RF TEST REPORT
No. 160401203SHA-001

Applicant	:	Ningbo Safen Electronics Technology Co.,Ltd Shigongshan Village, Longshan Town, Cixi City, Zhejiang Province, China
Manufacturer	:	Ningbo Safen Electronics Technology Co.,Ltd No. 1 Branch road, Taoyuan Road Guanhaiwei Town, Cixi City, Zhejiang Province, China
Product Name	:	Remote Controller
Type/Model	:	SFC103
TEST RESULT	**:**	**PASS**

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2016): Radio Frequency Devices

ANSI C63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices

Date of issue: August 12, 2016, 2016

Prepared by:

Wade Zhang

Wade Zhang (*Project Engineer*)

Reviewed by:

Daniel . Zhao

Daniel Zhao (*Reviewer*)

Description of Test Facility

Name: Intertek Testing Services Limited Shanghai
Address: Building No.86, 1198 Qinzhou Road(North), Shanghai 200233, P.R. China

FCC Registration Number: 236597
IC Assigned Code: 2042B-1

Name of contact: Jonny Jing
Tel: +86 21 64956565 ext. 271
Fax: +86 21 54262335 ext. 271

Content

SUMMARY 1
DESCRIPTION OF TEST FACILITY 2
1. GENERAL INFORMATION 4
1.1 Applicant Information 4
1.2 Identification of the EUT 4
1.3 Technical specification 4
1.4 Mode of operation during the test / Test peripherals used 5
2. TEST SPECIFICATION 6
2.1 Instrument list 6
2.2 Test Standard 6
2.3 Test Summary 7
3. FUNDAMENTAL & SPURIOUS EMISSION & RESTRICT BAND RADIATED EMISSION 8
3.1 Test limit 8
3.2 Test Configuration 9
3.3 Test procedure and test setup 9
3.4 Test protocol 10
4. DEACTIVATING TIME 13
4.1 Test limit 13
4.2 Test Configuration 13
4.3 Test procedure and test setup 14
4.4 Test protocol 14
5. POWER LINE CONDUCTED EMISSION 15
5.1 Limit 15
5.2 Test configuration 15
5.3 Test procedure and test set up 16
5.4 Test protocol 16
6. EMISSION BANDWIDTH 17
6.1 Test limit 17
6.2 Test Configuration 17
6.3 Test procedure and test setup 17
6.4 Test protocol 18
7. DUTY CYCLE 19

1. General Information

1.1 Applicant Information

Applicant	:	Ningbo Safen Electronics Technology Co.,Ltd Shigongshan Village, Longshan Town, Cixi City, Zhejiang Province, China
Name of contact	:	Wang Hardy
Tel	:	13817862372
Fax	:	0574-63537803
Manufacturer	:	Ningbo Safen Electronics Technology Co.,Ltd No. 1 Branch road, Taoyuan Road Guanhaiwei Town, Cixi City, Zhejiang Province, China

1.2 Identification of the EUT

Equipment	:	Remote Controller
Type/model	:	SFC103
FCC ID	:	2AH6M-C13

1.3 Technical specification

Operation Frequency Band	:	433.92MHz
Rating	:	DC12V
Modulation	:	ASK
Antenna Designation	:	Integral antenna, non-user removable
Gain of Antenna	:	0dBi
Channel Description	:	There is one channel only, namely 433.92MHz.
Description of EUT	:	There have only one model. The EUT is a transmitter to control the working condition of the corresponding receiver.
Category of EUT	:	Class B
EUT type	:	☒ Table top☐ Floor standing
Sample received date	:	May 24, 2016
Sample Identification No	:	*0160524-37-001*
Date of test	:	May 25, 2016 ~ June 17, 2016

1.4 Mode of operation during the test / Test peripherals used

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.

The EUT is a handheld device, so three axes (X, Y, Z) were observed while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded.

2. Test Specification

2.1 Instrument list

Selected	Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
☒	PXA Analyzer	N9030A	Agilent	EC5338	2016/3/4	2017/3/3
☒	Vector SG	N5182B	Agilent	EC5175	2016/3/4	2017/3/3
☒	Power sensor	U2021XA	Agilent	EC5338-1	2016/3/4	2017/3/3
☒	MXG Analog SG	N5181A	Agilent	EC5338-2	2016/3/4	2017/3/3
☒	Power meter	N1911A/N1921A	Agilent	EC4318	2016/4/10	2017/4/9
☒	EMI chamber	3m	Albatross	EC 3048	2016/5/5	2017/5/4
☒	Test Receiver	ESIB 26	R&S	EC 3045	2015/10/20	2016/10/19
☒	Test Receiver	ESCI 7	R&S	EC4501	2016/2/24	2017/2/23
☒	Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2016/5/30	2017/5/29
☒	Horn antenna	HF 906	R&S	EC 3049	2015/9/12	2016/9/11
☒	Horn antenna	HAP18-26W	TOYO	EC 4792-3	2014/6/12	2017/6/11
☒	Pre-amplifier	Pre-amp 18	R&S	EC 5262	2016/5/24	2017/5/23
☒	Pre-amplifier	Tpa0118-40	R&S	EC 4792-2	2016/4/11	2017/4/10

