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FCC
Dynamic Frequency Selection
Test Report

Under:
FCC 15 Subpart E, Paragraph 15.407
Operation within the bands 5.25-5.35 GHz and 5.47-5.725 GHz
Client Without Radar Detection
(NII) Unlicensed National Information Infrastructure

Prepared For :

Grandstream Networks, Inc.

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

FCC ID: YZZGXV3370
EUT: IP Multimedia Phone
Model: GXV3370

May 11, 2018 **Issue Date:**
Original Report **Report Type:**
 **Test Engineer:** Jacky Huang
 **Review By:** Apollo Liu / Manager

Table of Contents

Report Revision History

Report #	Version	Description	Issued Date
KSZ2018031601J05	Rev.01	Initial issue of report	April 24, 2018
KSZ2018031601J05	Rev.02	Update the signature of cover page & section 1.2	May 11, 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 Detai1. 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 16, 2018
Date of Receipt of Test Item: March 16, 2018
Date of Test : March 23~April 24, 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 Multimedia Phone
Brand Name:	Grandstream
Model Name:	GXV3370
EUT RF Technology:	☒Bluetooth v3.0 + EDR ☒ Bluetooth v4.0 LE ☐Bluetooth v4.2 LE ☐Bluetooth v5.0 LE ☒WLAN 2.4GHz 802.11b/g/n HT/20/40 ☒WLAN 5GHz 802.11a/n HT20/HT40 ☐WLAN 5GHz 802.11ac VHT20/VHT40/VHT80
HW Version:	v1.2A
SW Version:	1.0.0.5
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.	

Additional Information

Standard Product Specification		
Tx/Rx Frequency Range	☒5250~5350 MHz	☒5470~5725 MHz
DFS Function	☐Master	☐Client with radar detection
	☒Client without radar detection	
EUT WLAN Technology	☒5250~5350 MHz	
	☒WLAN 5GHz 802.11a ☒WLAN 5GHz 802.11n HT20 ☒WLAN 5GHz 802.11n HT40 ☐WLAN 5GHz 802.11ac VHT20 ☐WLAN 5GHz 802.11ac VHT40 ☐WLAN 5GHz 802.11ac VHT80	
	☒5470~5725 MHz	
	☒WLAN 5GHz 802.11a ☒WLAN 5GHz 802.11n HT20 ☒WLAN 5GHz 802.11n HT40 ☐WLAN 5GHz 802.11ac VHT20 ☐WLAN 5GHz 802.11ac VHT40 ☐WLAN 5GHz 802.11ac VHT80	
Antenna Type / Gain	☒5250~5350 MHz	
	Ant.1: Internal PCB Antenna with gain 4 dBi	
	☒5470~5725 MHz	
	Ant.1: Internal PCB Antenna with gain 4 dBi	
Type of Modulation	☒802.11a/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) ☐802.11ac : OFDM (BPSK / QPSK / 16QAM / 64 QAM / 256QAM)	

Specification of Accessory				
☒**AC/DC Adapter #1 (EU)**	**Brand Name**	Sunlight	**Model Name**	H18DE1200150A
	Power Rating	I/P: AC 100-240V~50/60Hz, 0.8A; O/P:DC 12V /1.5A		
☒**AC/DC Adapter #2 (EU)**	**Brand Name**	Frecom	**Model Name**	F18W8-120150SPAVY
	Power Rating	I/P: AC 100-240V~50/60Hz, 0.6A; O/P:DC 12V /1.5A		

Transmit Power Control (TPC)
U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW. Maximum EIRP of this device is less than 500mW, therefore it's not require TPC function according to FCC15E RF report.

Statement of Manufacturer
Manufacturer statement confirming that information regarding the parameters of the detected Radar Waveforms is not available to the end user. And the device doesn't have Ad Hoc mode on DFS frequency band.

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 E FCC KDB 905462 D02 UNII DFS Compliance Procedures New Rules FCC KDB 905462 D03 UNII Clients Without Radar Detection New Rules
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:

UNII	Bandwidth / Channel	Test Item	Limit	Result
UNII Band 2-A 5250~5350MHz and UNII Band 2-C 5470~5725MHz	40MHz / CH102_5510MHz	Channel Move Time	10 sec	PASS
		Channel Closing Transmission time	200 ms + aggregate of 60 ms over remaining 10 s period	PASS
		Non-Occupancy Period and Client Beacon Test	30 minutes	PASS

Note: The Product is slave without radar detection function.

3. EUT Modifications

No modification by test lab.

4. Requirements and Parameters for DFS Test s

4.1 Applicability of DFS Requirement

Table 1: Applicability of DFS Requirements Prior to Use of a Channel

Requirement	DFS Operational mode		
	☐Master	☒Client Without Radar Detection	☐Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

Table 2: Applicability of DFS requirements during normal operation

Requirement	DFS Operational mode		
	☐Master	☒Client Without Radar Detection	☐Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes
Client Beacon Test	N/A	Yes	Yes

Additional requirements for devices with multiple bandwidth modes	DFS Operational mode	
	☐Master Device or Client with Radar Detection	☒Client Without Radar Detection
U-NII Detection Bandwidth and Statistical Performance Check	All BW modes must be tested	Not required
Channel Move Time and Channel Closing Transmission Time	Test using widest BW mode available	Test using the widest BW mode available for the link
All other tests	Any single BW mode	Not required
Note: Frequencies selected for statistical performance check (Section 7.8.4) should include several frequencies within the radar detection bandwidth and frequencies near the edge of the radar detection bandwidth. For 802.11 devices it is suggested to select frequencies in each of the bonded 20 MHz channels and the channel center frequency.		

4.2 DFS Detection Thresholds and Response Requirement

Below table provides the DFS Detection Thresholds for Master Devices as well as Client Devices incorporating In-Service Monitoring.

