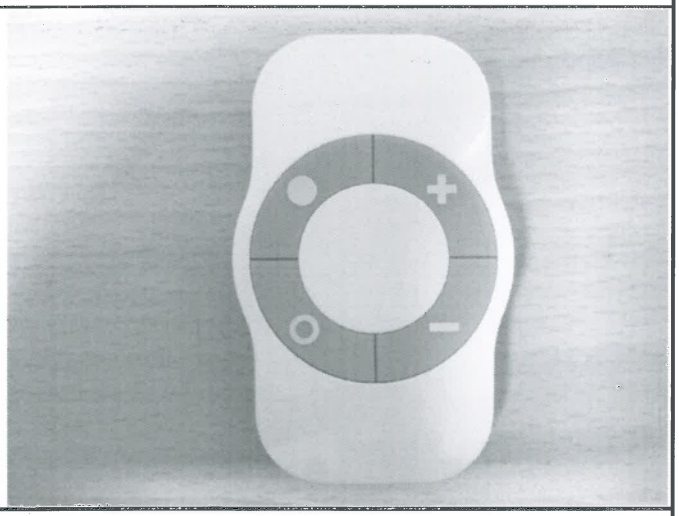
Prüfbericht-Nr.: *Test Report No.:*	**50045317 001**	**Auftrags-Nr.:** *Order No.:*	**154157285**	**Seite 1 von 22** *Page 1 of 22*
Kunden-Referenz-Nr.: *Client Reference No.:*	**639393**	**Auftragsdatum:** *Order date:*	**2016.04.03**	
Auftraggeber: *Client:*	**ID-RF SAS** 121 RUE DES HETRES, ST CYR EN VAL, France			
Prüfgegenstand: *Test item:*	**Z-Wave Controller**			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	**CRC-3US-1** **FCC ID: 2AIHGCRC-3US-1** **IC: 21504-CRC3US1**			
Auftrags-Inhalt: *Order content:*	**Complete test**			
Prüfgrundlage: *Test specification:*	**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: *Date of receipt:*	**2016.03.30**			
Prüfmuster-Nr.: *Test sample No.:*	**A000351921-001**			
Prüfzeitraum: *Testing period:*	**2016.04.07 to 2016.04.10**			
Ort der Prüfung: *Place of testing:*	**MRT Technology(Suzhou) Co., Ltd.**			
Prüflaboratorium: *Testing laboratory:*	**TÜV Rheinland (Shanghai) Co., Ltd.**			
Prüfergebnis*: *Test result*:*	**Pass**			



geprüft von / *tested by*:

Datum / *Date*	Name / Stellung / *Name / Position*	Unterschrift / *Signature*
2016.08.11	Elliot Zhang / Senior Project Engineer	

kontrolliert von / *reviewed by*:

Datum / *Date*	Name / Stellung / *Name / Position*	Unterschrift / *Signature*
2016.08.11	Shi Li / Section Manager	

Sonstiges / *Other*

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

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

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 basics 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 Controller.
For details refer to the User Manual and Circuit Diagram.

3.2 Ratings and System Details

Kind of Equipment	:	Z-Wave Controller
Type Designation	:	CRC-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
- PCB Layout
- Photo Document
- Circuit Diagram
- Instruction Manual
- 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

5.1.2 Field Strength of Fundamental Emissions

RESULT: **Pass**

Date of testing	:	2016.04.07
Test standard	:	FCC Part 15.249 RSS-210 Issue 8 December 2010
Test procedure	:	ANSI C63.10: 2013
Limit	:	FCC Part 15.249(a) Clause A2.9(a) of RSS-210 Issue 8 December 2010
Kind of test site	:	3m Semi-Anechoic Chamber