2.2 Test Standard

47CFR Part 15:2016
ANSI C63.10: 2013

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	RESULT
Fundamental & spurious emission	15.231(b)	Pass
Restrict band radiated emission	15.205	Pass
Power line conducted emission	15.207	NA
Emission bandwidth	15.231(c)	Pass
Deactivating time	15.231(a)(1)	Pass

3. Fundamental & Spurious Emission & Restrict band radiated emission

Test result: PASS

3.1 Test limit

3.1.1 The emission shall test through the 10th harmonic or to 40GHz, whichever is lower. It must comply with the limits below:

Fundamental Frequency (MHz)	Fundamental limit (uV/m)	Spurious limit (uV/m)
☐ 40.66 – 40.70	2250	225
☐ 70 – 130	1250	125
☐ 130 - 174	1250 to 3750	125 to 375
☐ 174 - 260	3750	375
☒ 260 – 470	3750 to 12500	375 to 1250
☐ Above 470	12500	1250

The formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(Frequency) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(Frequency) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

For that the EUT use fundamental frequency of 433.92MHz, after calculation, the limit is:

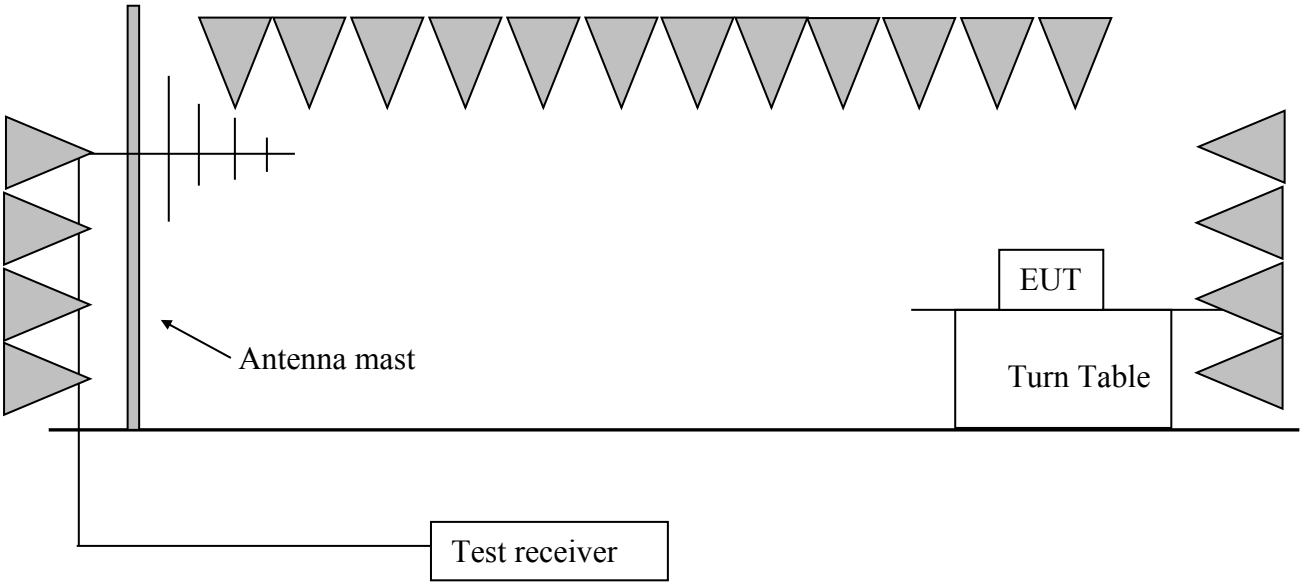
Fundamental limit = 41.6667 * 433.92 - 7083.3333 = 10996.68 uV/m = 80.80dBuV/m
Spurious limit = 81 – 20 = 60.80dBuV/m

