

RF TEST REPORT

No. 160401203SHA-002

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 : SFC105

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

Prepared by:



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1. General Information

1.1 Applicant Information

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Province, China

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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 : SFC105

FCC ID : 2AH6M-C15

1.3 Technical specification

Operation Frequency : 433.92MHz

Band

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 : *0160524-37-002*

No

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
<input checked="" type="checkbox"/>	PXA Analyzer	N9030A	Agilent	EC5338	2016/3/4	2017/3/3
<input checked="" type="checkbox"/>	Vector SG	N5182B	Agilent	EC5175	2016/3/4	2017/3/3
<input checked="" type="checkbox"/>	Power sensor	U2021XA	Agilent	EC5338-1	2016/3/4	2017/3/3
<input checked="" type="checkbox"/>	MXG Analog SG	N5181A	Agilent	EC5338-2	2016/3/4	2017/3/3
<input checked="" type="checkbox"/>	Power meter	N1911A/N1921A	Agilent	EC4318	2016/4/10	2017/4/9
<input checked="" type="checkbox"/>	EMI chamber	3m	Albatross	EC 3048	2016/5/5	2017/5/4
<input checked="" type="checkbox"/>	Test Receiver	ESIB 26	R&S	EC 3045	2015/10/20	2016/10/19
<input checked="" type="checkbox"/>	Test Receiver	ESCI 7	R&S	EC4501	2016/2/24	2017/2/23
<input checked="" type="checkbox"/>	Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2016/5/30	2017/5/29
<input checked="" type="checkbox"/>	Horn antenna	HF 906	R&S	EC 3049	2015/9/12	2016/9/11
<input checked="" type="checkbox"/>	Horn antenna	HAP18-26W	TOYO	EC 4792-3	2014/6/12	2017/6/11
<input checked="" type="checkbox"/>	Pre-amplifier	Pre-amp 18	R&S	EC 5262	2016/5/24	2017/5/23
<input checked="" type="checkbox"/>	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 REFERENCE	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

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Test result: PASS

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

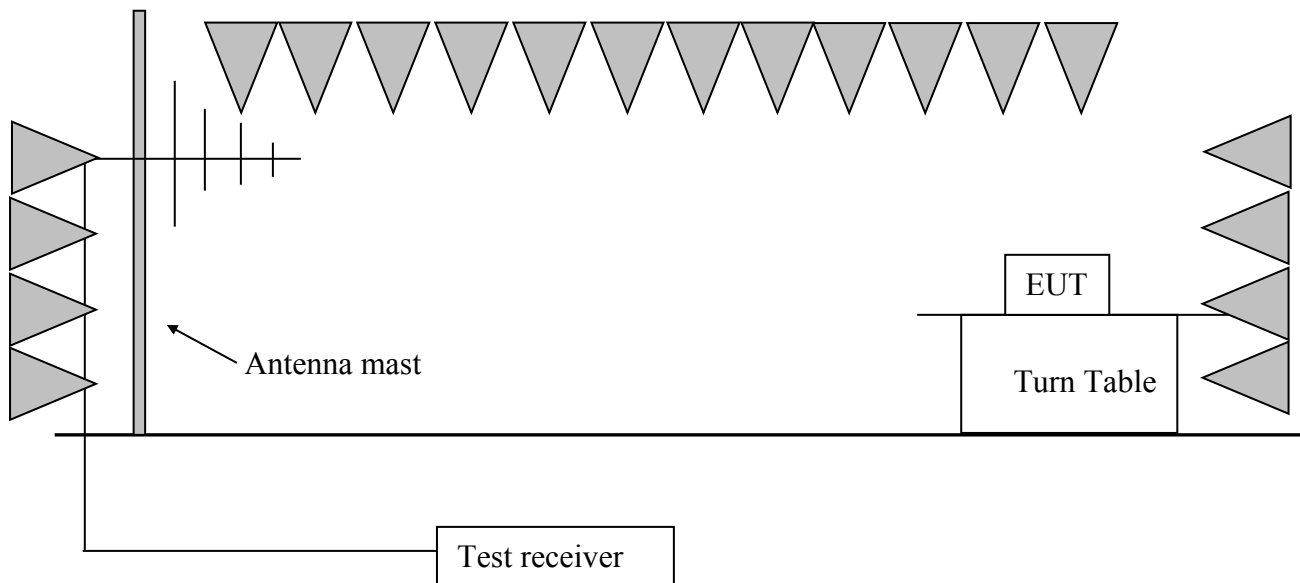
The formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(Frequency) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(Frequency) - 7083.3333. The maximum permitted unwanted emission level is 20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

