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FCC TEST REPORT

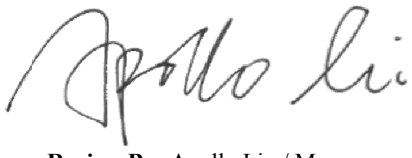
Under
FCC 15 Subpart C, Paragraph 15.247
Operation within the bands902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz
(DSS) Spread Spectrum Transmitter

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

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Report Revision History

Report #	Version	Description	Issued Date
KSZ2018031601J01	Rev.01	Initial issue of report	April 24, 2018
KSZ2018031601J01	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
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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	2402~2480 MHz
Number of Channels	79
Carrier Frequency of Each Channel	f=2402+k MHz (k=0,1,2…,78)
Antenna Type / Gain	InternalPCB Antenna / gain 3 dBi
Type of Modulation	Bluetooth BR 1Mbps: GFSK Bluetooth EDR 2Mbps: π/4-DQPSK Bluetooth EDR 3Mbps: 8DPSK

Specification of Accessory				
☒AC/DC Adapter #1 (US)	**Brand Name**	Sunlight	**Model Name**	H18US1200150A
	Power Rating	I/P: AC 100-240V~50/60Hz, 0.8A; O/P:DC 12V /1.5A		
☒AC/DC Adapter #2 (US)	**Brand Name**	Frecom	**Model Name**	F18W8-120150SPAUY
	Power Rating	I/P: AC 100-240V~50/60Hz, 0.6A; O/P:DC 12V /1.5A		

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 15.247 ANSI C63.10-2013
Note: 1) All test items were verified and recorded according to the standards and without any deviation during the test. 2) This EUT has also been tested and complied with the requirements of FCC 15 Part 15, Subpart B, recorded in a separate test report.

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
15.247(a)(1)	Number of Hopping Channels	>15	PASS	Complies.
15.247(a)(1)	Hopping Channel Separation	≥ 2/3 of 20dB BW	PASS	Complies.
15.247(a)(1)	Dwell Time	≤ 0.4sec in 31.6sec period	PASS	Complies.
15.247(a)(1)	20dB Bandwidth	N/A	PASS	Complies.
15.247(b)(1)	Conducted Output Power	<=1 w for 1Mbps <=125 mW for 2,3Mbp	PASS	Complies.
15.247(d)	Radiated Band Edges and Radiated Spurious Emission	FCC 15.209(a) & 15.247(d)	PASS	Complies
15.247(d)	Conducted Band Edges	≤ 20dBc	PASS	Complies
15.247(d)	Conducted Spurious Emission	≤ 20dBc	PASS	Complies
15.207	Conducted Emission	FCC15.207(a)	PASS	Complies
15.203 & 15.247(b)	Antenna Requirement	N/A	PASS	Complies
15.247(i) & 1.1307(b)(1) & 2.1091	Maximum Permissible Exposure (MPE)	< 1mW/cm^2	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

The EUT has one internal PCB antenna, which was permanently attached and the gain is 3 dBi, Therefore the EUT complies with Section 15.203 of the FCC rules.

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
6 dB & 99% Bandwidth	-	5%
Peak Power	-	1.10
Peak PowerSpectral Density	-	1.10
Band EdgesMeasurement	-	1.10

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

3. EUT Modifications

No modification by test lab.

4. Conducted Power Line Test

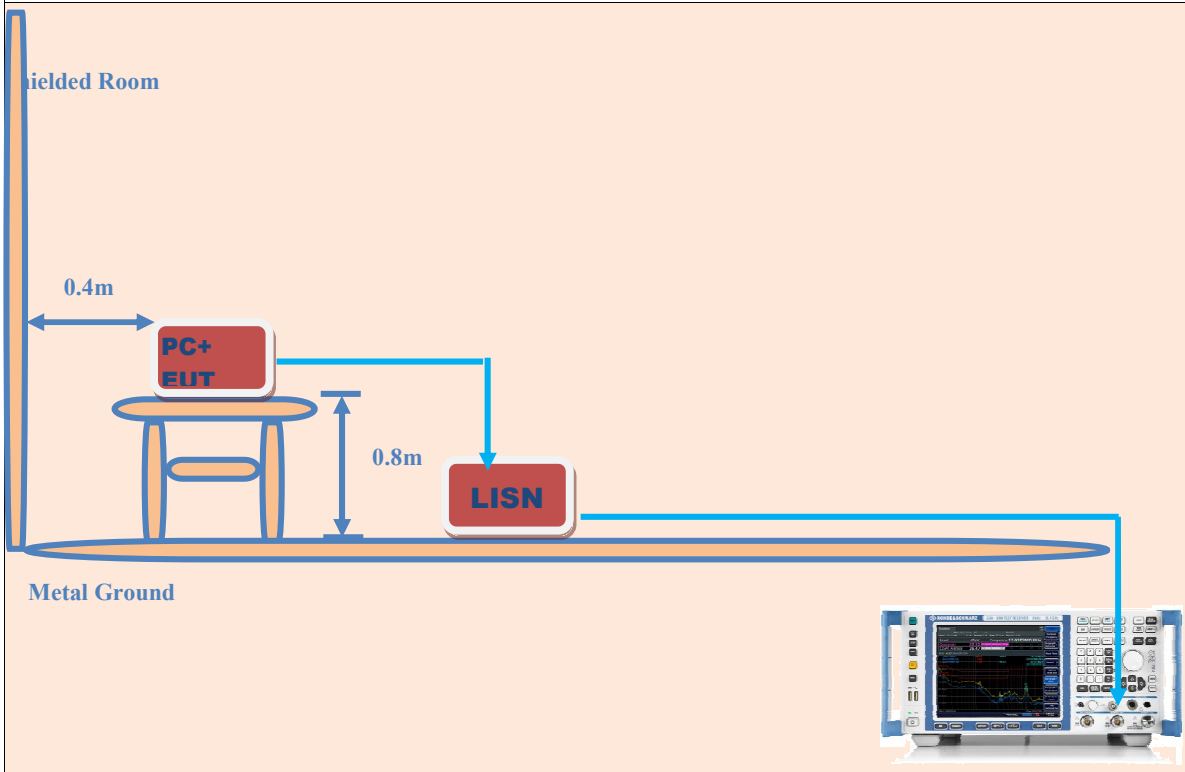
4. 1 Test Equipment

Please refer to Section 10 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

Description of Bluetooth Test Mode

Channel	Frequency (MHz)	Bluetooth RF Output Power Data Rate / Modulation					
		GFSK_DH5		π/4-DQPSK_2DH5		8DPSK_3DH5	
		1Mbps		2Mbps		3Mbps	
CH00	2402	6.75	dBm	5.90	dBm	6.36	dBm
CH39	2441	6.60	dBm	5.72	dBm	5.90	dBm
CH78	2480	6.48	dBm	5.59	dBm	5.69	dBm

Note:
1) All the test data for each data rate were verified, but only the worst case was reported.
2) The data rate was set in 1Mbps for all the test items due to the highest RF output power.