//

3.1.2 The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

3.2 Test Configuration



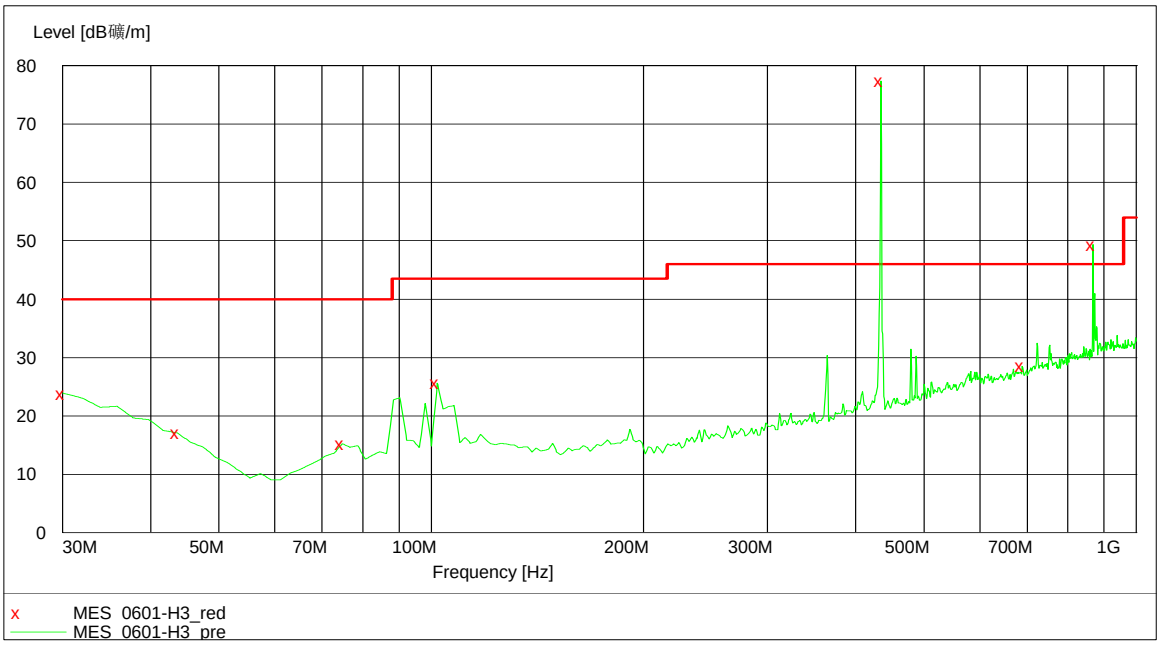
3.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, the pre-amplifier and high pass filter is equipped just at the output terminal of the antenna.
The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.
Both horizontal and vertical polarities of the receiving antenna were assessed and the higher reading was listed in this report.
The radiated emission was measured using the test receiver with the resolutions bandwidth set as:
RBW=300 Hz, VBW=1 kHz (9 kHz~150 kHz);
RBW=10kHz, VBW=30kHz (150kHz~30MHz);
RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