DFS Detection Thresholds for Master Devices and Client Devices With Radar Detection

Maximum Transmit Power	Value (See Notes 1 , 2 and 3)
EIRP ⩾ 200 milliwatt	-64 dBm
EIRP < 200 milliwatt and power spectral density < 10 dBm / MHz	-62 dBm
EIRP < 200 milliwatt and that do not meet the power spectral density requirement	-64 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna. **Note 2**: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response. **Note3**: EIRP is based on the highest antenna gain. For MIMO devices refer to KDB Publication 662911 D01.	

DFS Response Requirement Values

Maximum Transmit Power	Value (See Notes 1 , 2 and 3)
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds.
Channel Move Time	10 seconds. (See Note 1.)
Channel Closing Transmission Time	200 milliseconds + an aggregate of 60 milliseconds over remaining 10 second period. (See Notes 1 and 2.)
U-NII Detection Bandwidth	Minimum 100% of the U- NII 99% transmission power bandwidth. (See Note 3.)
Note 1: Channel Move Time and the Channel Closing Transmission Time should be performed with Radar Type 0. The measurement timing begins at the end of the Radar Type 0 burst. **Note 2**: The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate a Channel move (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions. **Note 3**: During the U-NII Detection Bandwidth detection test, radar type 0 should be used. For each frequency step the minimum percentage of detection is 90 percent. Measurements are performed with no data traffic.	

4.3 Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

4.3.1 Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Number of Trials
0	1	1428	18	See Note 1	See Note 1
1	1	Test A: 15 unique PRI values randomly selected from the list of 23 PRI values in Table 5a Test B: 15 unique PRI values randomly selected within the range of 518-3066 µsec, with a minimum increment of 1 µsec, excluding PRI values selected in Test A	$\text{Roundup}\left\{\left(\frac{1}{360}\right)\cdot\left(\frac{19\cdot 10^6}{\text{PRI}_{\mu\text{sec}}}\right)\right\}$	60%	30
2	1-5	150-230	23-39	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120
Note 1: Short Pulse Radar Type 0 should be used for the detection bandwidth test, channel move time, and channel closing time tests.					

A minimum of 30 unique waveforms are required for each of the Short Pulse Radar Types 2 through 4. If more than 30 waveforms are used for Short Pulse Radar Types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. If more than 30 waveforms are used for Short Pulse Radar Type 1, then each additional waveform is generated with Test B and must also be unique and not repeated from the previous waveforms in Tests A or B.

Pulse Repetition Intervals Values for Test A

Pulse Repetition Frequency Number	Pulse Repetition Frequency (Pulses Per Second)	Pulse Repetition Interval (Microseconds)
1	1930.5	518
2	1858.7	538
3	1792.1	558
4	1730.1	578
5	1672.2	598
6	1618.1	618
7	1567.4	638
8	1519.8	658
9	1474.9	678
10	1432.7	698
11	1392.8	718
12	1355	738
13	1319.3	758
14	1285.3	778
15	1253.1	798
16	1222.5	818
17	1193.3	838
18	1165.6	858
19	1139	878
20	1113.6	898
21	1089.3	918
22	1066.1	938
23	326.2	3066

The aggregate is the average of the percentage of successful detections of Short Pulse Radar Types 1-4. For example, the following table indicates how to compute the aggregate of percentage of successful detections.

Radar Type	Number of Trials	Number of Successful Detections	Minimum Percentage of Successful Detection
1	35	29	82.9%
2	30	18	60%
3	30	27	90%
4	50	44	88%
Aggregate (82.9% + 60% + 90% + 88%)/4 = 80.2%			

4.3.2 Long Pulse Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Number of Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse Radar Type waveforms. If more than 30 waveforms are used for the Long Pulse Radar Type waveforms, then each additional waveform must also be unique and not repeated from the previous waveforms.

4.3.3 Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per Burst	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Number of Trials
6	1	333	9	0.333	300	70%	30

For the Frequency Hopping Radar Type, the same Burst parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm.

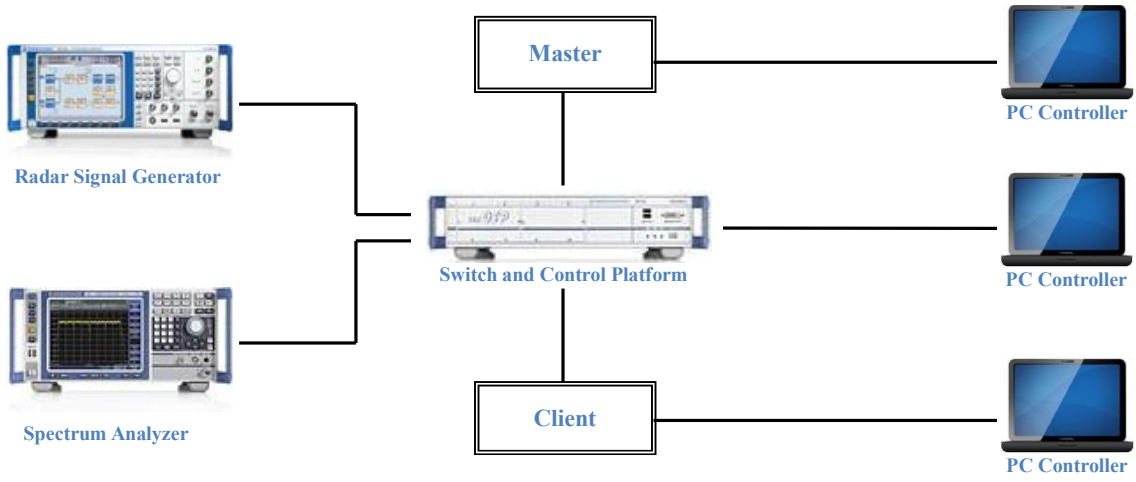
The first frequency in a hopping sequence is selected randomly from the group of 475 integer frequencies from 5250 – 5724 MHz. Next, the frequency that was just chosen is removed from the group and a frequency is randomly selected from the remaining 474 frequencies in the group. This process continues until all 475 frequencies are chosen for the set. For selection of a random frequency, the frequencies remaining within the group are always treated as equally likely.

