Global No.1 Testing Laboratory Universal Certification Solution

FCC TEST REPORT

Product name:	30K
FCC ID:	S7A-SP46
Model:	SP46
Standards:	FCC CFR 47 PART 15 SUBPART C, Section 15.247
Applicant:	SENA TECHNOLOGIES.Inc
Test Report No.:	UCSFR-1709-006

UCS Co., Ltd.

#702, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 14056 Korea.
Tel: +82-1833-5681 / Fax: +82-31-420-5685 / Open Site: +82-31-355-2666
Online: http://www.ucs.co.kr

FCC Test Report

Report Number		UCSFR-1709-006		
Applicant	Company Name	SENA TECHNOLOGIES.Inc		
	Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul		
Product	Product Name	30K		
	FCC ID	S7A-SP46		
	Model No.	SP46		
	Family Model Name	-		
	Manufacturer	SENA TECHNOLOGIES.Inc		
	Serial No.	-	Country of origin	Korea
Other	Receipt Date	2017.09.07	Receipt Number	UCS-R-2017-1199
	Issued Date	2017.09.11	Tested Date	2017.09.07 ~ 2017.09.07
Standards		FCC CFR 47 PART 15 SUBPART C, Section 15.247		
Tested by		H. K. Lee (Sign)		
Approved by		T. Y. Yoon (Sign)		

UCS Co., Ltd.

#702, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 14056 Korea.
Tel : +82-1833-5681, Fax : +82-31-420-5685

Contents

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
UCSFR-1709-006	11-Sept-17	Initial Issue	All

1. Applicant Information

Applicant Name : SENA TECHNOLOGIES.Inc
Address : 19, Heolleung-ro 569-gil, Gangnam-gu, Seoul
Country of Origin : KOREA

2. EUT (Equipment under test) Information

Product name	30K
Basic Model name	SP46
Family Model Name	-
Power source	DC 3.7 V
Output Power	MAX 7.92dBm
Ferquency range	2 402 MHz ~ 2 480 MHz
Number of channels	40 Ch
Modulation Technique	GFSK
Antenna specification	Chip Antenna / 0 dBi (Peak Gain)

3. Laboratory Information

UCS Co., Ltd.

#702, 268, Hagui-ro, Dongan-gu, Anyang-si, Gyeonggi-do, 14056 Korea.

ER Center

- #35-13 Hwalcho-gil, 109beon-gil, Hwaseong-si, Gyeonggi-do, 18278 Korea

Test site

- FCC Registration Number: 767461
- This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.

4. Test Configuration and Condition

4.1 EUT operating condition

- The EUT had been tested under the operating condition.
- There are three channels have been tested as following:
- Channel Low and Channel High with higher data rate were chosen for full testing.

Channel	Frequency (MHz)
Low	2 402
Middle	2 440
High	2 480

- The measurements were taken in continuous transmitting mode using the TEST MODE.
- For controlling the EUT as TEST MODE, the test program and the cable assembly were provided by the applicant.

4.2 EUT modifications

- None

5. Summary of Test Results and Measurement Procedures

5.1 Summary of test results

Standard	Test Item	CFR 47 Section	Result
FCC CFR 47 PART 15 SUBPART C, Section 15.247	Spurious Emission, Band Edge, and Restricted bands	15.247(d), 15.209	PASS

- The tests were performed according to the method of measurements prescribed in KDB No.558074 D01 v04

5.2 Radiated emission test

Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10:2013 to determine the worse operating conditions. The radiated emissions measurements were performed on the 3 m open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