Figure 1: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT X Axis

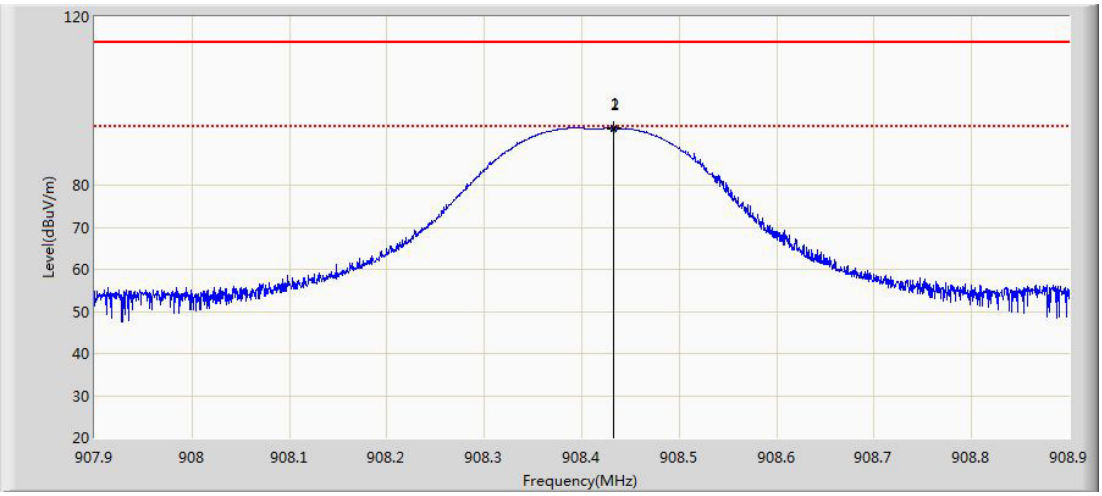


Table 4: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT X Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.433	93.562	69.361	-20.438	114.000	24.201	PK
908.433	93.402	69.200	-0.598	94.000	24.201	QP

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

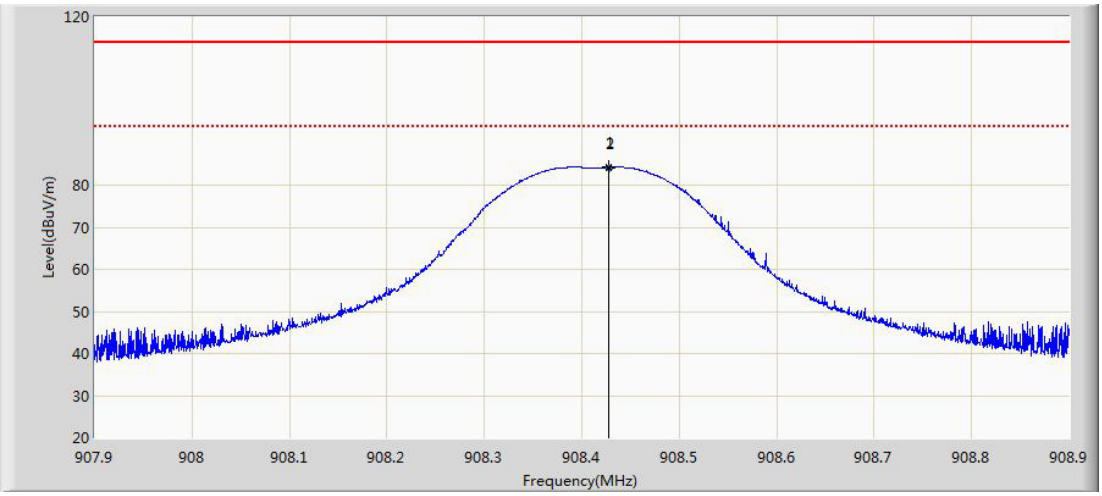


Table 5: Field Strength of Fundamental Emissions, Antenna Vertical, EUT X Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.428	84.254	60.052	-29.746	114.000	24.201	PK
908.428	83.962	59.760	-10.038	94.000	24.201	QP