4.3.4 DFS Test System

KMO DFS test system consists of two subsystems:

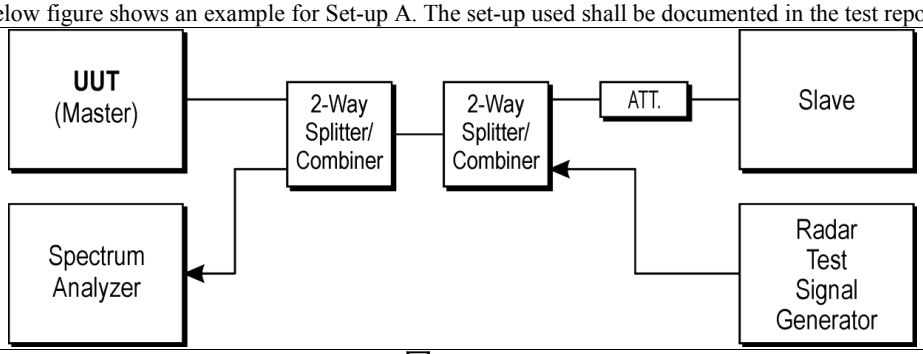
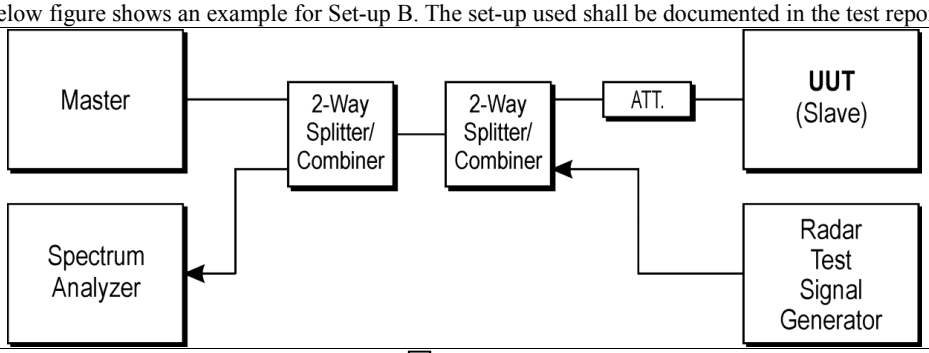
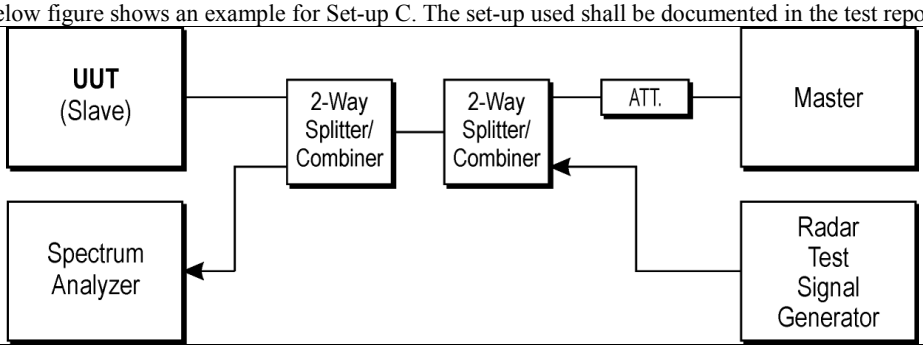
a) The radar signal generating subsystem is used for the DFS signal generation. This instrument is capable of generating all the above waveforms with Pulse Sequencer Software.

b) The traffic monitoring subsystem is used for record all plot & data.



Support Unit				
Device	**Manufacturer**	**Model #**	**FCC ID**	**Gain**
Router	NETGEAR	R7800	PY315100319	5G Ant gain : 1.61dB Maximum EIRP : 25.47dBm
☒ This device was functioned as a Master device during the DFS test. ☐ This device was functioned as a Client device during the DFS test.				

4.4 DFS Test Setup

Test Setup
☐**Set-up A**
Set-up A is a set-up whereby the UUT is a RLAN device operating in master mode. Radar test signals are injected into the UUT. This set-up also contains a RLAN device operating in slave mode which is associated with the UUT. Below figure shows an example for Set-up A. The set-up used shall be documented in the test report.

☒**Set-up B**
Set-up B is a set-up whereby the UUT is a RLAN device operating in slave mode, with or without Radar Interference Detection function. This set-up also contains a RLAN device operating in master mode. The radar test signals are injected into the master device. The UUT (slave device) is associated with the master device. Below figure shows an example for Set-up B. The set-up used shall be documented in the test report.

☐**Set-up C**
The UUT is a RLAN device operating in slave mode with Radar Interference Detection function. Radar test signals are injected into the slave device. This set-up also contains a RLAN device operating in master mode. The UUT (slave device) is associated with the master device. Below figure shows an example for Set-up C. The set-up used shall be documented in the test report.


