FCC Part 15C
Measurement and Test Report

For

Cyrus Technology GmbH

Hergelsbendenstrasse 49, 52080 Aachen, Germany

FCC ID: 2AI3KCS28SA

FCC Rule(s):	FCC Part 15.225
Product Description:	Rugged phone
Tested Model:	CS28SA
Report No.:	STR17128182I-6
Sample Receipt Date:	2017-11-17
Tested Date:	2017-11-18 to 2017-12-05
Issued Date:	2017-12-20
Tested By:	Jason Su / Engineer
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	Cyrus Technology GmbH
Address of applicant:	Hergelsbendenstrasse 49, 52080 Aachen, Germany
Manufacturer:	Cyrus Technology GmbH
Address of manufacturer:	Hergelsbendenstrasse 49, 52080 Aachen, Germany

General Description of EUT	
Product Name:	Rugged phone
Trade Name:	CYRUS
Model No.:	CS28SA
Rated Voltage:	DC 3.85V
Battery Capacity:	4000mAh
Power Adapter:	Model: Y733-20 Input:AC100-240V 50/60Hz 0.3A Output: DC5V 2000mA
Software Version:	CS28E_V1.09_2017_10_31
Hardware Version:	L808F-MB
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:	55.55dBuV/m (at 3m)
Antenna Type:	Integral Antenna
Lowest Internal Frequency	13MHz
Device Category:	Portable Device

1.2 Test Standards

The following report is prepared on behalf of the Cyrus Technology GmbH in accordance with FCC Part 15, Subpart C, and section 15.203,15.205,15.209 and 15.225 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203,15.205,15.209 and 15.225 rules.

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, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB-C Cable	1.0	Shielded	Without Core
Earphone	1.2	Unshielded	Without Core

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%
Transmitter Spurious Emissions	Radiated	±5.1dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2018-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2018-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2018-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11

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 Limit	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

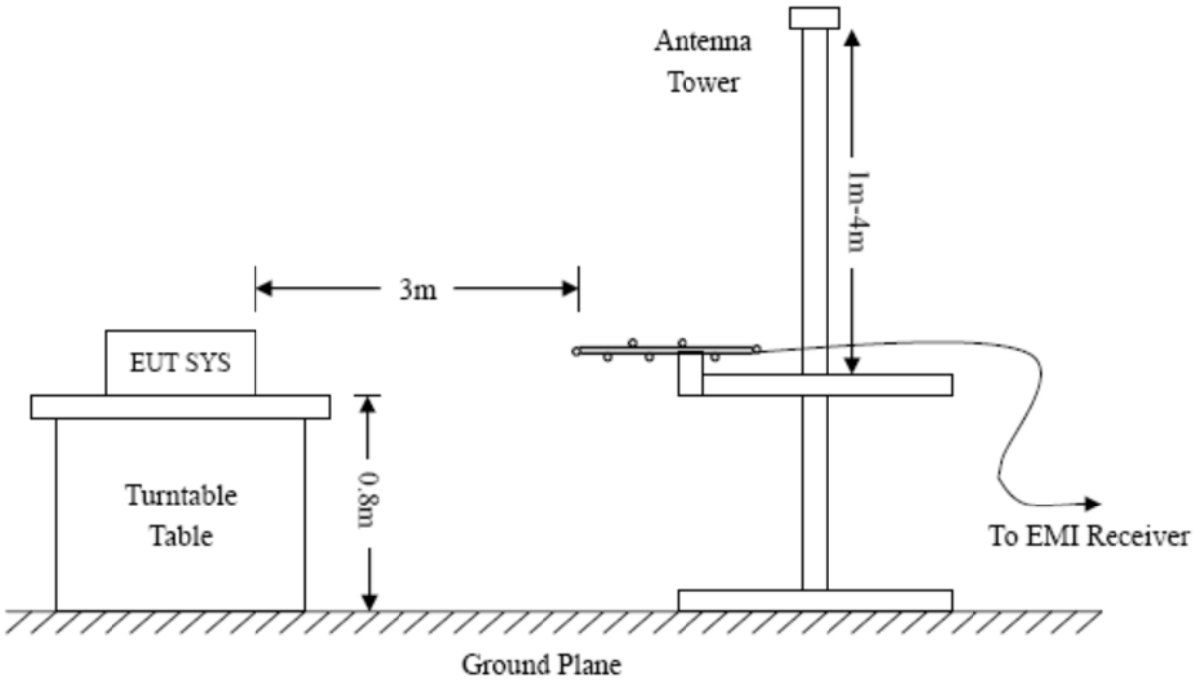
According to §15.225(a), The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

