

FCC Part 15C

Measurement and Test Report

For

Cyrus Technology GmbH

Hergelsbendenstrasse 49, D-52080 Aachen, Germany

FCC ID: 2AI3KCM17SA2

FCC Rule(s): FCC Part 15.225

Product Description: Rugged Phone

Tested Model: CM17SA

Report No.: STR18108156I-6

Sample Receipt Date: 2018-10-18

Tested Date: 2018-10-18 to 2018-11-08

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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM Test Technology Co., Ltd.

TABLE OF CONTENTS

1. GENERAL INFORMATION.....	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	3
1.2 TEST STANDARDS.....	4
1.3 TEST METHODOLOGY.....	4
1.4 TEST FACILITY.....	4
1.5 EUT SETUP AND TEST MODE.....	5
1.6 MEASUREMENT UNCERTAINTY.....	5
1.7 TEST EQUIPMENT LIST AND DETAILS.....	6
2. SUMMARY OF TEST RESULTS.....	7
3. ANTENNA REQUIREMENT.....	8
3.1 STANDARD APPLICABLE.....	8
3.2 TEST RESULT.....	8
4. RADIATED EMISSIONS.....	9
4.1 STANDARD APPLICABLE.....	9
4.2 TEST PROCEDURE.....	9
4.3 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	10
4.4 SUMMARY OF TEST RESULTS/PLOTS.....	11
5. OUT OF BAND EMISSIONS.....	14
5.1 STANDARD APPLICABLE.....	14
5.2 TEST PROCEDURE.....	14
5.3 SUMMARY OF TEST RESULTS/PLOTS.....	14
6. FREQUENCY STABILITY.....	15
6.1 STANDARD APPLICABLE.....	15
6.2 TEST PROCEDURE.....	15
6.3 SUMMARY OF TEST RESULTS/PLOTS.....	15
7. EMISSION BANDWIDTH.....	16
7.1 APPLICABLE STANDARD.....	16
7.2 TEST PROCEDURE.....	16
7.3 SUMMARY OF TEST RESULTS/PLOTS.....	16
8. CONDUCTED EMISSIONS.....	18
8.1 TEST PROCEDURE.....	18
8.2 BASIC TEST SETUP BLOCK DIAGRAM.....	18
8.3 TEST RECEIVER SETUP.....	18
8.4 SUMMARY OF TEST RESULTS/PLOTS.....	18

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Cyrus Technology GmbH
Address of applicant: Hergelsbendenstrasse 49, D-52080 Aachen, Germany

Manufacturer: Cyrus Technology GmbH
Address of manufacturer: Hergelsbendenstrasse 49, D-52080 Aachen, Germany

General Description of EUT	
Product Name:	Rugged Phone
Trade Name:	Cyrus
Model No.:	CM17SA
Rated Voltage:	DC3.8V
Power Adapter Model:	Model: JWS664-501000 Input: AC100-240V 50/60Hz 0.2A Output: DC5V 1000mA
Note: The test data is gathered from a production sample, provided by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	NFC
Frequency Range:	13.56MHz
Max. Field Strength:	71.20dBuV/m (at 3m)
Antenna Type:	Integral Antenna
Lowest Internal frequency of EUT:	13.56MHz

1.2 Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.225: Operation within the band 13.110-14.010 MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013,

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated in the continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	13.56MHz

Test Conditions	
Temperature:	22~25 °C
Relative humidity	50~55 %.
ATM Pressure:	1019 mbar

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Frequency Deviation	2.3%	± 5%
Conducted Emissions	Conducted	9-150kHz ± 3.74dB
		0.15-30MHz ± 3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ± 4.52dB
		0.2-1GHz ± 5.56dB
		1-6GHz ± 3.84dB
		6-18GHz ± 3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2018-05-22	2019-05-21
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2018-05-22	2019-05-21
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2018-05-22	2019-05-21
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2018-05-22	2019-05-21
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2018-05-22	2019-05-21
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2018-05-22	2019-05-21
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2018-05-22	2019-05-21
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2018-05-22	2019-05-21
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2018-05-22	2019-05-21
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2018-03-19	2019-03-18
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2018-03-19	2019-03-18
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2018-03-19	2019-03-18
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2018-03-19	2019-03-18
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§15.209	Radiated Emission	Compliant
§15.225(a)	Field Strength	Compliant
§15.225(b)(c)	Out of Band Emission	Compliant
§15.225(e)	Frequency Stability	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.215(c)	Emission Bandwidth	Compliant

N/A: not applicable

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 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 this section.

