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FCC TEST REPORT

Under:
FCC 15 Subpart C, Paragraph 15.209
Operation within the bands 125 kHz
DCD - Part 15 Low Power Transmitter Below 1705 kHz

Prepared For:

Grandstream Networks, Inc.

126 Brookline Ave, 3rd Floor Boston, MA 02215, USA

FCC ID: YZZGDS3705
EUT: IP Audio Door System
Model: GDS3705

May 30, 2018 **Issue Date:**
Original Report **Report Type:**
Test Engineer: Jacky Huang
Review By: Apollo Liu / Manager

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Report Revision History

Report #	Version	Description	Issued Date
KSZ2018032301J01	Rev.01	Initial issue of report	April 23, 2018
KSZ2018032301J01	Rev.02	Update section 4.7 & 7.2 & 9	May 30, 2018

1. General Information

1. 1 Notes

The test results of this report relate exclusively to the test item specified in 1.6. The KMO Lab does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the KMO Lab.

1. 2 Testing Laboratory

Test Firm Name:	**Ke Mei Ou Lab Co., Ltd.**
Test Firm Address:	2013-2016, 20th Floor, Business Center, Jiahui Xin Cheng, No 3027, Shen Nan Road, Fu Tian, Shen Zhen, Guang Dong, P. R. China
FCC Designation Number:	CN1532
Test Firm Registration Number:	344480
Internet:	www.kmolab.com
Email:	kmo@kmolab.com
ANSI-ASQ National Accreditation Board/ACLASS ISO/IEC 17025 Accredited Lab for telecommunication standards. The Registration Number is AT-1532. The testing quality system meets with ISO/IEC-17025 requirements, This approval results is accepted by MRA of ILAC.	

1. 3 Details of Applicant

Name: **Grandstream Networks, Inc.**
Address: **126 Brookline Ave, 3rd Floor Boston, MA 02215, USA**

1. 4 Application Details

Date of Receipt of Application: March 23, 2018
Date of Receipt of Test Item: March 23, 2018
Date of Test : March 28~May 30, 2018

1. 5 Details of Manufacturer

Name: **Grandstream Networks, Inc.**
Address: **126 Brookline Ave, 3rd Floor Boston, MA 02215, USA**

1. 6 Test Item

EUT Feature	
EUT Description:	IP Audio Door System
Brand Name:	Grandstream
Model Name:	GDS3705
EUT RF Technology:	☒ DCD - Part 15 Low Power Transmitter Below 1705 kHz
HW Version:	v1.4A
SW Version:	1.0.0.23
EUT Stage:	Identical Prototype
Note: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.	

Standard Product Specification	
Channel Frequency:	125 kHz
Channel Number:	1
Type of Modulation	ASK
EUT Operational Condition	☐ AC
	☒ DC → ☐ From Battery ☐ External AC adapter ☒ POE

Additional Information

Specification of Accessory				
☐AC/DC Adapter #1 (US)	**Brand Name**	-	**Model Name**	-
	Power Rating	-		
☐AC/DC Adapter #2 (US)	**Brand Name**	-	**Model Name**	-
	Power Rating	-		

1. 7 Applicable Standards

Applicable Standards
According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards: FCC Part 15 Subpart C ANSI C63.10-2013
Note: All test items were verified and recorded according to the standards and without any deviation during the test.

2. Technical Test

2. 1 Summary of Test Results

The EUT has been tested according to the following specifications:

FCC Rules	Test Type	Limit	Result	Notes
15.203	Antenna Requirement	FCC 15.203	PASS	Complies.
15.207	AC Power-line Conducted Emissions	FCC 15.207	PASS	DC Power
15.209	Transmitter Radiated Emissions	FCC 15.209	PASS	Complies.
15.215(c)	Emission Bandwidth	N/A	PASS	Complies.

2. 2 Antenna Requirement

A. Regulation

FCC section 15.203, 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 Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

B. Result

Antenna Information		
☒	Integral antenna (antenna permanently attached)	
	☐	Temporary RF connector provided
	☒	No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
☐	External antenna (dedicated antennas)	
	☐	Single power level with corresponding antenna(s).
	☐	Multiple power level and corresponding antenna(s).

2. 3 Measurement Uncertainty

Measurement	Frequency	Uncertainty
Conducted emissions	0.15MHz~30MHz	1.72
Radiated emissions	30MHz ~ 300MHz	3.88
Radiated emissions	300MHz ~1000MHz	3.86
Radiated emissions	>1000MHz	4.42

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. EUT Modifications

No modification by test lab.

4. Conducted Power Line Test

4. 1 Test Equipment

Please refer to Section 8 this report.

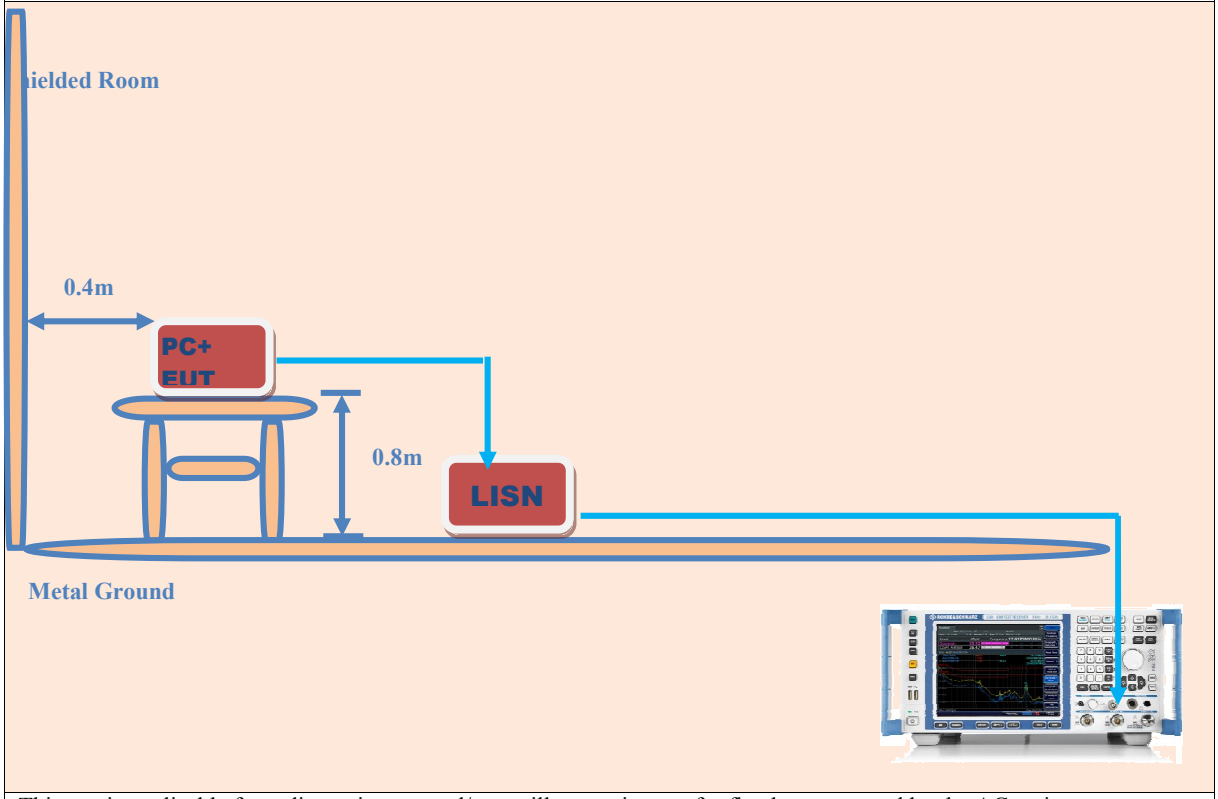
4. 2 Test Procedure

Test Method	
☒	The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. Both sides of A.C. 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 C63.10:2013 on conducted measurement. Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

4. 3 Test Setup

Test Setup

AC Line Conducted Emissions



This test is applicable for radio equipment and/or ancillary equipment for fixed use powered by the AC mains.
This test shall be performed on a representative configuration of the radio equipment, the associated ancillary equipment, or a representative configuration of the combination of radio and ancillary equipment.
This test assesses the level of internally generated electrical noise present on the AC power input/output ports.

4. 4 Configuration of the EUT

The EUT was configured according to ANSI C63.10:2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

EUT Operation Test Setup				
☒	Operated Mode for Worst Duty Cycle			
	☒	Operated normal mode for worst duty cycle	☐	Operated test mode for worst duty cycle
☒	Test Signal Duty Cycle (x)			
	☒	100.00%	☐	Other
☒	Modulation			
	☒	ASK	☐	Other
☒	Test Channel Frequencies (kHz)			
	☒	125	☐	Other

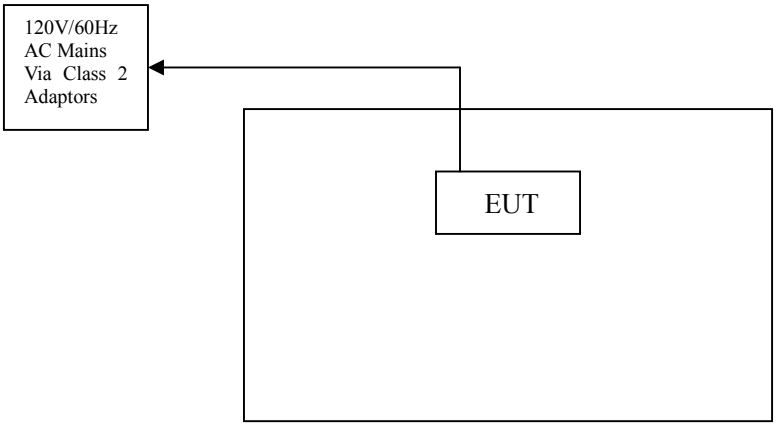
The Worst Case Mode for Following Conformance Tests				
☒	Tests Item			
	☒	AC power-line conducted emissions	☒	Emission Bandwidth, Field Strength of Fundamental Emissions Transmitter Radiated Unwanted Emissions
☒	Condition			
	☒	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz	☒	Radiated measurement
☒	Operating Mode			
	☒	Operating Mode Description	☐	Other
☒	Orthogonal Planes of EUT			
	☐	X Plane	☐	Y Plane
	☒	Y Plane	☐	Other

Support Unit				
Device	**Manufacturer**	**Model # Serial #**	**FCC ID**	**Cable**
Notebook	ACER	ZQE	HLZ-AR5B97	1.5m unshielded power cord
AC/DC Adapter [Note]	Frecom	F18W8-120150SPAUY	DOC	1.5m unshielded power cord

Note: Support for AC power-line conducted emission testing only.

4. 5 EUT Operating Condition

Operating condition is according to ANSI C63.10:2013.