6. Test Results

6.1 Spurious emissions and band edge, restricted bands

6.1.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

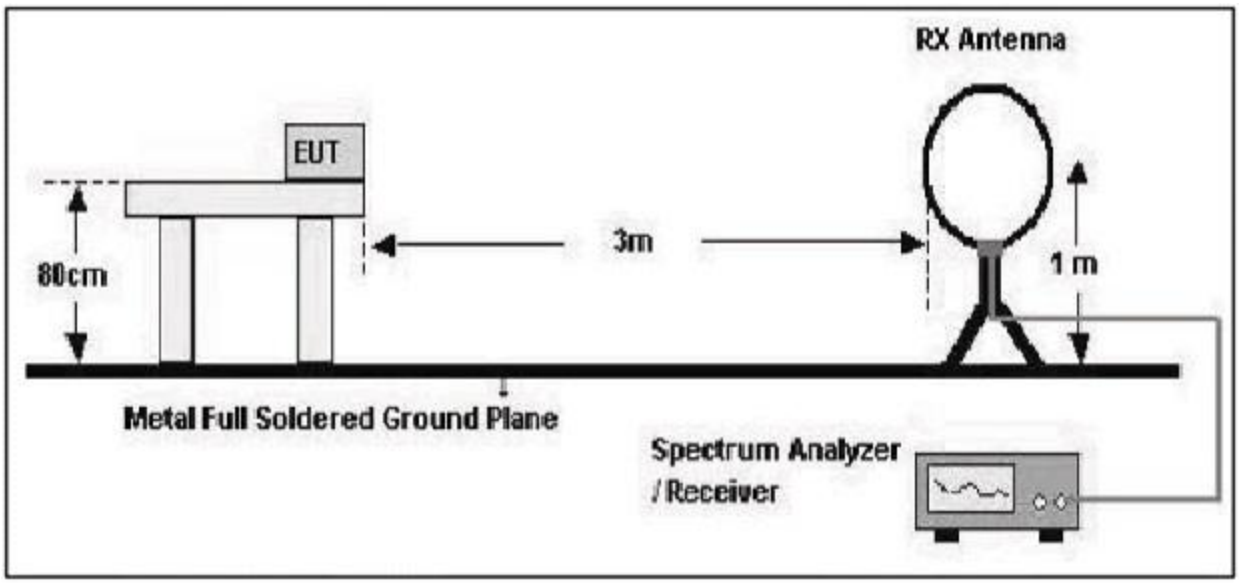
According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency [MHz]	Field strength [μV/m]	Field strength [dBμV/m]	Measurement distance [m]
0.009 ~ 0.490	2 400 / F (kHz)	-	300
0.490 ~ 1.705	24 000 / F (kHz)	-	30
1.705 ~ 30	30	29.54	30
30 ~ 88	100	40.00	3
88 ~ 216	150	43.52	3
216 ~ 960	200	46.02	3
Above 960	500	53.98	3

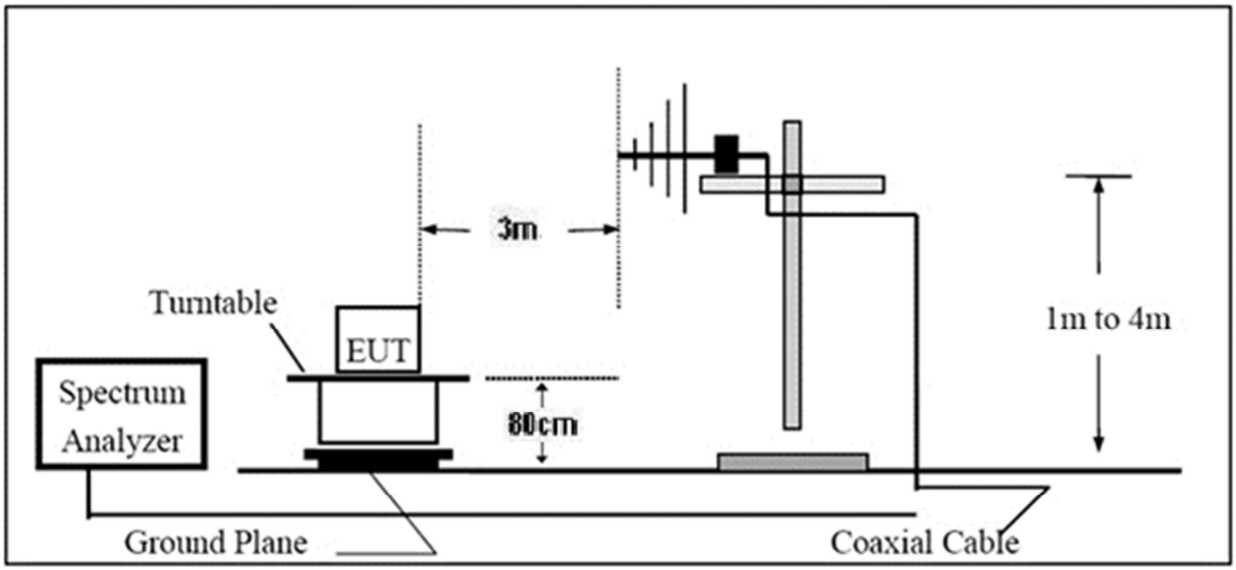
The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1 000 MHz are based on the average value of measured emissions.