3.2 Test Result

This product has an integral antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard Applicable

According to §15.225(a), The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

According to §15.225(d) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

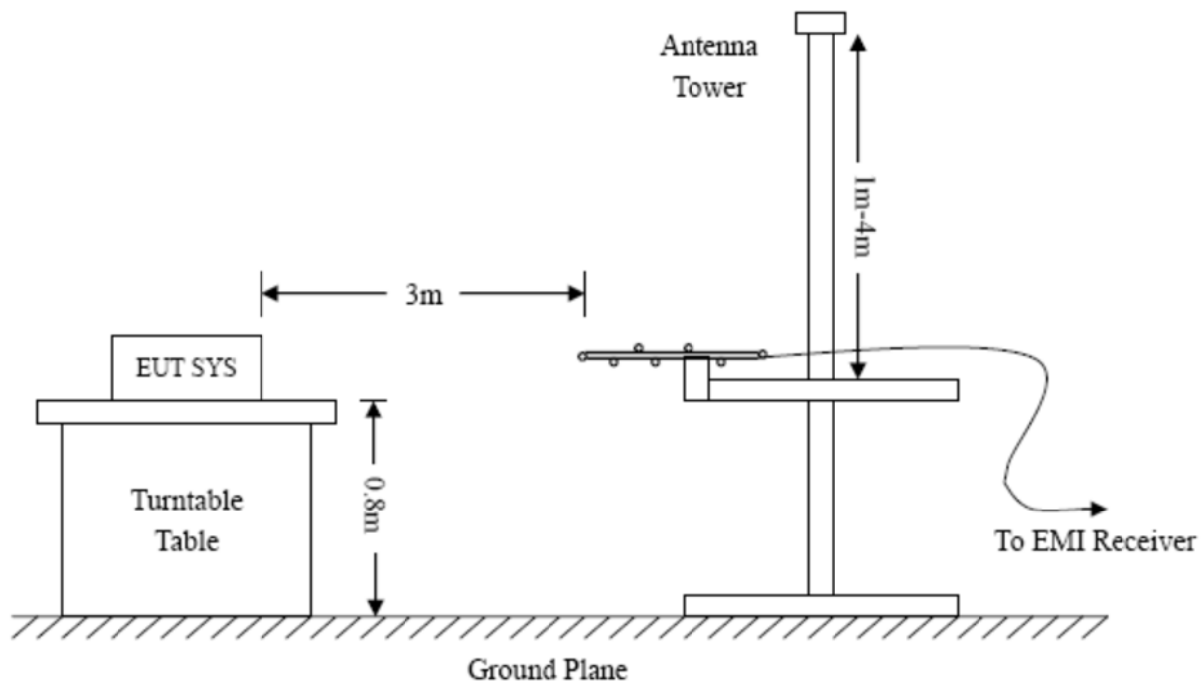
Note: Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

