

FCC PART 15.225

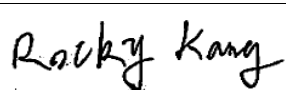
TEST REPORT

For

i.safe MOBILE GmbH

i_Park Tauberfranken 10 97922 Lauda-Koenigshofen, Germany

FCC ID: 2AACZ-IS5201

Report Type: Original Report	Product Type: TD-LTE Digital Mobile Phone
Report Number: RSZ180411007-00E	
Report Date: 2018-05-30	
Rocky Kang 	
Reviewed By: RF Engineer	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *i.safe MOBILE GmbH*'s product, model number: *IS520.1 (FCC ID: 2AACZ-IS5201)* or the "EUT" in this report was a *TD-LTE Digital Mobile Phone*, which was measured approximately: 15.4 cm (L) * 7.8 cm (W) * 2.4 cm (H), rated with input voltage: DC 3.8 V battery or DC 5V from adapter.

Adapter Information:

Model: ICP12-050-2000B

Input: AC 100-240V, 50/60Hz, 0.3 A

Output: DC 5V, 2000 mA

**All measurement and test data in this report was gathered from production sample serial number: 1800508. (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-04-11.*

Objective

This Type approval report is prepared on behalf of *i.safe MOBILE GmbH* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The objective is to determine the compliance of the EUT with FCC rules, section 15.203, 15.205, 15.207, 15.209 and 15.225.

Related Submittal(s)/Grant(s)

FCC Part 15B JBP, Part 15.247 DSS & DTS, Part 22H /24E / 27 PCE and Part 15.407 NII submissions with FCC ID: 2AACZ-IS5201.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter	uncertainty
Occupied Channel Bandwidth	±5%
RF Output Power with Power meter	±0.5dB
RF conducted test with spectrum	±1.5dB
AC Power Lines Conducted Emissions	±1.95dB
All emissions, radiated	±4.88dB
Temperature	±3°C
Humidity	±6%
Supply voltages	±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

EUT Exercise Software

No Exercise Software was used.

Equipment Modifications

No modification on the EUT.

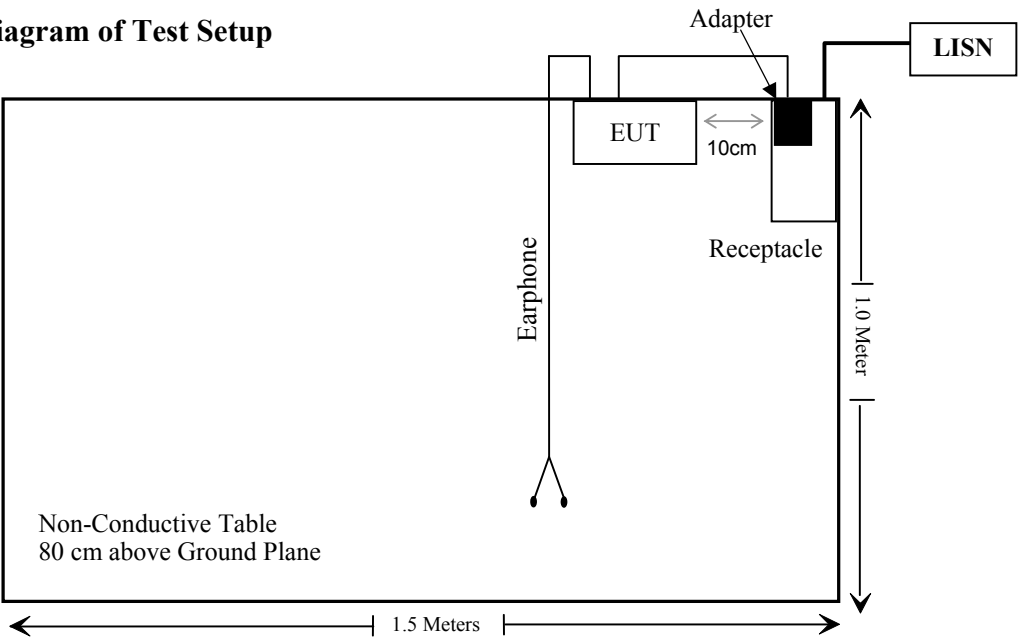
Local Support Equipment

Manufacturer	Description	Model	Serial Number
N/A	N/A	N/A	N/A

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable USB Cable	1.0	EUT	Adapter