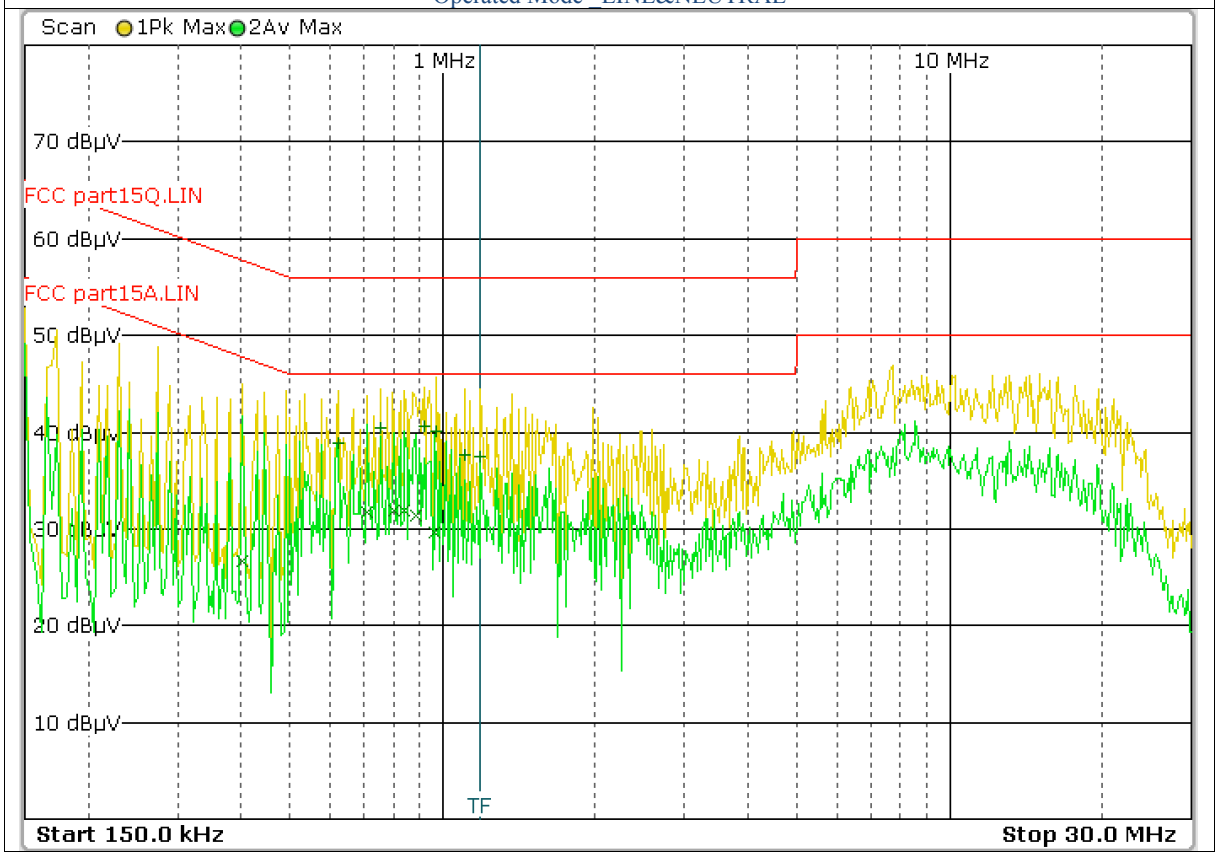
4. 6 Conducted Power Line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)	
Frequency Range (MHz)	**QP/AV**
0.15 – 0.5	66-56/56-46
0.5 – 5.0	56/46
5.0 - 30	60/50

Note: In the above table, the tighter limit applies at the band edges.

4. 7 Conducted Power Line Test Result

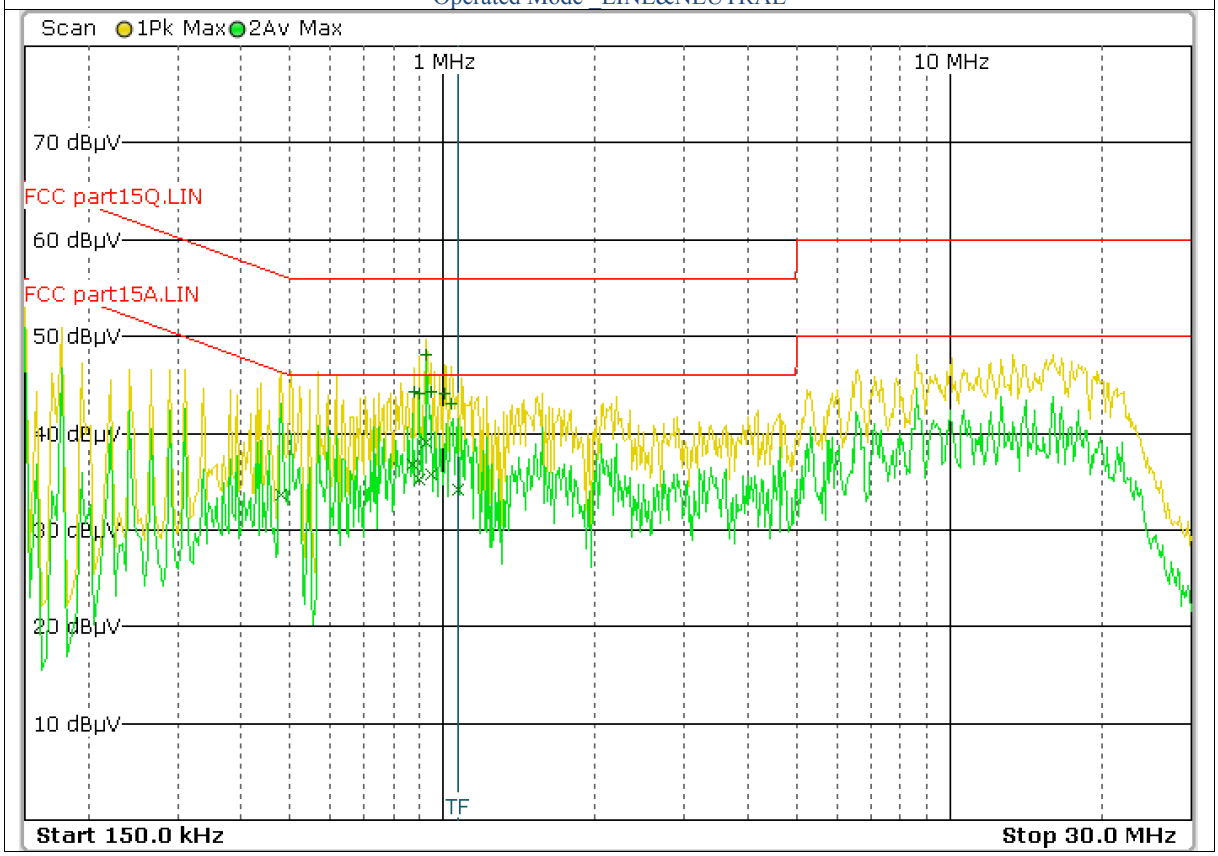
Operated Mode _LINE&NEUTRAL



FCC15										
Frequency (MHz)	Read Level (dBuV) QP	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV) QP	Emission (dBuV) AV	Line/ Neutral	Limit (dBuV) QP	Limit (dBuV) AV	Margin(dBuV) QP	Margin(dBuV) AV
0.622	28.40	18.16	10.40	38.80	28.56	Line	56.00	46.00	-17.20	-17.44
0.754	30.00	21.29	10.40	40.40	31.69	Line	56.00	46.00	-15.60	-14.31
0.802	30.55	21.52	10.40	40.95	31.92	Line	56.00	46.00	-15.05	-14.08
0.918	30.15	21.05	10.40	40.55	31.45	Line	56.00	46.00	-15.45	-14.55
0.974	29.61	19.26	10.40	40.01	29.66	Line	56.00	46.00	-15.99	-16.34
1.106	27.16	16.27	10.40	37.56	26.67	Line	56.00	46.00	-18.44	-19.33
FCC15										

Note:
1.Uncertainty in conducted emission measured is <+/ -2dB.
2.The emission levels of other frequencies were very low against the limit.
3.All Reading Levels are Quasi-Peak and Average value.
4.Emission = Meter Reading + Factor; Factor = Insertion Loss + Cable Loss.
5.Margin Value= Emission Level - Limit Value.

Operated Mode _LINE&NEUTRAL



FCC15										
Frequency (MHz)	Read Level (dBuV) QP	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV) QP	Emission (dBuV) AV	Line/ Neutral	Limit (dBuV) QP	Limit (dBuV) AV	Margin(dBuV) QP	Margin(dBuV) AV
0.482	29.73	23.29	10.40	40.13	33.69	Neutral	56.30	46.30	-16.17	-12.61
0.878	33.89	26.43	10.40	44.29	36.83	Neutral	56.00	46.00	-11.71	-9.17
0.898	33.67	24.83	10.40	44.07	35.23	Neutral	56.00	46.00	-11.93	-10.77
0.930	37.68	28.61	10.40	48.08	39.01	Neutral	56.00	46.00	-7.92	-6.99
0.946	33.80	25.33	10.40	44.20	35.73	Neutral	56.00	46.00	-11.80	-10.27
1.006	33.64	23.73	10.40	44.04	34.13	Neutral	56.00	46.00	-11.96	-11.87
FCC15										

Note:
1.Uncertainty in conducted emission measured is <+/ -2dB.
2.The emission levels of other frequencies were very low against the limit.
3.All Reading Levels are Quasi-Peak and Average value.
4.Emission = Meter Reading + Factor; Factor = Insertion Loss + Cable Loss.
5.Margin Value= Emission Level - Limit Value.

5. Radiated Emission Test

5. 1 Test Equipment

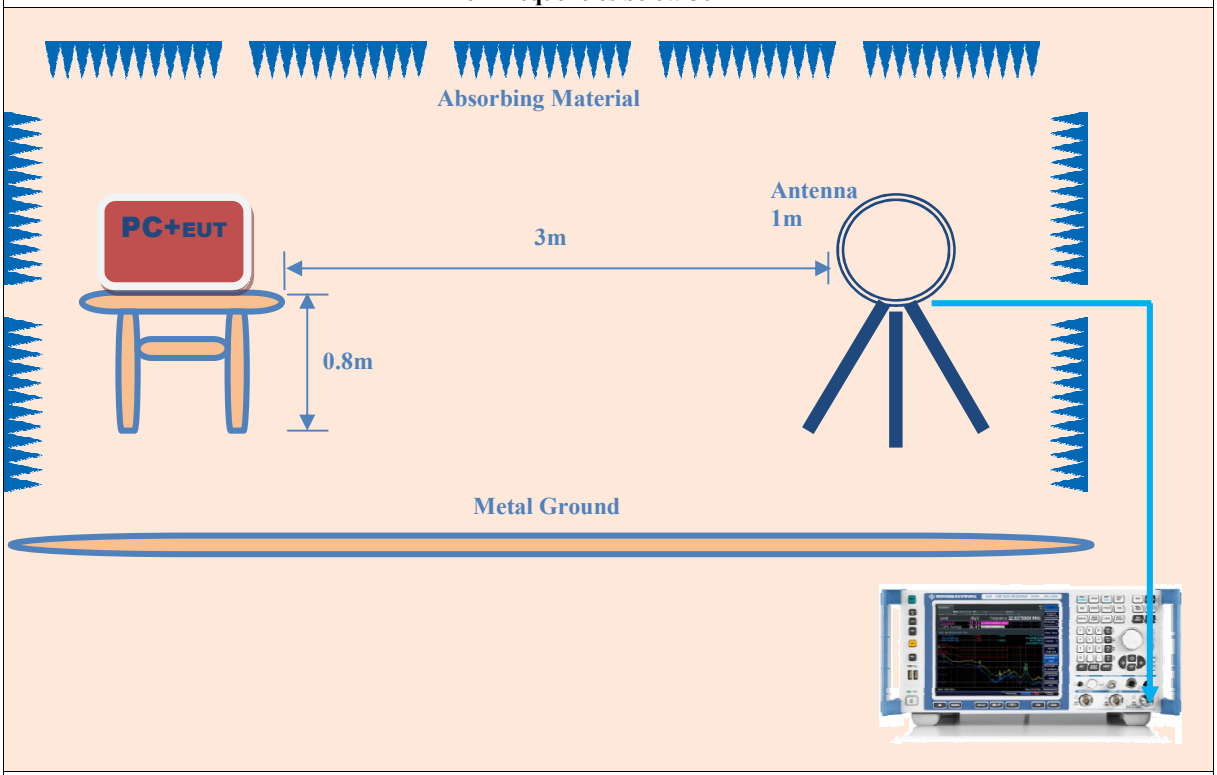
Please refer to Section 8 this report.

5. 2 Test Procedure

1. The EUT was tested according to ANSI C63.10:2013.
2. The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8m. All set up is according to ANSI C63.10:2013.
3. The frequency spectrum from 9kHz to 25 GHz was investigated. All readings from 9kHz to 150kHz are quasi-peak values with a resolution bandwidth of 200 Hz. All readings from 150kHz to 30MHz are quasi-peak values with a resolution bandwidth of 9 KHz. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 KHz Measurements were made at 3 meters.(Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz. The frequency bands 9-90 kHz, 110-490 kHz measurements employing an average detector and other below 30MHz measurements employing a CISPR quasi-peak detector. Test distance is 3m.)
4. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. The Receiving antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency. Emissions below 30MHz were measured with a loop antenna while emission above 30MHz were measured using a broadband E-field antenna.
5. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.10:2013.