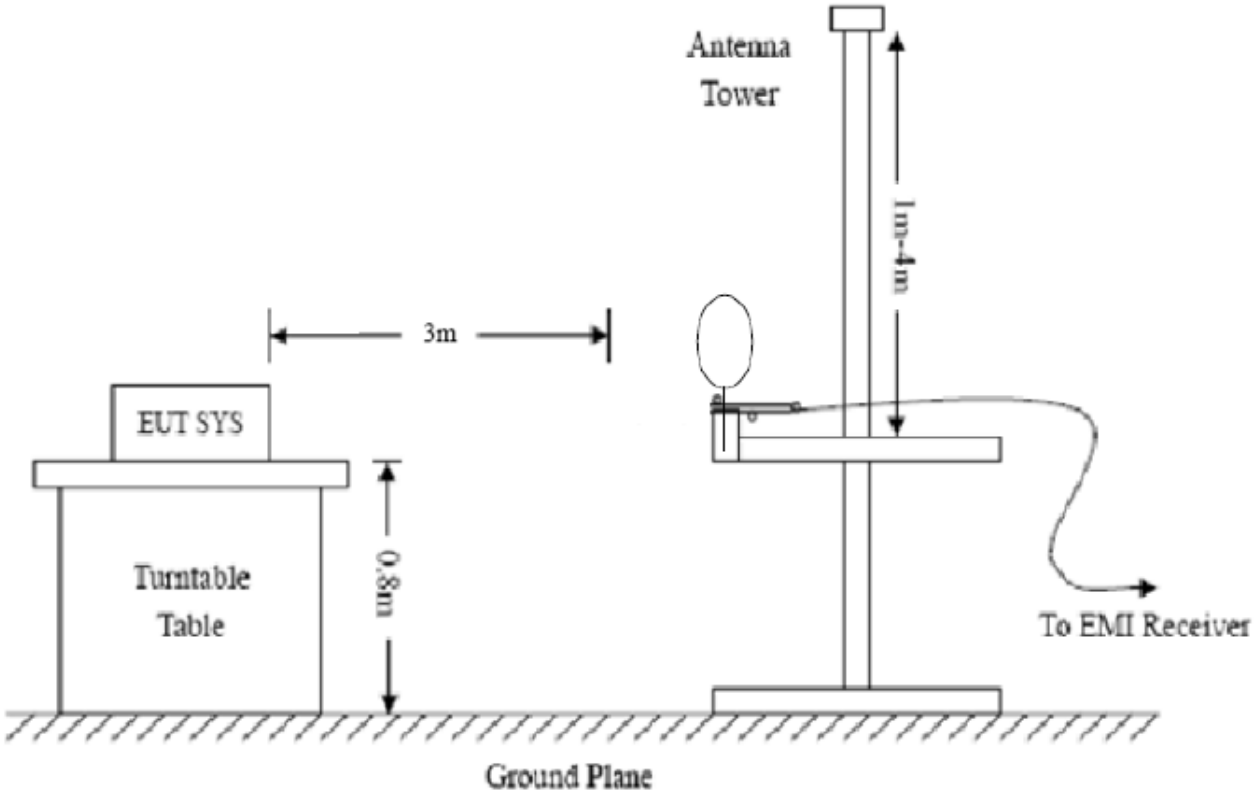
According to §15.225(d) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

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	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=300KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	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:

Corr. Ampl. = Indicated Reading – Corr. Factor

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

Margin = Corr. Ampl. – FCC Part 15 Limit

4.4 Environmental Conditions

Temperature:	26° C
Relative Humidity:	52%

ATM Pressure:	1022 mbar

4.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.225 standards, and had the worst margin of:

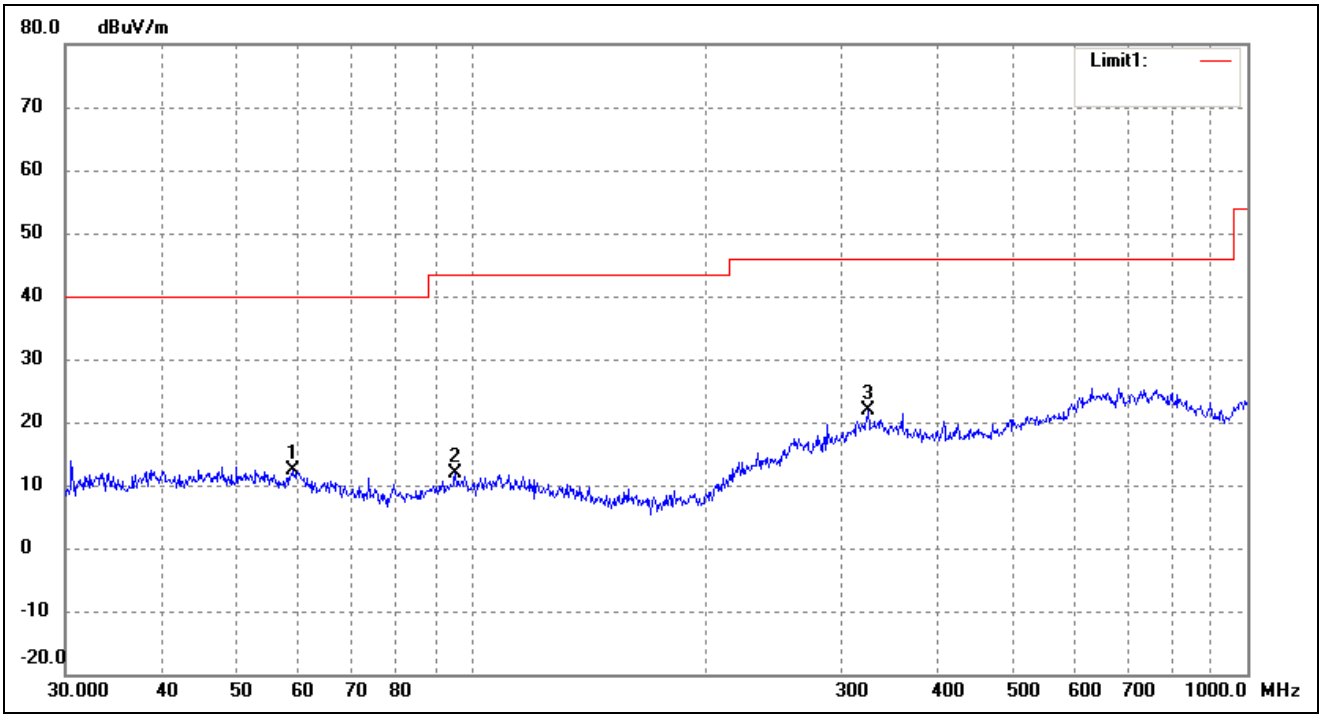
-24.07 dB at **324.4561 MHz** in the **Horizontal** polarization, **9 kHz to 1 GHz, 3Meters**

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

Frequency	Reading	Correction Factor	Result	Limit	Margin	Polar	Detector
MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	X/Y/Z	
13.5600	66.60	-11.05	55.55	124.0	-68.45	X	Peak
27.1200	41.76	-7.54	34.22	69.5	-35.28	X	Peak
13.5600	65.60	-11.05	54.55	124.0	-69.45	Y	Peak
27.1200	41.76	-7.54	34.22	69.5	-35.28	Y	Peak
13.5600	13.6227	64.60	-11.05	53.55	-64.60	Z	Peak
27.1200	27.1200	41.76	-7.54	34.22	-41.76	Z	Peak