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

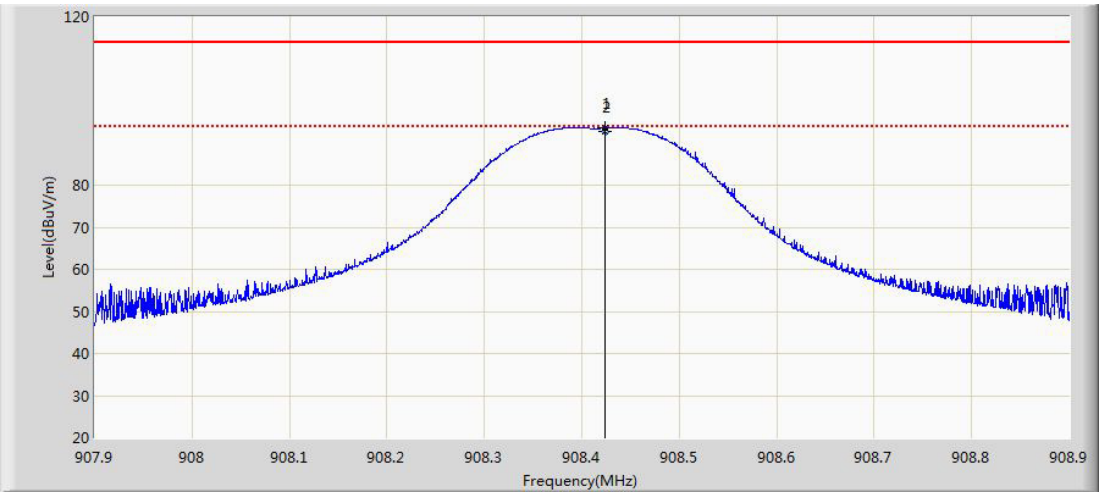


Table 6: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Y Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.424	93.546	69.345	-20.454	114.000	24.201	PK
908.424	92.732	68.530	-1.268	94.000	24.201	QP

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

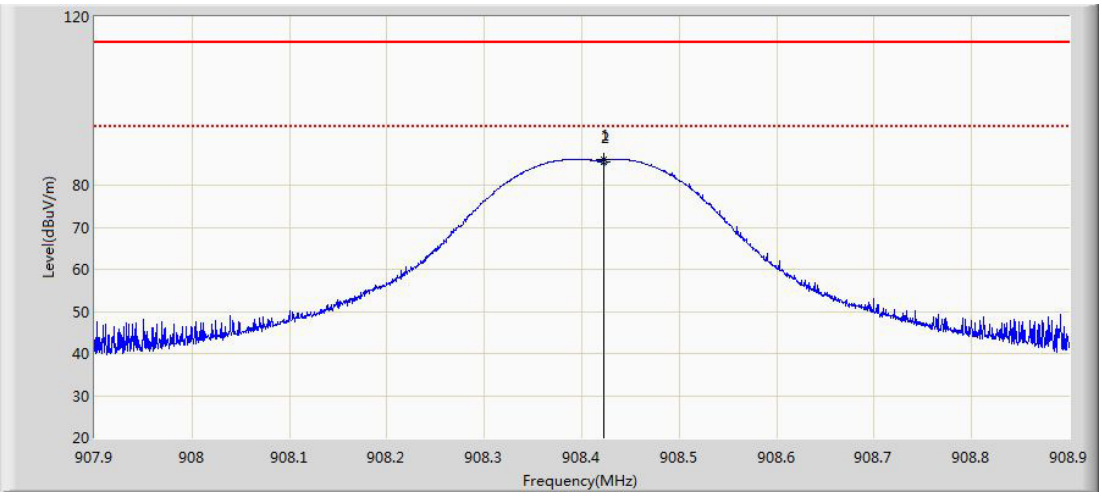


Table 7: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Y Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.423	86.045	61.843	-27.955	114.000	24.201	PK
908.423	85.442	61.240	-8.558	94.000	24.201	QP

