

Transmit Simultaneously Report

1. Product Information

Name of EUT	Locator
Model Number	Aroco Locator AL312, Aroco Locator AL312-M, Aroco Locator AL312-P, Aroco Locator AL312-E, Aroco Locator, Aroco AL312, Aroco Care AL312, Aroco Tracker AL312, Rodsum AL312, Rodsum Wireless AL312
Model Declaration	PCB board, structure and internal of these model(s) are the same, Only model name is different for these models.
Test Model	Aroco Locator AL312
Modulation Type	GMSK for GSM/GPRS; 8-PSK for EDGE; QPSK for UMTS; QPSK, 16QAM for LTE
Antenna Gain	1.2dBi (max.) For GSM 850; 1.2dBi (max.) For GSM 900; 1.6dBi (max.) For DCS 1800; 1.6dBi (max.) For PCS 1900; 1.6dBi for WCDMA Band I; 1.6dBi for WCDMA Band II; 1.2dBi for WCDMA Band V; 1.2dBi for WCDMA Band VIII; 1.6dBi for LTE Band 1; 1.6dBi for LTE Band 2; 1.6dBi for LTE Band 3; 1.6dBi for LTE Band 4; 1.2dBi for LTE Band 5; 1.2dBi for LTE Band 7; 1.2dBi for LTE Band 8; 2.0dBi (max.) For BT and WLAN
Hardware version	HQ3512-V1.1
Software version	AL312-V1.1
GSM/EDGE/GPRS Operation Frequency Band	GSM850/PCS1900/GPRS850/GPRS1900/EDGE850/EDGE1900
UMTS Operation Frequency Band	UMTS FDD Band I/II/V/VIII
LTE Operation Frequency Band	LTE FDD band 1, 2, 3, 4, 5, 7, 8
GSM/EDGE/GPRS	Supported GSM/GPRS/EDGE
GSM Release Version	R99
GSM/EDGE/GPRS Power Class	GSM850:Power Class 4/ PCS1900:Power Class 1
GPRS/EDGE Multislot Class	GPRS/EDGE: Multi-slot Class 12
GPRS operation mode	Class B
WCDMA Release Version	R8
HSDPA Release Version	Release 8
HSUPA Release Version	Release 6
DC-HSUPA Release Version	Not Supported
LTE Release Version	R9
LTE/UMTS Power Class	Class 3
WLAN FCC Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
WLAN FCC Operation frequency	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz IEEE 802.11n HT40:2422-2452MHz
Antenna Type	LDS Antenna
BT Modulation Type	GFSK (BT V4.0)
Extreme temp. Tolerance	-20°C to +55°C
GPS function	Support and only RX
FM function	Not Supported
NFC Function	Operating Frequency: 13.56MHz; Modulation Type: ASK; Loop Antenna, 0dBi (max.)
Extreme vol. Limits	3.40VDC to 4.30VDC (nominal: 3.80VDC)

2. Summary of Test Results

Applied Standard: FCC Part 15 Subpart C		
FCC Rules	Description of Test	Result
§15.209	Radiated Emissions	Compliant

3. Description of Test Modes

The EUT works in the X-axis, Y-axis, Z-axis. The following operating modes were applied for the related test items. All test modes were tested, only the result of the worst case was recorded in the report.

Transmit Simultaneously For Radiated Emission	
Test Mode	
Mode 1	BT LE+GPRS 850
Mode 2	BT LE +GPRS 1900
Mode 3	BT LE +WCDMA band II
Mode 4	BT LE +WCDMA band V
Mode 5	BT LE + E-UTRA Band 2
Mode 6	BT LE + E-UTRA Band 4
Mode 7	BT LE + E-UTRA Band 5
Mode 8	BT LE + E-UTRA Band 7
Mode 9	WIFI+GPRS 850
Mode 10	WIFI+GPRS 1900
Mode 11	WIFI +WCDMA band II
Mode 12	WIFI +WCDMA band V
Mode 13	WIFI + E-UTRA Band 2
Mode 14	WIFI + E-UTRA Band 4
Mode 15	WIFI + E-UTRA Band 5
Mode 16	WIFI + E-UTRA Band 7

4. Summary of Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2018-06-16	2019-06-15
2	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2018-11-15	2019-11-14
3	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2018-06-16	2019-06-15
4	Positioning Controller	MF	MF-7082	N/A	2018-06-16	2019-06-15
5	EMI Test Software	AUDIX	E3	N/A	2018-06-16	2019-06-15
6	EMI Test Receiver	R&S	ESR 7	101181	2018-06-16	2019-06-15
7	AMPLIFIER	QuieTek	QTK	CHM/0809065	2018-11-15	2019-11-14
8	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2018-07-26	2019-07-25
9	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2018-07-26	2019-07-25
10	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2018-07-02	2019-07-01
11	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2018-09-20	2019-09-19
12	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-025	2018-09-20	2019-09-19
13	RF Cable-R03m	Jye Bao	RG142	CB021	2018-06-16	2019-06-15
14	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2018-06-16	2019-06-15

Note: All equipment is calibrated through GUANGZHOU LISAI CALIBRATION AND TEST CO.,LTD.