Bluetooth Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary Tables of Test Mode			
Test Item	Data Rate / Modulation		
	GFSK BT BD 1Mbps	π /4-DQPSK BT EDR 2Mbps	8DPSK BT EDR 3Mbps
Conducted Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Test Item	**BT BR 1Mbps GFSK**		
Radiated Cases	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz		
AC Conducted Emission	Mode 1: Bluetooth Link with Controller (Adapter #1 mode) Mode 2: Bluetooth Link with Controller (Adapter #2 mode)		

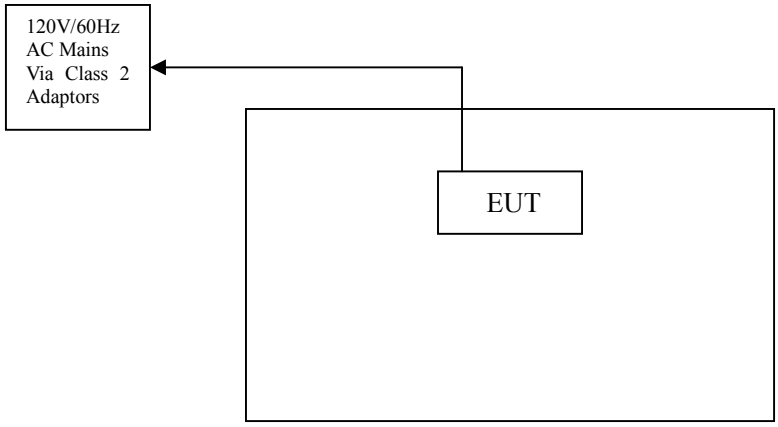
Note:
1) The worst case of conducted emission is mode 2; only the worst case was reported.
2) For Radiated case, The tests were performed with Adapter #1, Controller.

EUT Operation Test Setup
For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit/receive. For AC power line conducted emissions, the EUT was set to connect with the PC host under large package sizes transmission.

Support Unit				
Device	Manufacturer	Model # Serial #	FCC ID/ DoC	Cable
Notebook	ACER	ZQE	HLZ-AR5B97	1.5m unshielded power cord
-	-	-	-	-

4. 5 EUT Operating Condition

Operating condition is according to ANSI C63.10:2013.
a. Setup the EUT and simulators as shown on follow.
b. Enable RF signal and confirm EUT active.
c. Modulate output capacity of EUT up to specification.

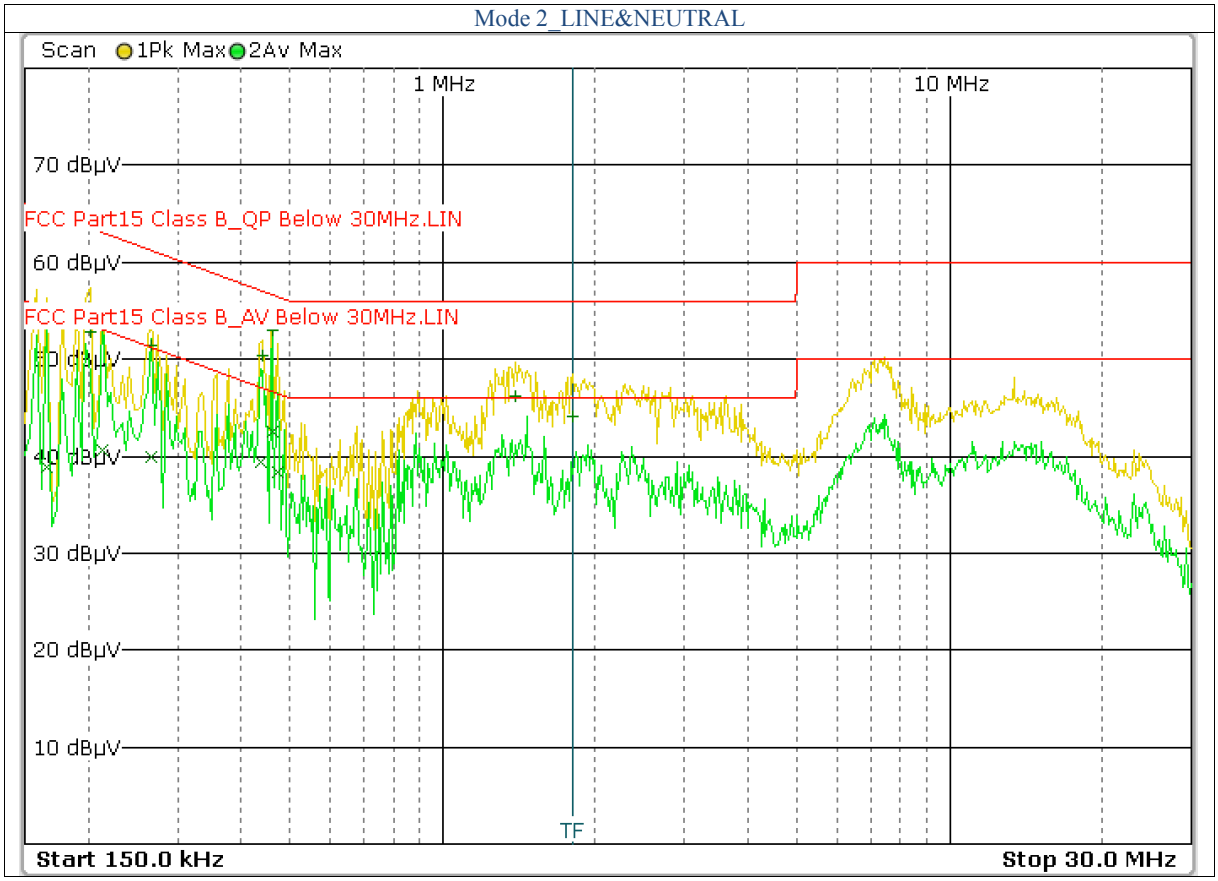


4. 6 Conducted Power Line Emission Limits

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

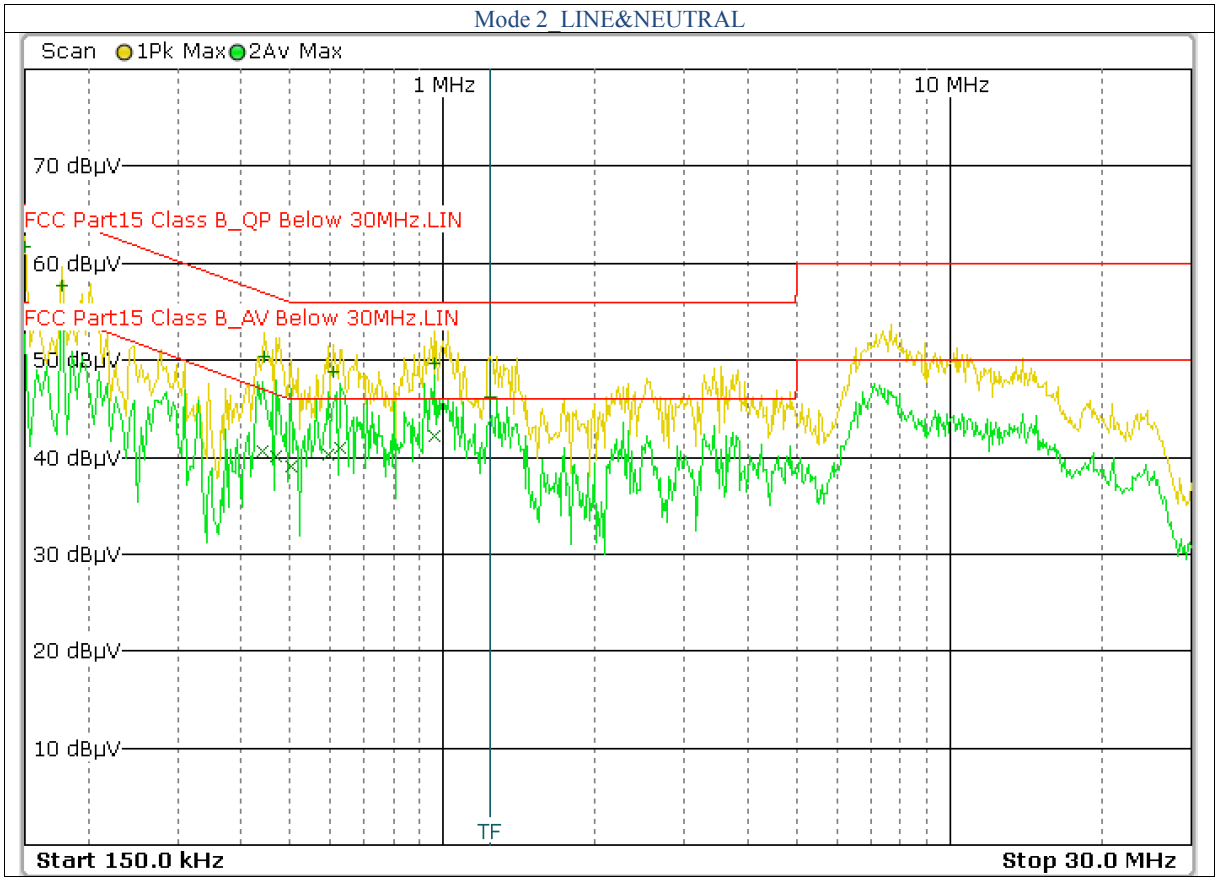
Note: In the above table, the tighter limit applies at the band edges.