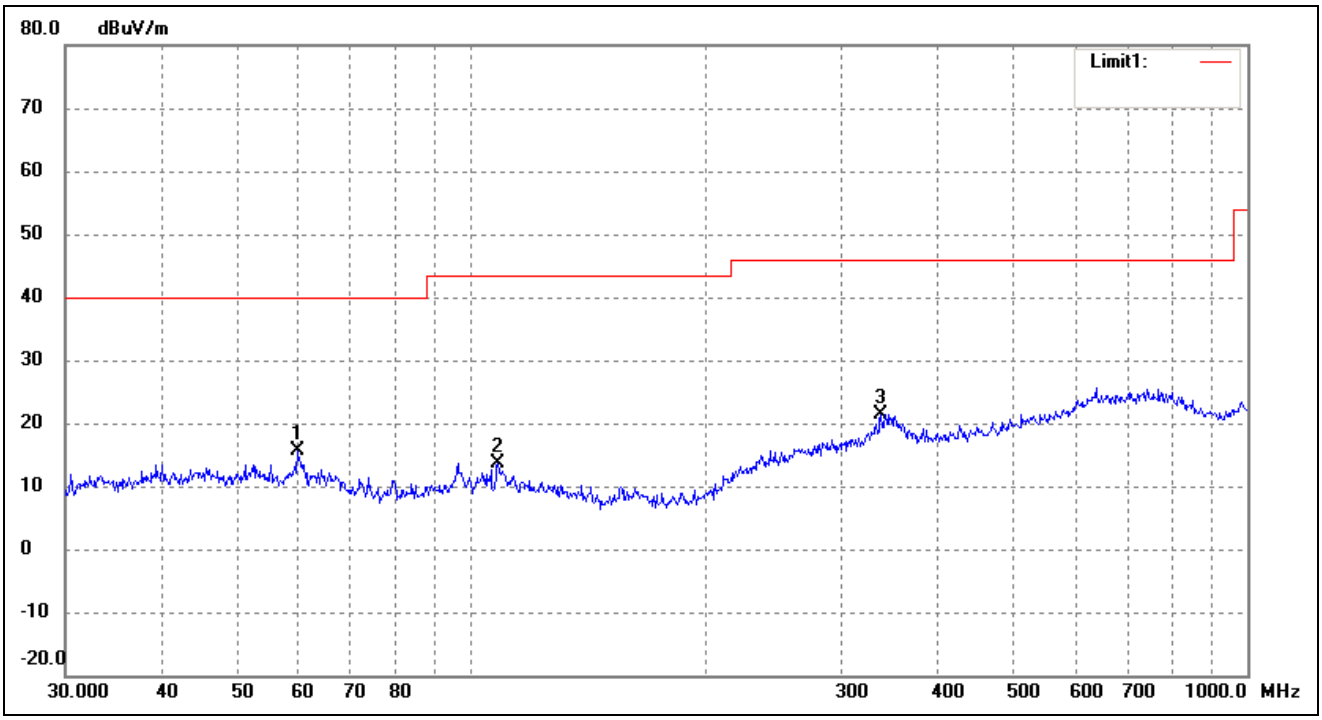
Plot of Radiated Emissions Test Data (Above 30 MHz)

EUT: *Rugged phone*
Tested Model: *CS28SA*
Operating Condition: *Transmitting*
Comment: *DC 3.85V*
Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	59.0251	28.85	-16.53	12.32	40.00	-27.68	251	100	QP
2	95.4270	29.04	-17.23	11.81	43.50	-31.69	92	100	QP
3	324.4561	31.37	-9.44	21.93	46.00	-24.07	261	100	QP

Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	59.6493	32.15	-16.51	15.64	40.00	-24.36	253	100	QP
2	108.2667	30.31	-16.61	13.70	43.50	-29.80	313	100	QP
3	337.2155	31.01	-9.62	21.39	46.00	-24.61	52	100	QP

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics. The measurements greater than 20dB below the limit from 9kHz to 30MHz.

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.