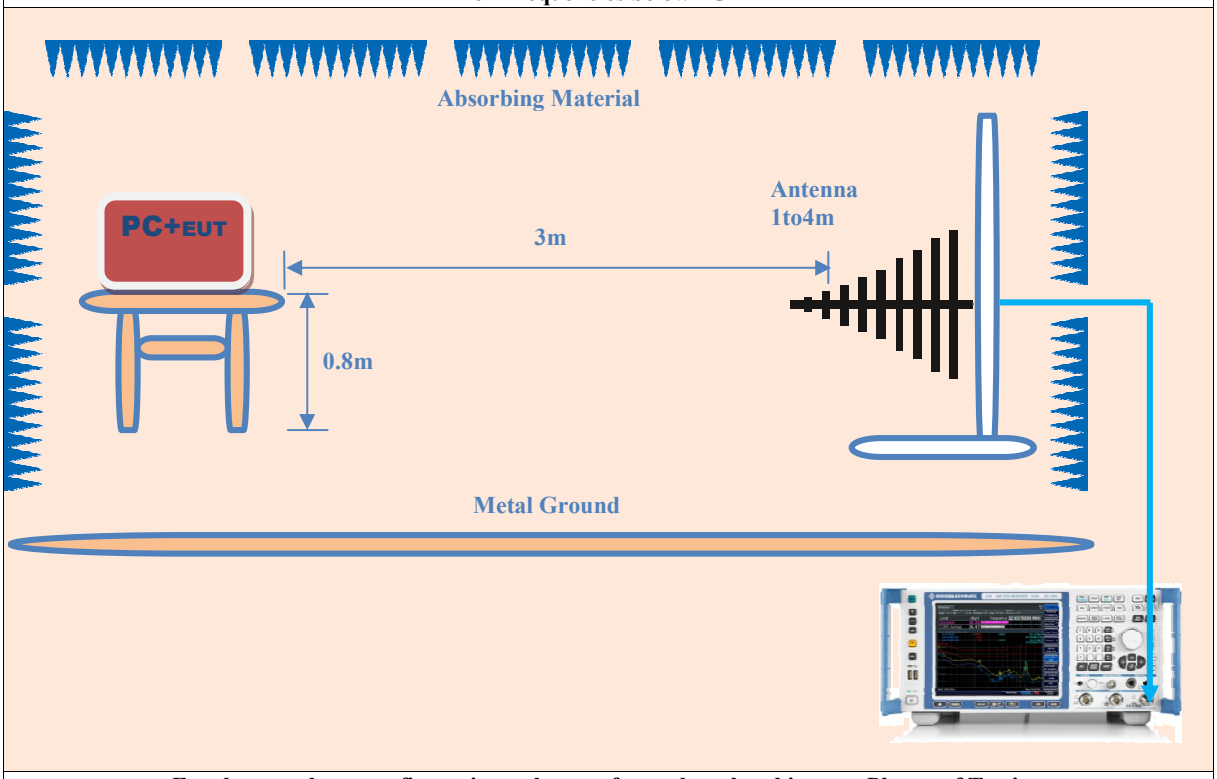
5. 3 Radiated Test Setup

For Frequencies below 30MHz



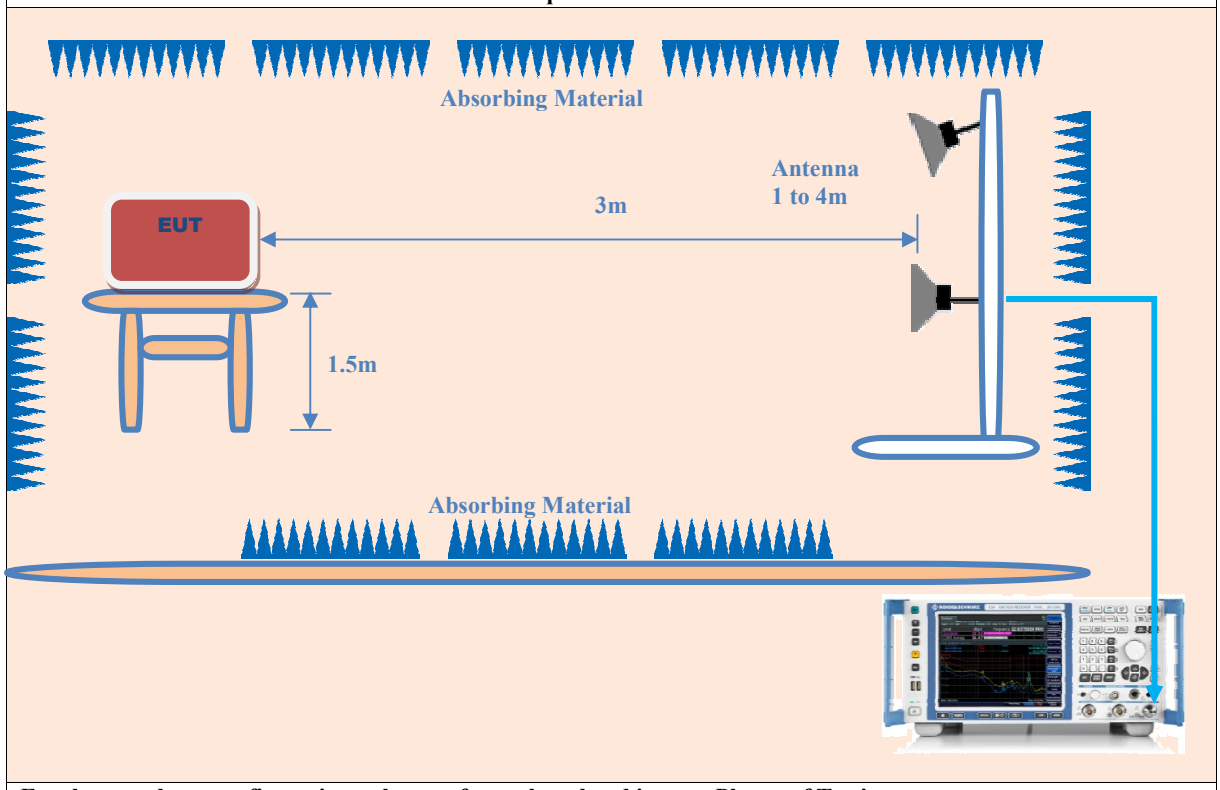
For the actual test configuration , please refer to the related items – Photos of Testing

For Frequencies below 1GHz



For the actual test configuration , please refer to the related items – Photos of Testing

For Frequencies above 1GHz



For the actual test configuration , please refer to the related items – Photos of Testing

5. 4 Configuration of the EUT

Same as section 4.4 of this report

5. 5 EUT Operating Condition

Same as section 4.5 of this report

5. 6 Radiated Emission Limit

In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced by modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in section 15.209(a), which lesser attenuation.

All other emissions inside restricted bands specified in section 15.205(a) shall not exceed the general radiated emission limits specified in section 15.209(a)

Note:

Applies to harmonics/spurious emissions that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

47 CFR §15.237(c): The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in section 15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, Para, 15.205(a) – Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41.			

[1]UntilFebruary1,1999,thisrestrictedbandshallbe0.490–0.510MHz.
[2]Above38.6

FCC 47 CFR, Part 15.209(a) – Field Strength Limits within Restricted Frequency Bands

Frequency(MHz)	Field strength (microvolts/meter)	Measure-mentdis-tance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100**	3
88–216	150**	3
216–960	200**	3
Above960	500	3

5. 7 Radiated Emission Test Result

Tx Radiated Emissions (Below 30MHz) 125 kHz

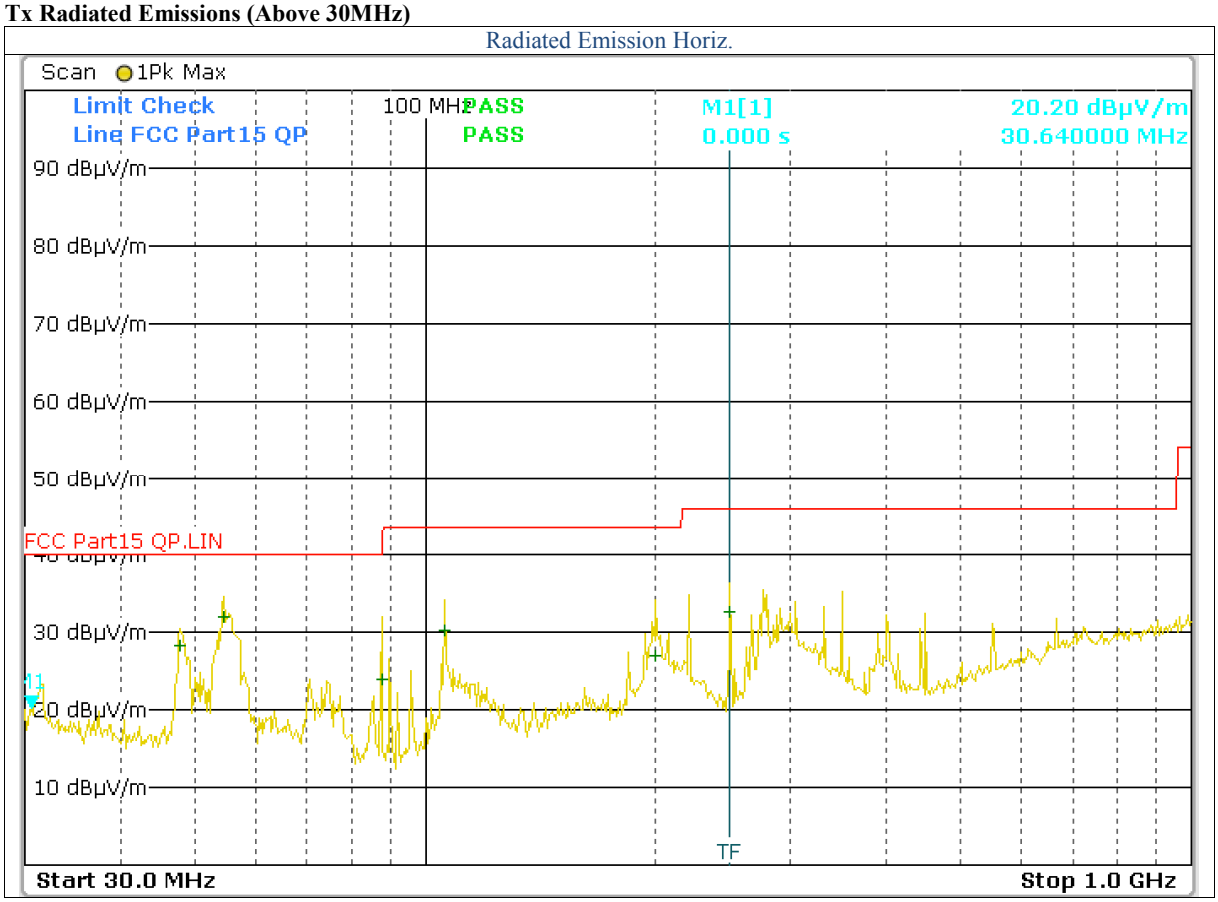
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Face/ Side	Limit QP (dBuV/m)	Margin QP (dB)
0.125	53.28	8.90	62.18	Side	105.66	-43.48
0.125	49.18	8.90	58.08	Face	105.66	-47.58
-						
-						
-						
-						

Tx Radiated Emissions (Below 30MHz)

Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
3.750	33.45	8.70	42.15	Side	69.50	-27.35
12.536	34.52	9.10	43.62	Side	69.50	-25.88
3.756	31.48	8.70	40.18	Face	69.50	-29.32
12.536	32.29	9.10	41.39	Face	69.50	-28.11
-						
-						