4. 7 Conducted Power Line Test Result



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
0.166	42.49	28.59	10.30	52.79	38.89	Line	65.16	55.16	-12.37	-16.27
0.266	41.08	29.65	10.30	51.38	39.95	Line	61.24	51.24	-9.86	-11.29
0.442	40.01	29.02	10.40	50.41	39.42	Line	57.02	47.02	-6.61	-7.60
0.462	42.53	32.07	10.40	52.93	42.47	Line	56.66	46.66	-3.73	-4.19
0.474	39.22	28.20	10.40	49.62	38.6	Line	56.44	46.44	-6.82	-7.84
1.390	35.86	22.55	10.40	46.26	32.95	Line	56.00	46.00	-9.74	-13.05
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.



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
0.150	51.47	25.35	10.30	61.77	35.65	Neutral	66.00	56.00	-4.23	-20.35
0.178	47.37	23.72	10.30	57.67	34.02	Neutral	64.58	54.58	-6.91	-20.56
0.446	40.00	30.27	10.40	50.40	40.67	Neutral	56.95	46.95	-6.55	-6.28
0.610	38.47	29.80	10.40	48.87	40.20	Neutral	56.00	46.00	-7.13	-5.80
0.996	39.24	31.77	10.40	49.64	42.17	Neutral	56.00	46.00	-6.36	-3.83
1.238	35.84	20.88	10.40	46.24	31.28	Neutral	56.00	46.00	-9.76	-14.72
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. FCC Part 15.247 Requirements for FHSS Systems

5. 1 Test Equipment

Please refer to Section 10 this report.

5. 2 Test Procedure

Refer to FCC 15.247(a)(2), ANSI C63.10:2013

20 dB Bandwidth:
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antennaport to the spectrum analyzer.
c. Set the spectrum analyzer as RBW = 30 kHz, VBW = 100 kHz, Span = 2 MHz, Sweep = 100ms.
d. Mark the peak frequency and –20dB (upper and lower) frequency.
e. Repeat until all the rest channels are investigated.

Peak Power:
Use the following spectrum analyzer settings:
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured; VBW ⩾ RBW; Sweep = auto
Detector function = peak; Trace = max hold

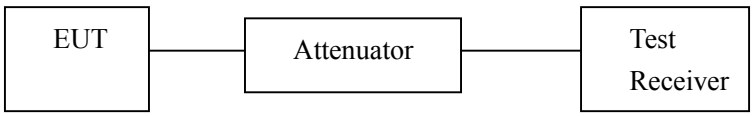
100kHz Bandwidth of Band Edges Measurement:
a. The transmitter output was connected to the spectrum analyzer via a low lose cable.
b. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge.
c. The band edges was measured and recorded.

Frequency Separation:
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antennaport to the spectrum analyzer.
c. Set the spectrum analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = 2 MHz, Sweep = 100ms.
d. Set center frequency spectrum analyzer = middle of hopping channel.

Number of Hopping Frequency:
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antennaport to the spectrum analyzer.
c. Set spectrum analyzer Start=2400MHz, Stop=2483.5MHz, RBW = 100 kHz, VBW = 300 kHz, Sweep=100ms
d. Max hold, view and count how many channel in the band.

Time of Occupancy (Dwell Time):
a. Place the EUT on the table and set it in the transmitting mode.
b. Remove the antenna from the EUT and then connect a low loss RF cable from the antennaport to the spectrum analyzer.
c. Set center frequency of spectrum analyzer = operating frequency, RBW = 100 kHz, VBW = 300 kHz, Sweep=2ms
d. Repeat above procedures until all frequency measured were complete.

5. 3 Test Setup



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 Limit

20 dB Bandwidth: For frequency hopping systems operating in the 2400MHz~2483.5MHz no limit for 20dB bandwidth
Peak Power: For frequency hopping systems operating in the 2400~2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725~5850MHz band: 1Watt. For all other frequency hopping systems in the 2400~2483.5MHz band: 0.125Watts.
100kHz Bandwidth of Band Edges Measurement: According to §15.247(c), in any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, 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).
Peak Power Spectral Density: According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission
Frequency Separation: According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.
Number of Hopping Frequency: According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400~2483.5MHz bands shall use at least 15 hopping frequencies.
Time of Occupancy (Dwell Time): According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400~2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

5. 7 Test Result

A. 20 dB Bandwidth

Refer to Appendix_DSS_BT.

B. Peak Power

Refer to Appendix_DSS_BT.

C. 100kHz Band Edges Measurement

Refer to Appendix_DSS_BT.

D. Frequency Separation

Refer to Appendix_DSS_BT.

E. Number of Hopping Frequency

Refer to Appendix_DSS_BT.

F. Time of Occupancy (Dwell Time)

Refer to Appendix_DSS_BT.

6. Transmitter Spurious Radiated Emission at 3 Meters

6. 1 Test Equipment

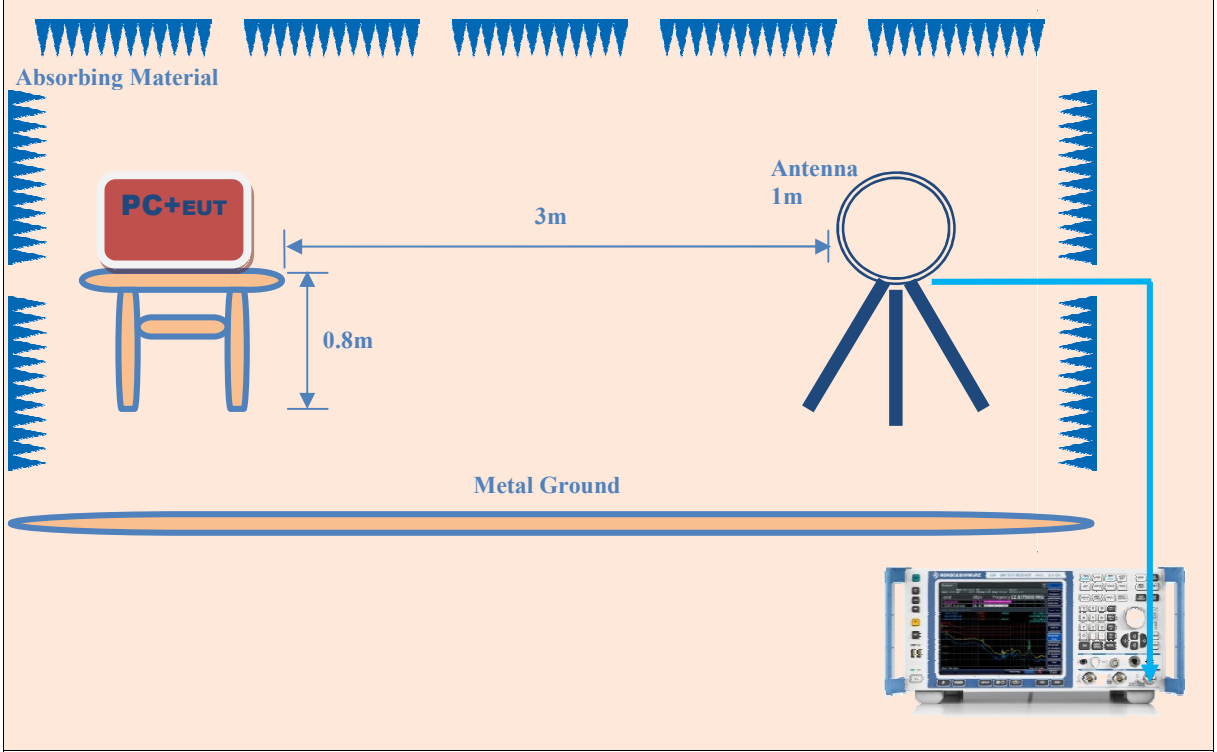
Please refer to Section 10 this report.