Fundamental limit = $41.6667 * 433.92 - 7083.3333 = 10996.68 \text{ uV/m} = 80.80 \text{ dBuV/m}$
 Spurious limit = $81 - 20 = 60.80 \text{ dBuV/m}$

////////////////////////////////////

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)

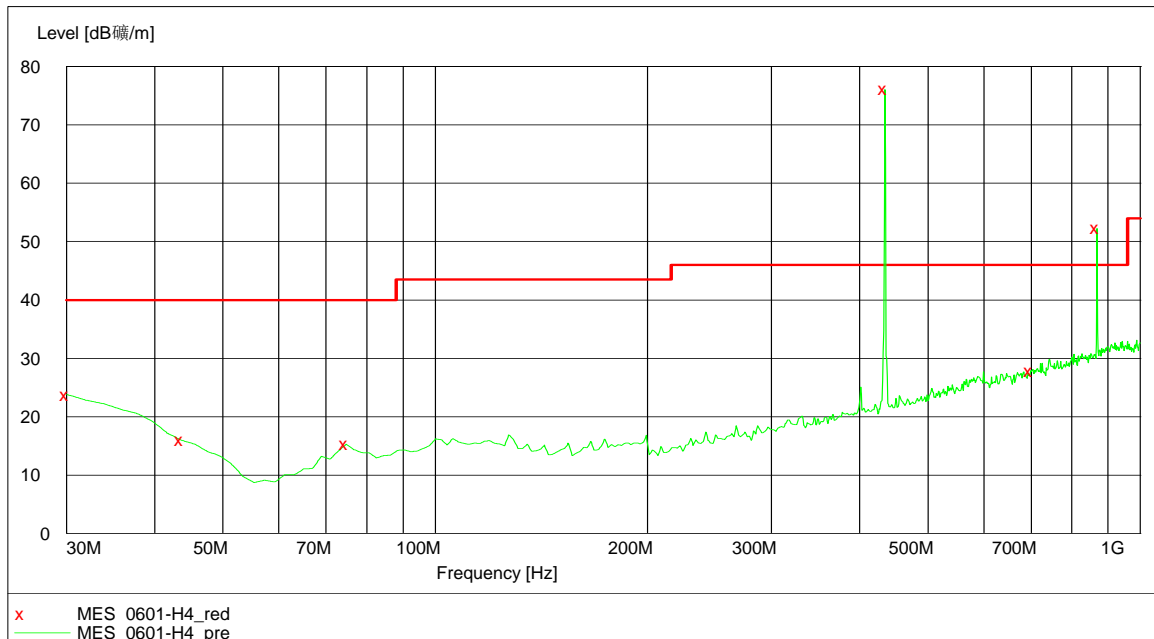
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