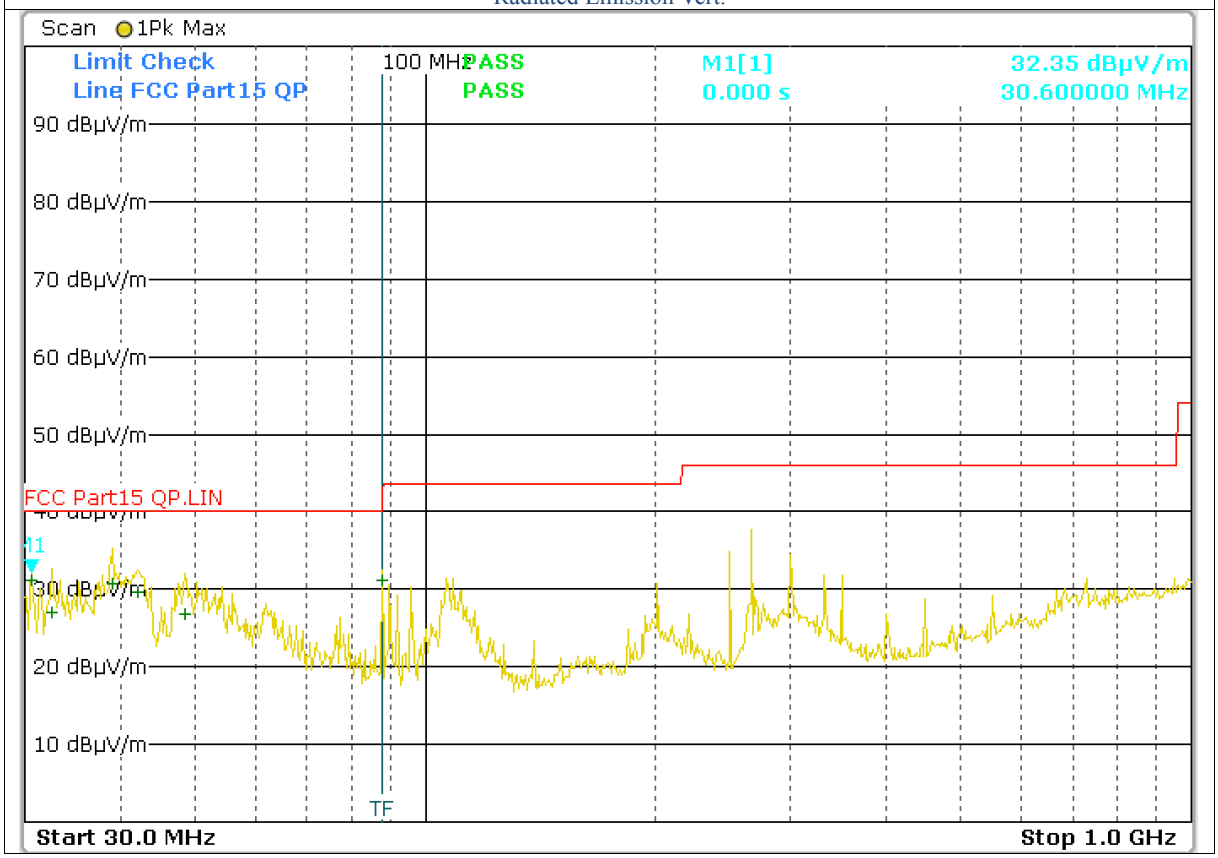
Note:
(1) All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
(2) "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
(3) Emission Level = Reading Level + Probe Factor + Cable Loss.

Tx Radiated Emissions (Above 30MHz)



Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
47.920	17.22	11.09	28.31	Horiz./	40.0	-11.69
54.600	21.30	10.66	31.96	Horiz./	40.0	-8.04
87.900	16.58	7.43	24.01	Horiz./	40.0	-15.99
106.200	21.56	8.67	30.23	Horiz./	43.5	-13.27
199.960	13.12	13.87	26.99	Horiz./	43.5	-16.51
250.040	17.68	14.94	32.62	Horiz./	46.0	-13.38

Radiated Emission Vert.



Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
30.600	19.12	12.06	31.18	Vert.	40.0	-8.82
32.560	14.96	12.06	27.02	Vert.	40.0	-12.98
39.000	19.00	11.78	30.78	Vert.	40.0	-9.22
42.080	18.18	11.54	29.72	Vert.	40.0	-10.28
48.520	15.69	11.09	26.78	Vert.	40.0	-13.22
87.800	23.64	7.43	31.07	Vert.	40.0	-8.93

Note:
(1) All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
(2) "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
(3) Emission Level = Reading Level + Probe Factor + Cable Loss.

6. Band Edge

6. 1 Test Equipment

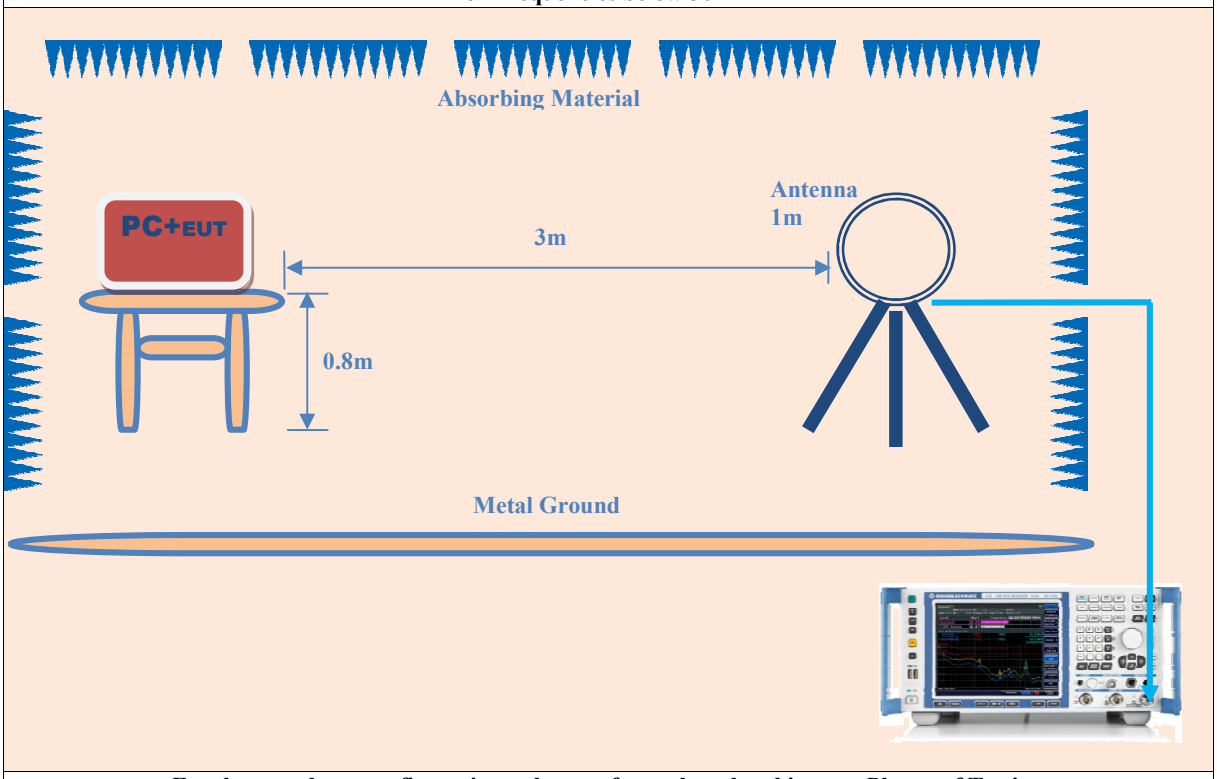
Please refer to Section 9 this report.

6. 2 Test Procedure

1. The EUT was tested according to ANSI C63.10, clause 6.9.3 for occupied bandwidth testing.
2. For radiated measurement. Loop antenna was rotated about the horizontal and vertical axis and the equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted field strength level

6. 3 Radiated Test Setup

For Frequencies below 30MHz



For the actual test configuration , please refer to the related items – Photos of Testing

6. 4 Configuration of the EUT

Same as section 4 . 4 of this report

6. 5 EUT Operating Condition

Same as section 4.5 of this report.

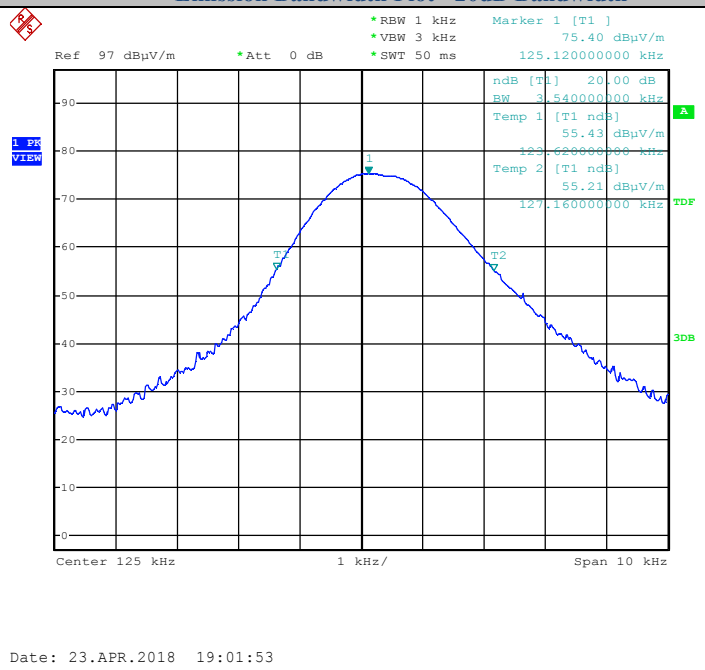
6. 6 Band Edge FCC 15.215(c) Limit

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 is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB 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 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.

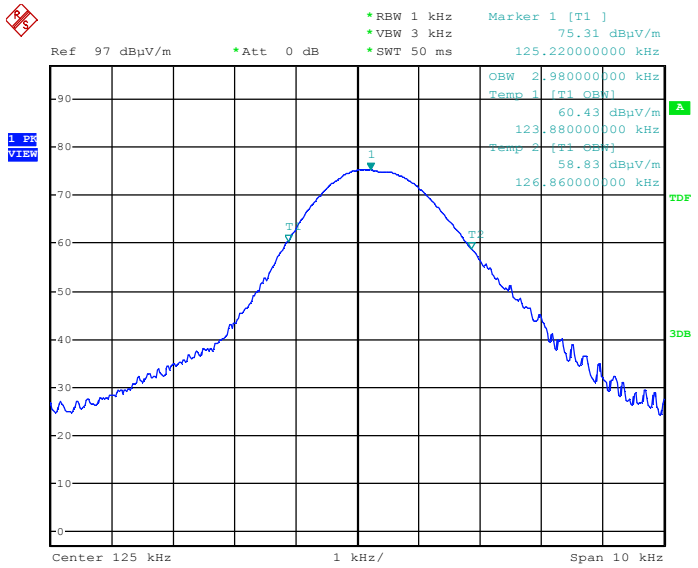
6. 7 Band Edge Test Result

Occupied Channel Bandwidth		
Frequency (kHz)	**20dB Bandwidth (kHz)**	**99% Bandwidth (kHz)**
125	3.52	3.06
Limit:	N/A	
Results:	PASS	