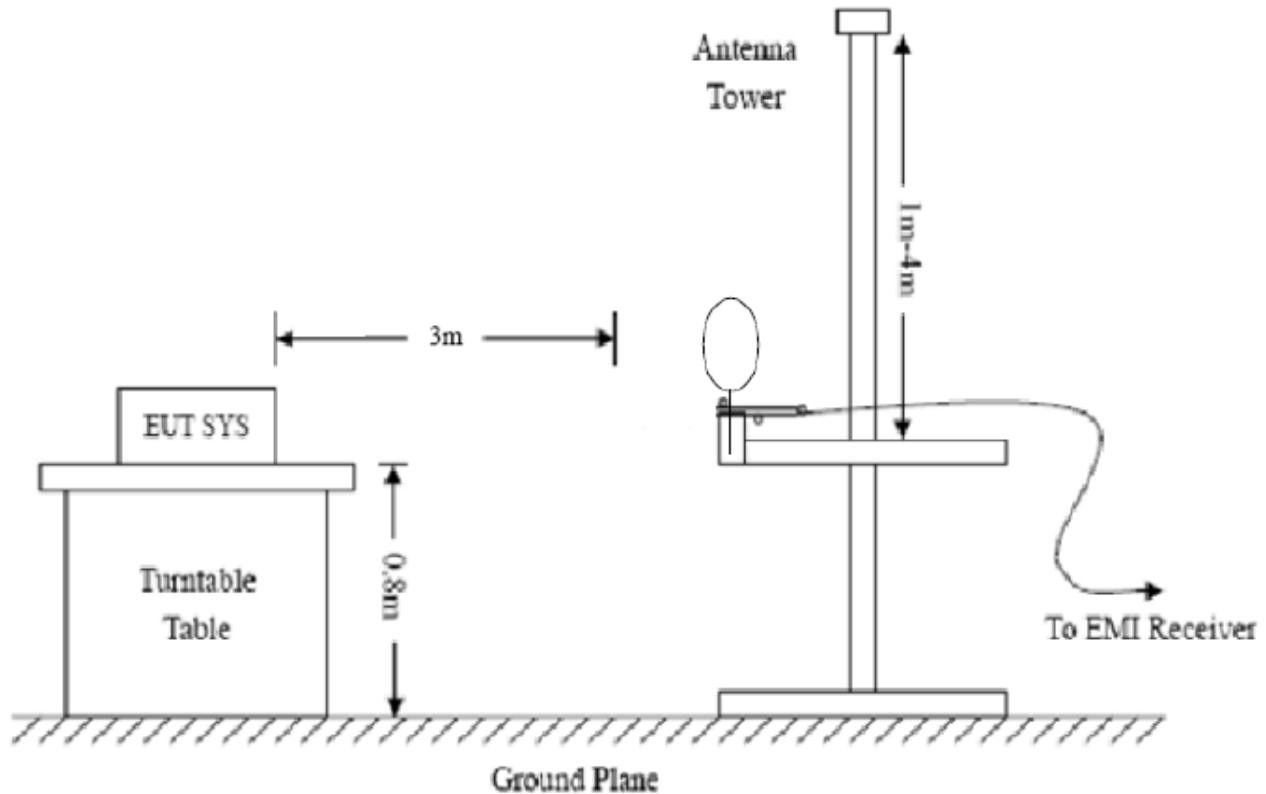
4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.225(d) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz
 RBW=10KHz,
 VBW =30KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak

Frequency :30MHz-1GHz
 RBW=120KHz,
 VBW=300KHz
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, QP

Frequency :Above 1GHz
 RBW=1MHz,
 VBW=3MHz(Peak), 10Hz(AV)
 Sweep time= Auto
 Trace = max hold
 Detector function = peak, AV

4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} - \text{Corr. Factor}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

4.4 Summary of Test Results/Plots

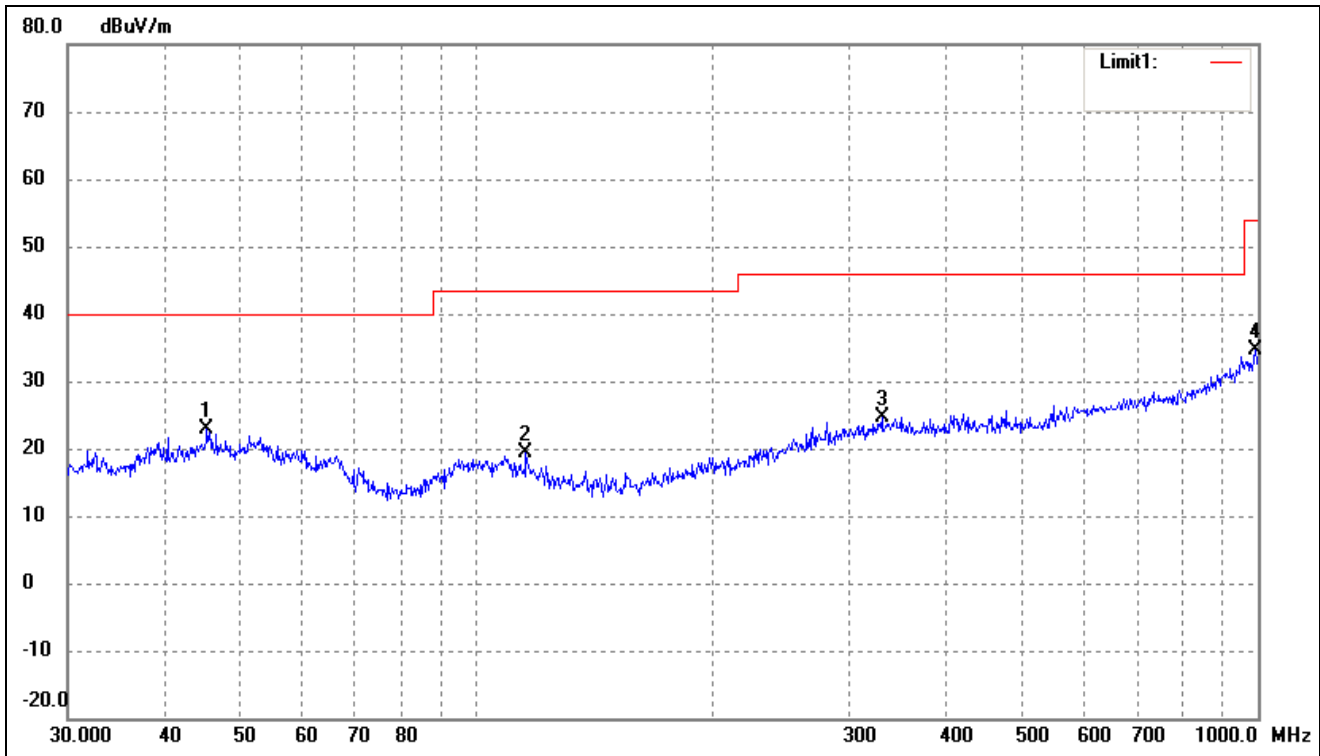
Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