3.4 Test protocol

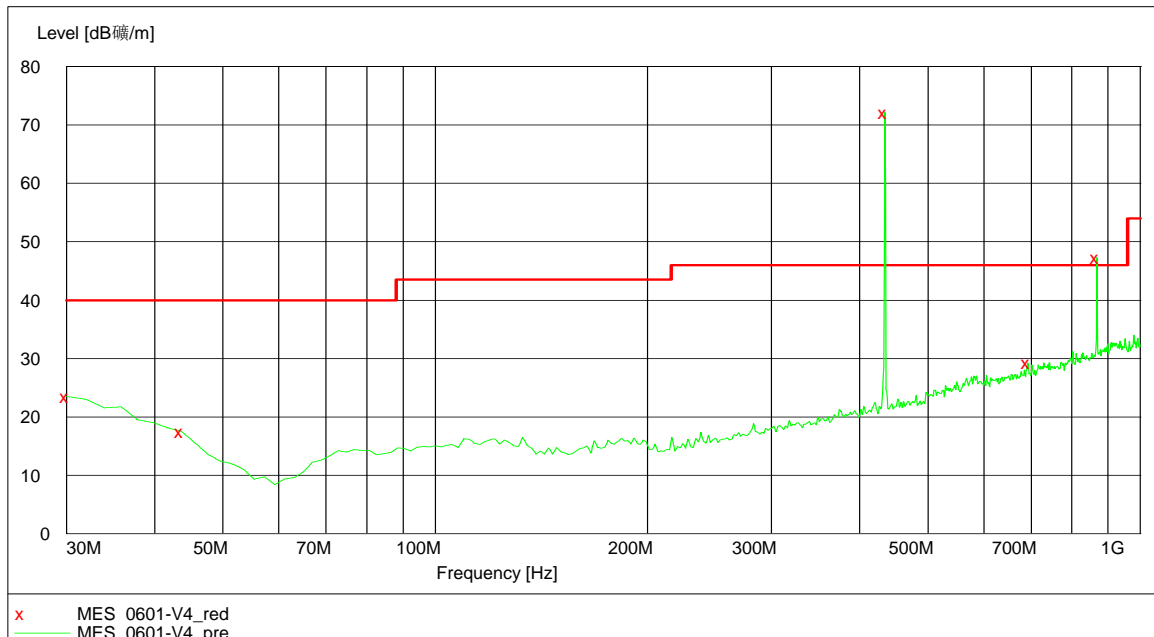
Temperature: 22°C

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	76.10	Fundamental	100.80	24.70	PK
H	867.82	25.10	52.30	Harmonics	80.80	28.50	PK
H	30.00	21.40	23.80	Harmonics	80.80	57.00	PK
H	43.61	13.90	16.00	Harmonics	80.80	64.80	PK
H	698.70	22.80	27.90	Harmonics	80.80	52.90	PK
H	1274.21	-18.40	54.30	Harmonics	80.80	26.50	PK
H	1715.26	-15.60	47.20	Harmonics	80.80	33.60	PK
V	433.92	18.30	72.10	Fundamental	100.80	28.70	PK
V	867.82	25.10	47.30	Harmonics	80.80	33.50	PK
V	30.00	21.40	23.50	Harmonics	80.80	57.30	PK
V	43.61	13.90	17.50	Harmonics	80.80	63.30	PK
V	692.87	22.80	29.30	Harmonics	80.80	51.50	PK
V	1272.54	-18.40	55.70	Harmonics	80.80	25.10	PK
V	1715.43	-15.60	48.10	Harmonics	80.80	32.70	PK
V	3909.81	-2.70	38.40	Restrict	74.00	35.60	PK
H	407.00	17.40	23.60	Restrict	46.00	22.40	PK
H	1722.40	-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	76.10	-8.03	68.07	80.80	12.73
H	867.82	52.30		44.27	60.80	16.53
H	1274.21	54.30		46.27	60.80	14.53
H	1715.26	47.20		39.17	60.80	21.63
V	433.92	72.10		64.07	80.80	16.73
V	867.82	47.30		39.27	60.80	21.53
V	1272.54	55.70		47.67	60.80	13.13
V	1715.43	48.10		40.07	60.80	20.73