Emission Bandwidth Plot - 20dB Bandwidth



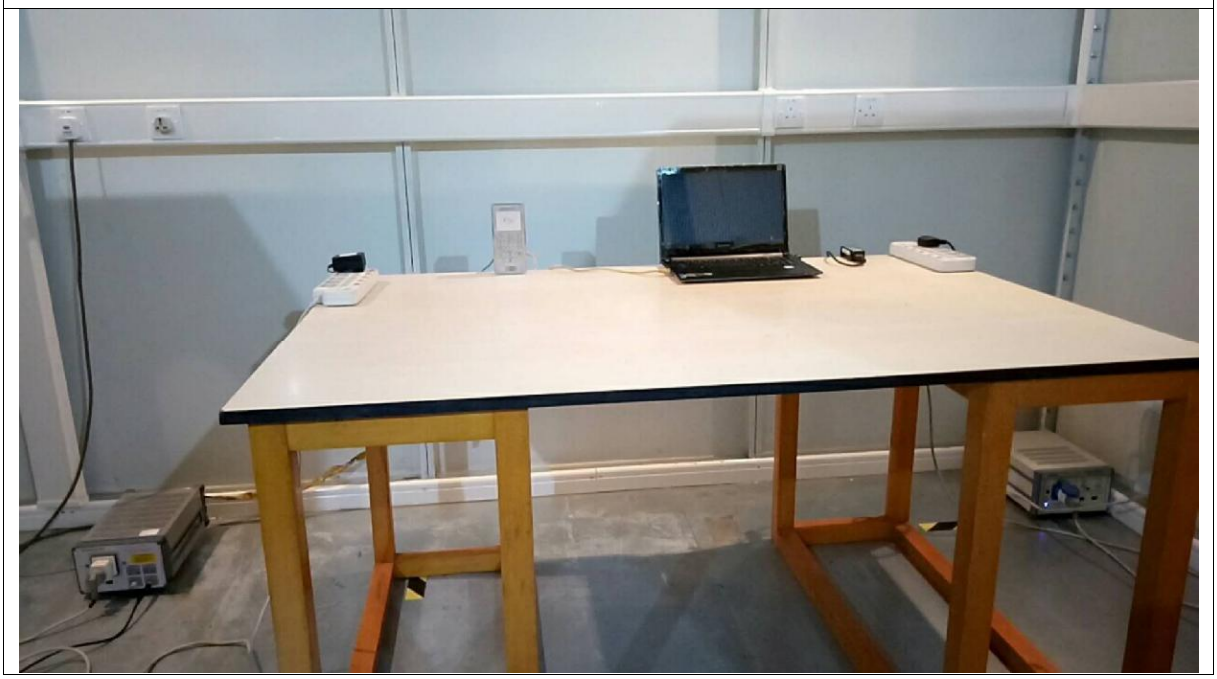
Emission Bandwidth Plot - 99% Bandwidth

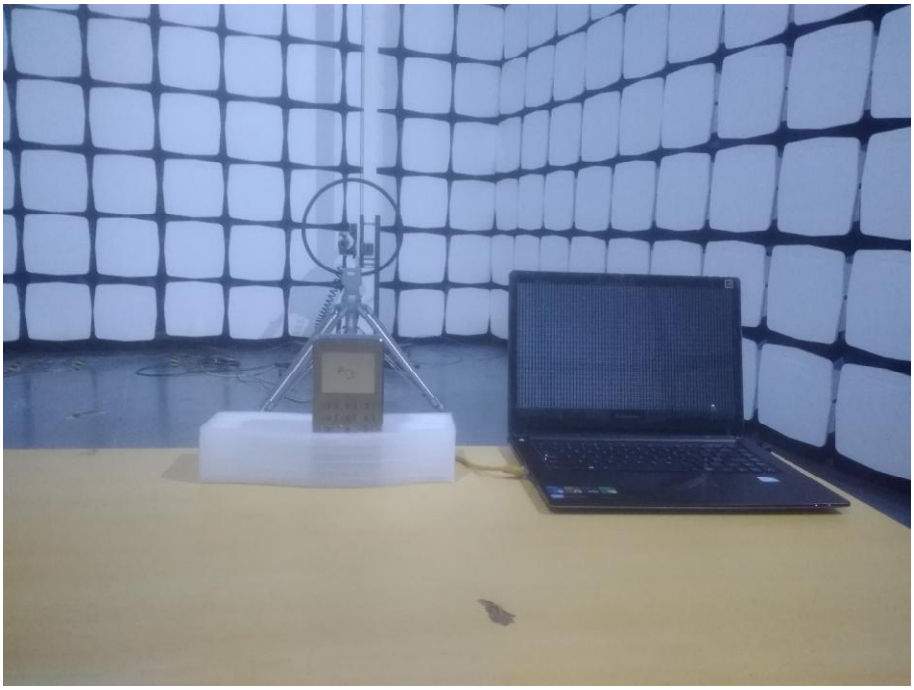


Date: 23.APR.2018 18:58:03

7. Photo of Testing

7.1 Emission test view

Conducted Emission test view


Radiated Emission test view (Below 30MHz)


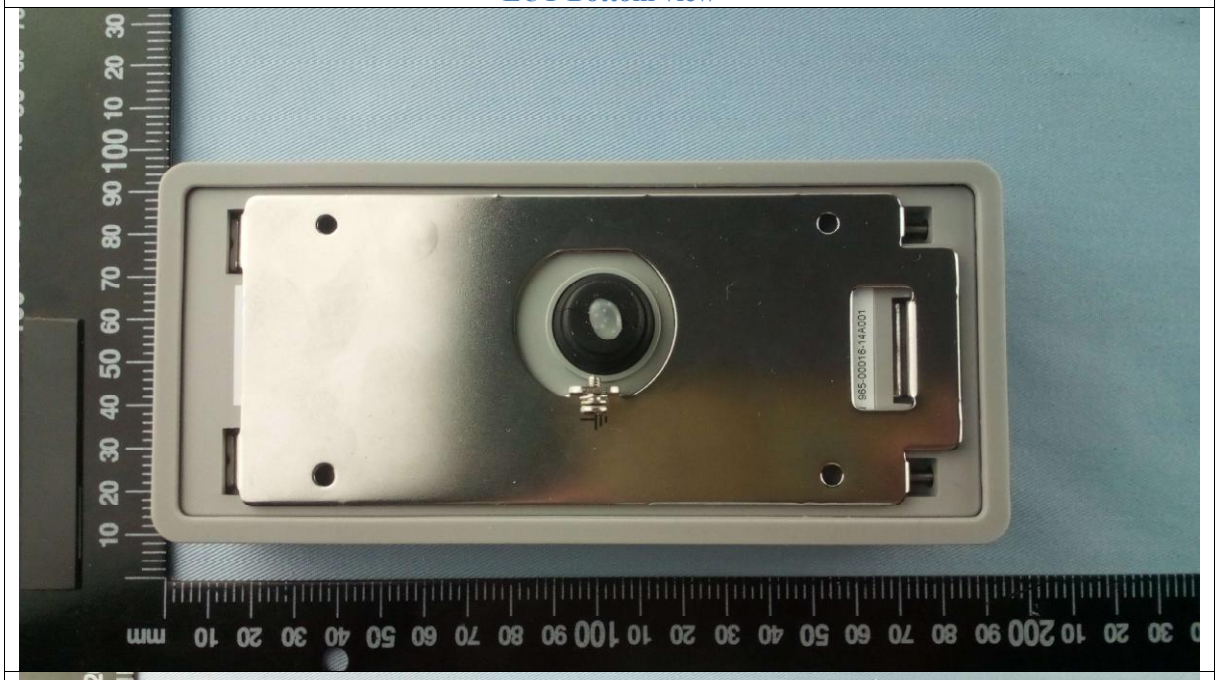
Radiated Emission test view (Above 30MHz)