➤ Below 30MHz

Frequency	Reading	Correction Factor	Result	Limit	Margin	Polar	Detector
MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	X/Y/Z	
13.5600	76.98	-10.91	66.07	124.00	-57.93	X	Peak
27.1200	46.18	-10.82	35.36	69.50	-34.14	X	Peak
13.5600	75.98	-10.91	65.07	124.00	-58.93	Y	Peak
27.1200	46.18	-10.82	35.48	69.50	-34.02	Y	Peak
13.5600	74.98	-10.91	64.07	124.00	-59.93	Z	Peak
27.1200	46.68	-10.82	35.86	69.50	-33.64	Z	Peak

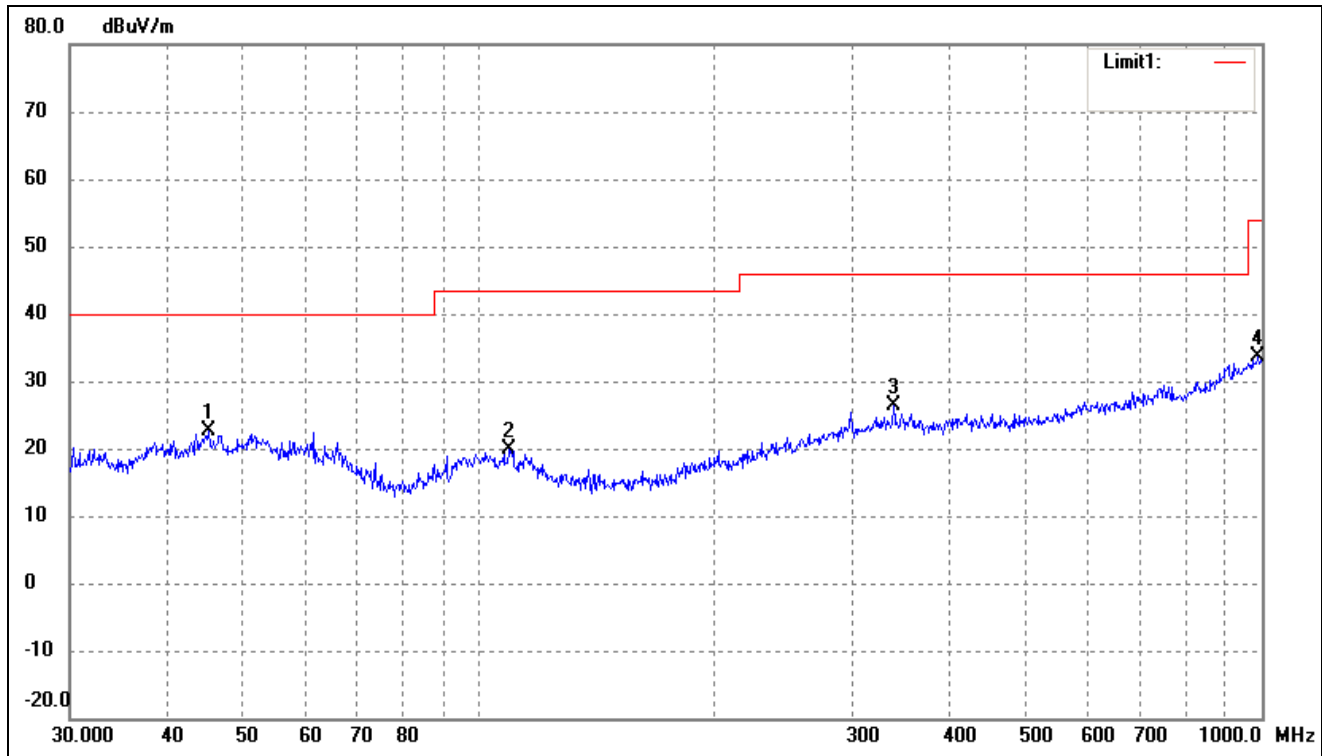
➤ Above 30MHz

Test Mode	TM1	Polarity:	Horizontal
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	45.2166	35.73	-12.96	22.77	40.00	-17.23	311	100	peak
2	115.7256	34.30	-14.89	19.41	43.50	-24.09	100	100	peak
3	330.1949	31.44	-6.77	24.67	46.00	-21.33	122	100	peak
4	993.0114	30.64	3.93	34.57	54.00	-19.43	109	100	peak

