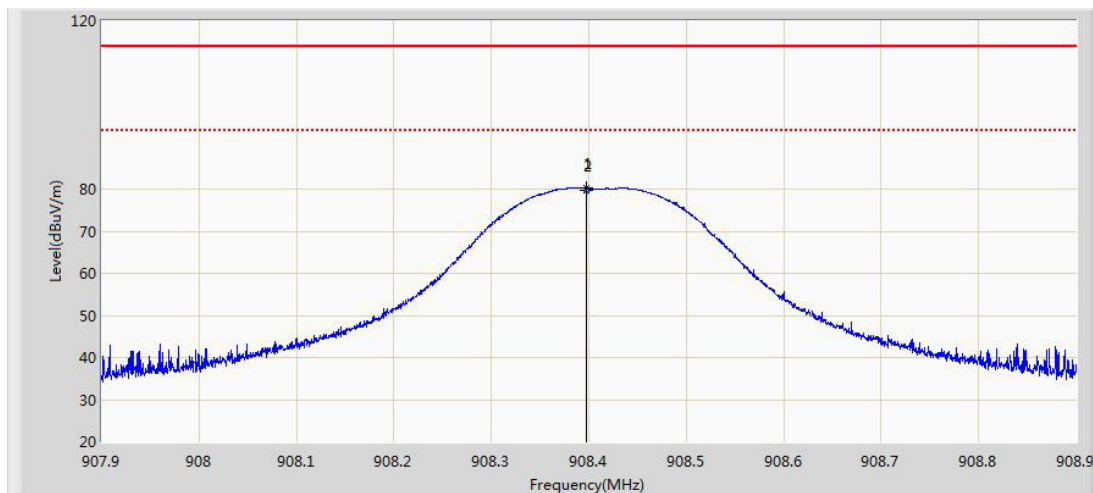
RSS-Gen 8.3 – Antenna Requirement

Requirement: Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.

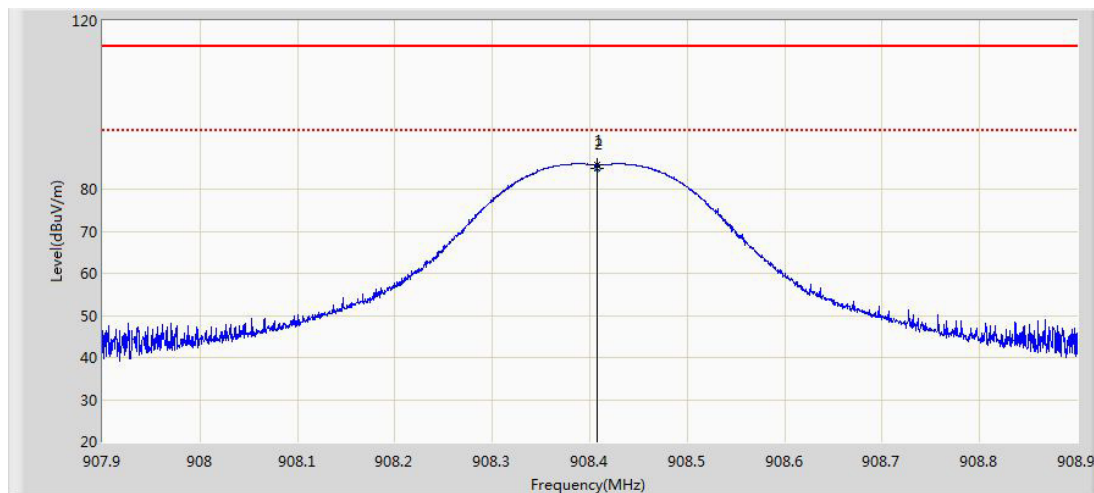
Results: The device has only one internal undetachable antenna. And testing was performed with the transmitter output power set at the maximum level.