Remark: 1. Correct Factor = $20\lg(\text{duty cycle}) = 20\lg(0.3967) = -7.75$

2. AV Reading = PK Reading + Correct Factor

3. Margin = limit - AV Reading

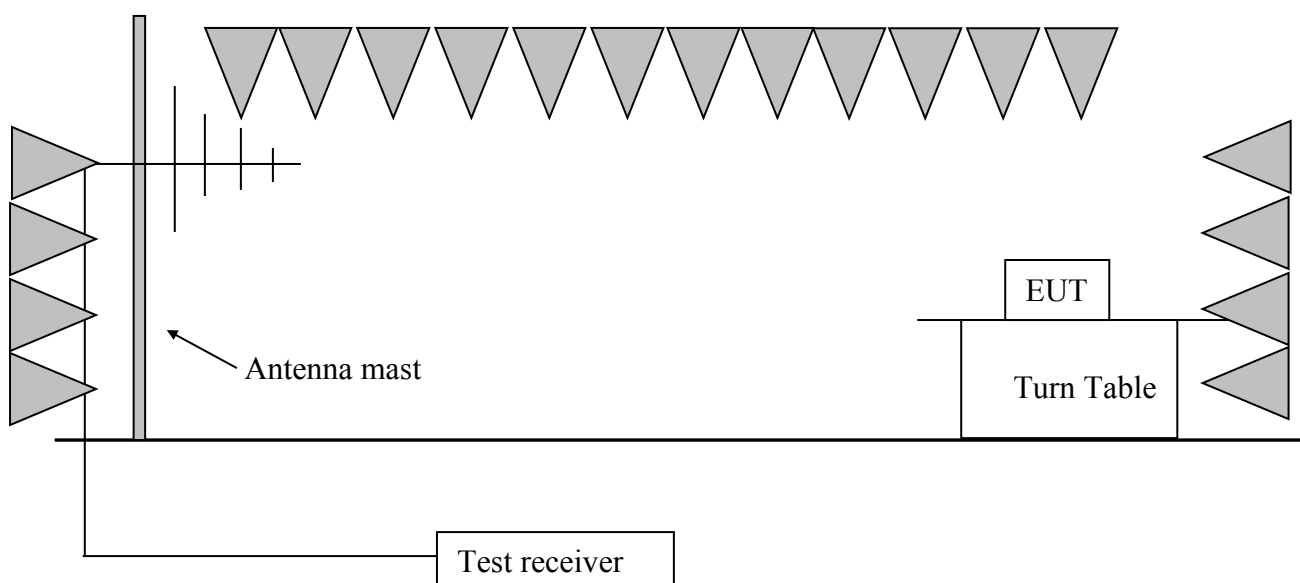
4. Deactivating time

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.

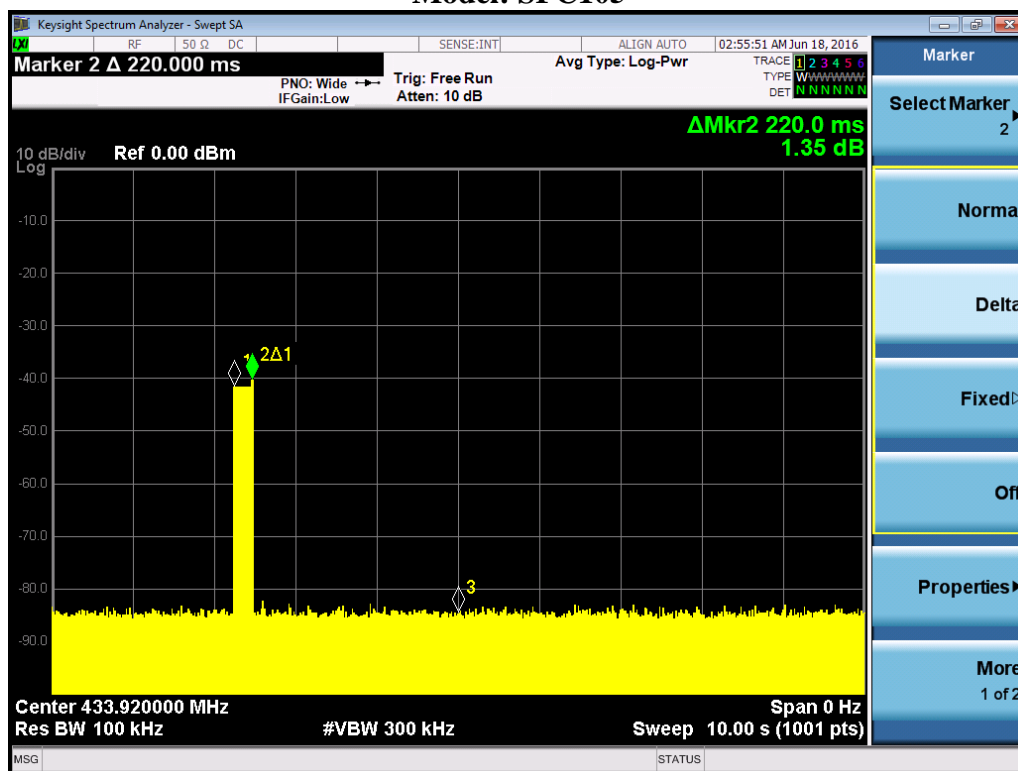
The EUT was switched once. The test receiver recorded the whole time from the triggered moment to the time of stopping radiating. For manual switching, to avoid uncertainty, the operating above would be repeated five times and the worst data is recorded.