4.5 DFS Test Method

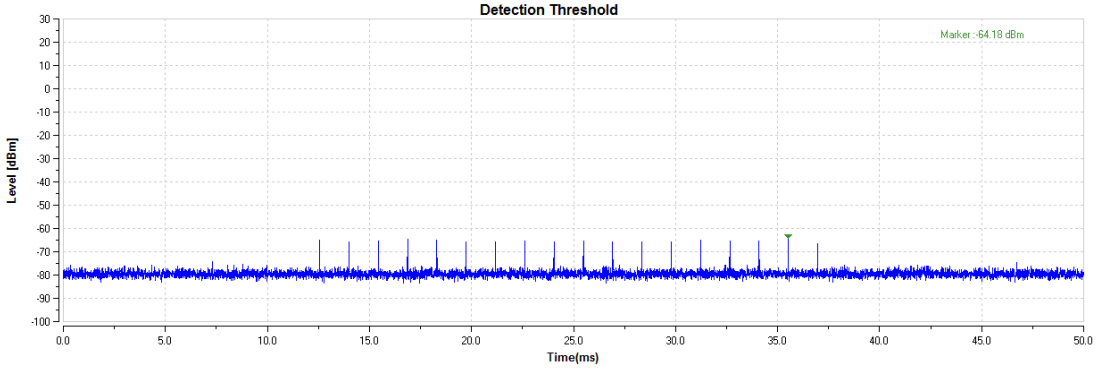
Test Method		
☒	A complete DFS Measurement System consists of two subsystems: (1) the Radar Signal Generating Subsystem and (2) the Traffic Monitoring Subsystem. The control PC is necessary for generating the Radar waveforms. The traffic monitoring subsystem is specified to the type of unit under test (UUT).	
☒	System testing will be performed with channel-loading using means appropriate to the data types that are used by the unlicensed device. The following requirements apply:	
	☐	Option 1: The data file must be of a type that is typical for the device (i.e., MPEG-2, MPEG-4, WAV, MP3, MP4, AVI, etc.) and must generally be transmitting in a streaming mode.
	☐	Option 2: Software to ping the client is permitted to simulate data transfer but must have random ping intervals.
	☒	Option 3: Timing plots are required with calculations demonstrating a minimum channel loading of approximately 17% or greater.
	☐	Option 4: Unicast or Multicast protocols are preferable but other protocols may be used. The appropriate protocol used must be described in the test procedures.
☒	Calibration of DFS Detection Threshold Level The measured channel is 5510MHz. The radar signal was the same as transmitted channels, and injected into the antenna of AP (master) or Client Device with Radar Detection, measured the channel closing transmission time and channel move time. The calibrated detection threshold level is set to -64dBm. The tested level is lower than required level hence it provides margin to the limit.	

4.6 DFS Test Results

4.6.1 Device Operating In Client without Radar Detection Mode.

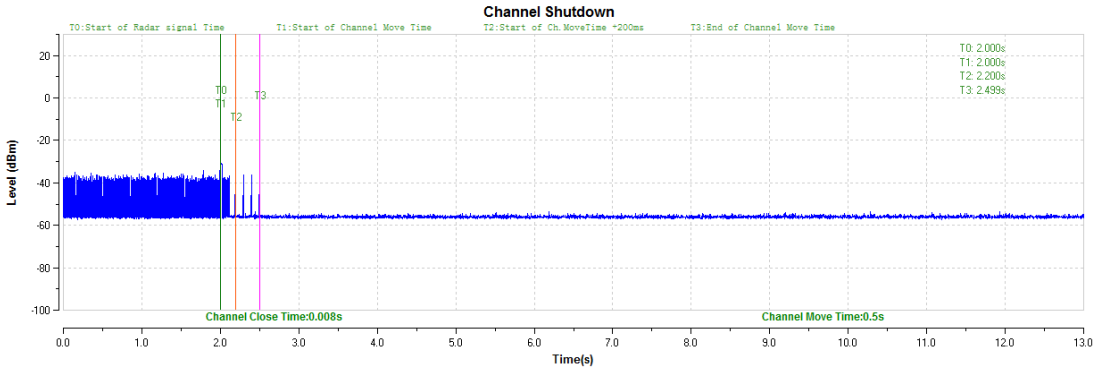
Client with injection at the Master. (The radar test signals are injected into the Master Device)

802.11n HT40_ Radar Signal 0_Detection Threshold	
For a detection threshold level of -64dBm, the required signal strength at EUT antenna location is -64 dBm. The tested level is lower than required level hence it provides margin to the limit.	
Mode: 11n	Ant: Ant1
Channel: 5510	Voltage: VN
Temperature: TN	**Result: PASS** **Value:** **Detection Threshold Level：-64.18 dBm**
Start Time: 22/04/2018 10:32:17	End Time: 22/04/2018 10:32:35



4.6.2 Channel Closing Transmission and Channel Move Time

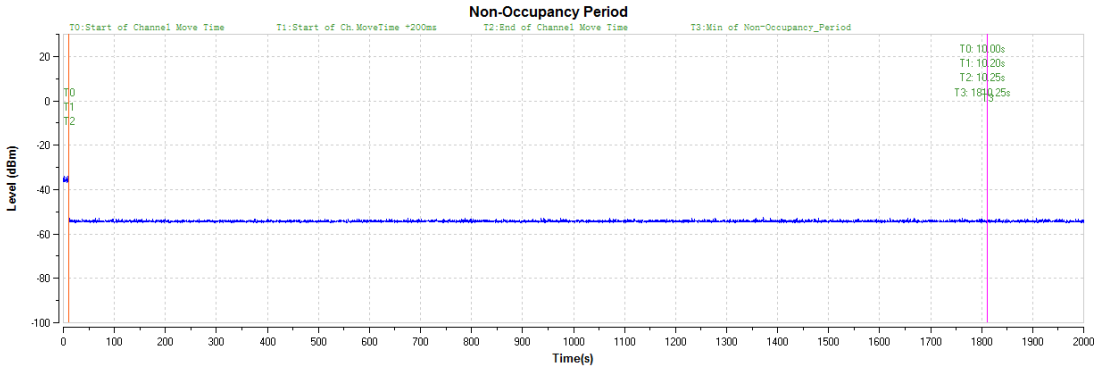
802.11n HT40_ Radar Signal 0_Channel Shutdown	
Mode: 11n	Ant: Ant1
Channel: 5510	Voltage: VN
Temperature: TN	**Result: PASS** **Value:** **Channel Move Time:0.5S,** **Channel Close Time:0.008S,** **Transmitter activity ratio:1.3873%,** **WaveformLength:2.57E-07s**
Start Time: 22/04/2018 19:38:03	End Time: 22/04/2018 19:38:42