Test Mode	TM1	Polarity:	Vertical
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	45.2166	35.55	-12.96	22.59	40.00	-17.41	309	100	peak
2	109.4116	33.89	-13.93	19.96	43.50	-23.54	93	100	peak
3	338.4001	33.05	-6.56	26.49	46.00	-19.51	257	100	peak
4	989.5355	29.78	3.88	33.66	54.00	-20.34	101	100	peak

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics.

5. OUT OF BAND EMISSIONS

5.1 Standard Applicable

According to FCC 15.225 (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters. (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

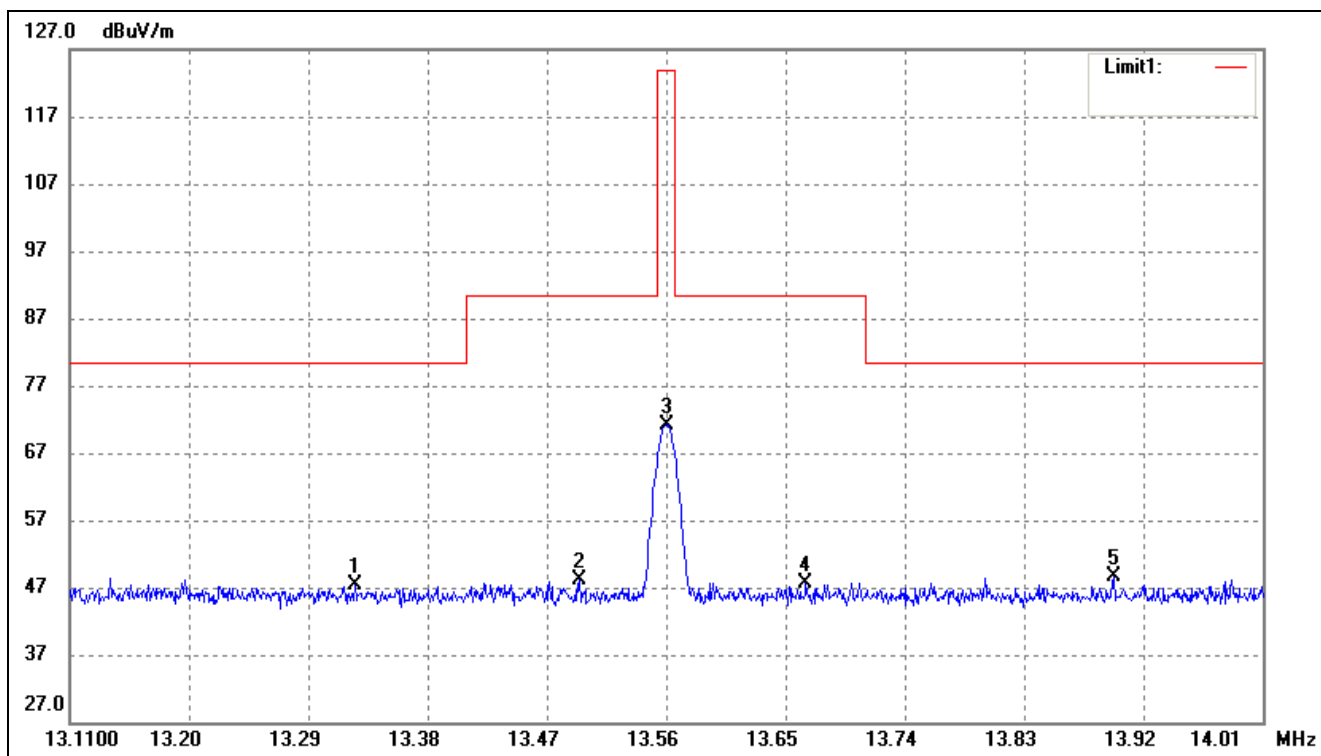
5.2 Test Procedure

As the radiation test, set the RBW=10kHz VBW=30kHz, observed the outside band of 13.11MHz to 14.01MHz, than mark the higher-level emission for comparing with the FCC rules.