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.

Model: SFC105



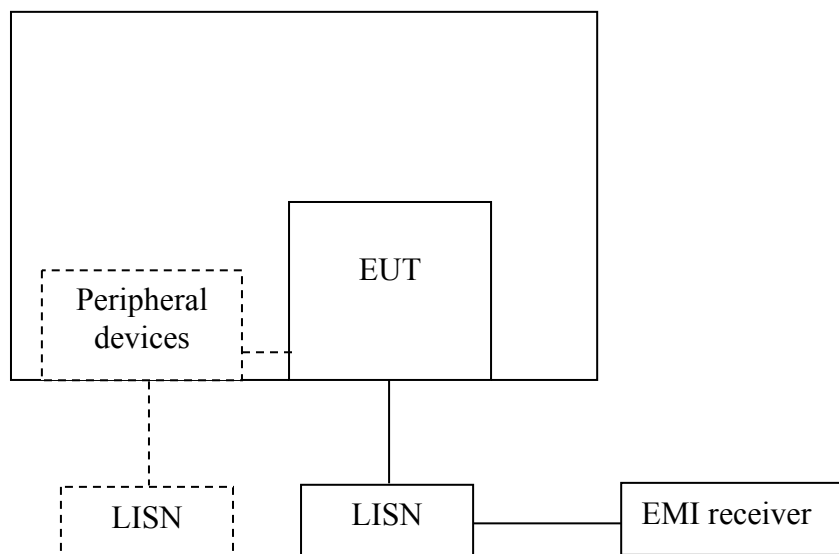
5. Power line conducted emission

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 $50\Omega/50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega/50\mu\text{H}$ 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

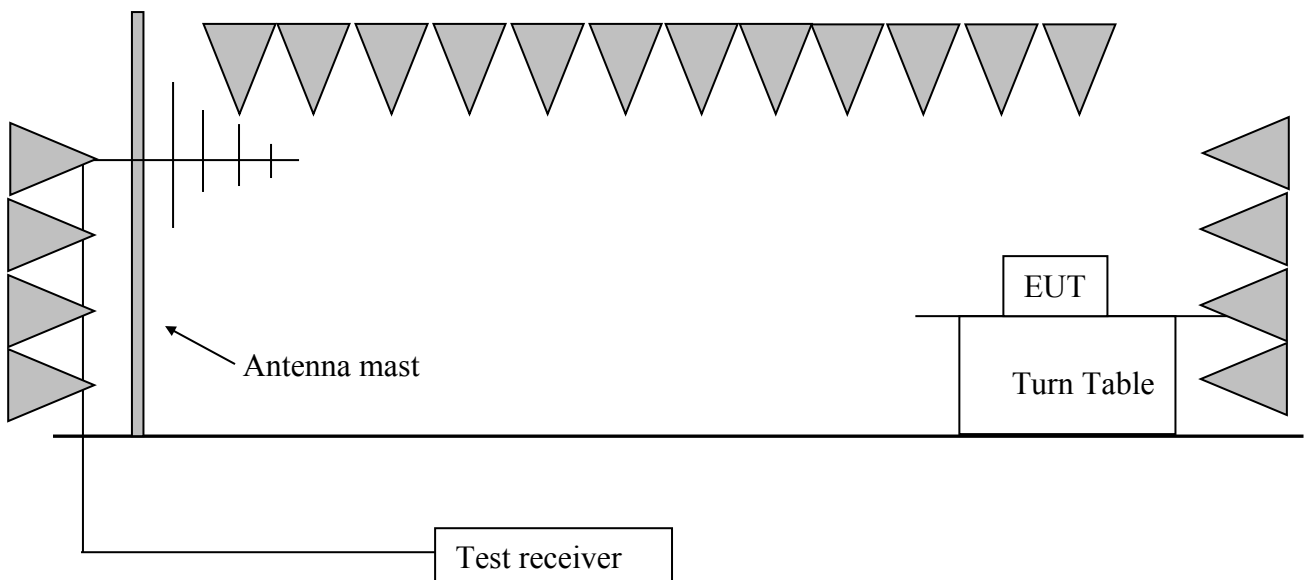
Test result: **PASS**

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 = $0.25\% * 433.92\text{MHz} = 1085\text{kHz}$