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207	AC Line Conducted Emission	Compliance
§15.225 §15.209 §15.205	Radiated Emission Test	Compliance
§15.225(e)	Frequency Stability	Compliance
§15.215(c)	20dB Emission Bandwidth	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2017-08-04	2018-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2017-11-19	2018-05-17
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
N/A	Conducted Emission Cable	N/A	UF A210B-1-0720-504504	2017-11-12	2018-05-12
Radiated Emission Test					
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-17
HP	Amplifier	HP8447E	1937A01046	2018-05-21	2018-11-19
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
ETS	Passive Loop Antenna	6512	00029604	2018-03-07	2021-03-06
Sonoma instrument	Amplifier	310N	186238	2017-11-19	2018-05-17
Sonoma instrument	Amplifier	310N	186238	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2017-11-19	2018-05-17
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2018-05-21	2018-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-17
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-21	2018-11-19
Fluke	Digital Multimeter	287	19000011	2018-04-09	2019-04-09
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2017-12-21	2018-12-21

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

Antenna Connected Construction

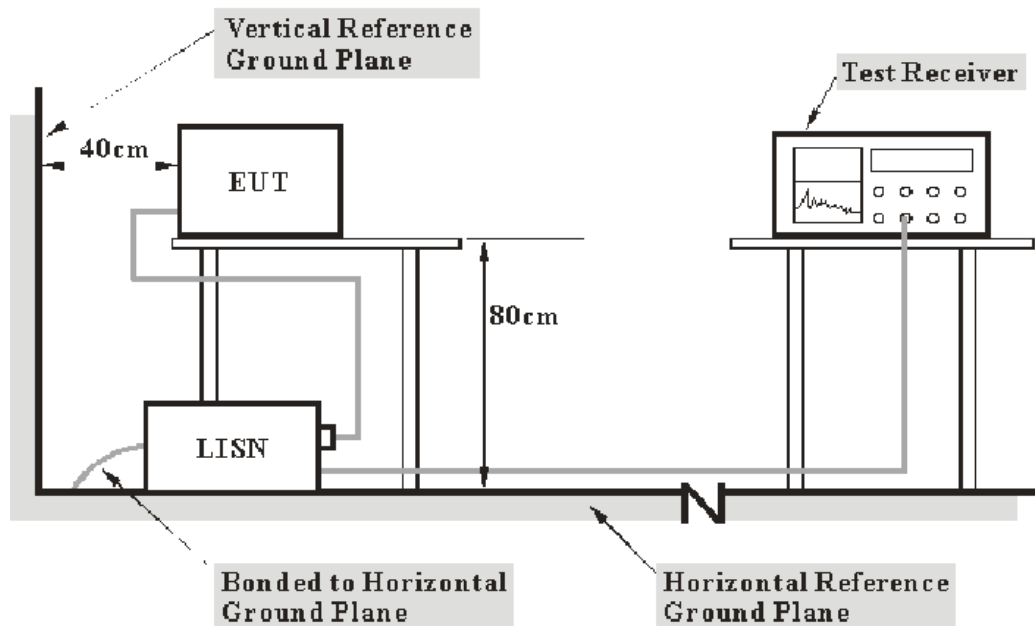
The EUT has an internal antenna arrangement, which was permanently attached, the antenna gain is -2.1 dBi, fulfill the requirement of this section. Please refer to EUT photos for details.