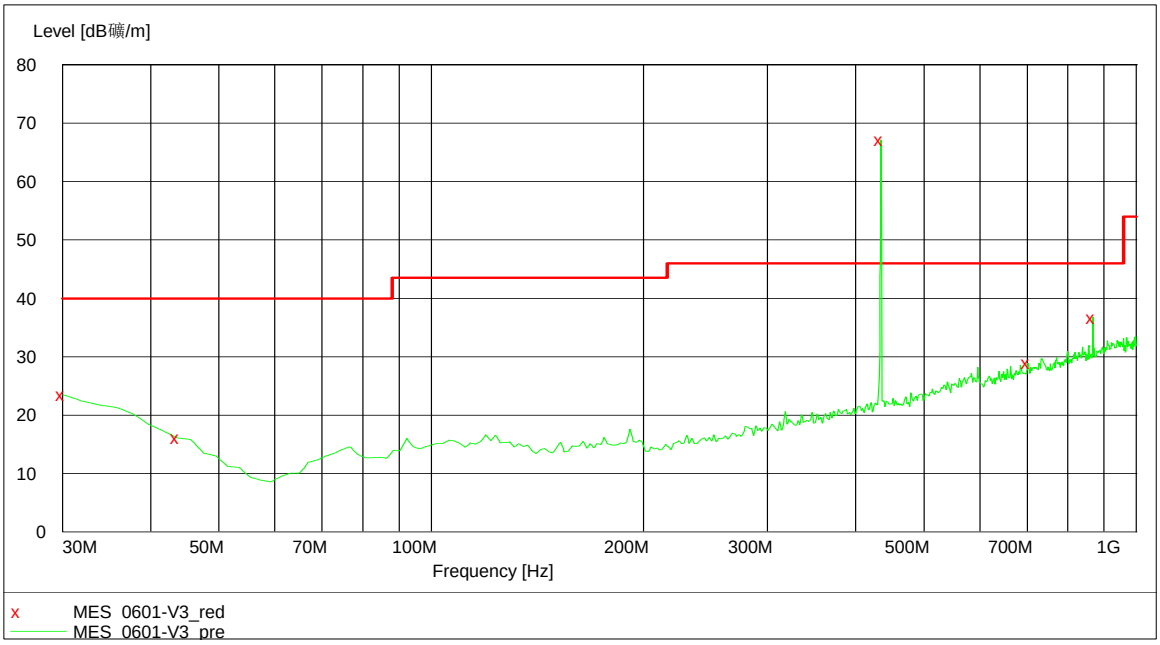
3.4 Test protocol

Temperature: 22°C
Relative humidity: 52%

Polarization: Horizontal



Polarization: Vertical



Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Emission Type	Limit (dBuV/m)	Margin	Detector
H	433.92	18.30	77.40	Fundamental	100.80	23.40	PK
H	867.82	25.10	49.30	Harmonics	80.80	31.50	PK
H	30.00	21.40	23.90	Harmonics	80.80	56.90	PK
H	43.61	13.90	17.10	Harmonics	80.80	63.70	PK
H	688.98	22.70	28.50	Harmonics	80.80	52.30	PK
H	1274.25	-18.40	54.50	Harmonics	80.80	26.30	PK
H	1715.24	-15.60	47.30	Harmonics	80.80	33.50	PK
V	433.92	18.30	67.10	Fundamental	100.80	33.70	PK
V	867.82	25.10	36.70	Harmonics	80.80	44.10	PK
V	30.00	21.40	23.50	Harmonics	80.80	57.30	PK
V	43.61	13.90	16.10	Harmonics	80.80	64.70	PK
V	702.59	22.90	28.90	Harmonics	80.80	51.90	PK
V	1272.32	-18.40	50.40	Harmonics	80.80	30.40	PK
V	1715.42	-15.60	43.70	Harmonics	80.80	37.10	PK
V	3909.23	-2.70	38.40	Restrict	74.00	35.60	PK
H	407.20	17.40	23.60	Restrict	46.00	22.40	PK
H	1722.50	-10.00	33.30	Restrict	74.00	40.70	PK

Remark: 1.Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz)
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. If PK reading is less than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV, limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m; Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

Calculating the AV value according to the duty cycle

Antenna	Frequency (MHz)	PK Reading (dBuV/m)	Correct Factor (dB)	AV Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	433.92	77.40	-7.80	69.6	80.80	11.2
H	867.82	49.30		41.5	60.80	19.3
H	1274.25	54.50		46.7	60.80	14.1
H	1715.24	47.30		39.5	60.80	21.3
V	433.92	67.10		59.3	80.80	21.5
V	867.82	36.70		28.9	60.80	31.9
V	1272.32	43.70		35.9	60.80	24.9
V	1715.42	38.40		30.6	60.80	30.2

Remark: 1.Correct Factor = 20lg (duty cycle) = 20lg (0.4075) = -7.80
2. AV Reading = PK Reading + Correct Factor
3. Margin = limit - AV Reading

4. Deactivating time

Test result: **PASS**

4.1 Test limit

☒ (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

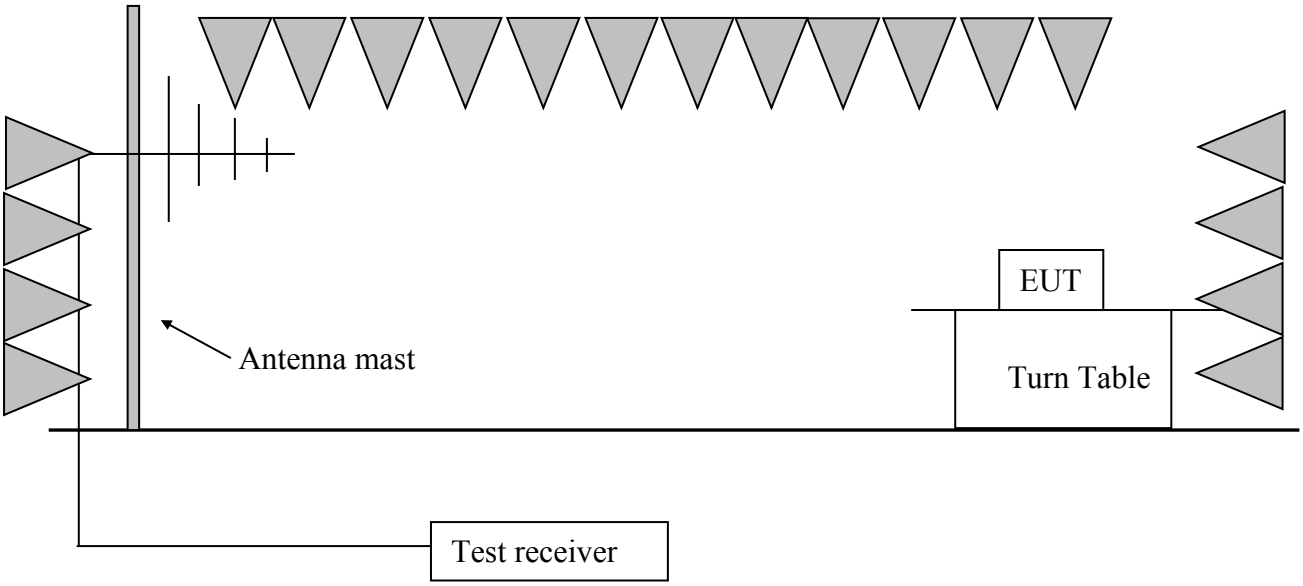
☐ (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

☐ (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

☐ (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

☐ (5) Transmission of set-up information for security systems may exceed the transmission duration limits in (1) and (2) above, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