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 1 meter to 4 meters to find out the maximum emission level.

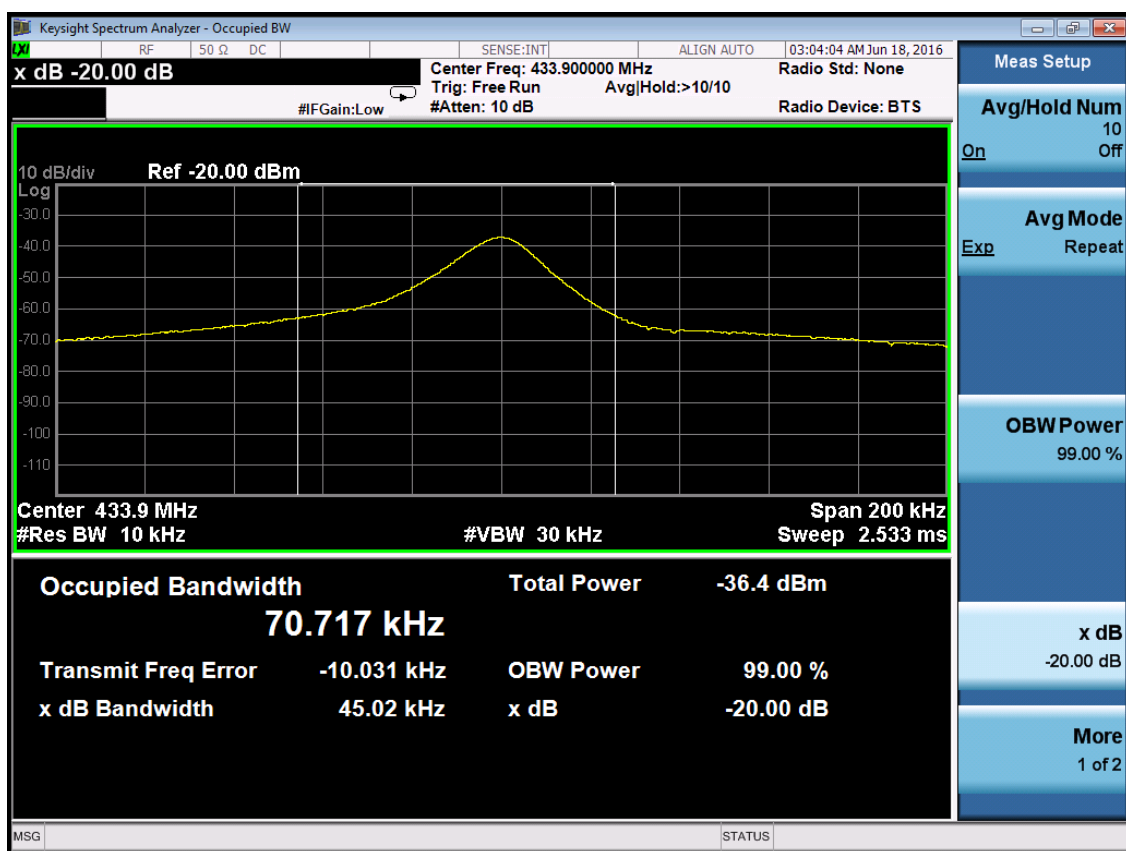
The central frequency of test receiver was set near the operating frequency of EUT.

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)
SFC105	45.02	1085



7. Duty Cycle

SFC105:

The test data with maximum duty cycle was listed below.

The worst Duty cycle= $(0.48 \times 12 + 0.12 \times 13) / 18.45 = 0.3967$