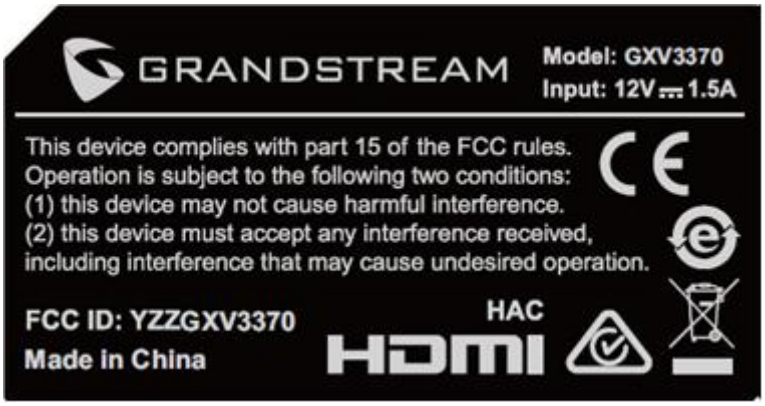
4.6.3 Non-Occupancy Period

Associate test:
During the 30 minutes observation time, UUT did not make any transmissions on a channel after a radar signal was detected on that channel by either the Channel Availability Check or the In-Service Monitoring.

802.11n HT40_ Radar Signal 0_Non-Occupancy Period	
Mode: 11n	Ant: Ant1
Channel: 5510	Voltage: VN
Temperature: TN	**Result: PASS** **Value:** **Channel Move Time:0S,** **Channel Close Time:0S,** **Transmitter activity ratio:1.5498%,** **Non-Occupancy Period:1810.25S** **WaveformLength:2.57E-07s**
Start Time: 22/04/2018 18:50:58	End Time: 22/04/2018 19:25:42



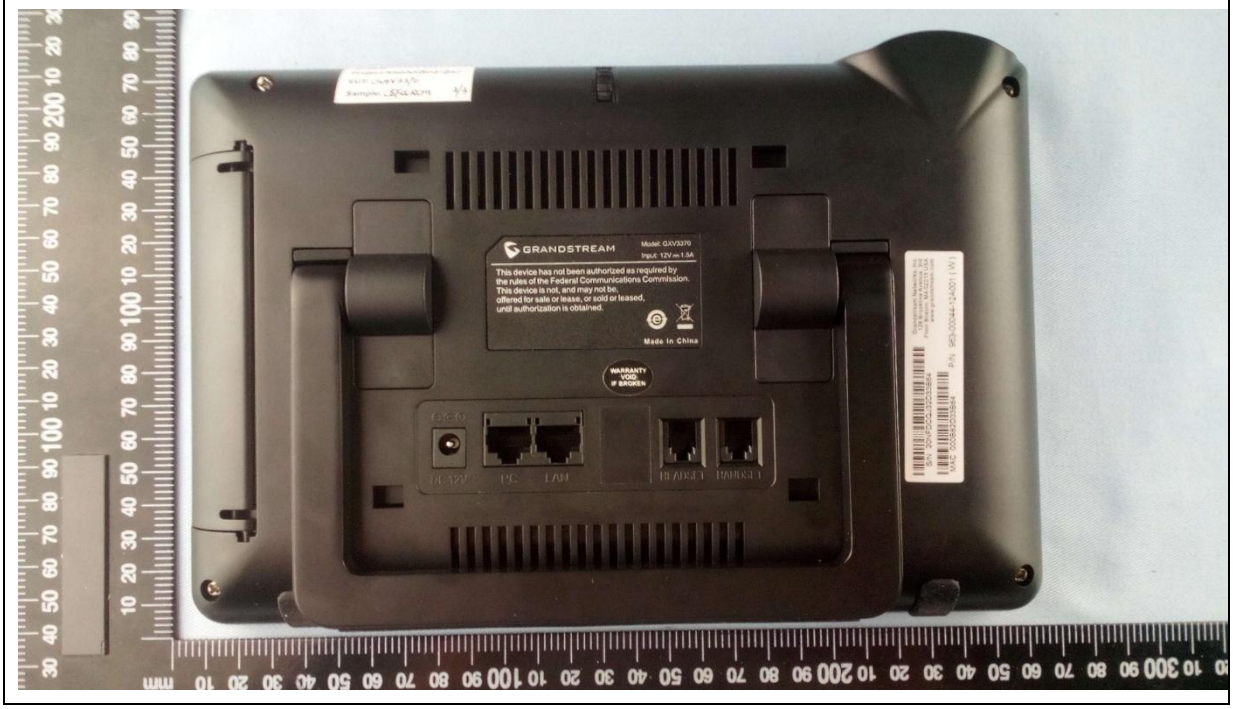
3. FCC ID Label



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 interferencethat may cause undesired operation of this device.**"