6. 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.
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 withall installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings wasperformed only when an emission was found to be marginal (within -4 dB of specification limit), and aredistinguished 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 ofANSI C63.10:2013.

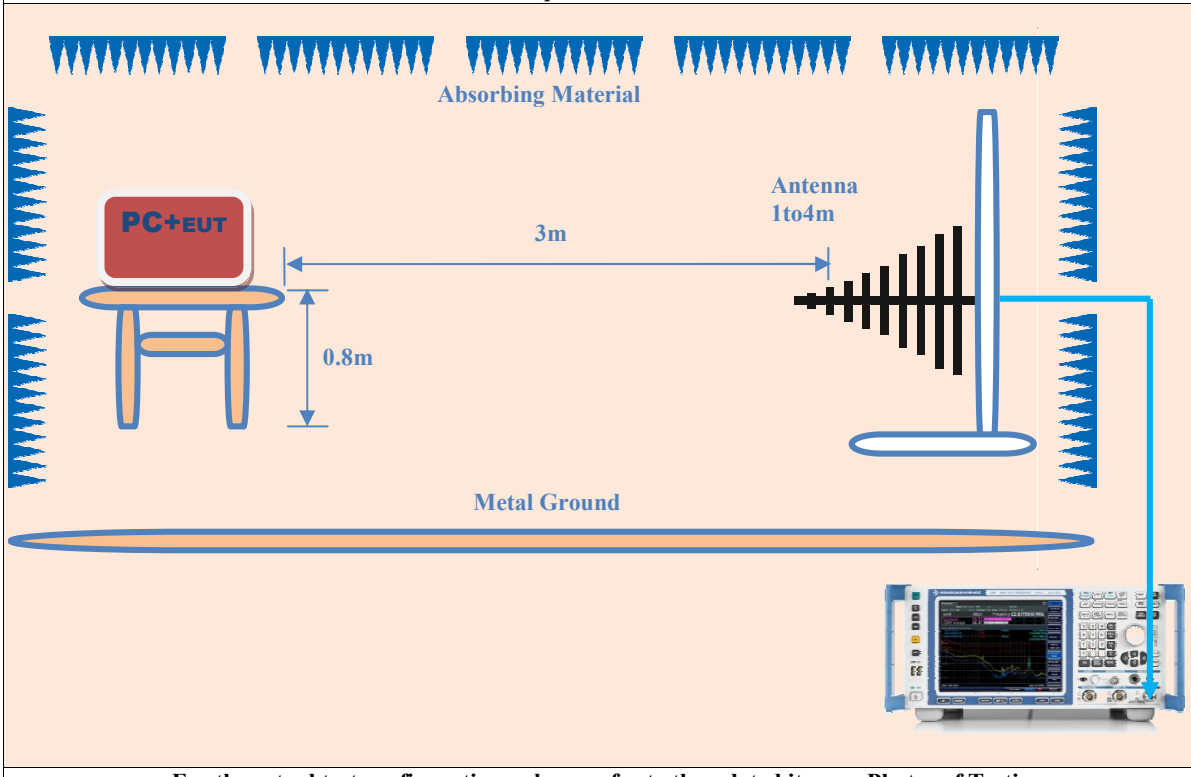
6. 3 Test Setup

For Frequencies below 30MHz



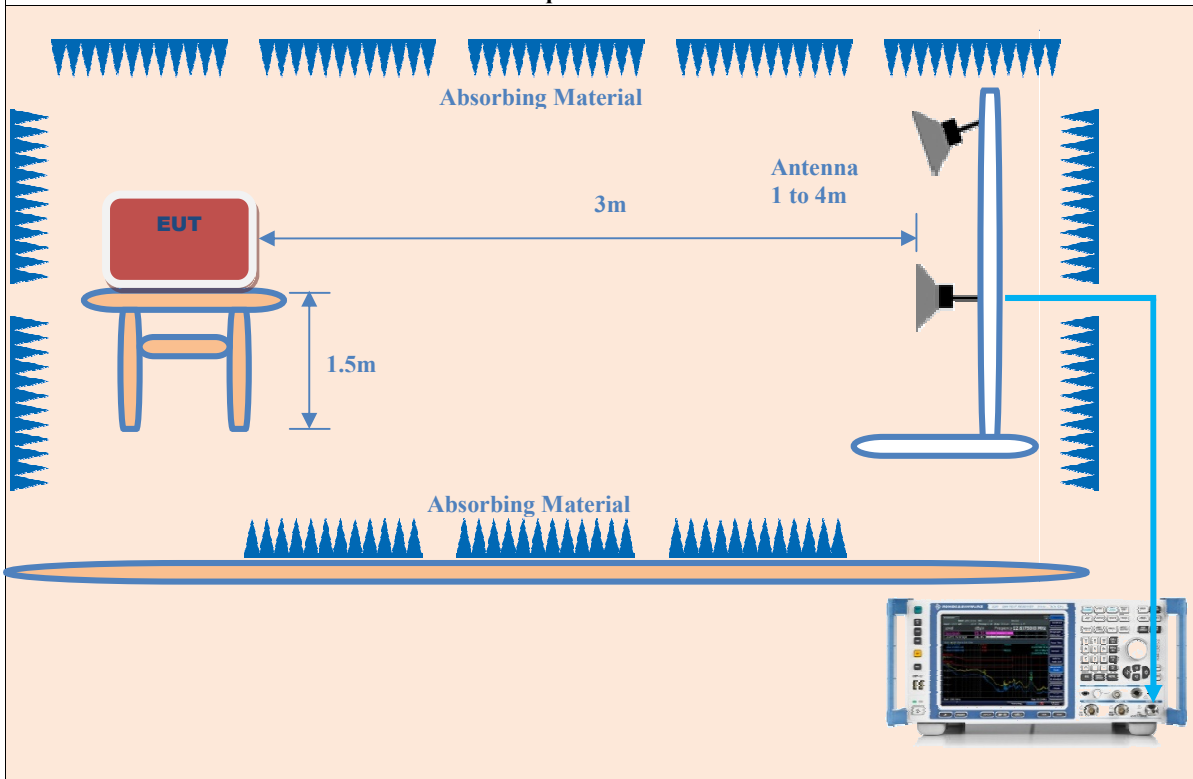
For the actual test configuration , please refer to the related items – Photos of Testing

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

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 Limit
In any 100 KHz bandwidth outside the operating frequency band, the radio frequency power that is produced bymodulation products of the spreading sequence, the information sequence and the carrier frequency shall beeither at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of thedesired 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 radiatedemission limits specified in section 15.209(a)