4.1. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

4.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty	Note
Radiation Uncertainty	9KHz~30MHz	3.10dB	(1)
	30MHz~200MHz	2.96dB	(1)
	200MHz~1000MHz	3.10dB	(1)
	1GHz~26.5GHz	3.80dB	(1)
	26.5GHz~40GHz	3.90dB	(1)

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

5. Radiated Emissions Measurement

5.1. Standard Applicable

1) Sequence of testing 30 MHz to 1 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

2) Sequence of testing 1 GHz to 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing above 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

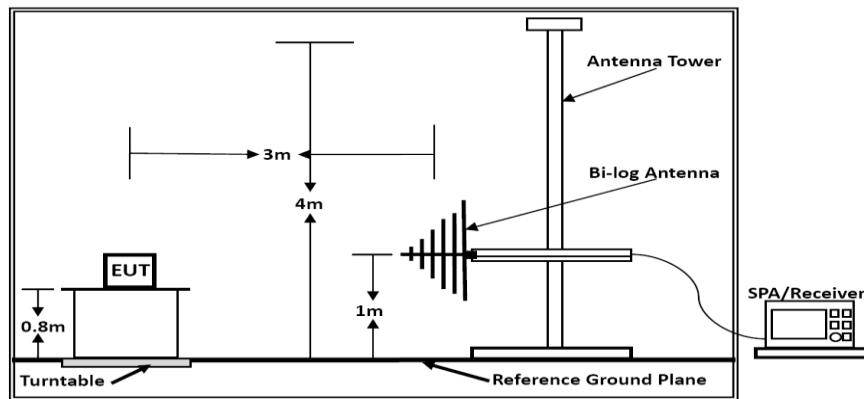
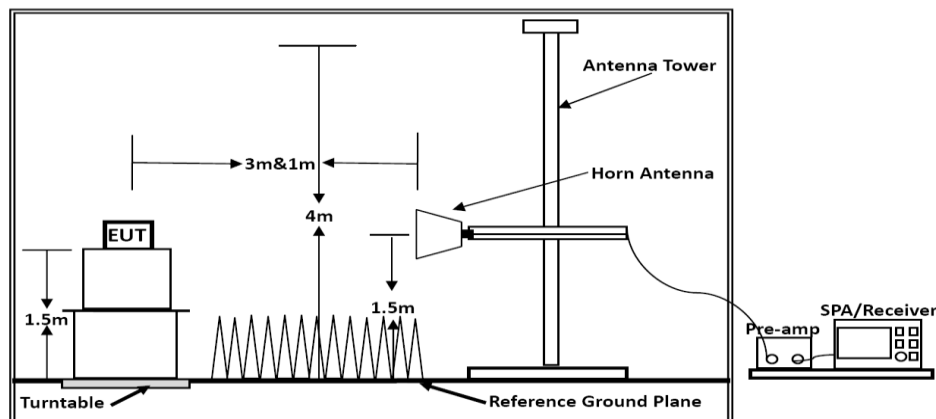
Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.2. Test Setup Layout**Below 1GHz****Above 1GHz**

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1.5m.

Distance extrapolation factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1.5m]})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.3. Results of Radiated Emissions

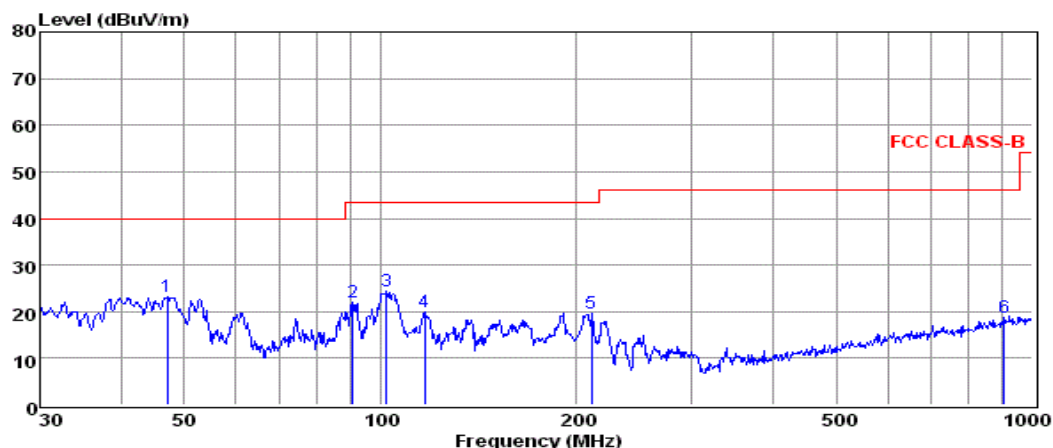
PASS.