7.2 Photograph - EUT

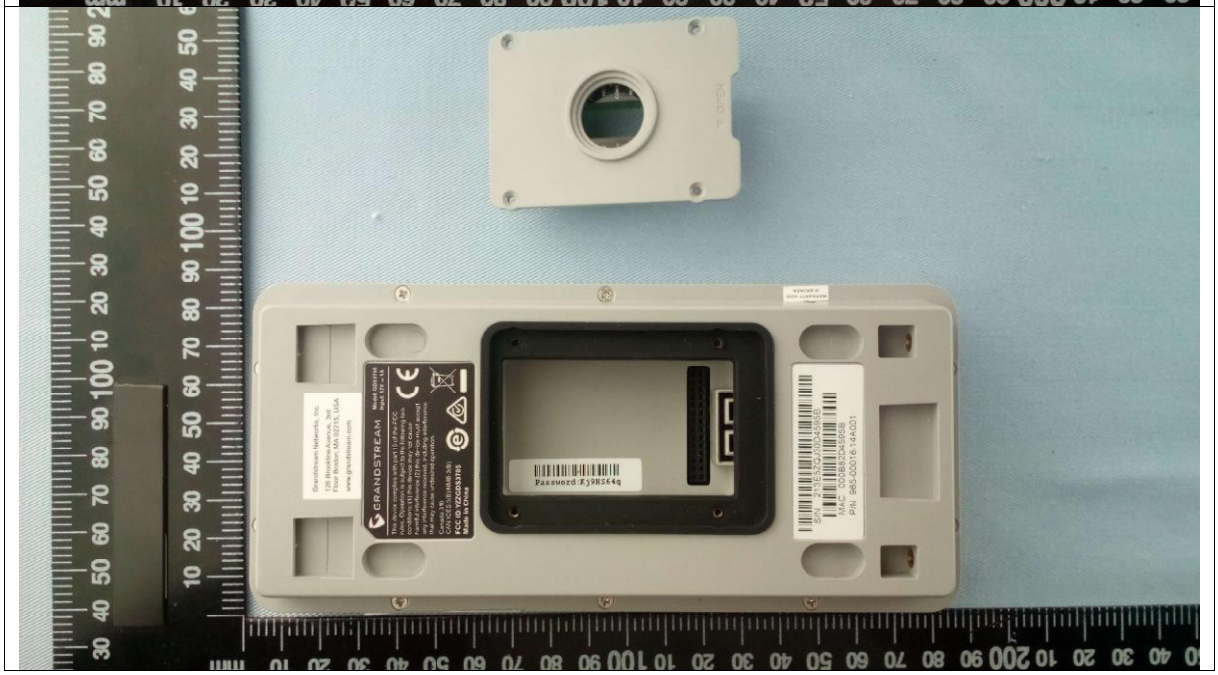
EUT top view

EUT side view

EUT Bottom view



GRANDSTREAM
OPEN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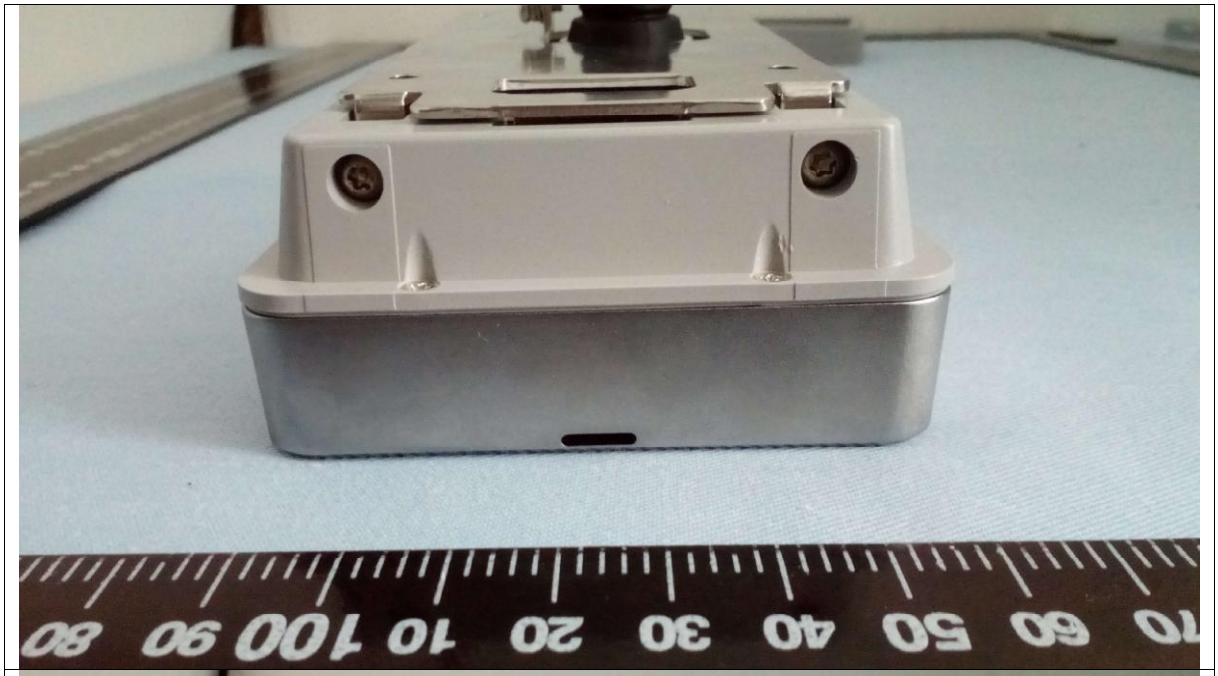
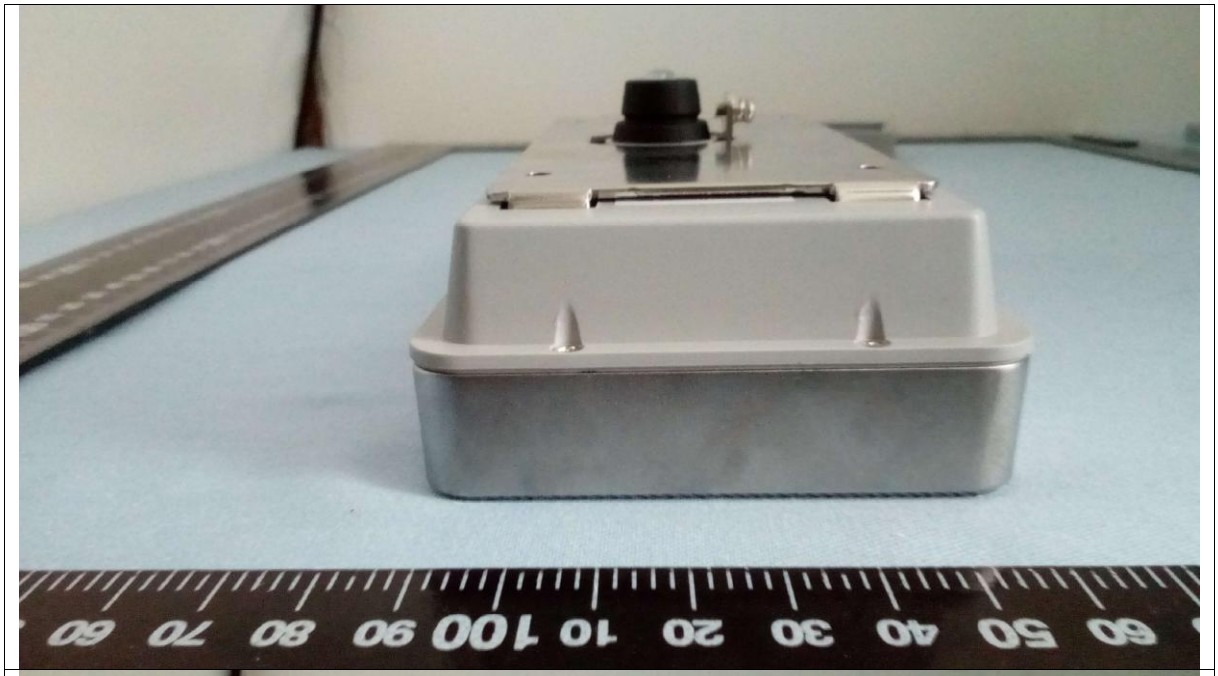
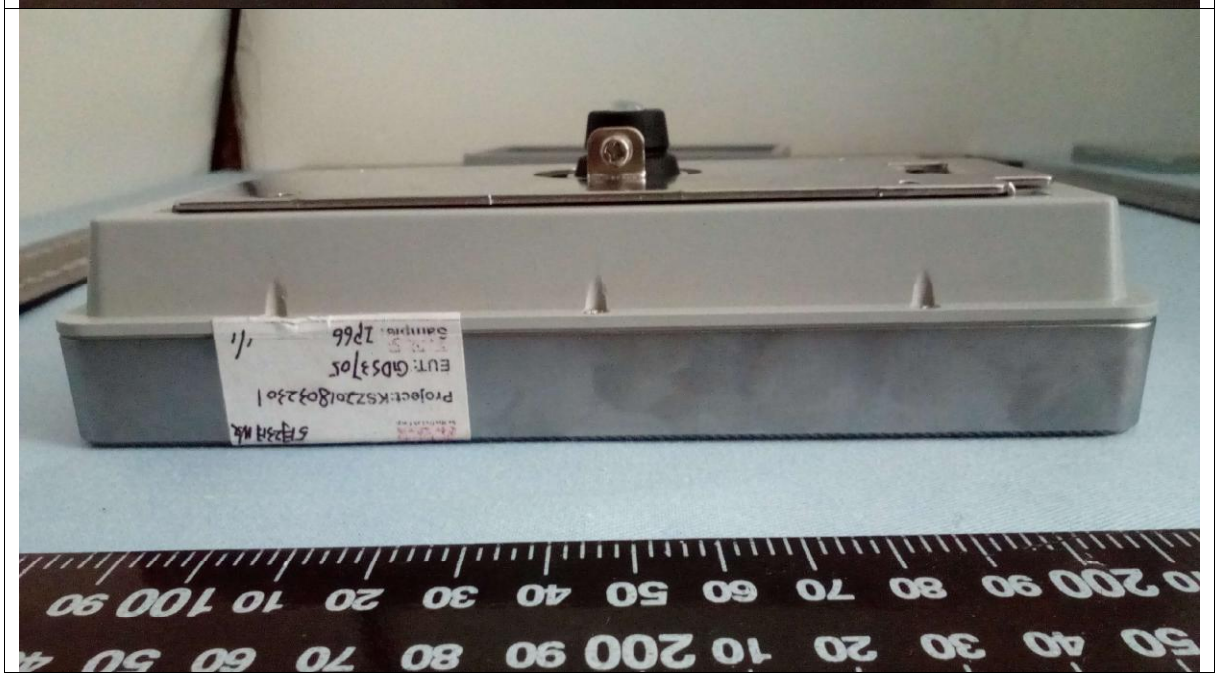
Password:Kj9N564q