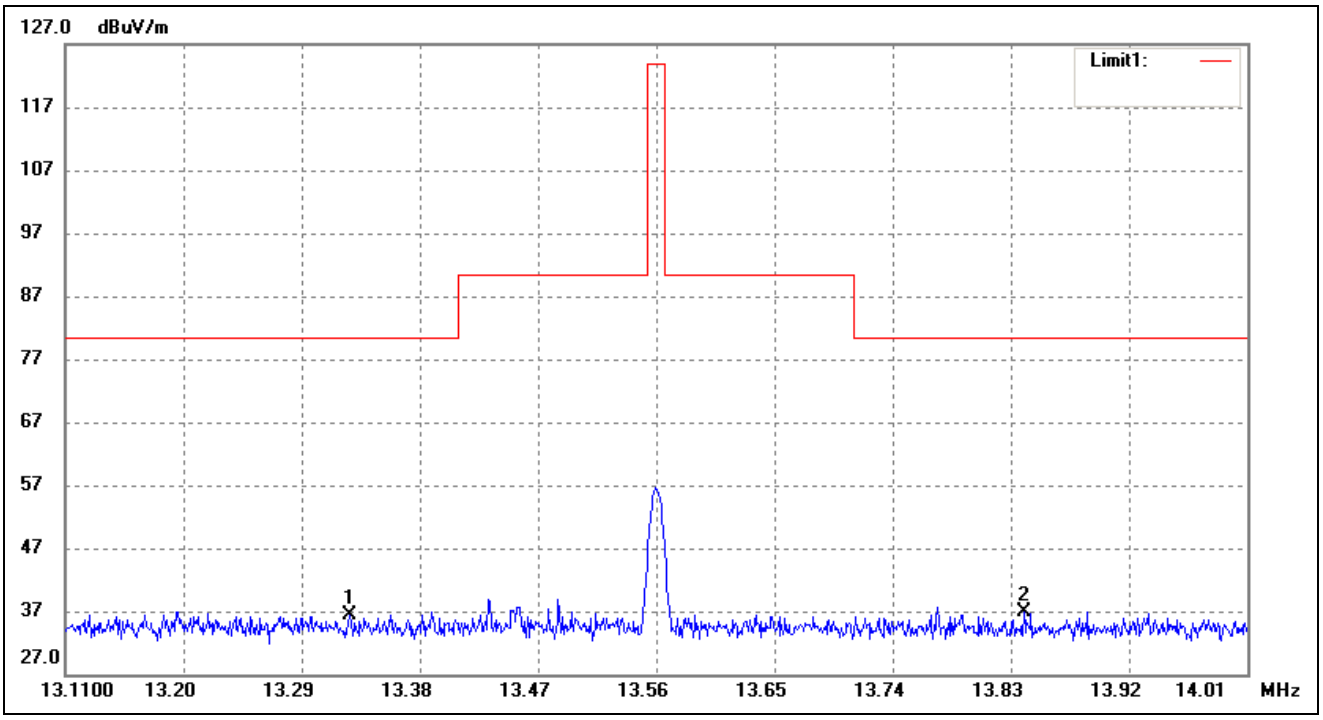
5.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1022 mbar

5.4 Summary of Test Results/Plots

Out of band emission

Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	13.3269	47.41	-11.04	36.37	80.50	-44.13	67	100	peak
2	13.8399	47.88	-11.07	36.81	80.50	-43.69	90	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 ±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 Environmental Conditions

Relative Humidity:	55%
ATM Pressure:	1015 mbar

6.4 Summary of Test Results/Plots

Reference Frequency: 13.56MHz, Limit: 100ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Error	
		Error (Hz)	Error (ppm)
50	3.85	195	14.38
40	3.85	214	15.78
30	3.85	265	19.54
20	3.85	250	18.44
10	3.85	255	18.81
0	3.85	175	12.91
-10	3.85	216	15.93
-20	3.85	228	16.81