4.2 Test Configuration

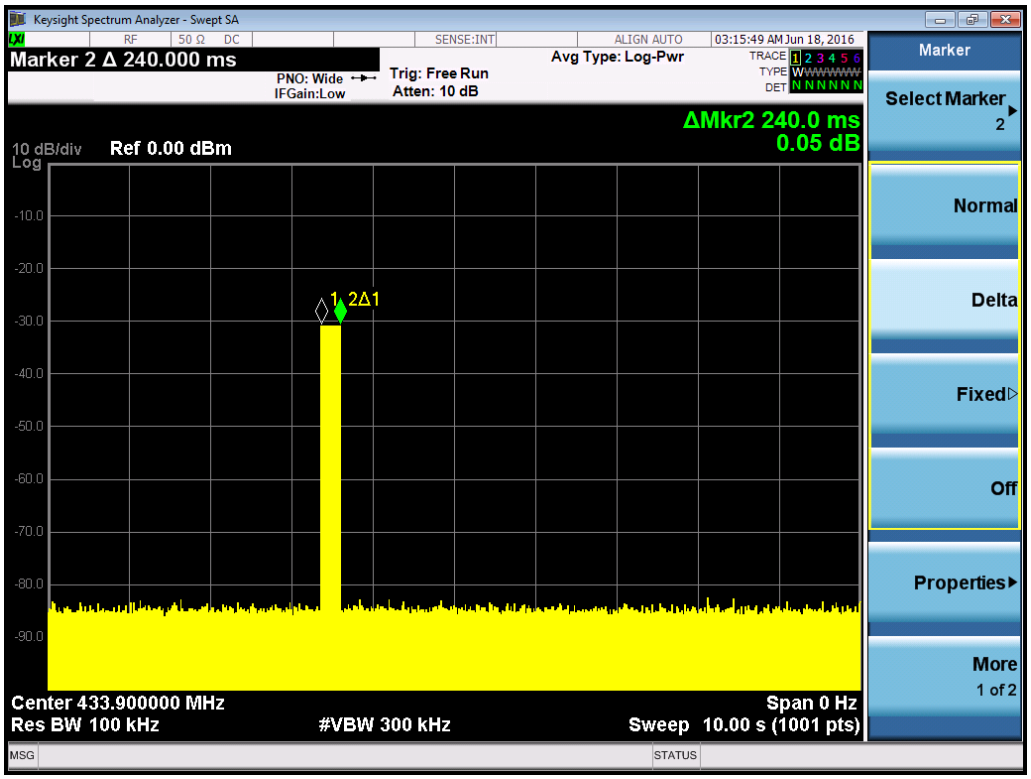


4.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber.
The central frequency of test receiver was set as the operating frequency of EUT and the Span was set as 0.
The EUT was switched once. The test receiver recorded the whole time from the triggered moment to the time of stopping radiating. For manual switching, to avoid uncertainty, the operating above would be repeated five times and the worst data is recorded.

4.4 Test protocol

Whole time from the triggered moment to the time of stopping radiating: 220ms.
As a result, the EUT complies with the limit of 5s' deactivating time.



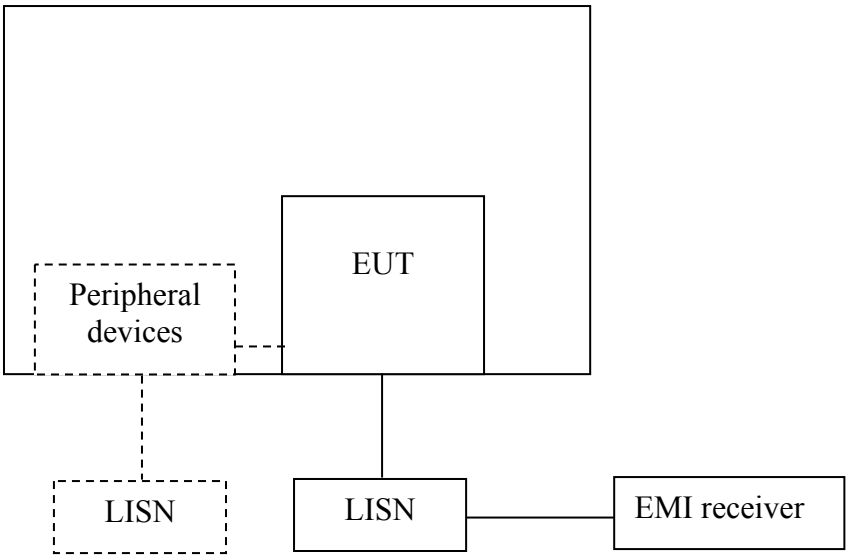
5. Power line conducted emission

Test result: **NA**

5.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

5.2 Test configuration



☐ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

5.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50Ω/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50Ω/50uH coupling impedance with 50Ω termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement.
The bandwidth of the test receiver is set at 9 kHz.