Only record the worst test result in this report.

The test data please refer to following page.

Below 1GHz (Worst case: WIFI+GPRS850)

Vertical



pol:

VERTICAL

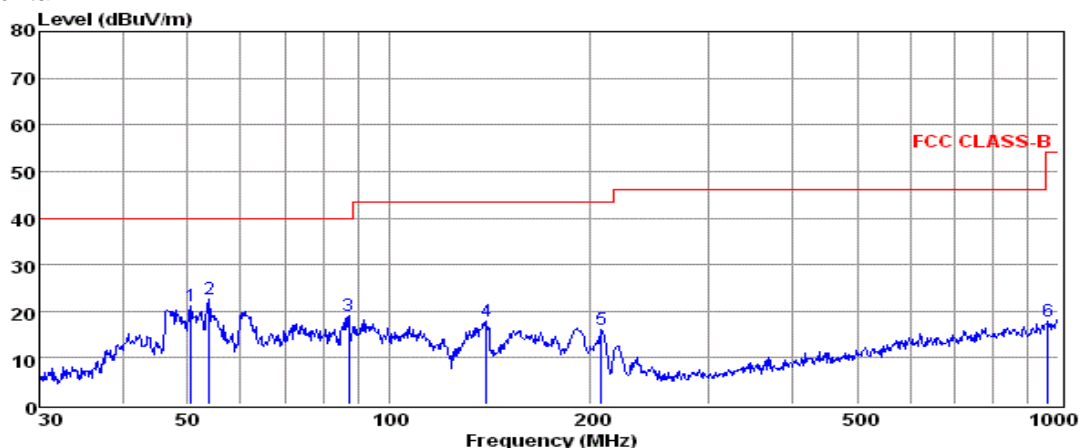
	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	46.99	9.27	0.35	13.43	23.05	40.00	-16.95	QP
2	90.54	9.42	0.68	12.00	22.10	43.50	-21.40	QP
3	102.00	10.77	0.60	12.98	24.35	43.50	-19.15	QP
4	116.95	8.09	0.68	11.02	19.79	43.50	-23.71	QP
5	210.79	7.66	0.93	10.91	19.50	43.50	-24.00	QP
6	906.48	-4.49	2.03	21.13	18.67	46.00	-27.33	QP

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that are 20db below the official limit are not reported

Horizontal



pol:

HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	50.59	7.22	0.54	13.22	20.98	40.00	-19.02	QP
2	53.88	9.19	0.46	13.07	22.72	40.00	-17.28	QP
3	87.11	7.55	0.47	10.98	19.00	40.00	-21.00	QP
4	139.85	8.96	0.75	8.20	17.91	43.50	-25.59	QP
5	207.12	4.48	0.86	10.79	16.13	43.50	-27.37	QP
6	965.54	-5.67	1.88	21.52	17.73	54.00	-36.27	QP

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that are 20db below the official limit are not reported