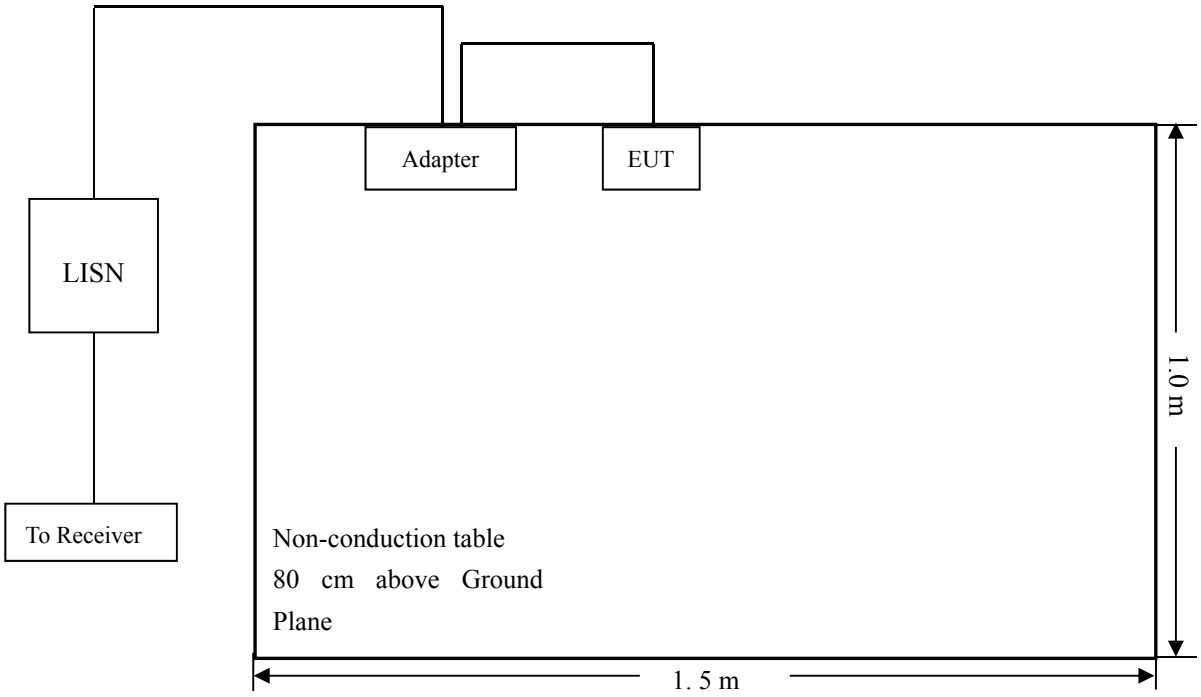
Reference Frequency: 13.56MHz, Limit: 100ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Error	
		Error (Hz)	Error (ppm)
20	3.50	250	18.44
	3.85	198	14.60
	4.20	235	17.33

7. Conducted Emissions

7.1 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.

7.2 Basic Test Setup Block Diagram



7.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

7.4 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

7.5 Summary of Test Results/Plots

According to the data in section 7.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

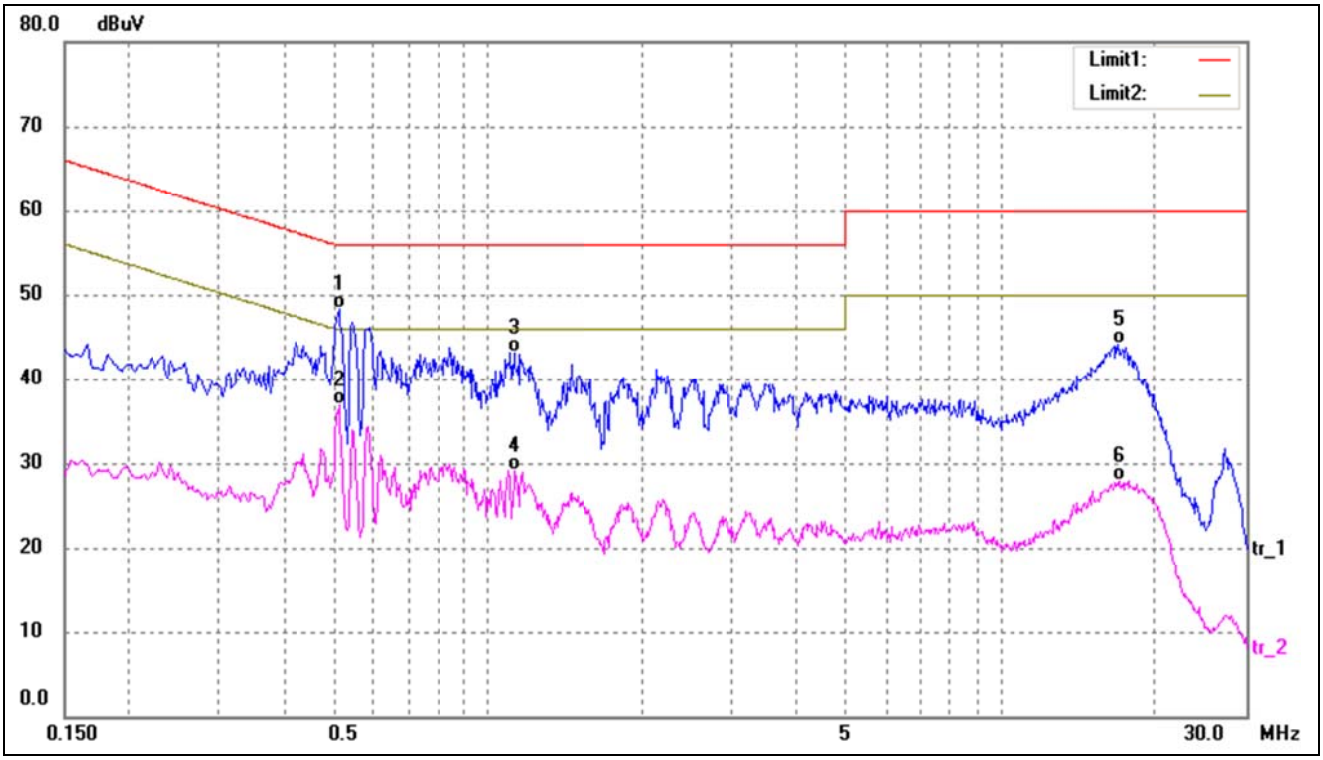
-7.62 dB at **0.5140MHz** in the **Neutral, QP** detector, 0.15-30MHz