Verdict: PASS

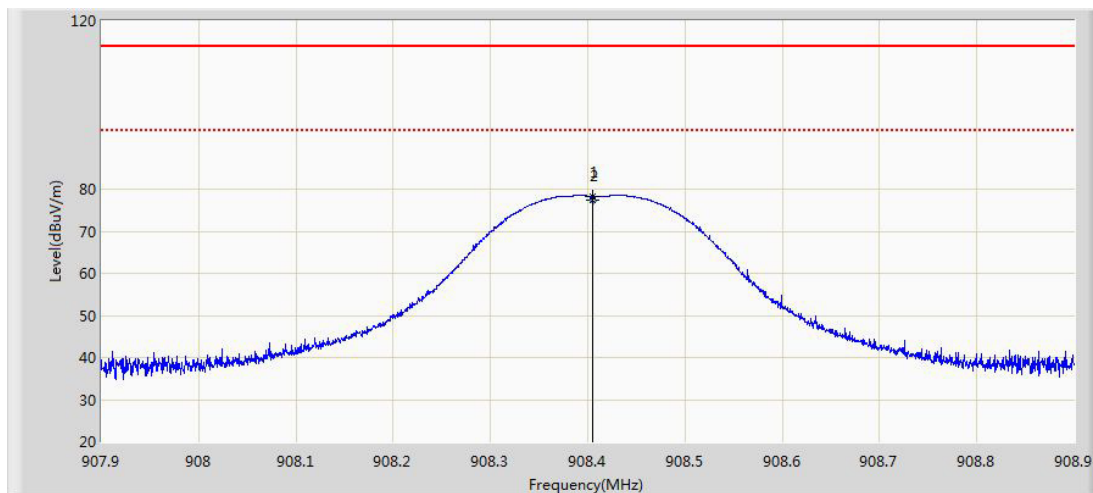
Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.400	87.874	63.672	-26.126	114.000	24.201	PK
908.400	87.062	62.860	-6.938	94.000	24.201	QP

Figure 2: Field Strength of Fundamental Emissions, Antenna Vertical, EUT X Axis

Table 5: Field Strength of Fundamental Emissions, Antenna Vertical, EUT X Axis

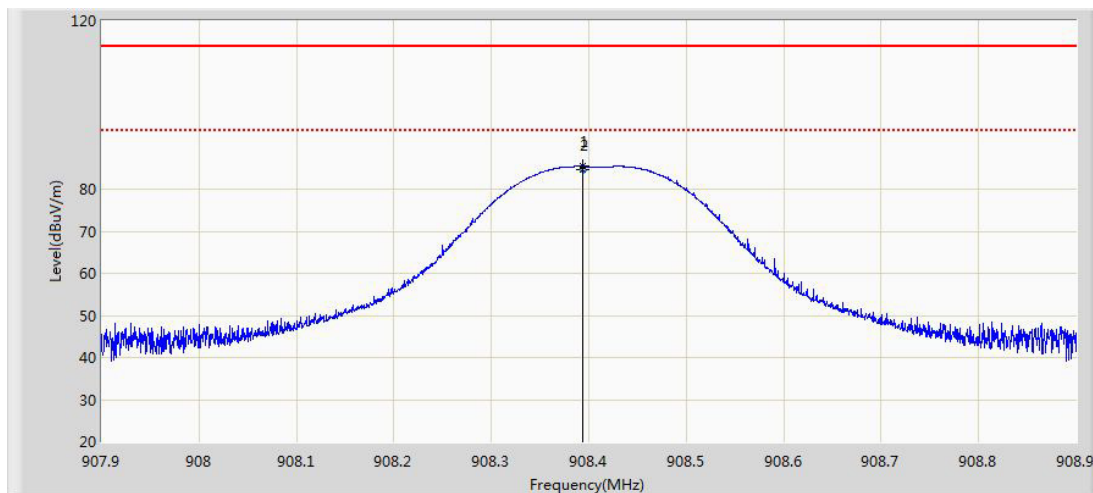
Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.398	80.171	55.969	-33.829	114.000	24.201	PK
908.398	79.722	55.520	-14.278	94.000	24.201	QP