FCC §15.207 – AC LINE CONDUCTED EMISSION

Applicable Standard

FCC§15.207

EUT Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter of Laptop was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

$$\text{Correction Factor} = \text{LISN VDF} + \text{Cable Loss} + \text{Transient Limiter Attenuation}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

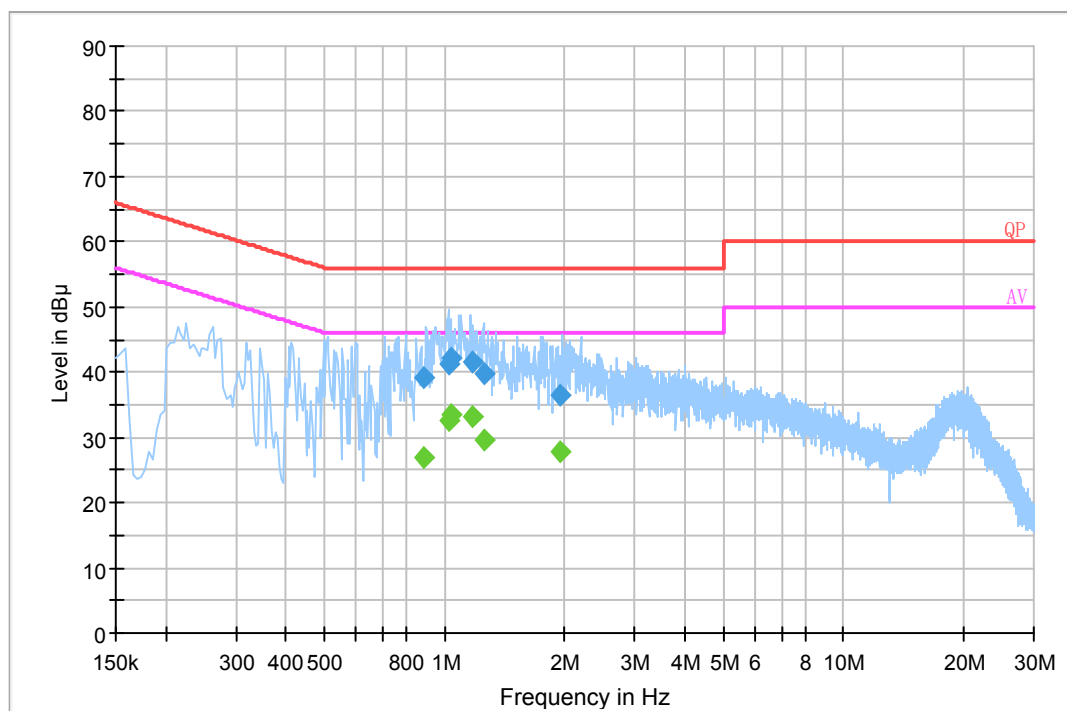
Environmental Conditions

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

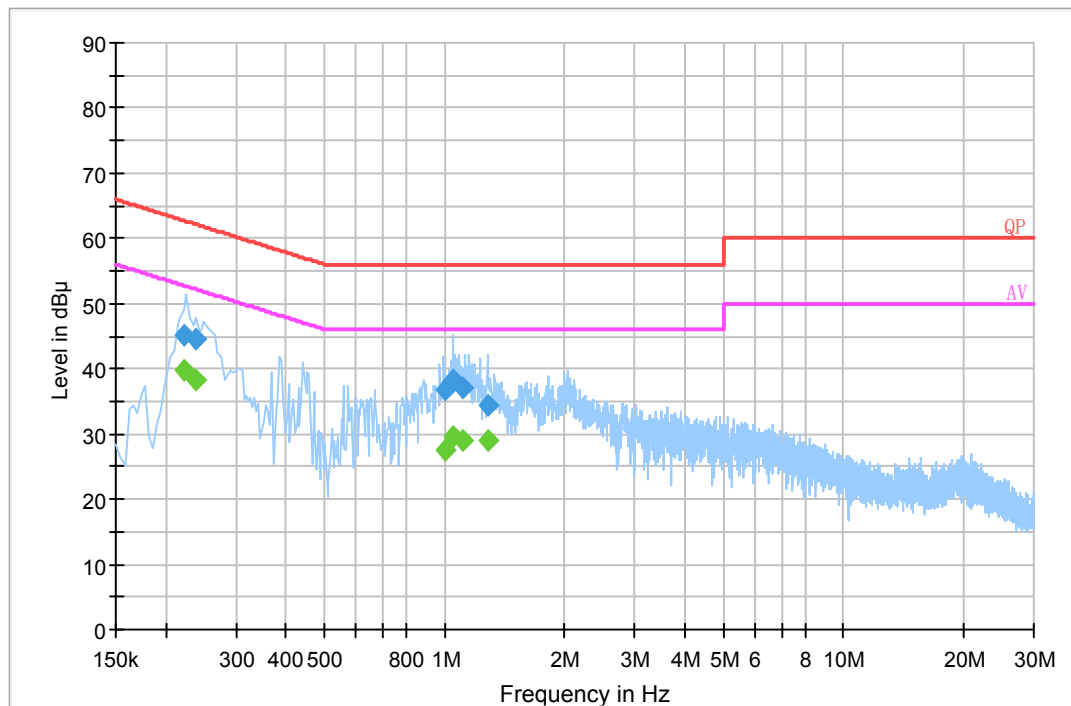
The testing was performed by Simon Wang on 2018-05-03.