Note:
Applies to harmonics/spurious emissions that fall in the restricted bands listed in section 15.205.Themaximum 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 instrumentemploying 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)	Fieldstrength (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

6. 7 Test Result

Restricted Frequency Bands Data_GFSK CH Low									
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2385.300	44.37	30.38	0.90	45.27	31.28	Horiz./	74.0	54.0	-28.73	-22.72
2388.900	43.31	29.95	0.90	44.21	30.85	Vert.	74.0	54.0	-29.79	-23.15
Restricted Frequency Bands Data_GFSK CH High									
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2498.600	43.90	29.84	0.37	44.27	30.21	Horiz./	74.0	54.0	-29.73	-23.79
2496.300	44.91	31.48	0.37	45.28	31.85	Vert.	74.0	54.0	-28.72	-22.15

Restricted Frequency Bands Data_ π /4-DQPSK CH Low									
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2385.620	43.97	30.14	0.90	44.87	31.04	Horiz./	74.0	54.0	-29.13	-22.96
2388.400	44.93	30.82	0.90	45.83	31.72	Vert.	74.0	54.0	-28.17	-22.28
Restricted Frequency Bands Data_ π /4-DQPSK CH High									
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2484.700	44.51	30.67	0.37	44.88	31.04	Horiz./	74.0	54.0	-29.12	-22.96
2487.520	45.25	30.91	0.37	45.62	31.28	Vert.	74.0	54.0	-28.38	-22.72

Restricted Frequency Bands Data_8DPSK CH Low									
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2385.600	44.39	30.66	0.90	45.29	31.56	Horiz./	74.0	54.0	-28.71	-22.44
2387.300	45.63	31.78	0.90	46.53	32.68	Vert.	74.0	54.0	-27.47	-21.32
Restricted Frequency Bands Data_8DPSK CH High									
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
2496.600	44.94	31.25	0.37	45.31	31.62	Horiz./	74.0	54.0	-28.69	-22.38
2494.120	45.31	31.68	0.37	45.68	32.05	Vert.	74.0	54.0	-28.32	-21.95

Harmonics Radiated Emission Data_GFSK CH Low										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
4804.000	29.75	16.48	10.10	39.85	26.58	Horiz./	74.0	54.0	-34.15	-27.42
4804.000	31.16	18.57	10.10	41.26	28.67	Vert.	74.0	54.0	-32.74	-25.33
7206.000	31.59	17.44	13.10	44.69	30.54	Horiz./	74.0	54.0	-29.31	-23.46
7206.000	33.48	18.94	13.10	46.58	32.04	Vert.	74.0	54.0	-27.42	-21.96
24020.00	-	-	-	-	-	-	-	-	-	-
24020.00	-	-	-	-	-	-	-	-	-	-
Harmonics Radiated Emission Data_GFSK CH Mid										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
4882.000	29.96	16.79	10.10	40.06	26.89	Horiz./	74.0	54.0	-33.94	-27.11
4882.000	31.27	19.53	10.10	41.37	29.63	Vert.	74.0	54.0	-32.63	-24.37
7323.000	31.96	17.81	13.10	45.06	30.91	Horiz./	74.0	54.0	-28.94	-23.09
7323.000	33.83	19.12	13.10	46.93	32.22	Vert.	74.0	54.0	-27.07	-21.78
24410.00	-	-	-	-	-	-	-	-	-	-
24410.00	-	-	-	-	-	-	-	-	-	-
Harmonics Radiated Emission Data_GFSK CH High										
Frequency (MHz)	Read Level (dBuV) PK	Read Level (dBuV) AV	Factor (dB)	Emission (dBuV/m) PK	Emission (dBuV/m) AV	Horiz./ Vert.	Limit (dBuV/m) PK	Limit (dBuV/m) AV	Margin(dB) PK	Margin(dB) AV
4960.000	29.42	16.58	10.10	39.52	26.68	Horiz./	74.0	54.0	-34.48	-27.32
4960.000	30.91	18.23	10.10	41.01	28.33	Vert.	74.0	54.0	-32.99	-25.67
7440.000	30.13	16.32	13.10	43.23	29.42	Horiz./	74.0	54.0	-30.77	-24.58
7440.000	31.41	16.96	13.10	44.51	30.06	Vert.	74.0	54.0	-29.49	-23.94
24800.00	-	-	-	-	-	-	-	-	-	-
24800.00	-	-	-	-	-	-	-	-	-	-

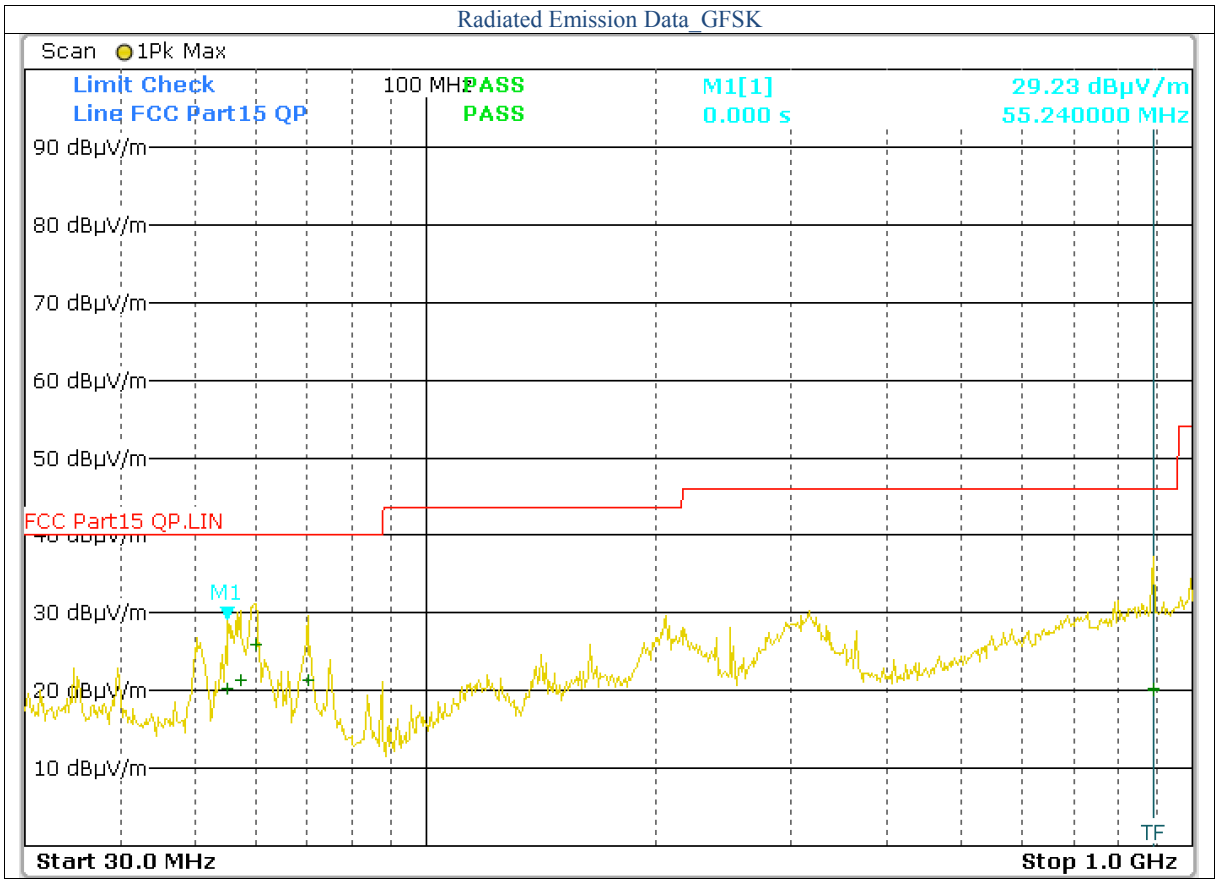
Note: (1) All Reading Levels below 1GHz are Quasi-Peak, above are peak and average value.
(2) Emission Level = Reading Level + Probe Factor + Cable Loss.
(3) Span shall wide enough to fully capture theemission being measured;
Set RBW = 1 MHz, VBW= 3MHz for f > 1 GHzfor peak measurement.
For average measurement: VBW = 10 Hz, whenduty cycle is no less than 98 percent. VBW ≥ 1/T,when duty cycle is less than 98 percent where T isthe minimum transmission duration over which thetransmitter is on and is transmitting at its maximumpower control level for the tested mode of operation.
(4) The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
(5)Where an emission level is indicated by a –, levels had a margin greater than 20 dBwhen compared to the limit.