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

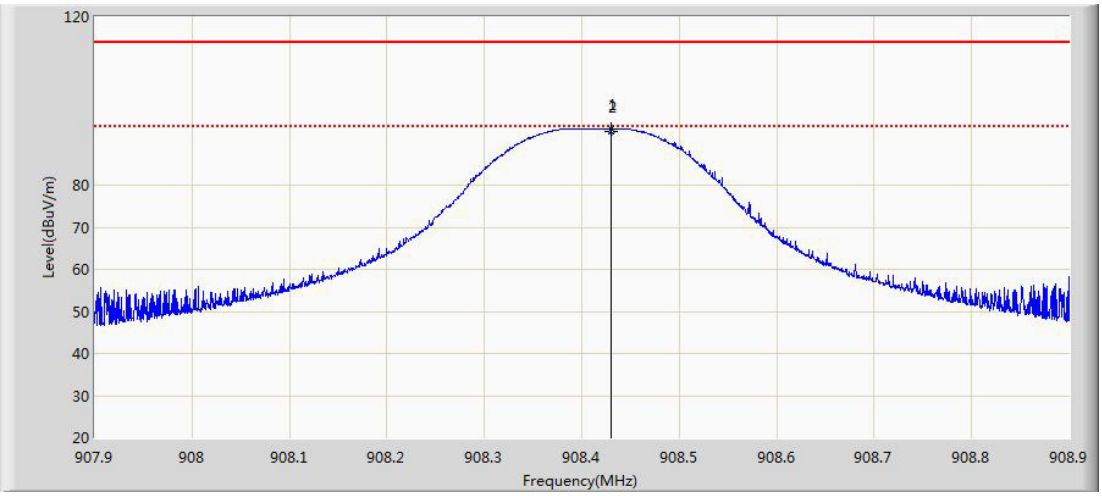


Table 8: Field Strength of Fundamental Emissions, Antenna Horizontal, EUT Z Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.430	93.418	69.217	-20.582	114.000	24.201	PK
908.430	92.762	68.560	-1.238	94.000	24.201	QP

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

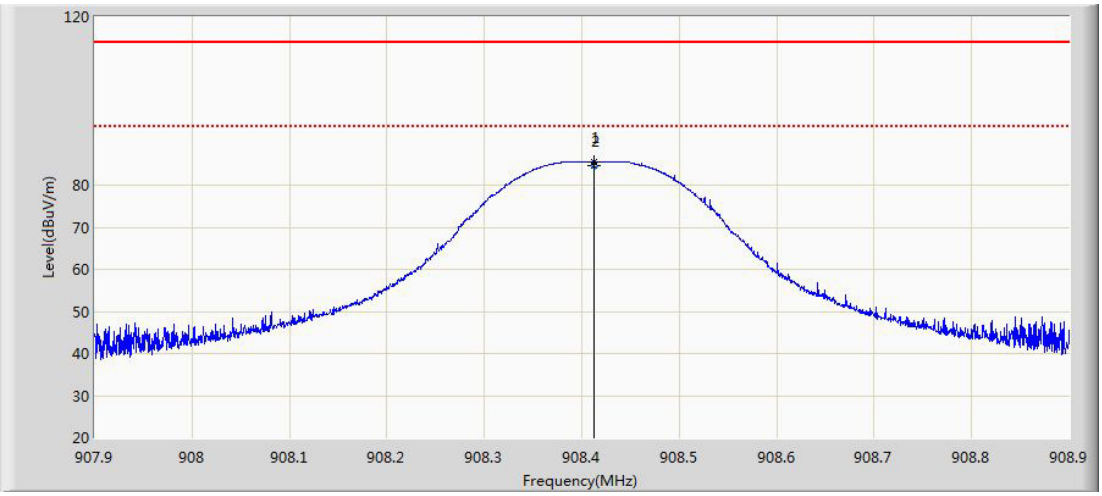


Table 9: Field Strength of Fundamental Emissions, Antenna Vertical, EUT Z Axis

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
908.413	85.411	61.209	-28.589	114.000	24.201	PK
908.413	84.672	60.470	-9.328	94.000	24.201	QP

5.1.3 Radiated Emissions

RESULT: **Pass**

Date of testing	:	2016.04.07
Test standard	:	FCC Part 15.249 RSS-210 Issue 8 December 2010
Test procedure	:	ANSI C63.10: 2013
Frequency range	:	9kHz – 30MHz 30MHz – tenth harmonic of the highest fundamental frequency
Limit	:	FCC Part 15.249(a) & FCC Part 15.249(e), FCC Part 15.249(d) & FCC Part 15.209; Clause A2.9(a) of RSS-210 Issue 8 December 2010, Clause A2.9(b) of RSS-210 Issue 8 December 2010 & Table 4 of RSS-Gen Issue4 November 2014
Kind of test site	:	3m Semi-Anechoic Chamber

Table 10: Radiated Emissions, 9kHz – 30MHz

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type
0.105	44.043	23.845	-63.137	107.180	20.198	QP
2.175	27.371	6.960	-42.129	69.500	20.412	QP
6.216	24.786	4.701	-44.714	69.500	20.085	QP

Table 11: Radiated Emissions, 30MHz – 10th harmonic of the highest fundamental frequency