6.1.2 Test setup layout

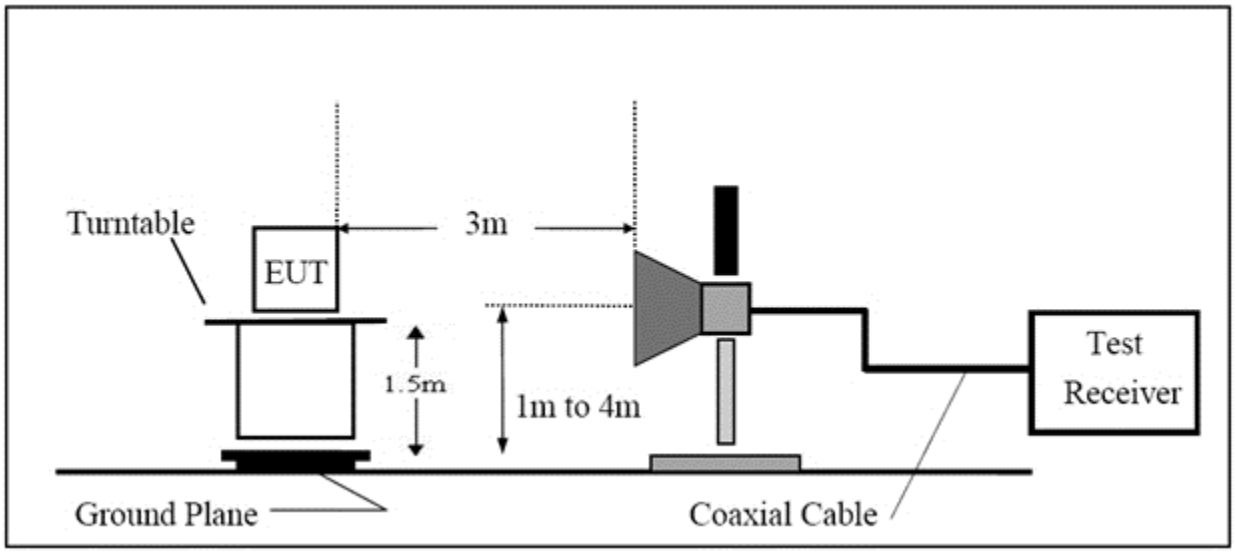
6.1.2.1 Radiated emission test set-up, frequency below 30 MHz



6.1.2.2 Radiated emission test set-up, frequency below 1 000 MHz



6.1.2.3 Radiated emission test set-up frequency above 1 000 MHz



6.1.3 Test procedure

1) Spurious radiated emissions:

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 MHz to 1 000 MHz using the Trilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.

4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a 4 × 4 meter at the Open Area Test Site. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

2) Marker-delta method at the edge of the authorized band of operation:

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the above Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1 % of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above spurious radiated emissions test procedure.

6.1.4 Results: Pass

Band-edge compliance of RF conducted/radiated emissions was shown in the 6.5.5 and 6.5.6

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Spurious RF conducted emissions were shown in the 6.5.7

NOTE: We took the insertion loss of the cable loss into consideration within the measuring instrument.