EUT operation mode: Transmitting

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.888470	39.2	20.0	56.0	16.8	QP
1.025150	41.3	20.0	56.0	14.7	QP
1.037330	42.3	20.0	56.0	13.7	QP
1.176570	41.5	20.0	56.0	14.5	QP
1.259190	39.6	20.0	56.0	16.4	QP
1.948450	36.6	20.0	56.0	19.4	QP
0.888470	27.0	20.0	46.0	19.0	Ave.
1.025150	32.6	20.0	46.0	13.4	Ave.
1.037330	33.4	20.0	46.0	12.6	Ave.
1.176570	33.2	20.0	46.0	12.8	Ave.
1.259190	29.5	20.0	46.0	16.5	Ave.
1.948450	27.8	20.0	46.0	18.2	Ave.

AC 120V/60 Hz, Neutral:

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.221500	45.2	20.1	62.8	17.6	QP
0.237500	44.5	20.1	62.2	17.7	QP
0.999090	36.8	20.0	56.0	19.2	QP
1.050250	38.3	20.0	56.0	17.7	QP
1.113110	37.0	20.0	56.0	19.0	QP
1.290770	34.3	20.0	56.0	21.7	QP
0.221500	39.8	20.1	52.8	13.0	Ave.
0.237500	38.2	20.1	52.2	14.0	Ave.
0.999090	27.5	20.0	46.0	18.5	Ave.
1.050250	29.6	20.0	46.0	16.4	Ave.
1.113110	28.9	20.0	46.0	17.1	Ave.
1.290770	29.1	20.0	46.0	16.9	Ave.

Note:

- 1) Correction Factor = LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

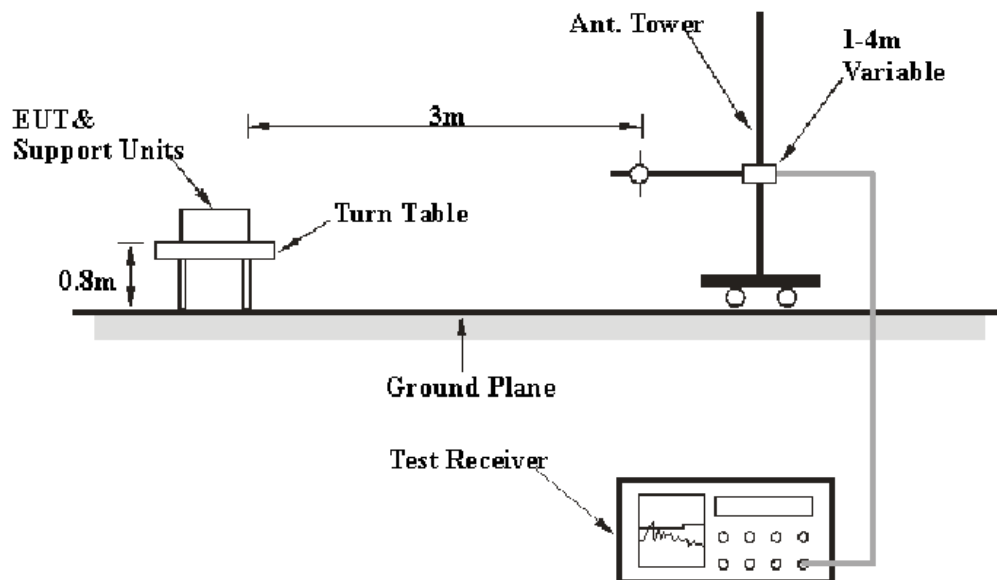
FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST

Applicable Standard

As per FCC Part 15.225

- (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

EUT Setup



Note: Antenna is set up at 1m during test for below 30MHz.

The radiated emission tests were performed in the 3-meter chamber a test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part Subpart C limits.

EMI Test Receiver Setup

According to FCC Rules, 47 CFR 15.33, the EUT emissions were investigated up to 1000 MHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
9 kHz – 150 kHz	300 Hz	1 kHz	/	QP
150 kHz – 30 MHz	10 kHz	30 kHz	/	QP
30 MHz – 1000 MHz	100 kHz	300 kHz	/	QP

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\begin{aligned}\text{Corrected Factor} &= \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain} \\ \text{Corrected Amplitude} &= \text{Meter Reading} + \text{Corrected Factor}\end{aligned}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr} , if L_m is less than L_{lim} , it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

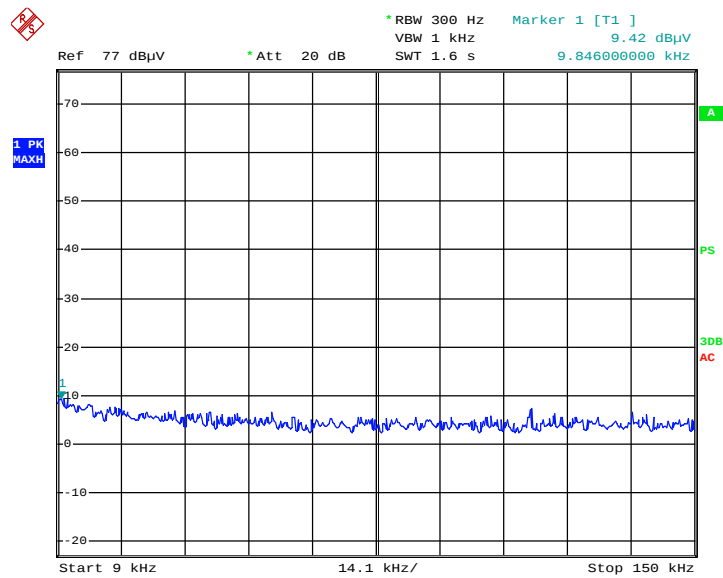
The testing was performed by Simon Wang on 2018-05-03 to 2018-05-30.

Test mode: Transmitting

1) Spurious Emissions (9 kHz~30 MHz):

Indicated		Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Freq. (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
0.00985	9.42	180	1	QP	71.8	0.1	30.2	51.12	127.74	Pass
0.269	41.3	180	1	QP	46.0	0.2	30.2	57.30	99.01	Pass