For Frequency below 30MHz

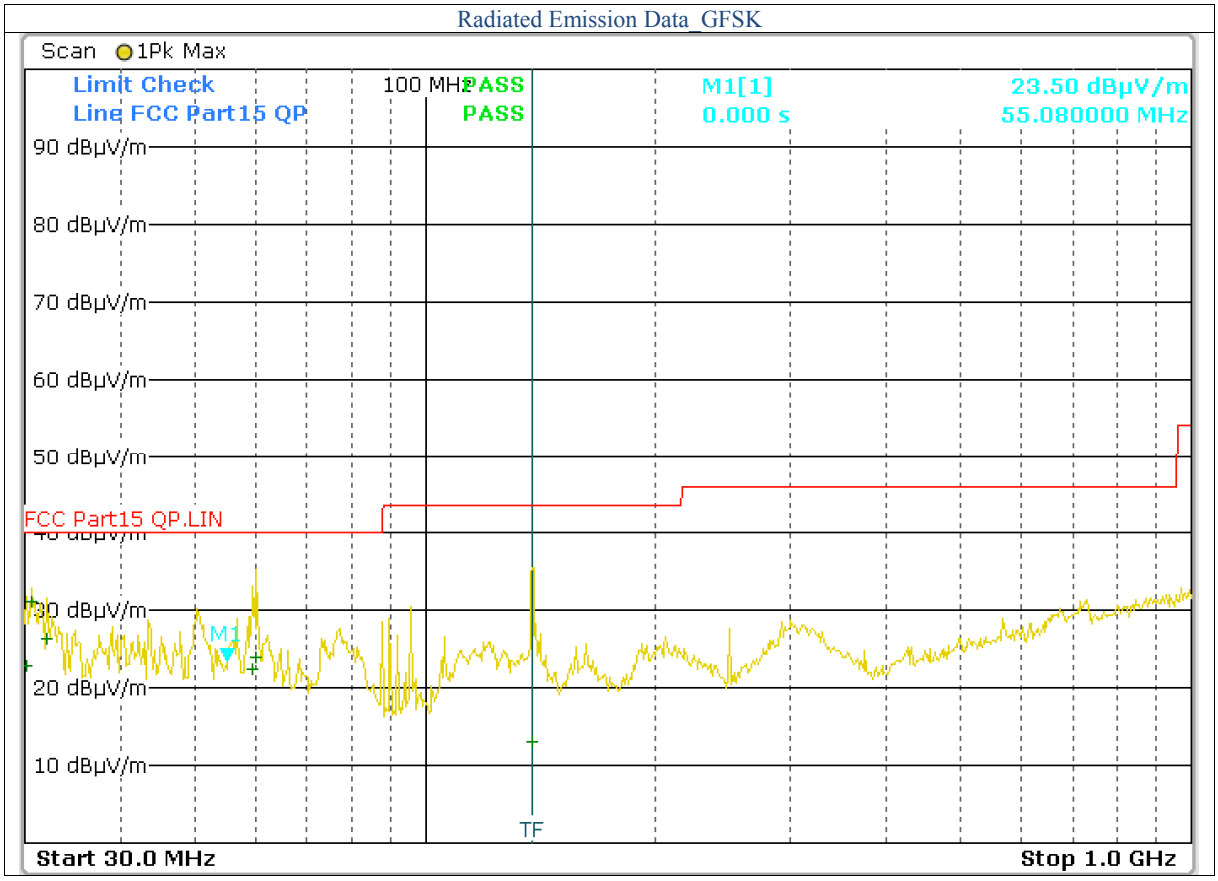
Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
N/A						
N/A						
N/A						
N/A						
N/A						
N/A						

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.

For Frequency from 30MHz to 1GHz



Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
55.24	9.64	10.66	20.30	Horiz./	40.0	-19.70
57.28	10.64	10.66	21.30	Horiz./	40.0	-18.70
59.96	15.29	10.66	25.95	Horiz./	40.0	-14.05
70.12	14.04	7.24	21.28	Horiz./	40.0	-18.72
888.52	2.32	22.68	25.00	Horiz./	46.0	-21.00
889.04	1.32	22.68	24.00	Horiz./	46.0	-22.00



Frequency (MHz)	Read Level (dBuV)	Factor (dB)	Emission (dBuV/m)	Horiz./ Vert.	Limit (dBuV/m)	Margin (dB)
30.12	10.81	12.06	22.87	Vert.	40.0	-17.13
30.64	18.99	12.06	31.05	Vert.	40.0	-8.95
32.04	14.26	12.06	26.32	Vert.	40.0	-13.68
59.44	11.83	10.66	22.49	Vert.	40.0	-17.51
60.08	15.10	8.81	23.91	Vert.	40.0	-16.09
137.88	10.28	13.83	24.11	Vert.	43.5	-19.39

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.

7. RF Exposure Requirements

7. 1 Limit

According to FCC 15.247(e)(i) and FCC 1.1307(b)(1), 2.1091 Systems operating under provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commissions guidelines.

TABLE1—LIMITSFORMAXIMUMPERMISSIBLEEXPOSURE(MPE)

Frequencyrange (MHz)	Electricfield strength (V/m)	Magneticfield strength (A/m)	Powerdensity (mW/cm^2)	Averagingtime (minutes)
(A)LimitsforOccupational/ControlledExposure				
0.3–3.0	614	1.63	*100	6
3.0–30	1842/f	4.89/f	*900/f^2	6
30–300	61.4	0.163	1.0	6
300–1,500			f/300	6
1,500–100,000			5	6
(B)LimitsforGeneralPopulation/UncontrolledExposure				
0.3–1.34	614	1.63	*100	30
1.34–30	824/f	2.19/f	*180/f^2	30
30–300	27.5	0.073	0.2	30
300–1,500			f/1500	30
1,500–100,000			1.0	30

f=frequencyinMHz*=Plane-waveequivalentpowerdensity

7. 2 MPE Calculation Method

The MPE was calculated at a given distance to show compliance with the power density limit.
The following formula was used to calculate the Power Density:

$S = PG/4\pi R^2$

S=Power density (in appropriate units, e.g. mW/cm^2)
P=Power input to the antenna
G=Power gain of the antenna relative to an isotropic radiator
R=Distance to the center of radiation of the antenna (e.g. cm)

7. 3 Test Result

Mode/Band	Maximum Antenna gain (dBi)	Maximum tune-up Conducted Power (dBm)	Evaluation Distance(cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
2402~2480MHz DH5_2402MHz	3.0	6.75	20	0.0019	1.0

Note: BT and 2.4GHz or 5GHz Wi-Fi can't transmit simultaneously.