7.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

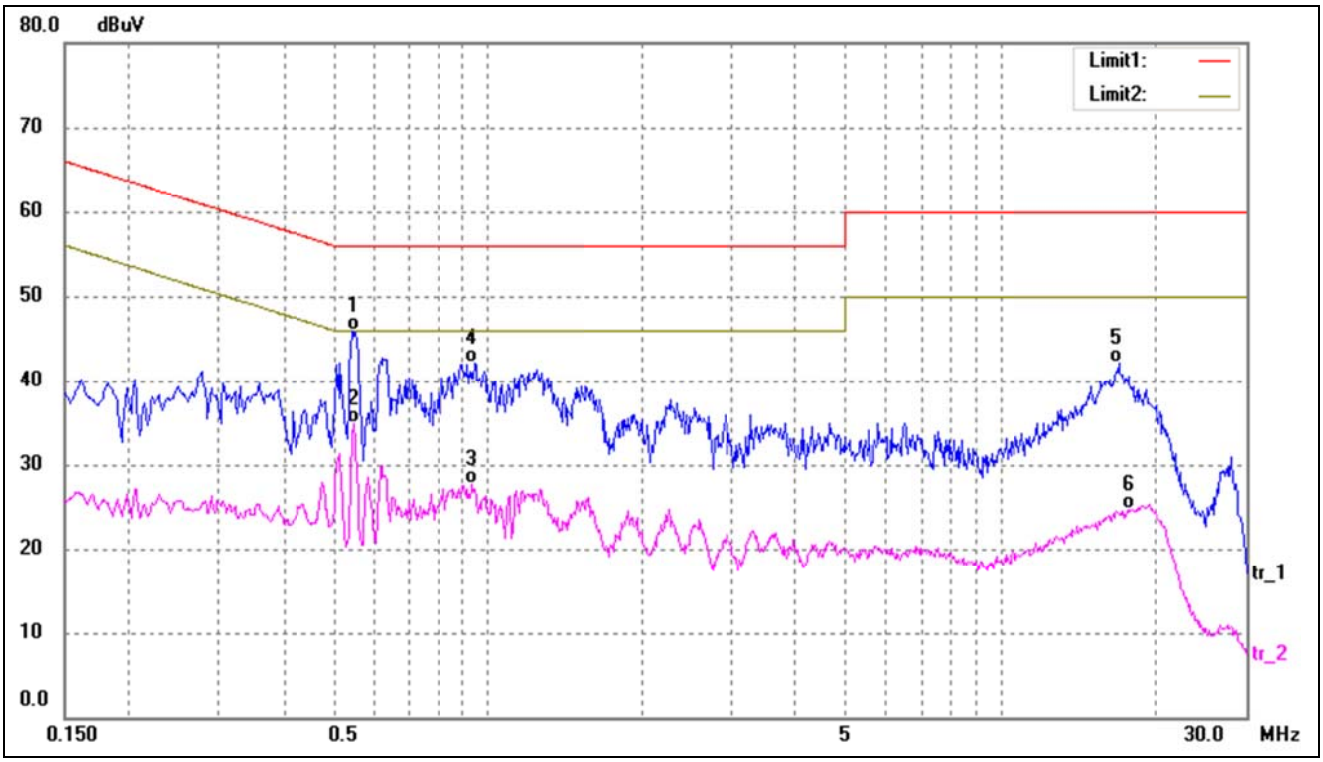
EUT: *Rugged phone*
Tested Model: *CS28SA*
Operating Condition: *Transmitting*
Comment: *AC 120V/60Hz*