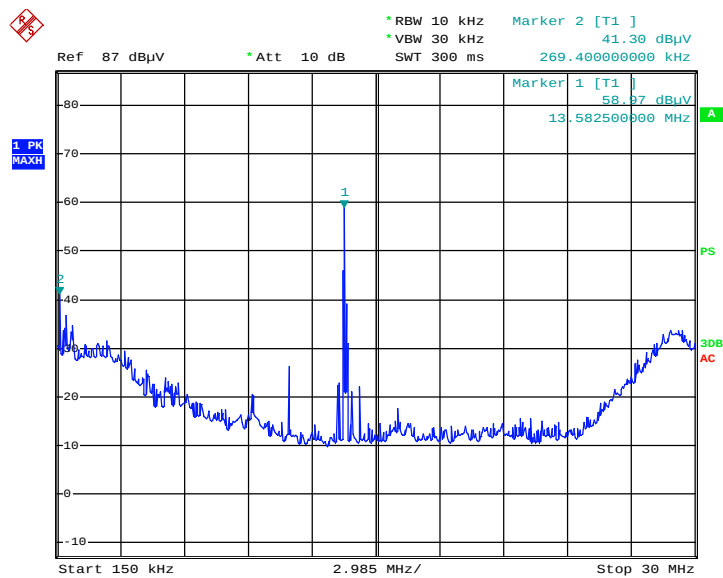
9 kHz~150 kHz



EUT

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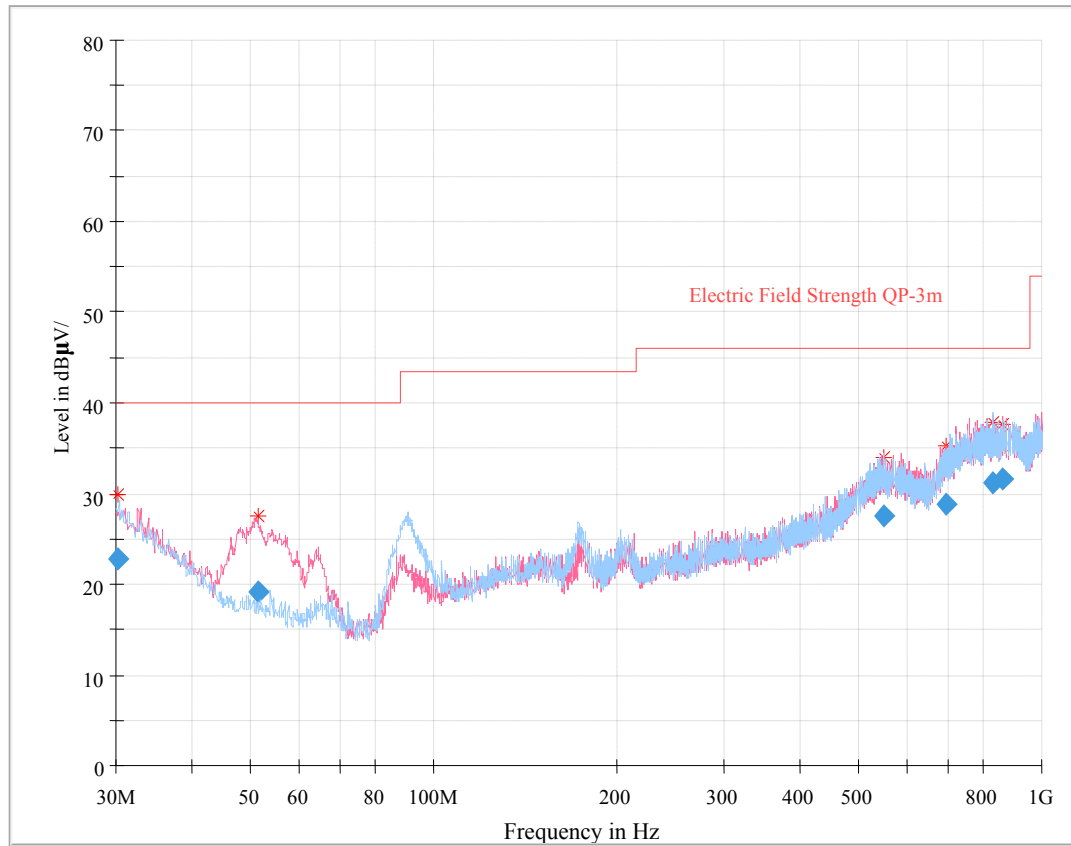
150 kHz~30 MHz



EUT

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2) Spurious Emissions (30 MHz~1GHz):



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
30.238071	22.84	341.0	H	51.0	0.6	40.00	17.16
51.521875	19.16	110.0	V	13.0	-10.8	40.00	20.84
550.228125	27.49	400.0	H	357.0	5.3	46.00	18.51
697.198125	28.84	254.0	V	315.0	6.8	46.00	17.16
833.750750	31.23	110.0	H	353.0	9.4	46.00	14.77
862.020125	31.69	245.0	V	332.0	9.7	46.00	14.31