8. Photos of Testing

8.1 EUT Test Photographs

Conducted Emission test view


Radiated Emission test view (Frequency from 30MHz to 1GHz)

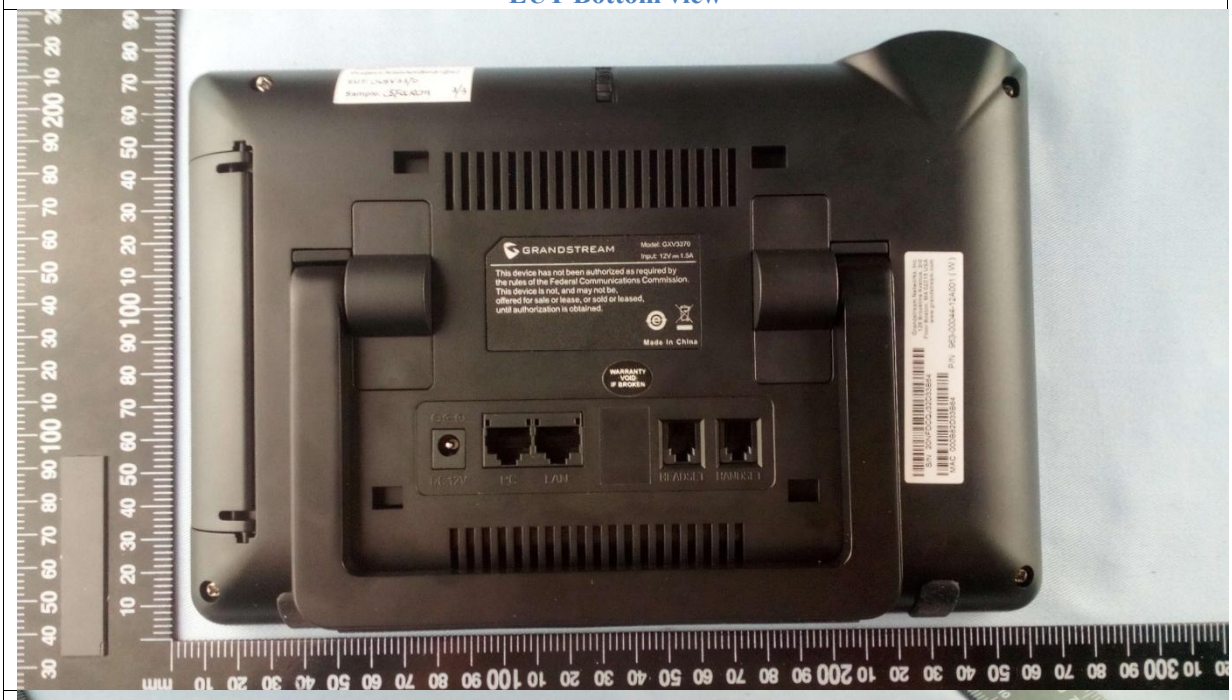

Radiated Emission test view (Frequency above 1GHz)