Test Specification: *Neutral*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.5140	38.58	9.80	48.38	56.00	-7.62	QP
2	0.5140	27.03	9.80	36.83	46.00	-9.17	AVG
3	1.1260	33.41	9.76	43.17	56.00	-12.83	QP
4	1.1300	19.28	9.76	29.04	46.00	-16.96	AVG
5	16.9100	34.42	9.64	44.06	60.00	-15.94	QP
6	17.0500	18.23	9.64	27.87	50.00	-22.13	AVG

Test Specification: *Line*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1*	0.5460	36.13	9.80	45.93	56.00	-10.07	QP
2	0.5500	25.11	9.80	34.91	46.00	-11.09	AVG
3	0.9340	17.90	9.77	27.67	46.00	-18.33	AVG
4	0.9460	32.30	9.76	42.06	56.00	-13.94	QP
5	16.9300	32.44	9.64	42.08	60.00	-17.92	QP
6	17.7380	15.00	9.65	24.65	50.00	-25.35	AVG

8. EMISSION BANDWIDTH

8.1 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.

8.2 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 ≥1% 20dB Bandwidth, VBW ≥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.

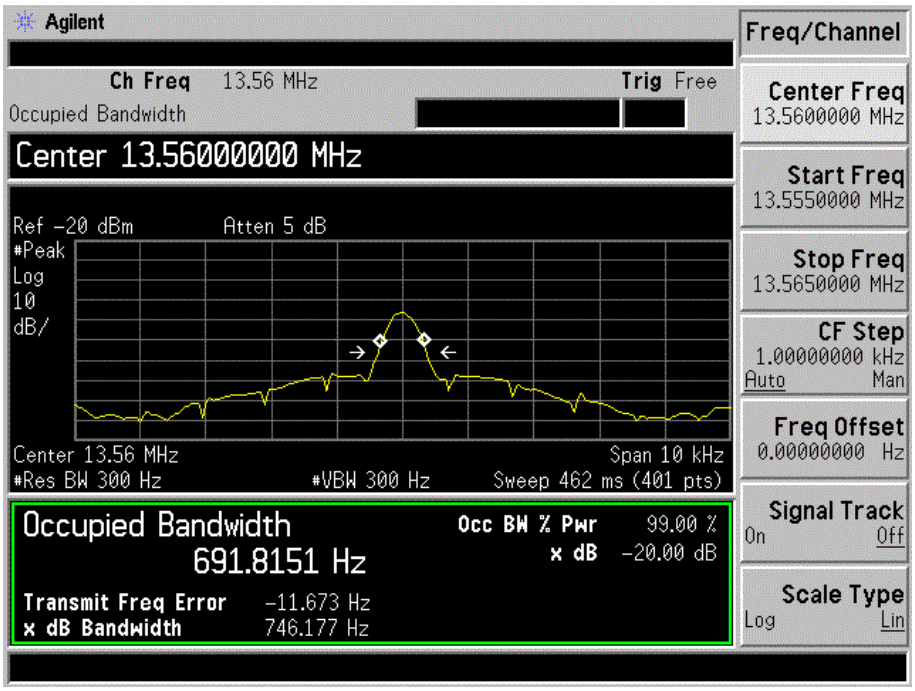
8.3 Environmental Conditions

Temperature:	26 °C
Relative Humidity:	45%
ATM Pressure:	1019 mbar

8.4 Summary of Test Results/Plots

Tx Frequency	20dB Emission bandwidth
13.56MHz	746.177Hz

Please refer to the test plots as below:



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