Frequency [MHz]	Measure Level [dBuV/m]	Reading Level [dBuV]	Over Limit [dB]	Limit [dBuV/m]	Factor [dB]	Type	Antenna Polarity
46.005	12.666	-2.340	-27.334	40.000	15.007	QP	H
55.220	13.288	-1.360	-26.712	40.000	14.648	QP	H
112.935	12.012	-0.420	-31.488	43.500	12.432	QP	H
364.650	14.664	-1.420	-31.336	46.000	16.085	QP	H
390.355	16.199	-0.310	-29.801	46.000	16.509	QP	H
533.430	19.061	0.230	-26.939	46.000	18.832	QP	H
2725.500	**46.852**	**49.363**	**-27.148**	**74.000**	**-2.510**	**PK**	**H**
4544.500	**43.804**	**42.578**	**-30.196**	**74.000**	**1.226**	**PK**	**H**
8913.500	44.510	33.977	-29.490	74.000	10.534	PK	H
46.005	17.156	2.150	-22.844	40.000	15.007	QP	V
50.370	13.260	-1.680	-26.740	40.000	14.940	QP	V
101.780	10.574	-2.630	-32.926	43.500	13.204	QP	V
354.950	14.352	-1.580	-31.648	46.000	15.932	QP	V

520.820	18.294	-0.340	-27.706	46.000	18.634	QP	V
636.735	20.730	0.210	-25.270	46.000	20.520	QP	V
2725.500	**45.285**	**47.796**	**-28.715**	**74.000**	**-2.510**	**PK**	**V**
8174.000	45.647	36.041	-28.353	74.000	9.606	PK	V

Note:
1. The Bold rows in the above table are the results for the Harmonic Radiated Emission.
2. 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

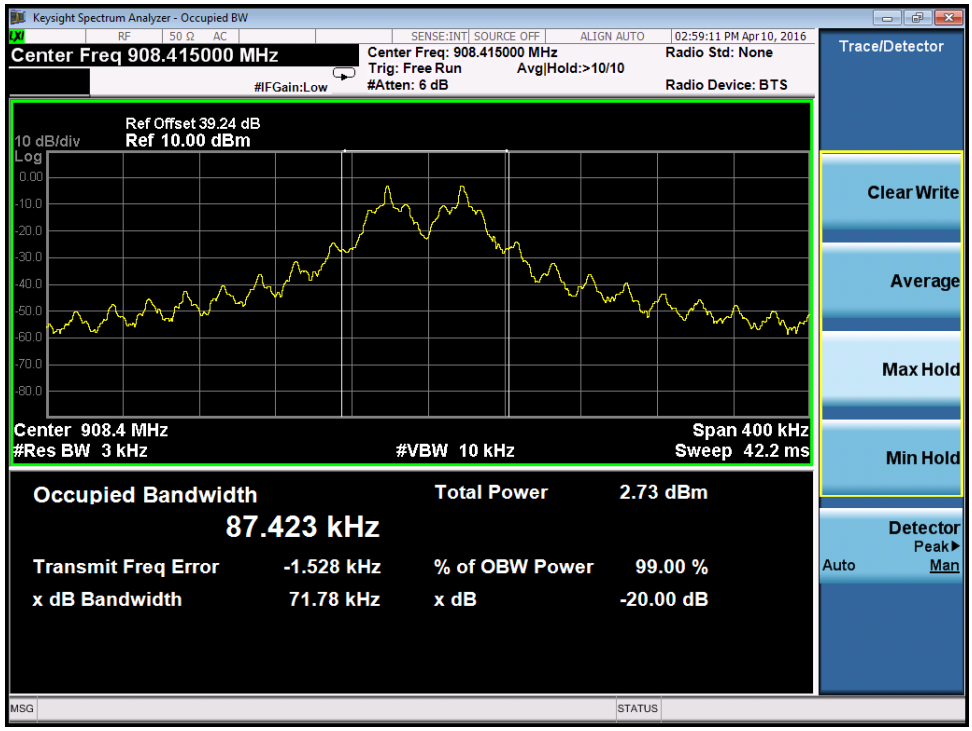


Table 12: 20dB Bandwidth and 99% Bandwidth

Channel Frequency [MHz]	20dB Bandwidth [kHz]	99% Bandwidth [kHz]
908.4	71.78	87.423

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]
0.908433	93.562	-1.67	0.681

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:

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

≤ 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 0.908433GHz is 15.73783mW
And the max allowed power for 10-g extremity SAR with distance 5mm at 0.908433GHz is 39.34457mW

The maximum conducted output power of the EUT is: 0.681mW 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 908.433MHz is 7mW

The maximum conducted output power of the EUT is: 0.681mW which is totally lower than the SAR test exclusion thresholds.

Conclusion

SAR data is not required for either FCC or IC.

6. List of Tables

7. List of Figures