5.3 Summary of Test Results/Plots

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

Test Mode	TM1	Polarity:	/
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No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	13.3251	58.20	-10.89	47.31	80.50	-33.19	106	100	peak
2	13.4943	59.02	-10.90	48.12	90.50	-42.38	217	100	peak
3	13.5600	82.10	-10.90	71.20	124.00	-52.80	74	100	peak
4	13.6653	58.55	-10.91	47.64	90.50	-42.86	245	100	peak
5	13.8975	59.48	-10.92	48.56	80.50	-31.94	170	100	peak

6. Frequency Stability

6.1 Standard Applicable

According to 15.225(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure.

6.3 Summary of Test Results/Plots

Reference Frequency: 13.56MHz, Limit: 100ppm				
Voltage(%)	Power(VDC)	TEMP($^{\circ}$ C)	Freq.Dev(Hz)	Deviation(ppm)
100%	3.8	-30	2	0.15
100%		-20	4	0.29
100%		-10	2	0.15
100%		0	0	0
100%		+10	0	0
100%		+20	0	0
100%		+30	3	0.22
100%		+40	2	0.15
100%		+50	3	0.22
Low	3.50	+20	2	0.15
High	4.35	+20	2	0.15

7. EMISSION BANDWIDTH

7.1 Applicable Standard

According to 15.215 (c), 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, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated 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 a 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.

7.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Set span = 10kHz, centered on a transmitting channel

RBW \geq 1% 20dB Bandwidth, VBW \geq RBW

Sweep = auto

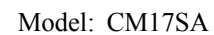
Detector function = peak

Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down of the emission.

7.3 Summary of Test Results/Plots

Tx Frequency	20dB Emission bandwidth(Hz)
13.56MHz	1240



*RBW 300 Hz
 *VBW 300 Hz
 Delta 1 [T1]
 -0.56 dB
 1.240000000 kHz
 Ref -10 dBm
 Att 10 dB
 SWT 450 ms

OBW 4.320000000 kHz
 Marker 1 [T1]
 13.559400000 MHz
 Temp 1 [T1 OBW]
 13.557800000 MHz
 Temp 2 [T1 OBW]
 13.562120000 MHz

-43.33 dBm
 -54.77 dBm
 -55.04 dBm

T1
 T2
 T3
 T4
 T5
 T6
 T7
 T8
 T9

Center 13.56 MHz
 2 kHz/
 Span 20 kHz

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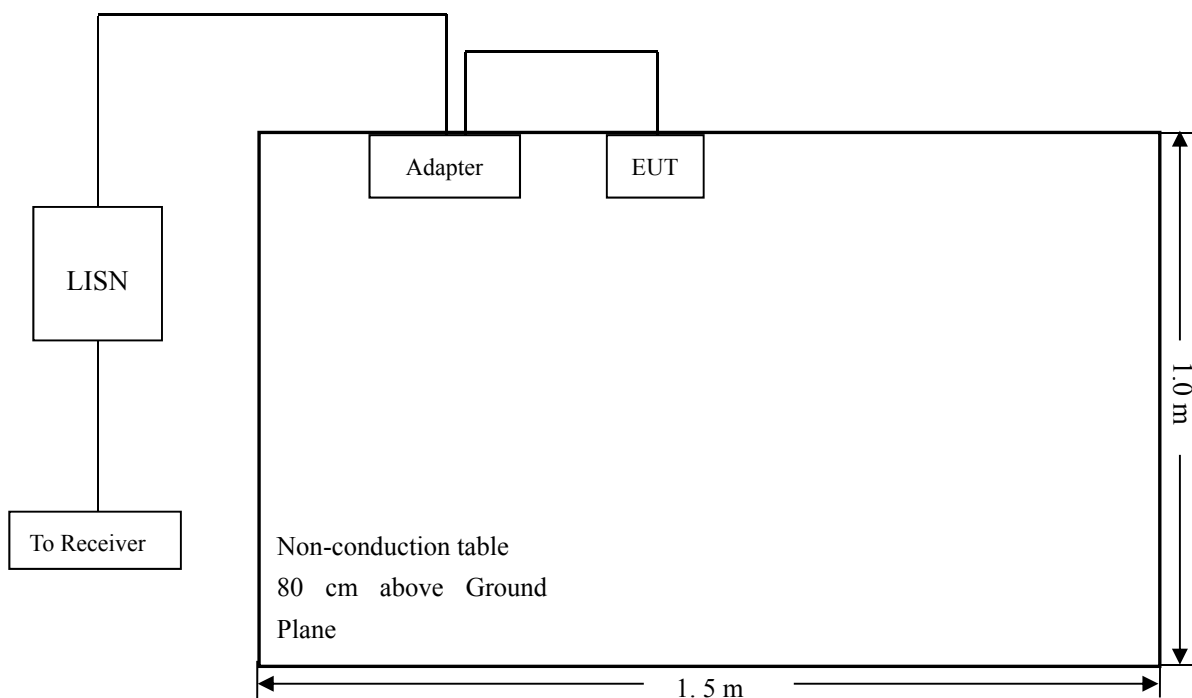
8. Conducted Emissions