5.4 Test protocol

N/A

6. Emission Bandwidth

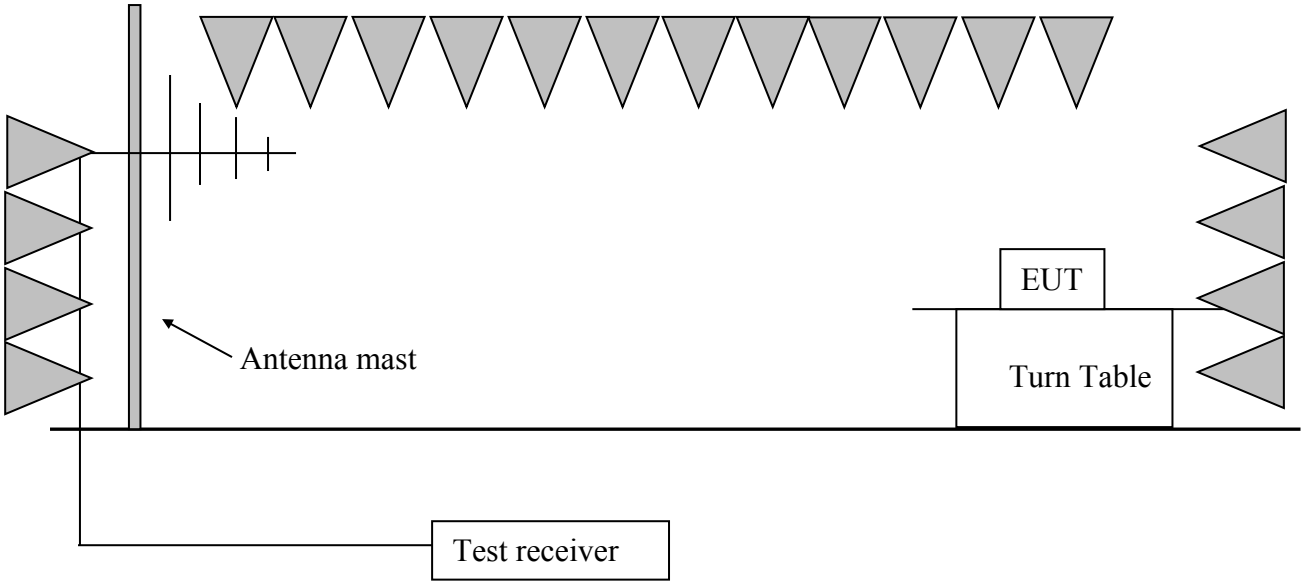
Test result: **PASS**

6.1 Test limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier.

The limit for the EUT = 0.25% * 433.92MHz = 1085kHz

6.2 Test Configuration



6.3 Test procedure and test setup

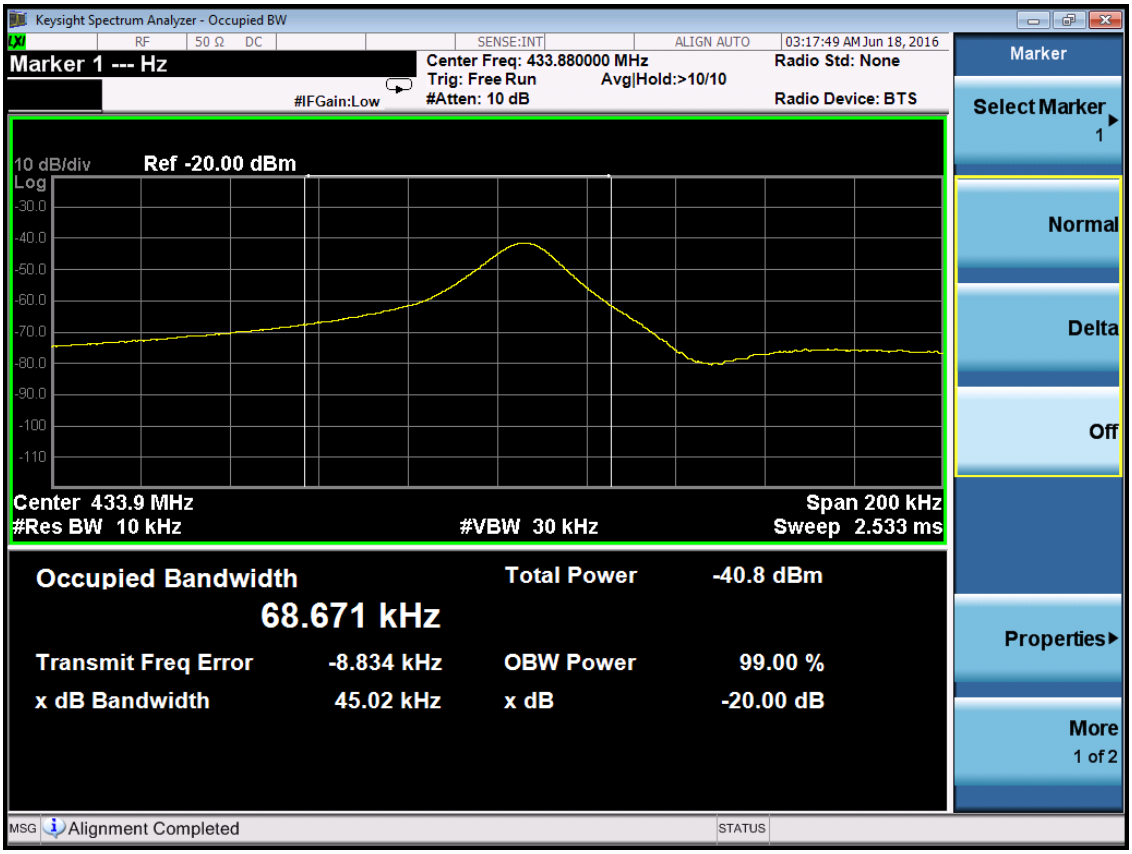
The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.
The central frequency of test receiver was set near the operating frequency of EUT.
The test was conducted using the Spectrum Analyzer with the resolutions bandwidth set at 10kHz, the video bandwidth set at 30kHz.