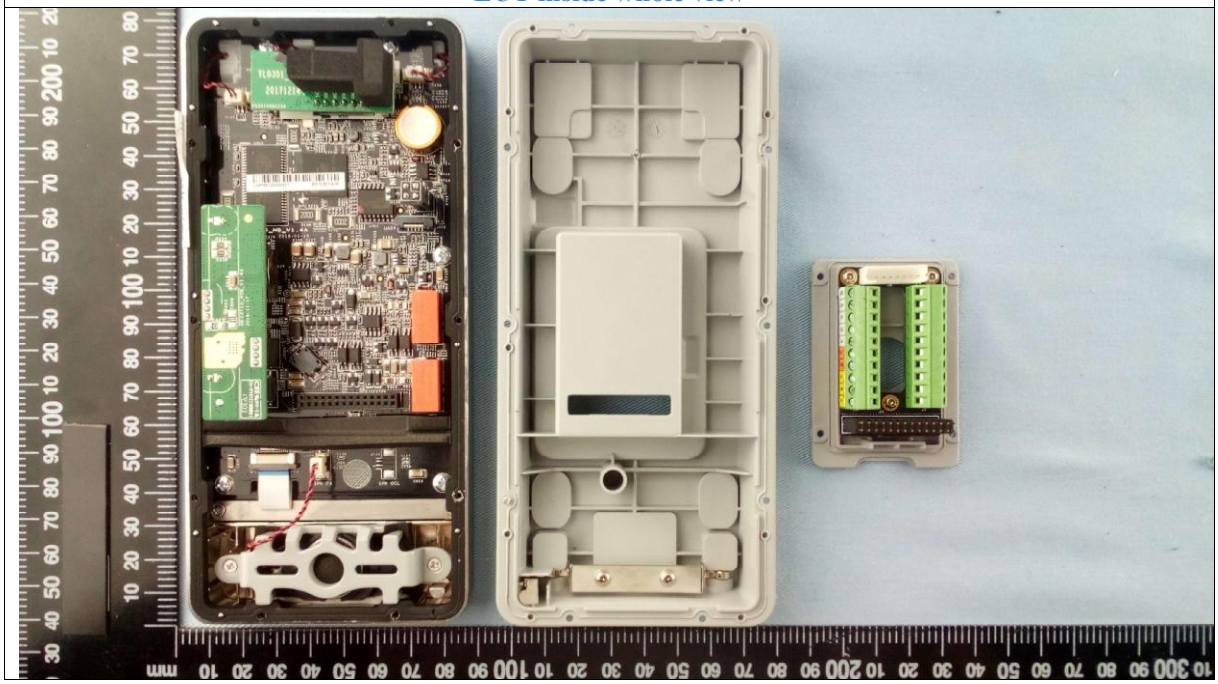
EUT side view



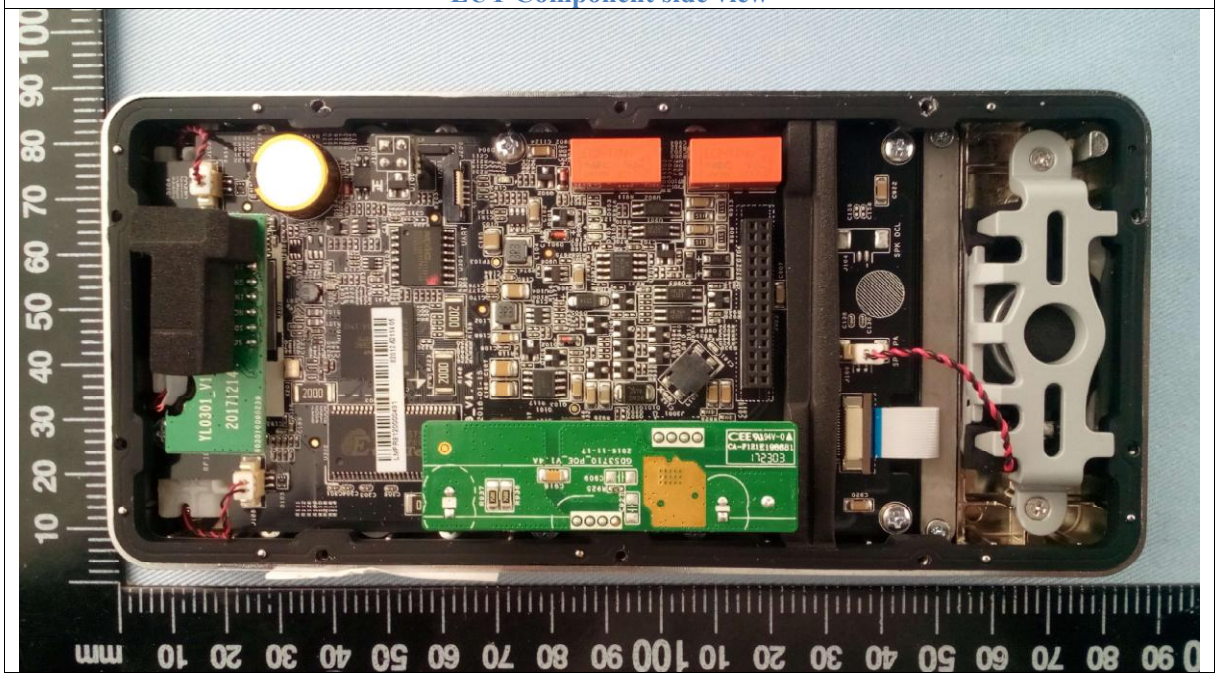


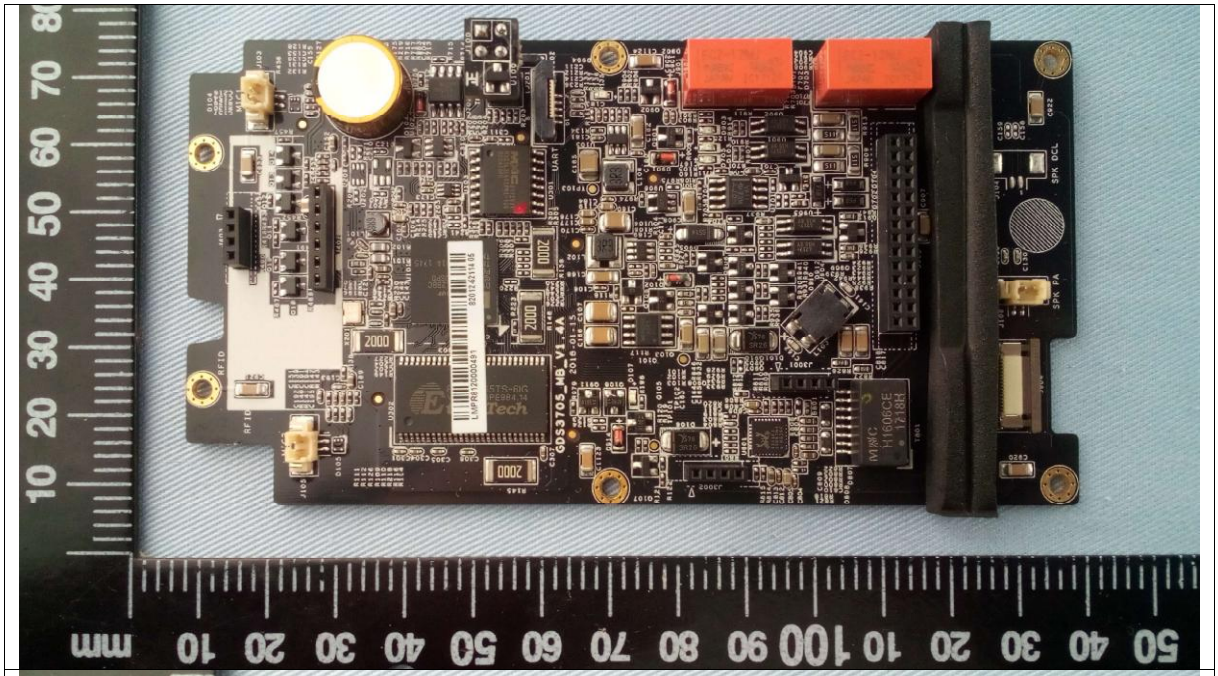

Project:KSZ2018032301
EUT:GDS3705
Sample:
1/1

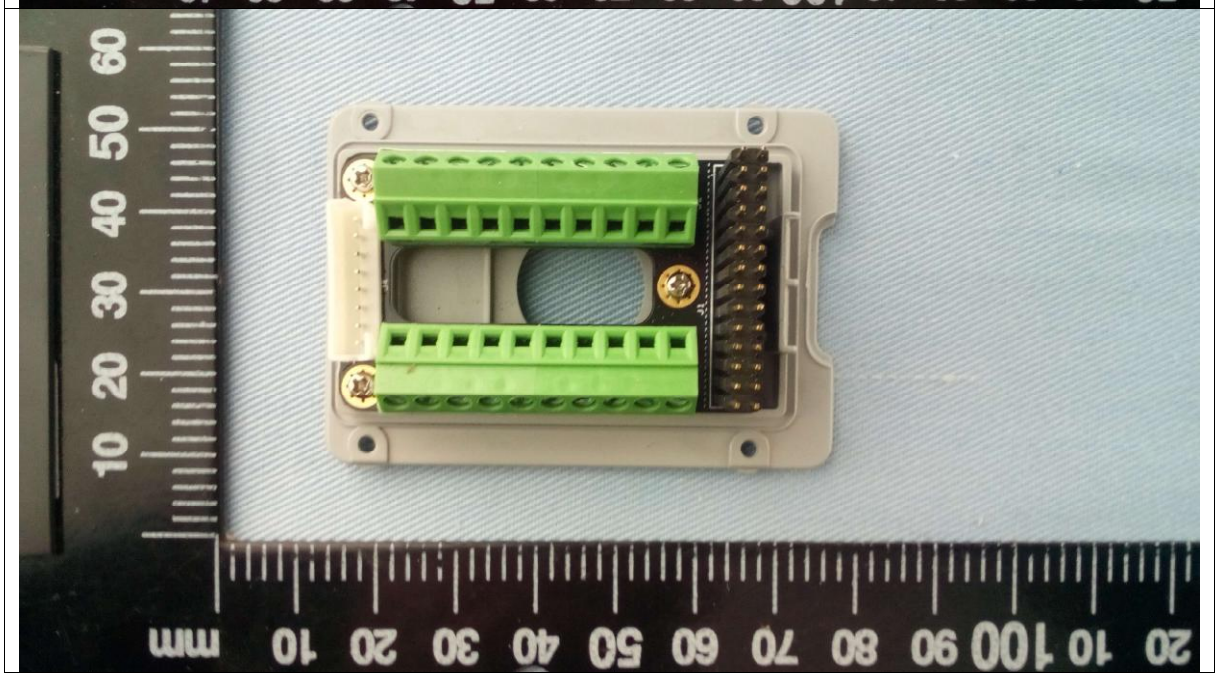
EUT inside whole view

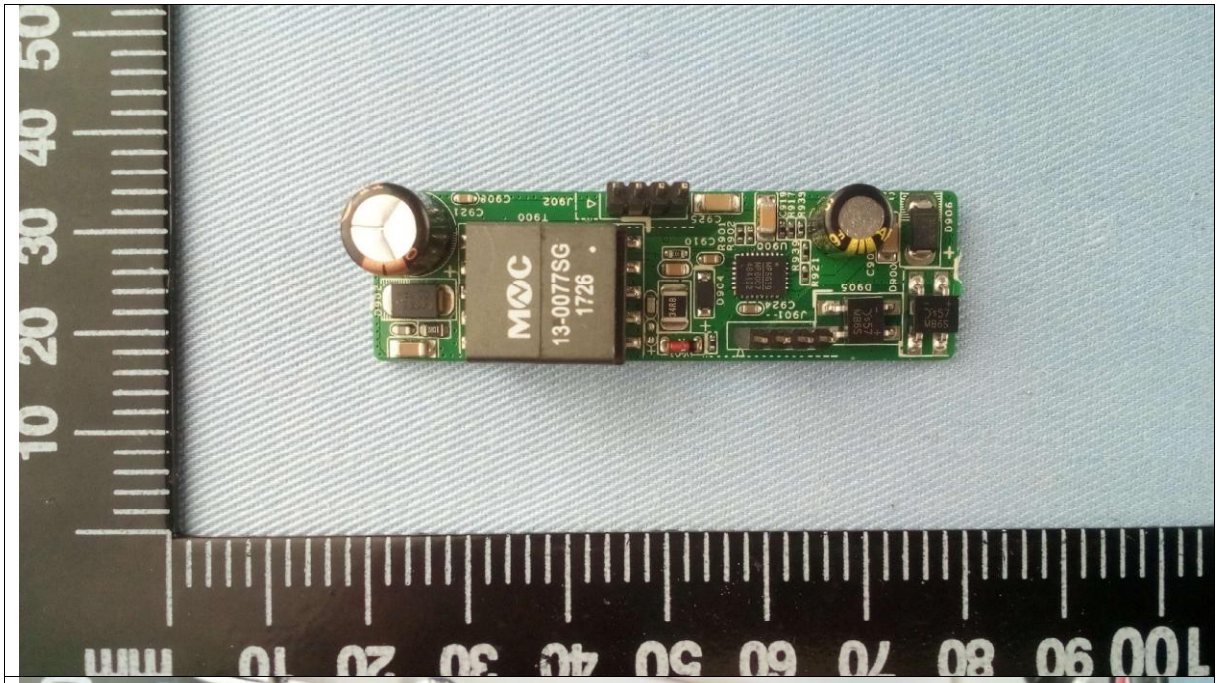


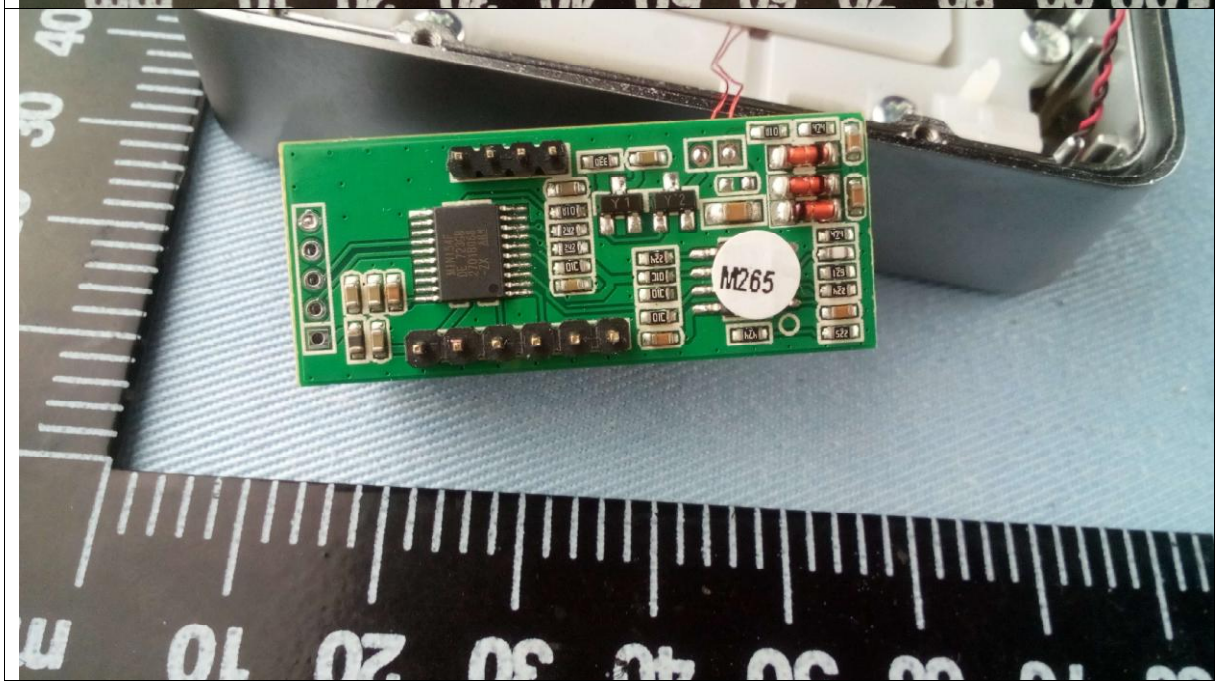
EUT Component side view



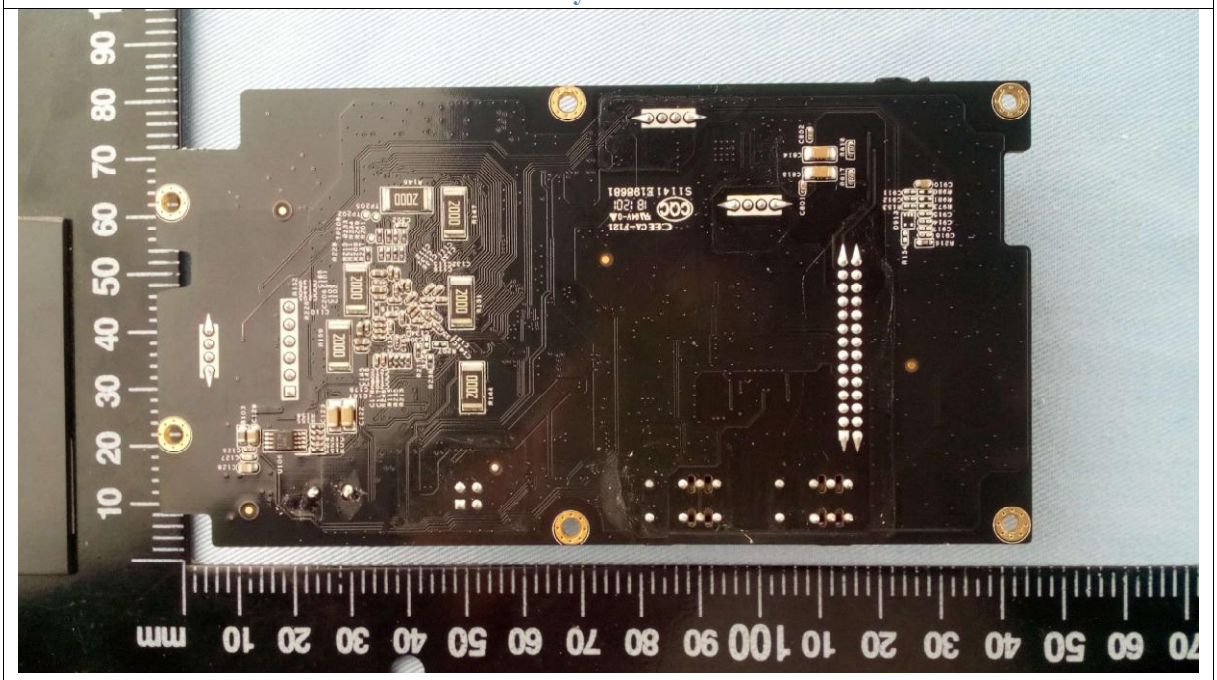


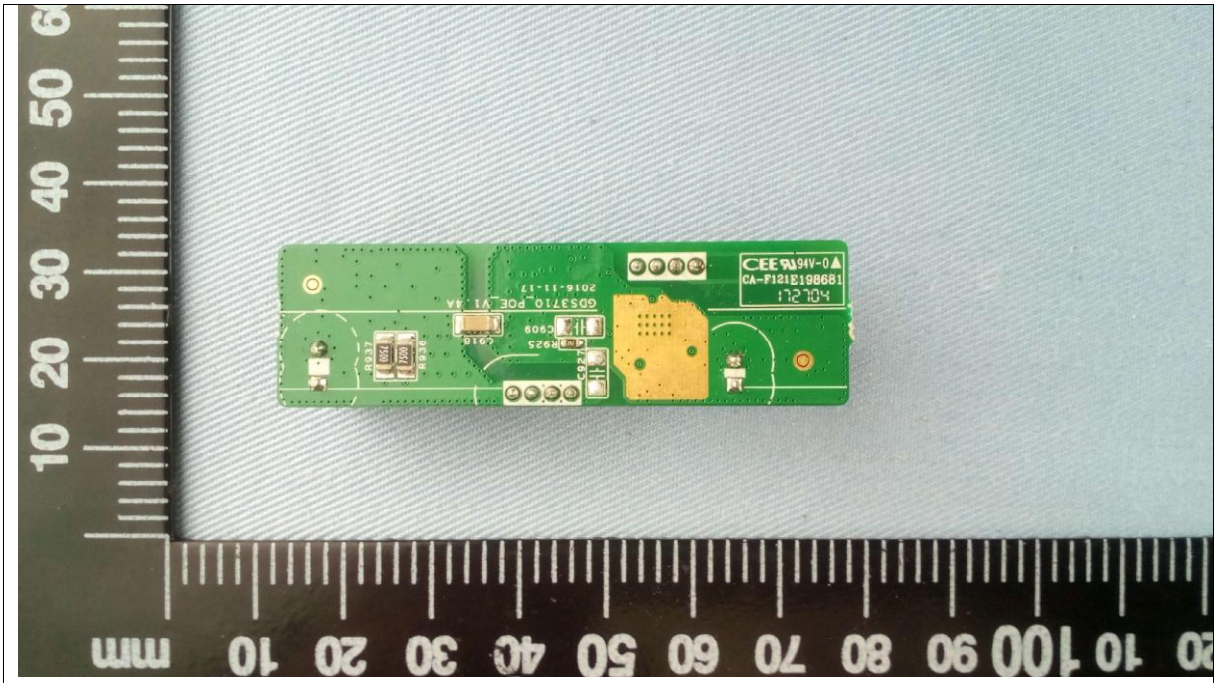


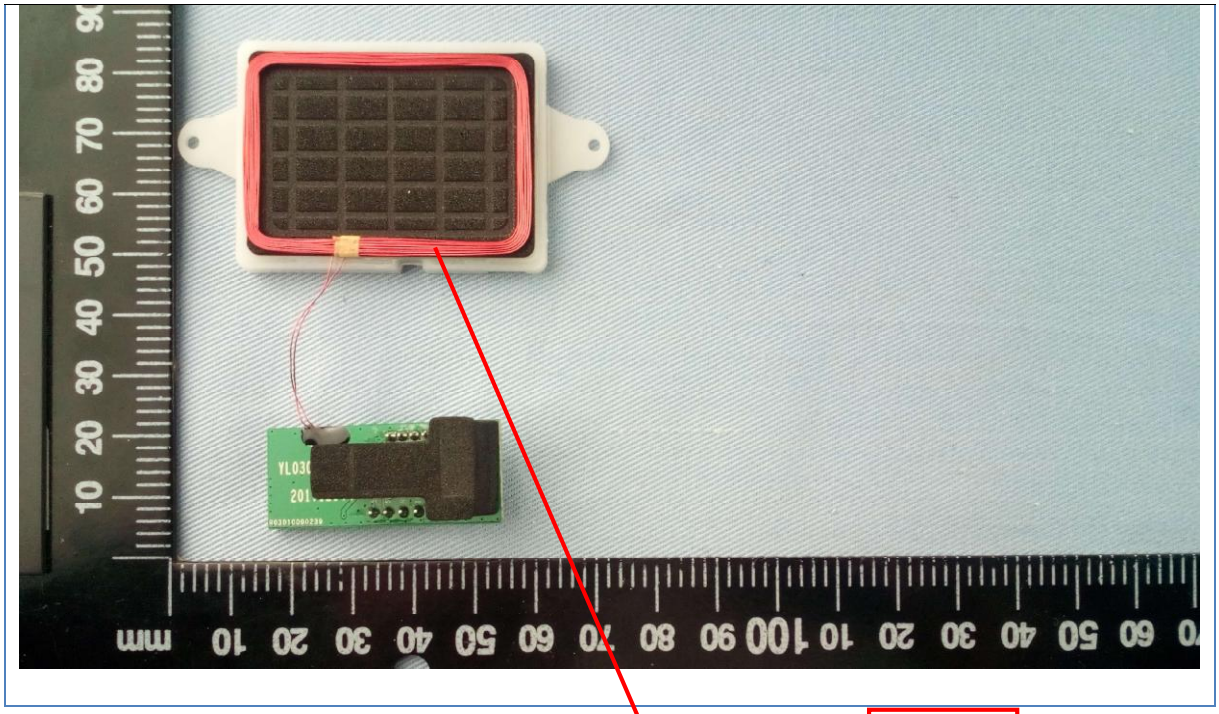

13-0077SG
1726


M265

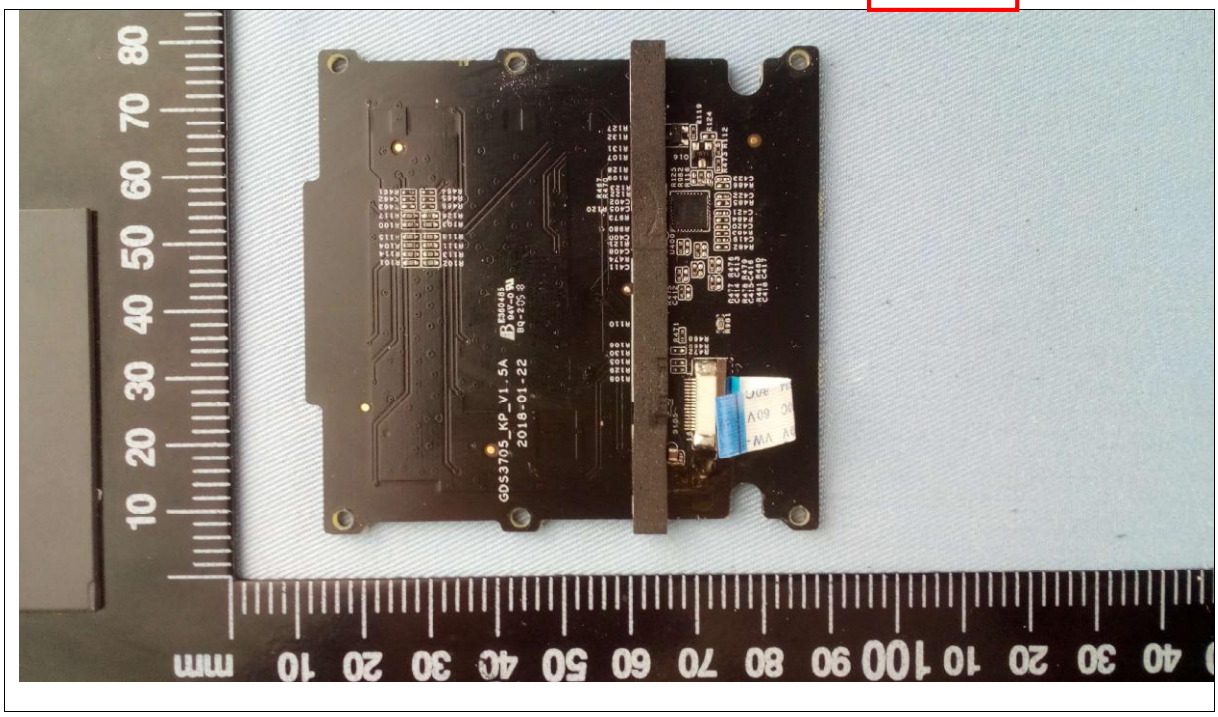
EUT Layout side view

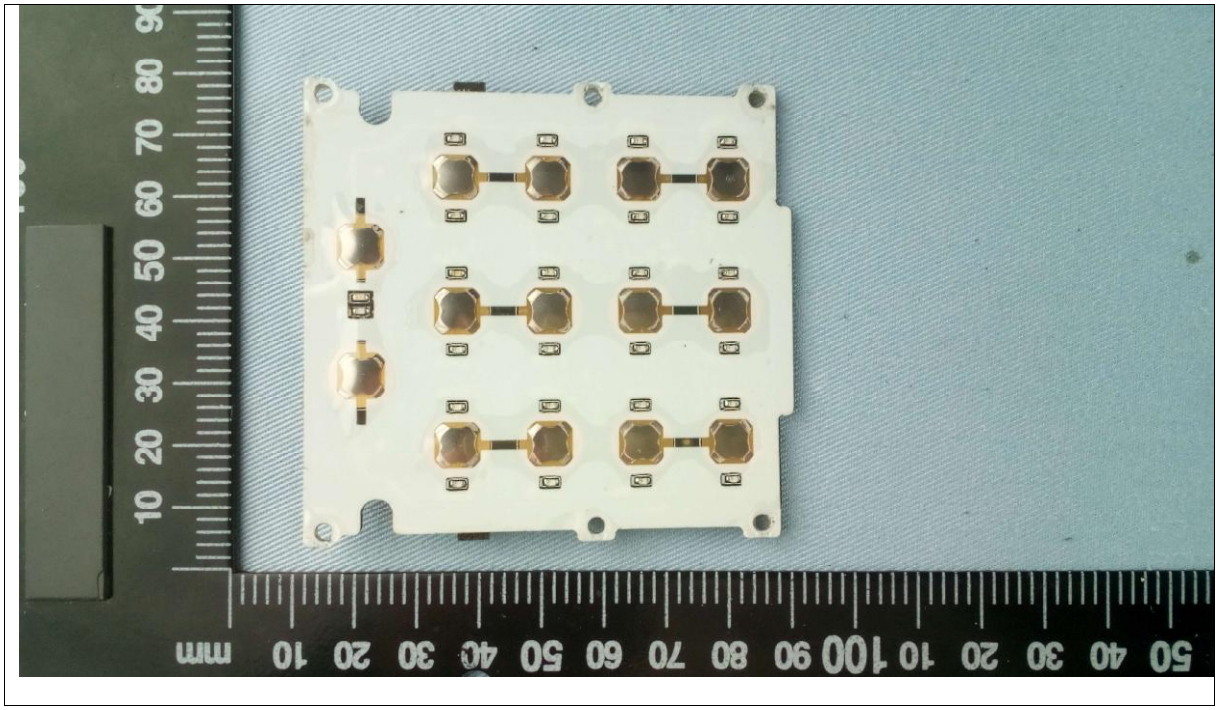




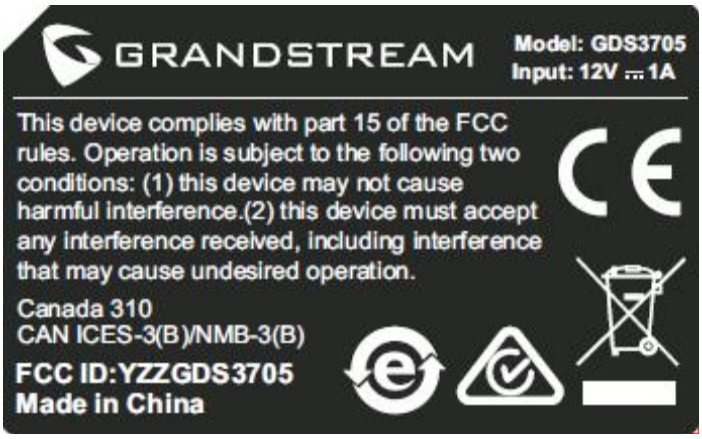


Antenna




mm
10 20 30 40 50 60 70 80 90
10 20 30 40 50 60 70 80 90 100 10 20 30 40 50

8. FCC ID Label



The following note shall be conspicuously placed in the user manual: "**Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.**"

The Label must not be a stick-on paper label. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT

9. Test Equipment

The following test equipments were used during the radiated & conducted emission test:

Equipment/ Facilities	Manufacturer	Model #	Serial No.	Cal/Char Date	Due Date
Turntable	Innco systems GmbH	CT-0801	N/A	NCR	NCR
Antenna Tower	Innco systems GmbH	MA-4640-XP-ET	N/A	NCR	NCR
Controller	Innco systems GmbH	CO3000	955/38850716L	NCR	NCR
EMI Test Receiver	Rohde & Schwarz	ESR7	101091	Dec.6, 2016	Dec.6, 2018
Spectrum Analyzer	Rohde & Schwarz	FSP40	100273	Dec.14, 2017	Dec.14, 2019
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100022	Feb.21, 2018	Feb.21, 2020
AMN	Rohde & Schwarz	ESH3-Z5	100197	Dec.25, 2017	Dec.25, 2019
AMN	CYBERTEK	EM5040A	E115040054	Sep.6, 2016	Sep.6, 2018
KMO Shielded Room	KMO	KMO-001	N/A	NCR	NCR
3m Anechoic Chamber	KMO	KMO-3AC	N/A	Dec.23, 2017	Dec.23, 2019