8.2 EUT Detailed Photographs

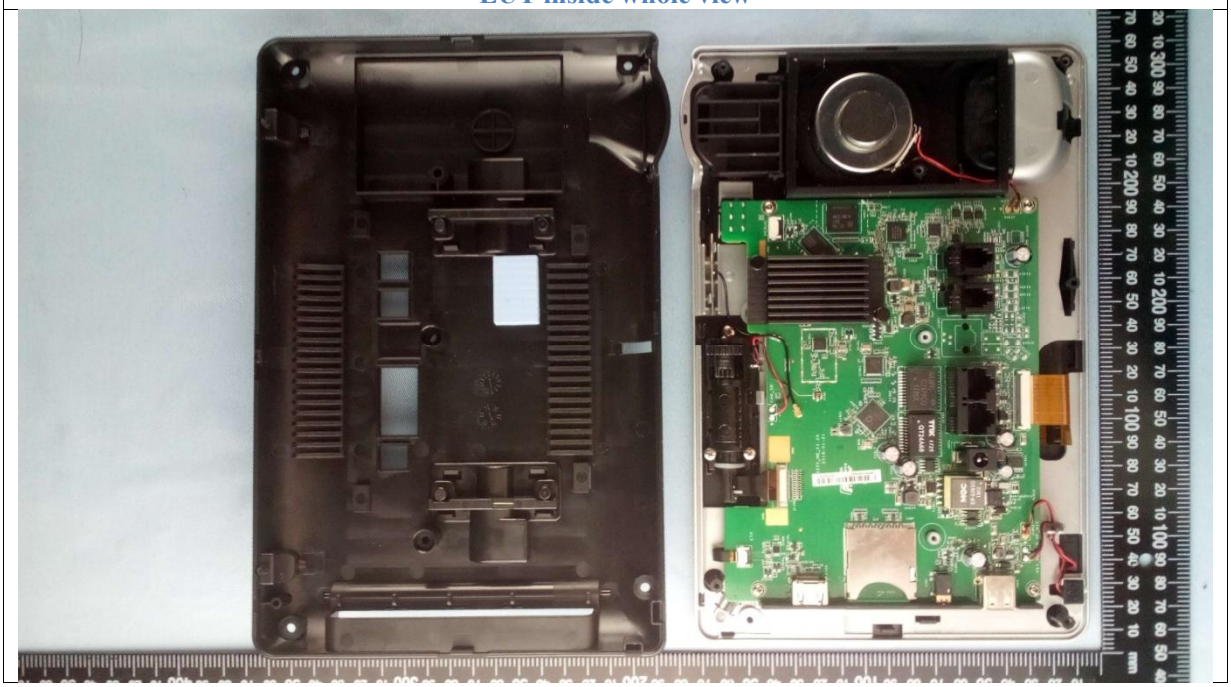
EUT top view

EUT Top view

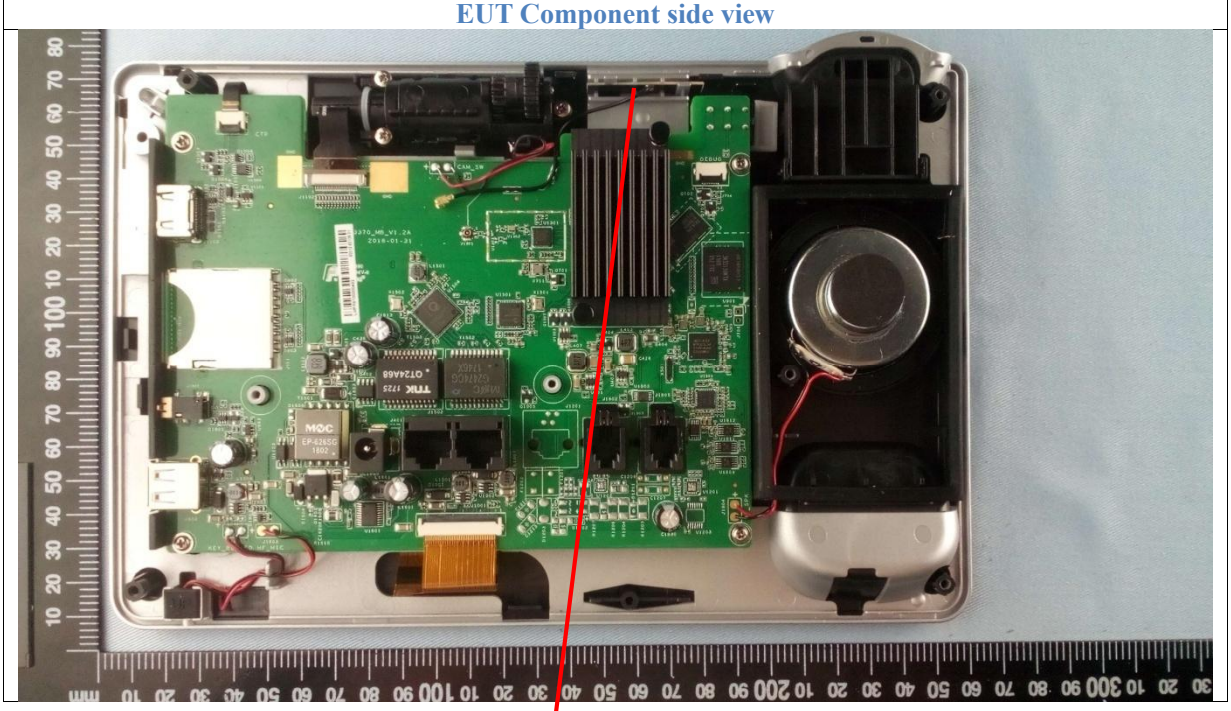
EUT Bottom view



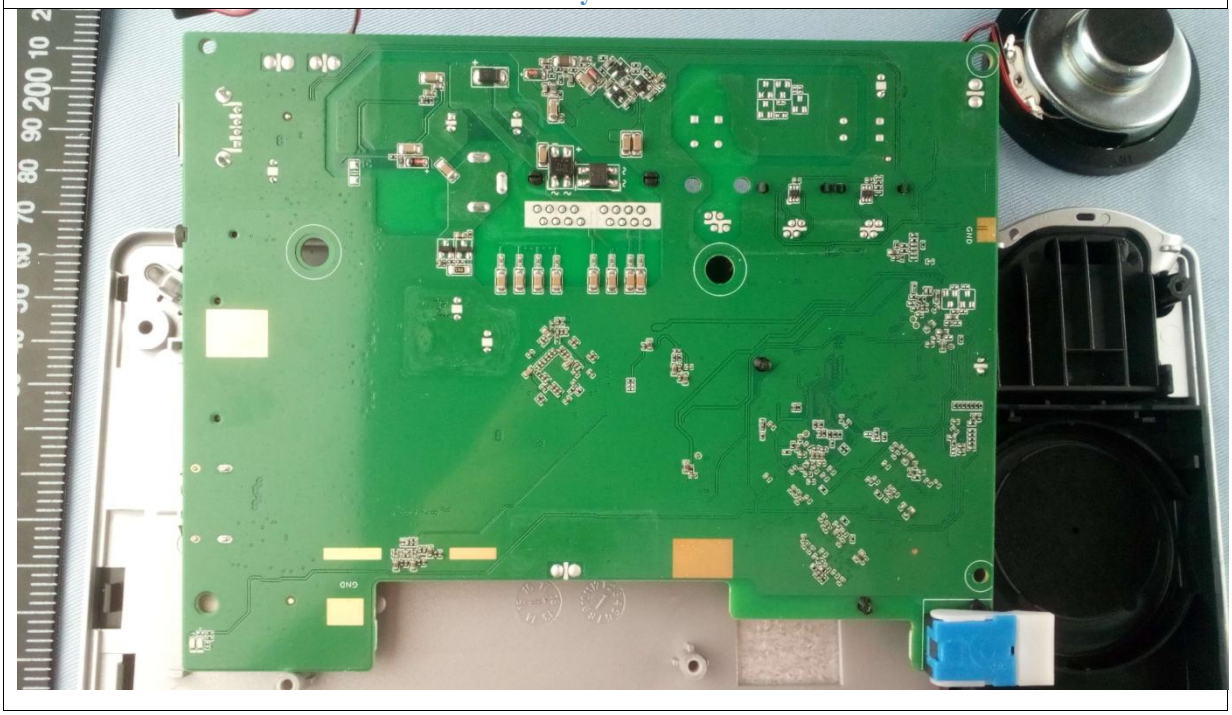
EUT inside whole view



EUT Component side view



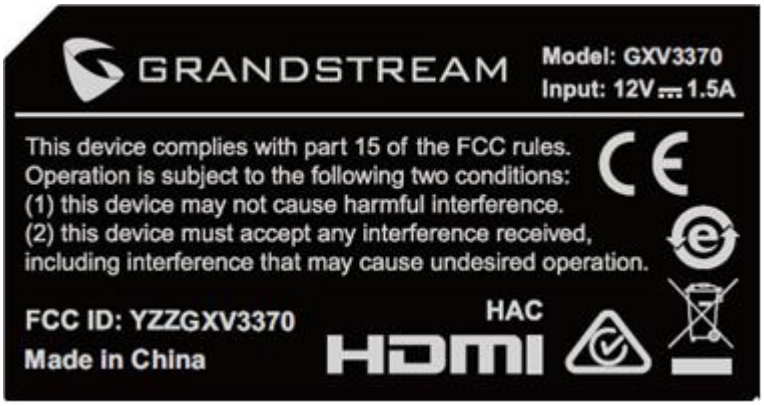
EUT Layout side view



AC/DC Adapter view

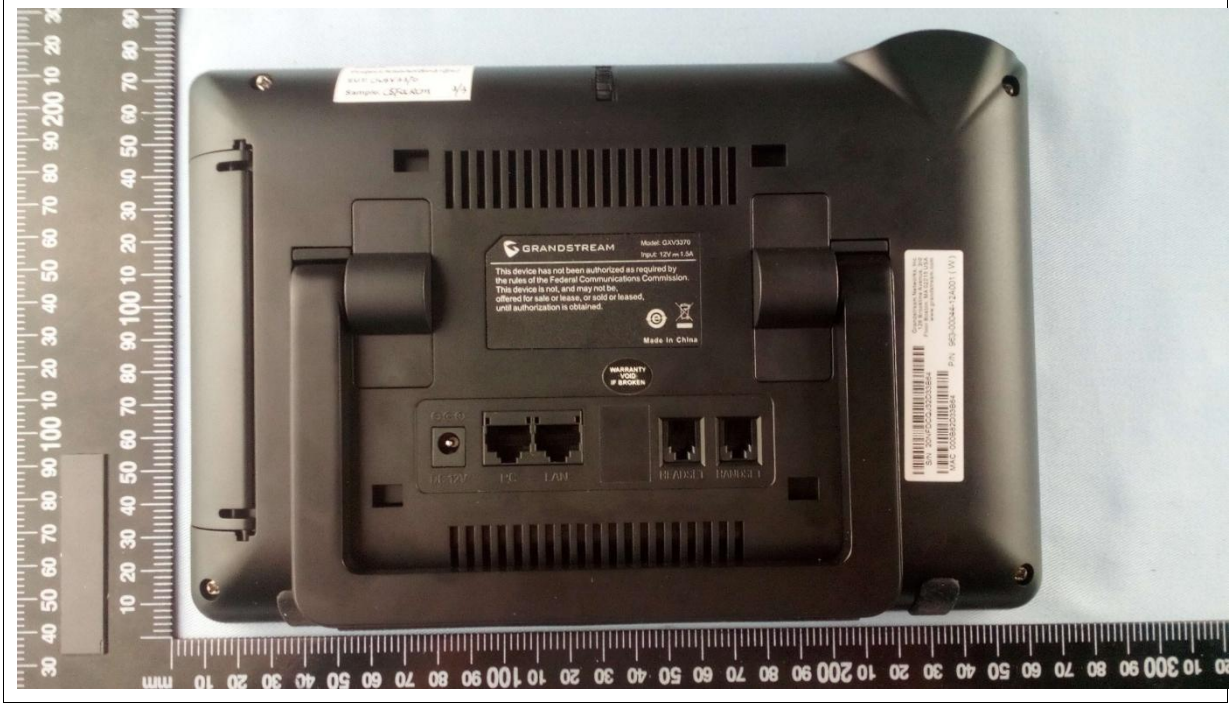
AC/DC Adapter view

9. 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


10. Test Equipment

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

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