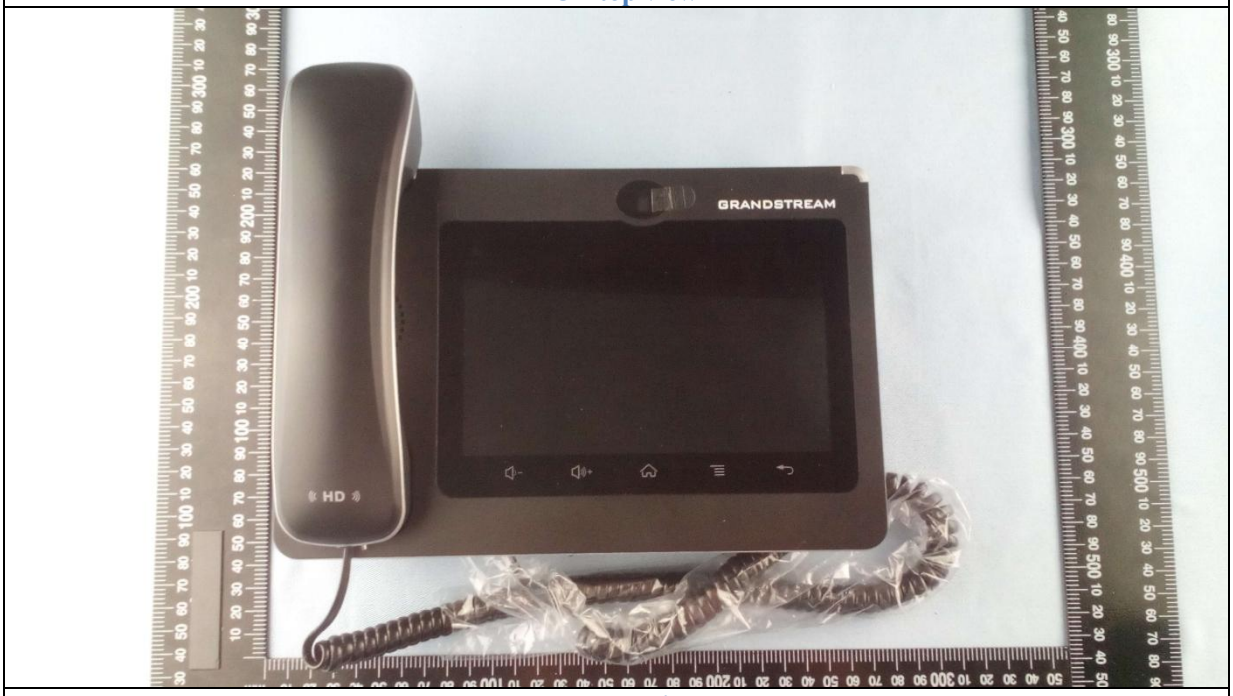
The Label must not be a stick-on paper label. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT



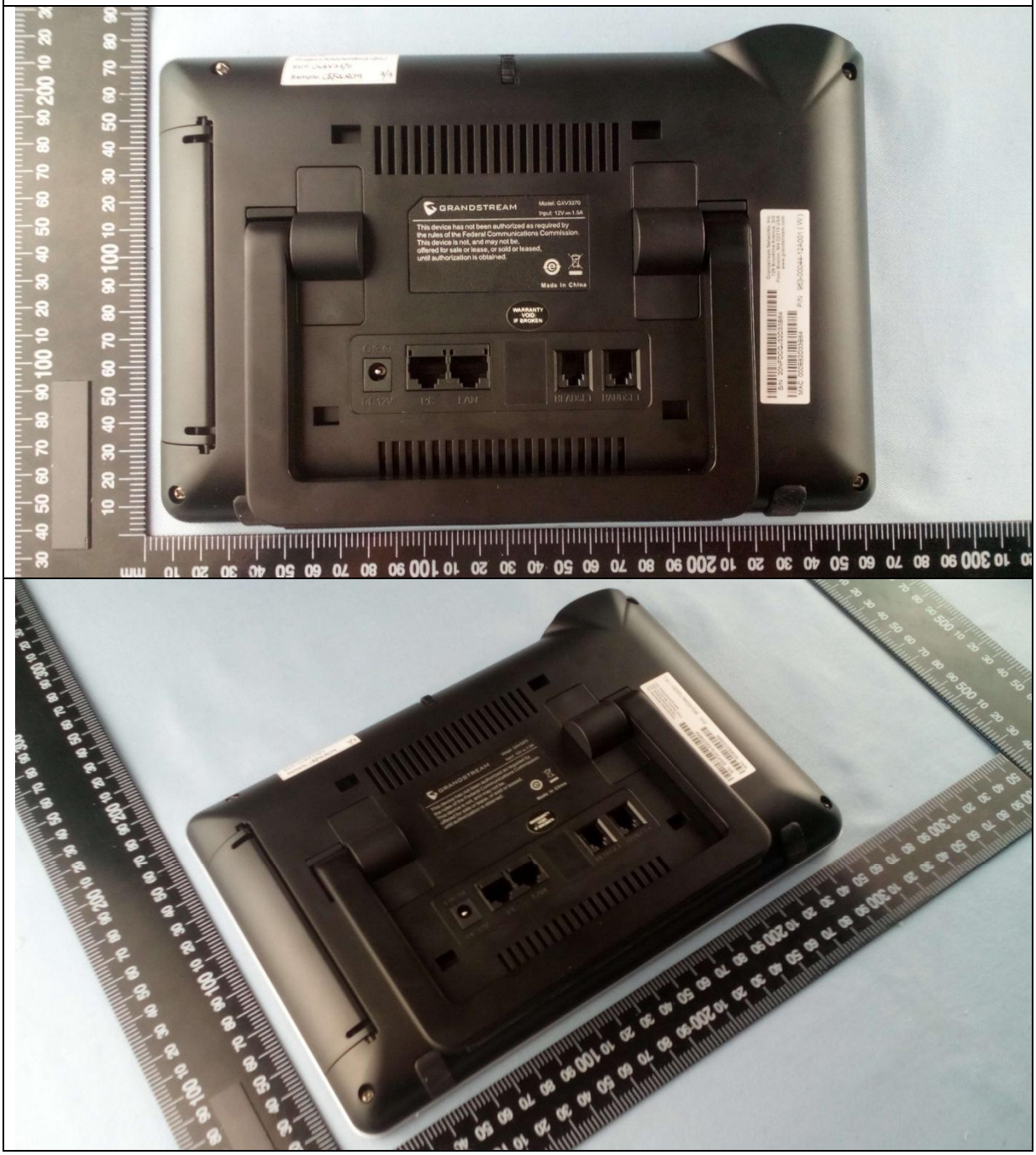
4. Photographs - EUT

EUT top view

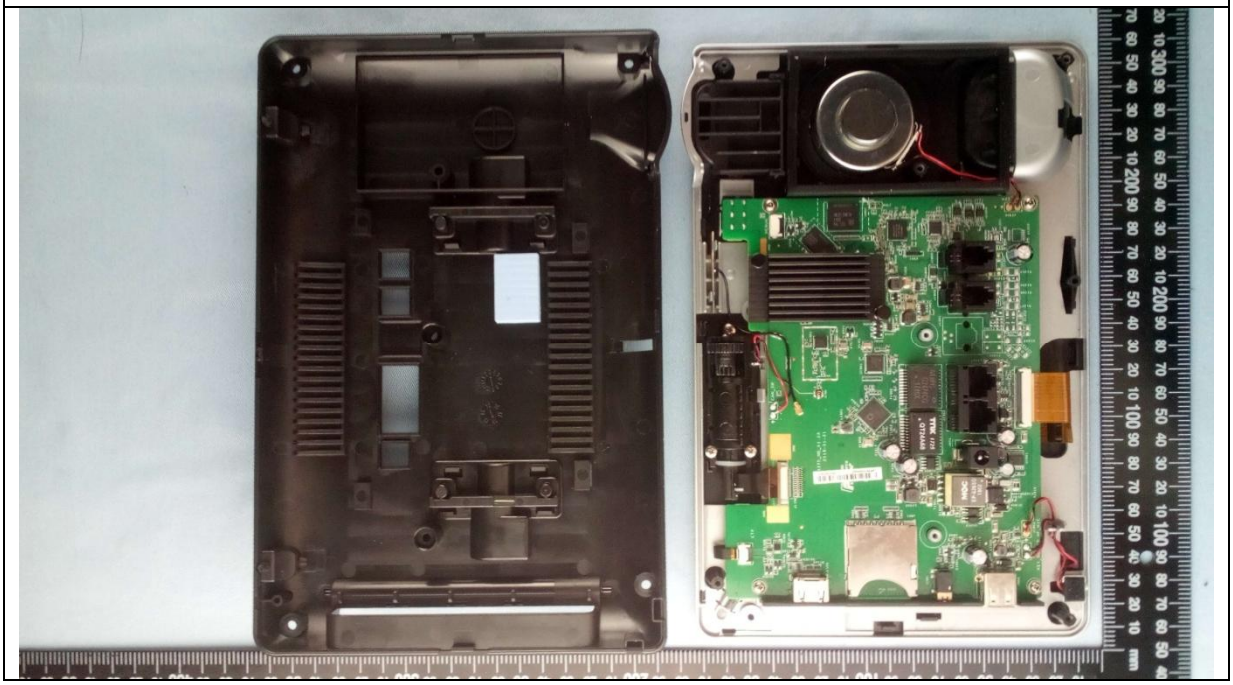


EUT Top view

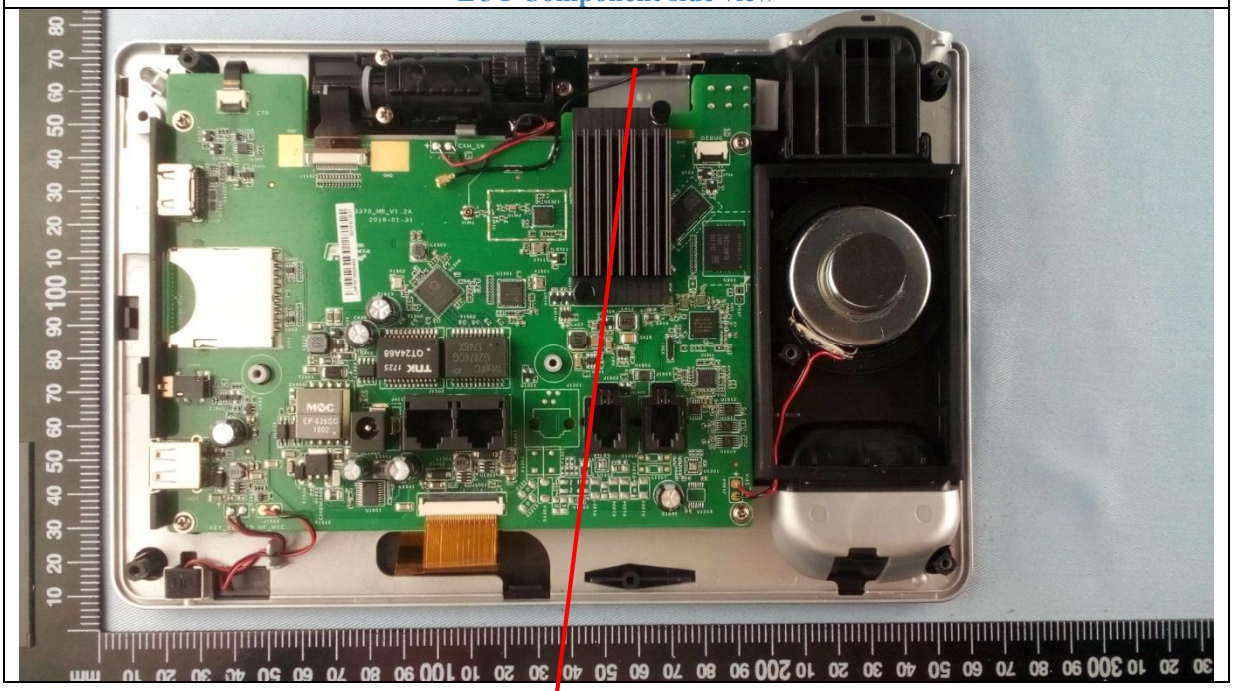
EUT Bottom view



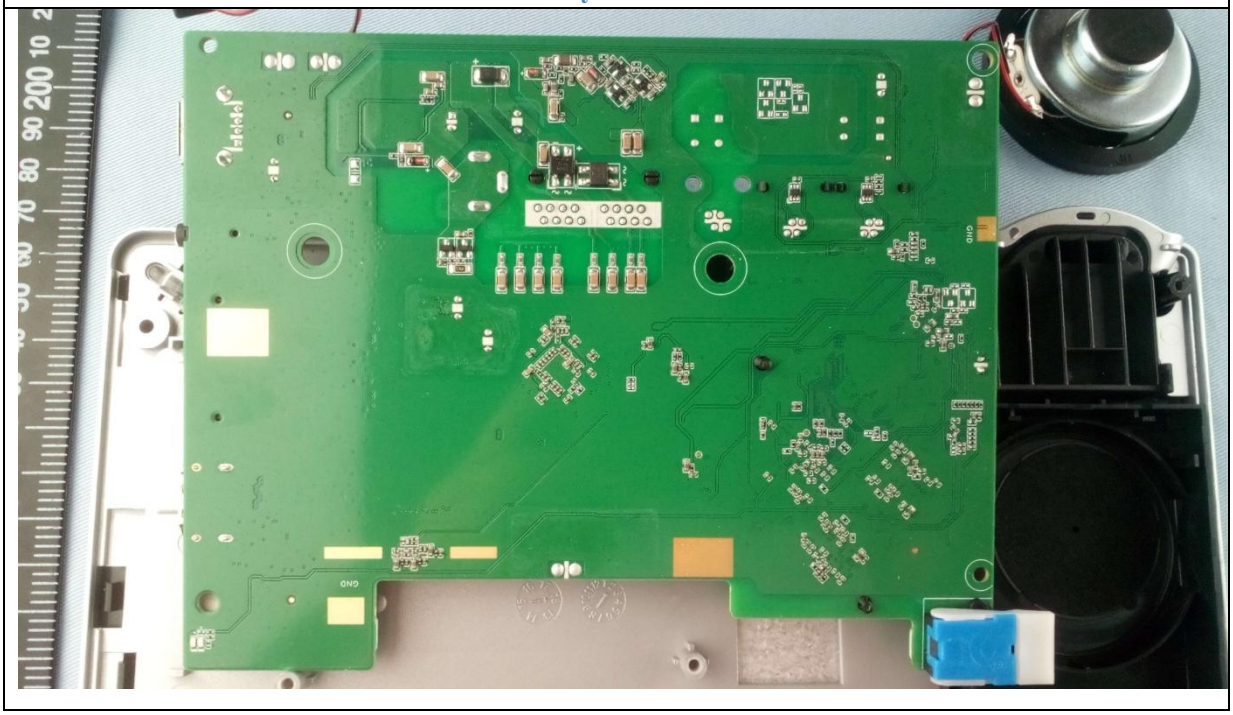
EUT inside whole view



EUT Component side view



EUT Layout side view



AC/DC Adapter view

AC/DC Adapter view

5 Test Equipment

Equipment/ Facilities	Manufacturer	Model #	Serial No.	Due Date
Turntable	Innco systems GmbH	CT-0801	KMO-SZ114	NCR
Antenna Tower	Innco systems GmbH	MA-4640-XP-ET	KMO-SZ115	NCR
Controller	Innco systems GmbH	CO3000	KMO-SZ116	NCR
Pre-Amplifier	Agilent	87405C	KMO-SZ155	Dec.6, 2019
Pre-Amplifier	Com-Power	PAM-840	KMO-SZ156	Dec.6, 2019
Horn Antenna	SCHWARZBECK	BBHA 9170	KMO-SZ157	Dec.6, 2019
EMI Test Receiver	Rohde & Schwarz	ESR7	KMO-SZ002	Dec.6, 2018
Spectrum Analyzer	Rohde & Schwarz	FSP40	KMO-SZ003	Dec.14, 2019
Loop Antenna	Rohde & Schwarz	HFH2-Z2	KMO-SZ004	Feb.21, 2020
Trilog-Super Broadband Antenna	SCHWARZBECK	VULB9161	KMO-SZ005	August 27, 2018
Trilog-Super Broadband Antenna	SCHWARZBECK	VULB9161	KMO-SZ006	August 19, 2018
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9120D	KMO-SZ007	August 19, 2018