***Note: Only record the worst test result in this report.

Above 1GHz**WIFI+GPRS850**

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4824.00	54.91	33.06	35.04	3.94	56.87	74.00	-17.13	Peak	Horizontal
4824.00	39.04	33.06	35.04	3.94	41.00	54.00	-13.00	Average	Horizontal
4874.00	53.96	33.16	35.15	3.96	55.93	74.00	-18.07	Peak	Horizontal
4874.00	37.71	33.16	35.15	3.96	39.68	54.00	-14.32	Average	Horizontal
4924.00	54.82	33.26	35.14	3.98	56.92	74.00	-17.08	Peak	Horizontal
4924.00	40.97	33.26	35.14	3.98	43.07	54.00	-10.93	Average	Horizontal
1648.40	50.35	30.42	31.01	2.12	51.88	74.00	-22.12	Peak	Horizontal
1648.40	36.47	30.42	31.01	2.12	38.00	54.00	-16.00	Average	Horizontal
1673.20	53.00	30.45	31.08	2.15	54.52	74.00	-19.48	Peak	Horizontal
1673.20	40.75	30.45	31.08	2.15	42.27	54.00	-11.73	Average	Horizontal
1697.60	49.52	30.58	31.12	2.17	51.15	74.00	-22.85	Peak	Horizontal
1697.60	40.10	30.58	31.12	2.17	41.73	54.00	-12.27	Average	Horizontal
4824.00	48.24	33.06	35.04	3.94	50.20	74.00	-23.80	Peak	Vertical
4824.00	39.90	33.06	35.04	3.94	41.86	54.00	-12.14	Average	Vertical
4874.00	51.15	33.16	35.15	3.96	53.12	74.00	-20.88	Peak	Vertical
4874.00	36.48	33.16	35.15	3.96	38.45	54.00	-15.55	Average	Vertical
4924.00	50.81	33.26	35.14	3.98	52.91	74.00	-21.09	Peak	Vertical
4924.00	36.06	33.26	35.14	3.98	38.16	54.00	-15.84	Average	Vertical
1648.40	56.18	30.42	31.01	2.12	57.71	74.00	-16.29	Peak	Vertical
1648.40	36.70	30.42	31.01	2.12	38.23	54.00	-15.77	Average	Vertical
1673.20	57.14	30.45	31.08	2.15	58.66	74.00	-15.34	Peak	Vertical
1673.20	41.11	30.45	31.08	2.15	42.63	54.00	-11.37	Average	Vertical
1697.60	56.95	30.58	31.12	2.17	58.58	74.00	-15.42	Peak	Vertical
1697.60	40.04	30.58	31.12	2.17	41.67	54.00	-12.33	Average	Vertical

WIFI+GPRS1900

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4824.00	56.26	33.06	35.04	3.94	58.22	74.00	-15.78	Peak	Horizontal
4824.00	37.27	33.06	35.04	3.94	39.23	54.00	-14.77	Average	Horizontal
4874.00	55.21	33.16	35.15	3.96	57.18	74.00	-16.82	Peak	Horizontal
4874.00	37.62	33.16	35.15	3.96	39.59	54.00	-14.41	Average	Horizontal
4924.00	55.47	33.26	35.14	3.98	57.57	74.00	-16.43	Peak	Horizontal
4924.00	40.99	33.26	35.14	3.98	43.09	54.00	-10.91	Average	Horizontal
3700.40	49.48	32.14	34.12	3.53	51.03	74.00	-22.97	Peak	Horizontal
3700.40	35.19	32.14	34.12	3.53	36.74	54.00	-17.26	Average	Horizontal
3760.00	49.87	32.17	34.15	3.55	51.44	74.00	-22.56	Peak	Horizontal
3760.00	39.83	32.17	34.15	3.55	41.40	54.00	-12.60	Average	Horizontal
3819.60	47.20	32.21	34.19	3.58	48.80	74.00	-25.20	Peak	Horizontal
3819.60	40.03	32.21	34.19	3.58	41.63	54.00	-12.37	Average	Horizontal
4824.00	48.98	33.06	35.04	3.94	50.94	74.00	-23.06	Peak	Vertical
4824.00	40.19	33.06	35.04	3.94	42.15	54.00	-11.85	Average	Vertical
4874.00	51.80	33.16	35.15	3.96	53.77	74.00	-20.23	Peak	Vertical
4874.00	36.52	33.16	35.15	3.96	38.49	54.00	-15.51	Average	Vertical
4924.00	49.37	33.26	35.14	3.98	51.47	74.00	-22.53	Peak	Vertical
4924.00	35.52	33.26	35.14	3.98	37.62	54.00	-16.38	Average	Vertical
3700.40	54.07	32.14	34.12	3.53	55.62	74.00	-18.38	Peak	Vertical
3700.40	37.14	32.14	34.12	3.53	38.69	54.00	-15.31	Average	Vertical
3760.00	56.30	32.17	34.15	3.55	57.87	74.00	-16.13	Peak	Vertical
3760.00	38.29	32.17	34.15	3.55	39.86	54.00	-14.14	Average	Vertical
3819.60	53.89	32.21	34.19	3.58	55.49	74.00	-18.51	Peak	Vertical
3819.60	39.13	32.21	34.19	3.58	40.73	54.00	-13.27	Average	Vertical

- 1). Only record the worst test result in this report
- 2). 18~25GHz at least have 20dB margin. No recording in the test report.

Revision History

Revision	Issue Date	Revisions	Revised By
000	January 08, 2019	Initial Issue	Gavin Liang

-----THE END OF REPORT-----