Figure 3: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Y Axis

Table 6: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Y Axis

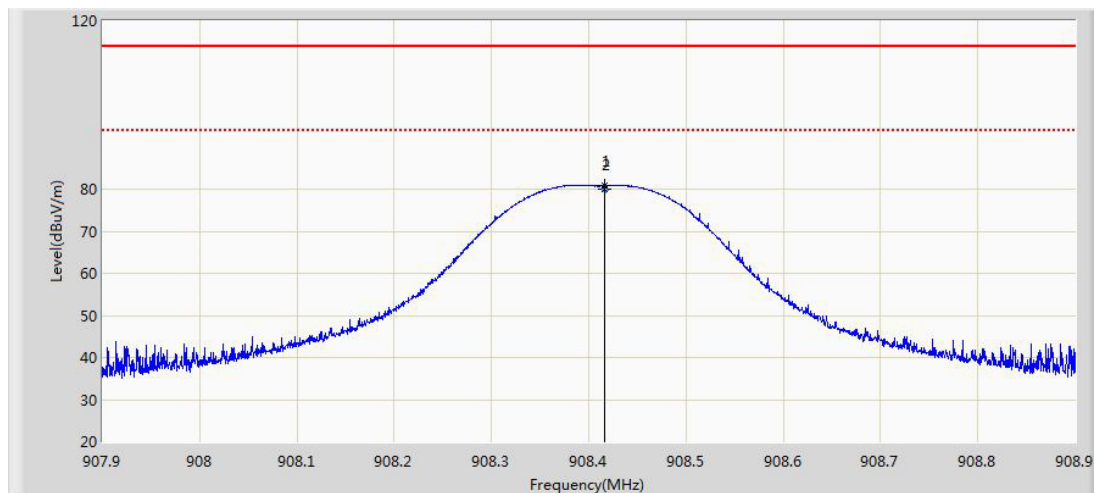
Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.408	85.801	61.599	-28.199	114.000	24.201	PK
908.408	85.066	60.864	-8.934	94.000	24.201	QP

Figure 4: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Y Axis

Table 7: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Y Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.405	78.301	54.099	-35.699	114.000	24.201	PK
908.405	77.352	53.150	-16.648	94.000	24.201	QP

Figure 5: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Z Axis

Table 8: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Z Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.394	85.397	61.195	-28.603	114.000	24.201	PK
908.394	84.672	60.470	-9.328	94.000	24.201	QP

Figure 6: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Z Axis

Table 9: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Z Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.416	80.755	56.553	-33.245	114.000	24.201	PK
908.416	80.062	55.860	-13.938	94.000	24.201	QP

1. The radiated emission below 30MHz is very low, so it was not shown on the report.
2. The Bold rows in the above table are the results for the Harmonic Radiated Emission.

3. The measurements using an average detector for the frequency above 1GHz were not performed since the results measured with a Peak detector are totally meet the average limit.

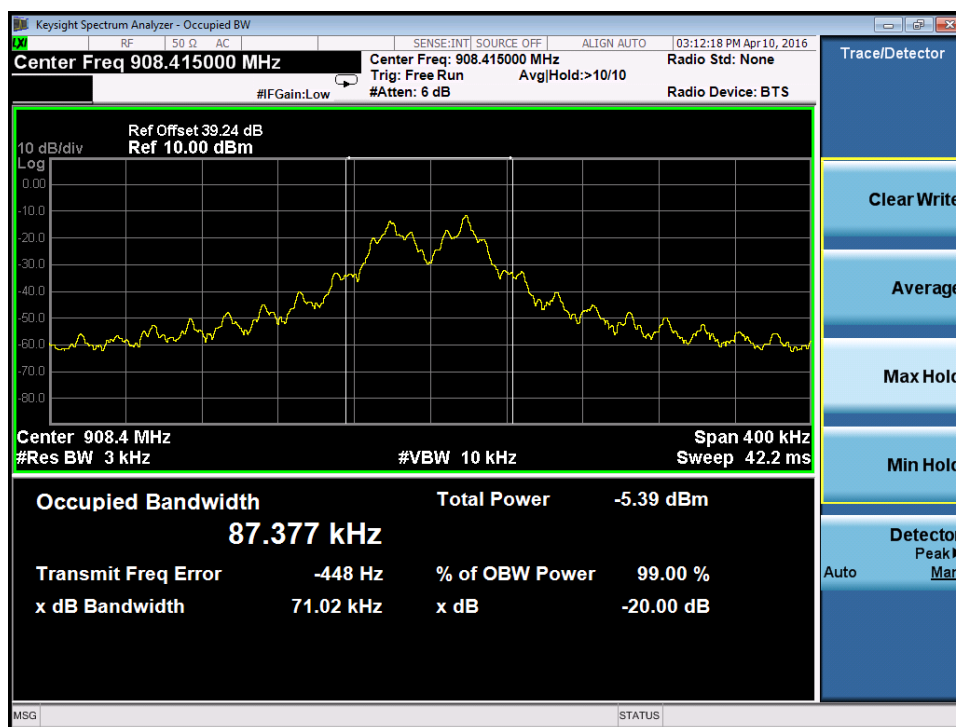
5.1.4 20dB Bandwidth and 99% Bandwidth

RESULT:

Pass

Date of testing	:	2016.04.10
Test standard	:	FCC Part 15.215 RSS-Gen Issue4 November 2014
Test procedure	:	ANSI C63.10: 2013
Limit	:	FCC Part 15.215(c) Clause 6.6 of RSS-Gen Issue4 November 2014

Figure 7: 20dB Bandwidth and 99% Bandwidth

**Table 11: 20dB Bandwidth and 99% Bandwidth**

Channel Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
908.4	71.02	87.377

5.1.5 RF Exposure Statement

RESULT:
Pass

Evaluate standard : FCC KDB # 447498 D01 V06
 RSS-102 Issue 5

Calculated Output Power

The maximum measured transmitter power is the following:

Frequency [GHz]	Field Strength of Fundamental Emissions [dBuV/m]	Field Strength of Fundamental Emissions [dBm]	Field Strength of Fundamental Emissions [mW]
0.908400	87.874	-7.354	0.184

Note: Relation between power, electric field strength, E

A simple relation can be established for perfect, ideal cases (which means free space, far field conditions) between E(V/m), D distance between the transmitting radio equipment and the point of measurement (m), e.i.r.p.(W).

$$E = \sqrt{\frac{30(e.i.r.p.)}{D}}$$

This represents a site gain of 4dB. The field strength as E(V/m) can be converted to dB(uV/m) as follows:

$$E(dB(uV / m)) = 120 + 20 \log E$$

Evaluation for FCC

According to FCC KDB # 447498 D01 V06, Clause 4.3.1

- (a) For 100MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$$\frac{(\text{max. power of channel, including tune - up tolerance, mW})}{(\text{min. test separation distance, mm})} \times \sqrt{f(\text{GHz})}$$

≤ 3.0 , for 1-g SAR, and ≤ 7.5 , for 10-g extremity SAR

So, the max allowed power for 1-g SAR with distance 5mm at 0.908400GHz is 15.73811mW

And the max allowed power for 10-g extremity SAR with distance 5mm at 0.908400GHz is 39.34529mW

The maximum conducted output power of the EUT is: 0.184mW which is totally lower than the SAR test exclusion thresholds.

Evaluation for IC

According to table 1 and note 4 of RSS-102 Issue 5, March 2015

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	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

For frequencies (835 MHz to 1900 MHz), the conservative limit of 1900MHz can be used for exemption limits.

So, the max allowed power for 1-g SAR with distance 5mm at 908.400MHz is 7mW

The maximum conducted output power of the EUT is: 0.184mW which is totally lower than the SAR test exclusion thresholds.

Conclusion

Since the distance of the device in generally using is lower than 5mm, so a distance of 5mm is applied to determine SAR test exclusion.
 SAR data is not required for either FCC or IC.

6. List of Tables

Table 1: List of Test and Measurement Equipment	5
Table 2: Measurement Uncertainty	6
Table 3: Antenna Requirement	9
Table 4: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT X Axis	11
Table 5: Field Strength of Fundamental Emissions, Antenna Vertical, EUT X Axis	12
Table 6: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Y Axis	13
Table 7: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Y Axis	14
Table 8: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Z Axis	15
Table 9: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Z Axis.....	16
Table 10: Radiated Emissions.....	17
Table 11: 20dB Bandwidth and 99% Bandwidth	19

7. List of Figures

Figure 1: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT X Axis	11
Figure 2: Field Strength of Fundamental Emissions, Antenna Vertical, EUT X Axis	12
Figure 3: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Y Axis	13
Figure 4: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Y Axis	14
Figure 5: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Z Axis	15
Figure 6: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Z Axis	16
Figure 7: 20dB Bandwidth and 99% Bandwidth	19