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9120D	KMO-SZ008	August 19, 2018
AMN	Rohde & Schwarz	ESH3-Z5	KMO-SZ009	Dec.25, 2019
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	KMO-SZ077	Dec.25, 2019
ISN	SCHWARZBECK	NTFM 8158 CAT3	KMO-SZ070	Dec.25, 2019
ISN	SCHWARZBECK	NTFM 8158 CAT5	KMO-SZ071	Dec.25, 2019
ISN	SCHWARZBECK	NTFM 8158 CAT6	KMO-SZ072	Dec.25, 2019
KMO Shielded Room	KMO	KMO-001	KMO-SZ036	NCR
Coaxial Cable with N-Connectors	SCHWARZBECK	AK9515H	KMO-SZ037	Sep.18, 2019
AC Power Source / Analyzer	Agilent	6813B	KMO-SZ166	July 14, 2019
AC Power Source / Analyzer	Tektronix	PA1000	KMO-SZ229	Dec.18, 2019
Power Meter	Rohde & Schwarz	OSP-B157	KMO-HK015	Dec.14, 2019
Regulatory Test System 30 MHz to 40 GHz	Rohde & Schwarz	TS8997	KMO-HK015	Dec.14, 2019
Digital Radio Communication Tester	Rohde & Schwarz	CMD60	KMO-SZ169	Dec.14, 2019
UNIVERSAL RADIO COMMUNICATION TESTER	Rohde & Schwarz	CMU200	KMO-SZ170	Dec.14, 2019
Program Control Telephone Exchanger	Excelltel	CDX8000-M	KMO-SZ221	NCR
3m Anechoic Chamber	KMO	KMO-3AC	KMO-3AC-1	Dec.23, 2019
Temperature Chamber	TABAI	PSL-4GTW	KMO-SZ230	Feb.10, 2019