8.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

8.2 Basic Test Setup Block Diagram



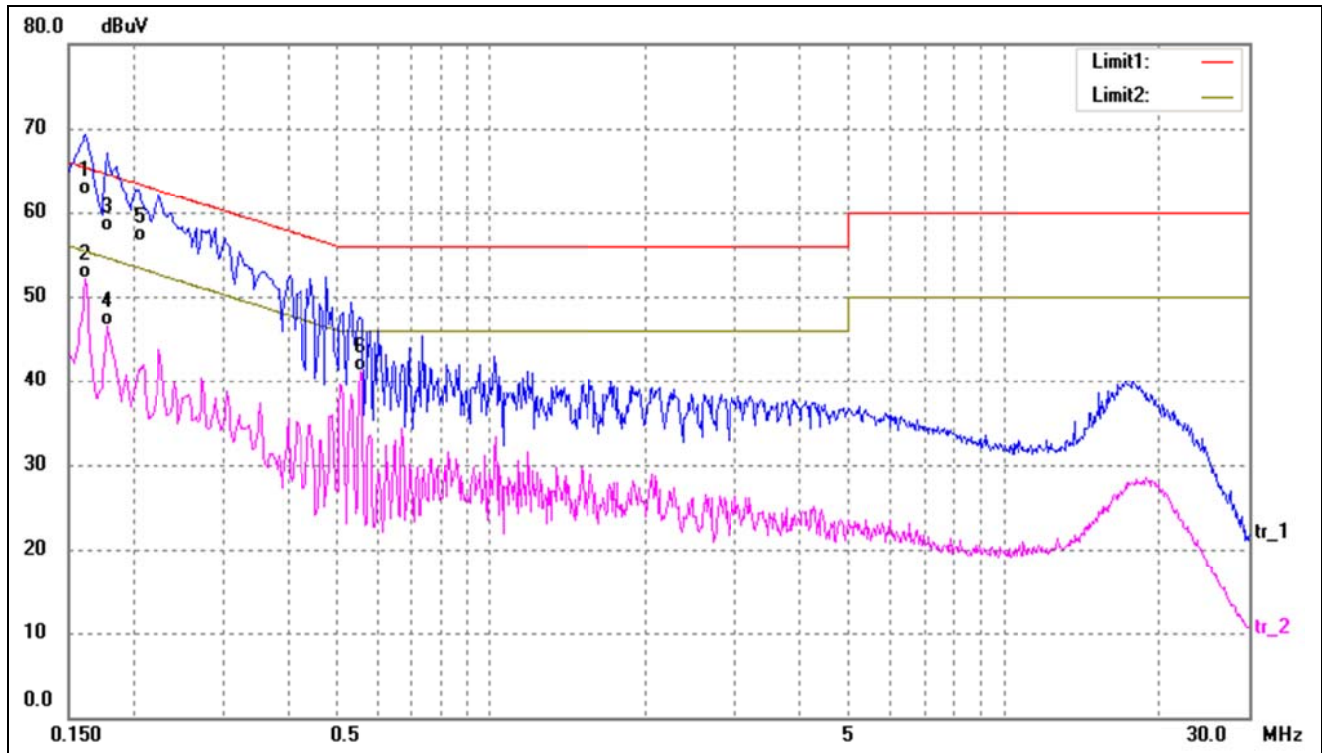
8.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency	150 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