Table 1 : Measured values of the field strength of spurious emission

Frequency [MHz]	Detect Mode	Polarization [V/H]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
Average/Peak/Quasi-peak data, emissions below 30 MHz					
	It was not found any emissions peaks found from the EUT.				
Quasi-peak data, emissions below 1 000 MHz					
	It was not found any emissions peaks found from the EUT.				

* Remark: “H” Horizontal, “V” Vertical

* **Margin [dB]** = Emission Level [dBμV/m] – Limit [dBμV/m

Table 2 : Measured values of the field strength of spurious emission

Frequency [MHz]	Detect Mode	Polarization [V/H]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
Peak/Average data, emissions above 1 000 MHz					
	It was not found any emissions peaks found from the EUT.				

* Remark: “H” Horizontal, “V” Vertical

* **Margin [dB]** = Emission Level [dBμV/m] – Limit [dBμV/m]
* There are no emission that exceed the level of 6dB below the applicable limit

6.1.5 Data of the band edge (Radiated)

Table 3 : Measured values of the band edge

Frequency [MHz]		Detect Mode	Polarization [V/H]	Emission Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]
2 402	2 367.50	Peak	V	44.11	74.00	-29.89
	2 367.50	Average	V	31.18	54.00	-22.82
	2 389.71	Peak	H	50.82	74.00	-23.18
	2 389.71	Average	H	38.15	54.00	-15.85
2 480	2 491.58	Peak	V	56.52	74.00	-17.48
	2 491.58	Average	V	35.04	54.00	-18.96
	2 498.65	Peak	H	56.52	74.00	-17.48
	2 498.65	Average	H	36.69	54.00	-17.31

* Remark: “H” Horizontal, “V” Vertical

* **Margin [dB]** = Emission Level [dBμV/m] – Limit [dBμV/m]

7. Test Equipment Used For Test

Used	Description	Manufacturer	Model Name	Serial Number	Specifications	Next Cal. Data	Due Cal
■	Spectrum Analyzer	H.P	E4407B	US39010225	9 kHz ~ 26.5 GHz	2018-08-07	1 Year
□	Spectrum Analyzer	ROHDE & SCHWARZ	FSP13	100640	9 kHz ~ 13.6 GHz	2018-08-03	1 Year
■	Test Receiver	ROHDE & SCHWARZ	ESPI3	101171	9 kHz ~ 3 GHz	2018-08-03	1 Year
□	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESR7	101184	10 Hz ~ 7 GHz	2018-02-03	1 Year
■	BI-LOG ANT	SCHWARZBECK	VULB 9163	691	30 MHz ~ 1 GHz	2018-02-29	2 Years
■	Loop Antenna	EMCO	6502	9801-3191	9 kHz ~ 30 MHz	2018-02-04	2 Years
■	Horn antenna	Schwarzbeck	BBHA 9120D	769	1 GHz ~ 18 GHz	2017-10-29	2 Years
■	Horn antenna	Schwarzbeck	BBHA9170	BBHA9170178	18 GHz ~ 40 GHz	2018-11-02	2 Years
■	Amplifier	310N	291723	SONOMA	9 kHz ~ 1 GHz	2018-08-03	1 Year
■	Microwave Preamplifier	Agilent	8449B	3008A02014	1 GHz ~ 26.5 GHz	2018-02-02	1 Year
■	DC Source Meter	Maynuo	M8811	080010960011103046	30 V 5 A	2018-08-03	1 Year
□	Two-Line V-Network	ROHDE & SCHWARZ	ENV216	3560.6550.12-101874-Rq	9 kHz ~ 30 MHz	2018-08-03	1 Year
□	EPM-P SERIES POWER METER	Agilent	E4416A	GB38272722	1 CH 100-240 VAC	2018-08-03	1 Year
□	Power Sensor	Agilent	8481A	US41030240	MAX.23 dBm AVG, 18 GHz	2018-08-03	1 Year
□	LISN/AMN	PMM	L3-32	1220X20311	32 A - 6 h	2018-08-03	1 Year
□	PULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	100059	0 MHz ~ 30 MHz	2018-02-02	1 Year