Note:

- 1) Correction Factor = Antenna factor(Rx) + Cable Loss – Amplifier factor
- 2) Corrected Amplitude = Reading + Correction Factor
- 3) Margin = Limit – Corrected Amplitude

3) Inband:

Indicated			Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Frequency Range (MHz)	Mark Point (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
13.110-13.410	13.403	50.60	0	1.2	QP	32.1	0.2	30.2	52.70	80.5	Pass
13.410-13.553	13.553	56.30	0	1.1	QP	32.1	0.2	30.2	58.40	90.5	Pass
13.553-13.567	13.566	58.97	0	1.3	QP	32.1	0.2	30.2	61.07	124.0	Pass
13.567-13.710	13.567	56.38	0	1.4	QP	32.1	0.2	30.2	58.48	90.5	Pass
13.710-14.010	13.895	49.84	0	1.2	QP	32.1	0.2	30.2	51.94	80.5	Pass

FCC§15.225(e) - FREQUENCY STABILITY

Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to PC, then to an external AC power supply and inductive antenna was connected to a Spectrum Analyzer. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable AC power supply Source. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.

Test Data

Environmental Conditions

Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2018-04-28.

Test Mode: Transmitting

Test Result: Pass

Voltage Supply (V _{DC})	Temperature (°C)	Measured Frequency (MHz)	Frequency Error (%)	Part 15.225 Limit
3.8V	-20	13.560096	0.00071%	$\pm 0.01\%$
	-10	13.560105	0.00077%	$\pm 0.01\%$
	0	13.560137	0.00101%	$\pm 0.01\%$
	10	13.560104	0.00077%	$\pm 0.01\%$
	20	13.560126	0.00093%	$\pm 0.01\%$
	30	13.560115	0.00085%	$\pm 0.01\%$
	40	13.560103	0.00076%	$\pm 0.01\%$
	50	13.560112	0.00083%	$\pm 0.01\%$
3.6V	20	13.560128	0.00094%	$\pm 0.01\%$
4.35V	20	13.560133	0.00098%	$\pm 0.01\%$

FCC§15.215(c) - 20dB EMISSION BANDWIDTH**Requirement**

Per 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the table of the chamber, Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

Test Data**Environmental Conditions**

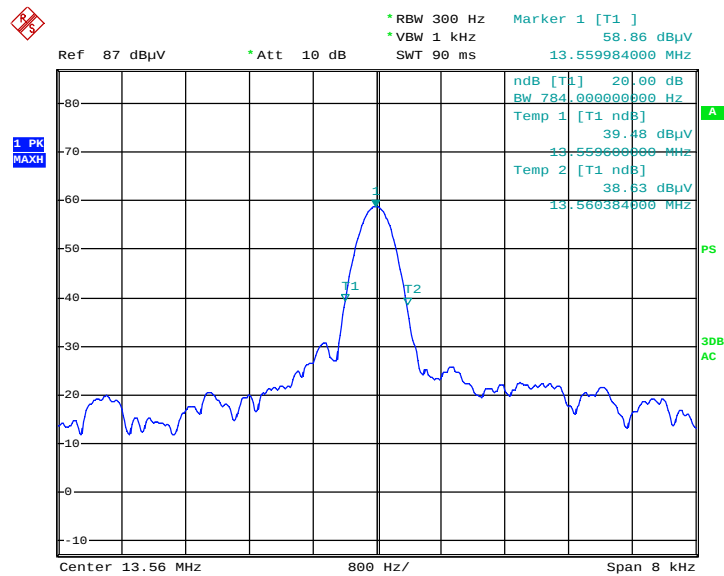
Temperature:	26 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2018-05-03.

Test Mode: Transmitting

Test Result: Pass

20 dB Emission Bandwidth



EUT
Date: 3.MAY.2018 21:27:24

***** END OF REPORT *****