6.4 Test protocol

Temperature : 25 °C

Relative Humidity : 55 %

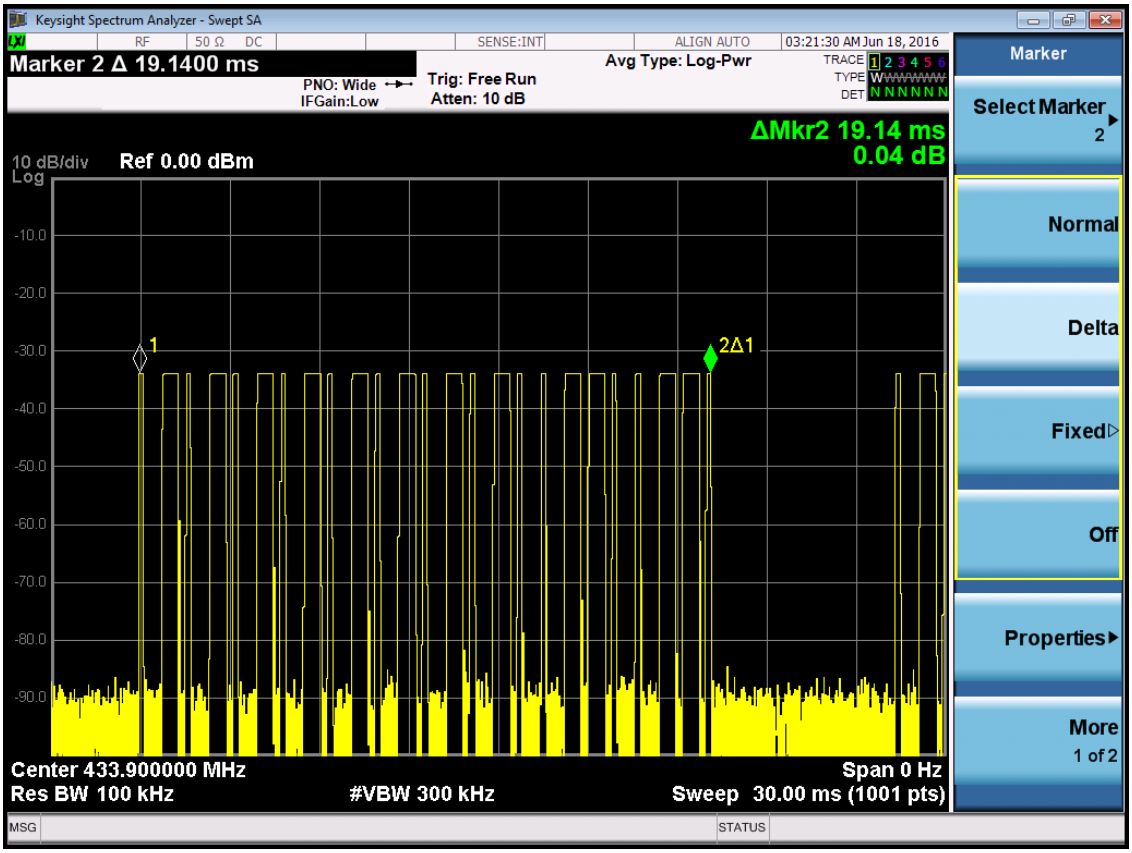
Model	Emission Bandwidth (kHz)	Limit (kHz)
SFC103	45.02	1085