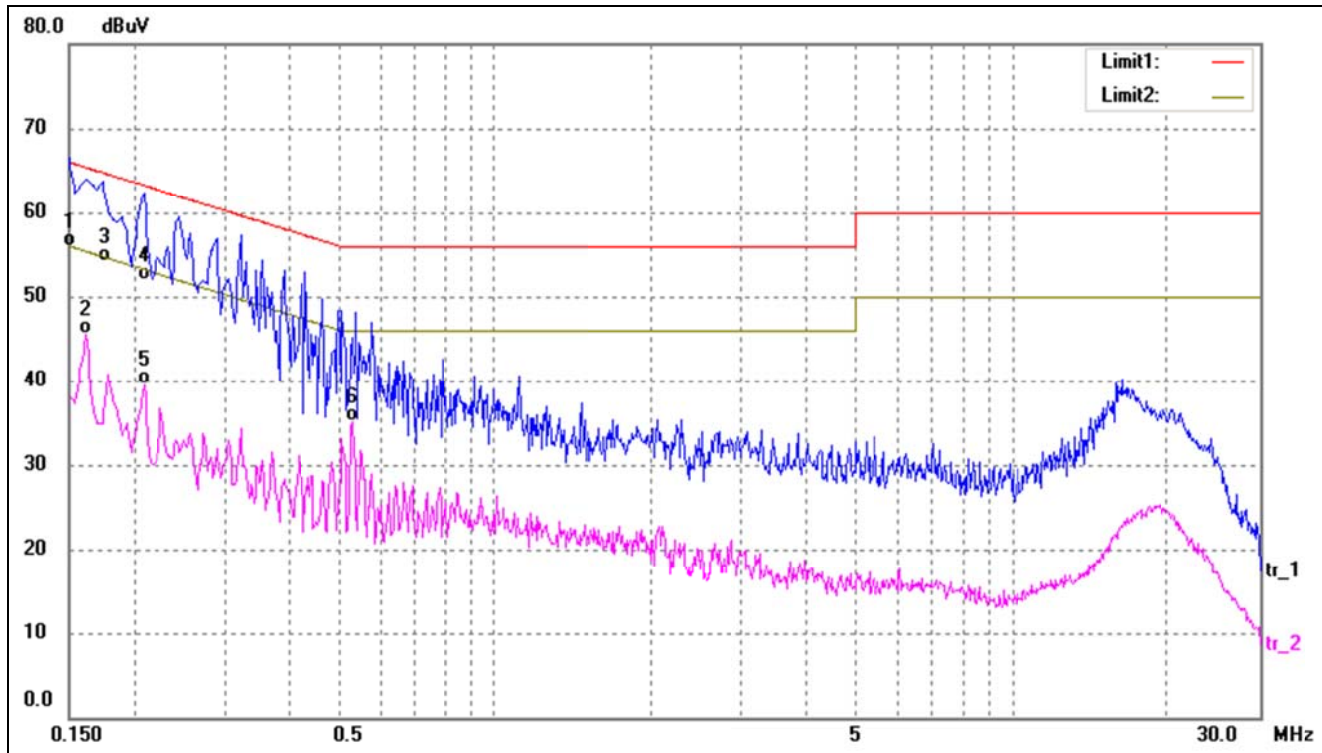
8.4 Summary of Test Results/Plots

Test Mode	TM1(AC120V 60Hz)	Polarity:	Neutral
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1620	52.07	10.10	62.17	65.36	-3.19	QP
2	0.1620	41.91	10.10	52.01	55.36	-3.35	AVG
3	0.1780	47.59	10.11	57.70	64.57	-6.87	QP
4	0.1780	36.40	10.11	46.51	54.57	-8.06	AVG
5	0.2060	46.34	10.12	56.46	63.36	-6.90	QP
6	0.5580	30.81	10.32	41.13	46.00	-4.87	AVG

Test Mode	TM1(AC120V 60Hz)	Polarity:	Line
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No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1500	45.88	10.10	55.98	66.00	-10.02	QP
2*	0.1620	35.44	10.10	45.54	55.36	-9.82	AVG
3	0.1740	43.95	10.11	54.06	64.77	-10.71	QP
4	0.2100	41.85	10.13	51.98	63.21	-11.23	QP
5	0.2100	29.38	10.13	39.51	53.21	-13.70	AVG
6	0.5300	24.71	10.30	35.01	46.00	-10.99	AVG

***** END OF REPORT *****