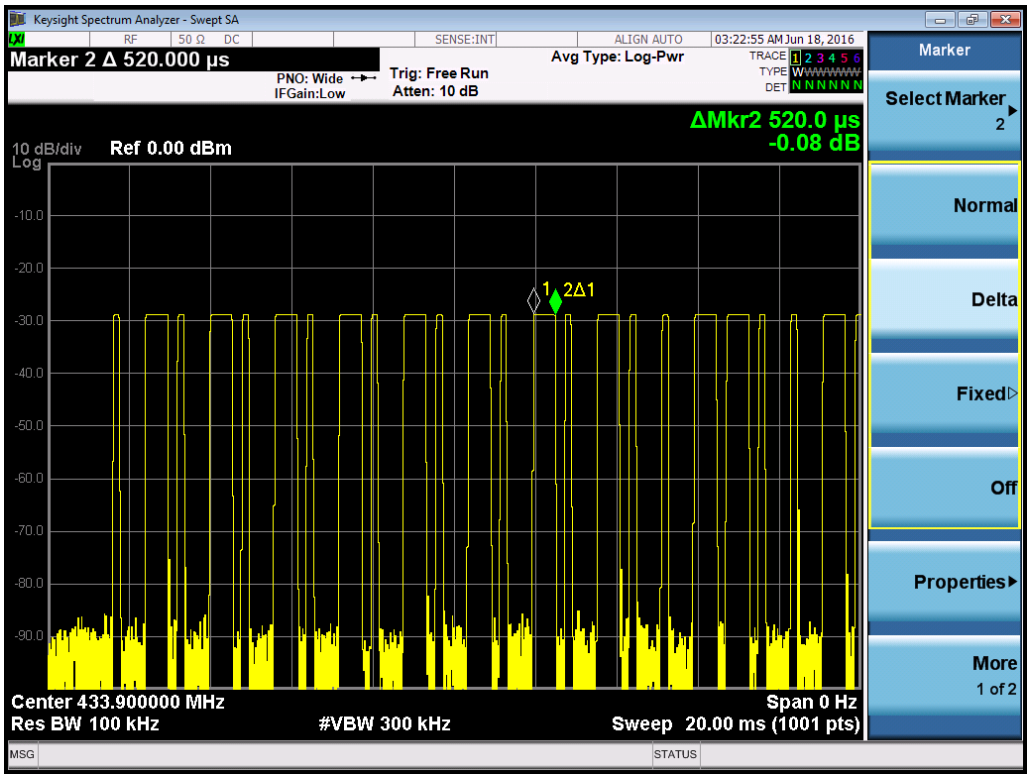


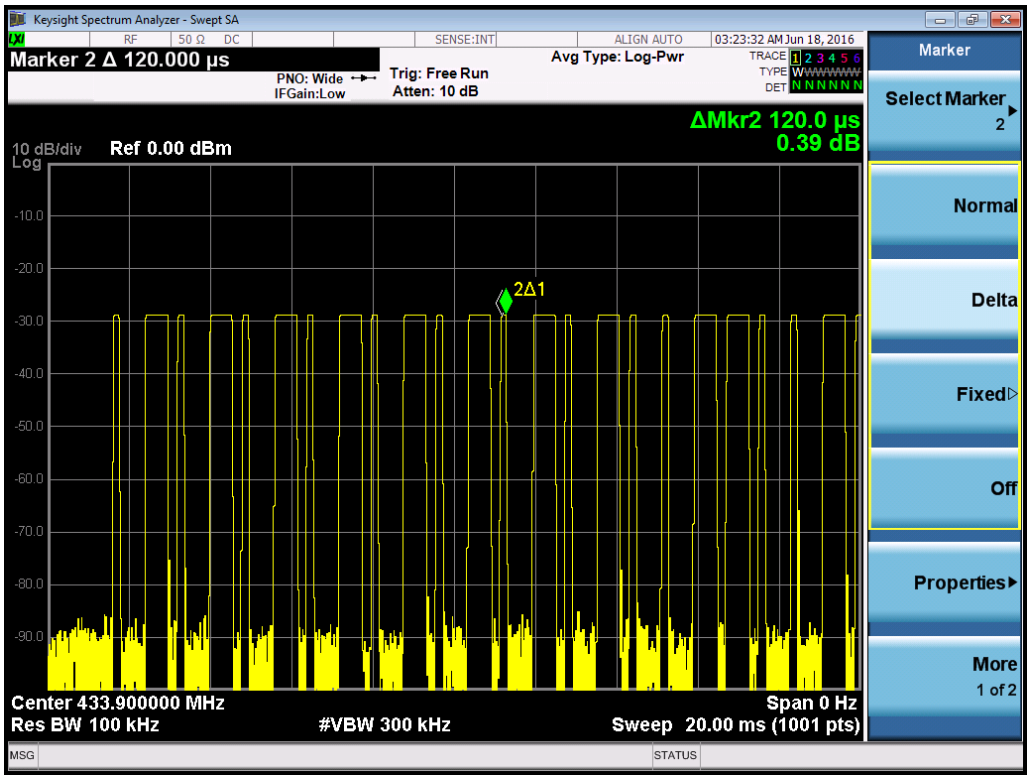
7. Duty Cycle

The test data with maximum duty cycle was listed below.

The worst Duty cycle= (0.52*12+0.12*13) / 19.14 = 0.4075




Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
03:22:55 AM Jun 18, 2016
Marker 2 Δ 520.000 µs
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET N N N N N N
ΔMkr2 520.0 µs
-0.08 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1 2Δ1
Center 433.900000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
MSG
STATUS
Marker
Select Marker
2
Normal
Delta
Fixed
Off
Properties
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω DC
SENSE:INT
ALIGN AUTO
03:23:32 AM Jun 18, 2016
Marker 2 Δ 120.000 µs
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET N N N N N N
ΔMkr2 120.0 µs
0.39 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
2Δ1
Center 433.900000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 20.00 ms (1001 pts)
MSG
STATUS
Marker
Select Marker
2
Normal
Delta
Fixed
Off
Properties
More
1 of 2