

FCC Part 15C Measurement and Test Report

For

Honeywell Integrated Technology(China) Co.,LTD

430 Li Bing Road, Shanghai ,P.R. China

FCC ID: 2AJAWVCU-047015EN

FCC Rule(s): FCC Part 15C

Product Description: Tema-Voyager TM Compact

Tested Model: VCU-047015EN1N01

Report No.: STR16078141I-1

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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.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Honeywell Integrated Technology(China) Co.,LTD
Address of applicant: 430 Li Bing Road, Shanghai ,P.R. China

Manufacturer: Honeywell S.r.l.
Address of manufacturer: Via PHILIPS 12, 20052, MONZA- ITALY

General Description of EUT	
Product Name:	Tema-Voyager TM Compact
Trade Name:	Honeywell
Model No.:	VCU-047015EN1N01
Adding Model(s):	/
Rated Voltage:	DC12V From Power Supply
Power Adapter Model:	RTU Q03 I/P: AC 120V/60Hz; O/P: DC 12V
<i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Frequency Range:	13.56MHz
Radiated H-Field:	59.02dBuV/m@3m(13.56MHz)
Type of Modulation:	FSK
No. of Channel	1
Type of Antenna:	Coil Antenna

1.2 Test Standards

The following report is prepared on behalf of the Honeywell Integrated Technology(China) Co.,LTD in accordance with FCC Part 15, Subpart C, and section 15.203,15.205, 15.207, 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, 15.207, 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.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

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.

CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road, Bao'an District, Shenzhen, P.R.C (518101).

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

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
RJ45 Cable*2	3.0	Shielded	Without Ferrite
AC Cable	1.3	Unshielded	Without Ferrite
Signal Cable	1.8	Unshielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	E23	/
Power Supply	Honeywell	RTU Q03	/

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
Frequency Deviation	2.3%	$\pm 5\%$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2016-06-04	2017-06-03
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
SEMT-1042	Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
SEMT-1121	Horn Antenna	ETS	3116B	00088203	2016-06-04	2017-06-03
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	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
§ 15.215(c)	Emission Bandwidth	Compliant

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 a Coil antenna, fulfill the requirement of this section.

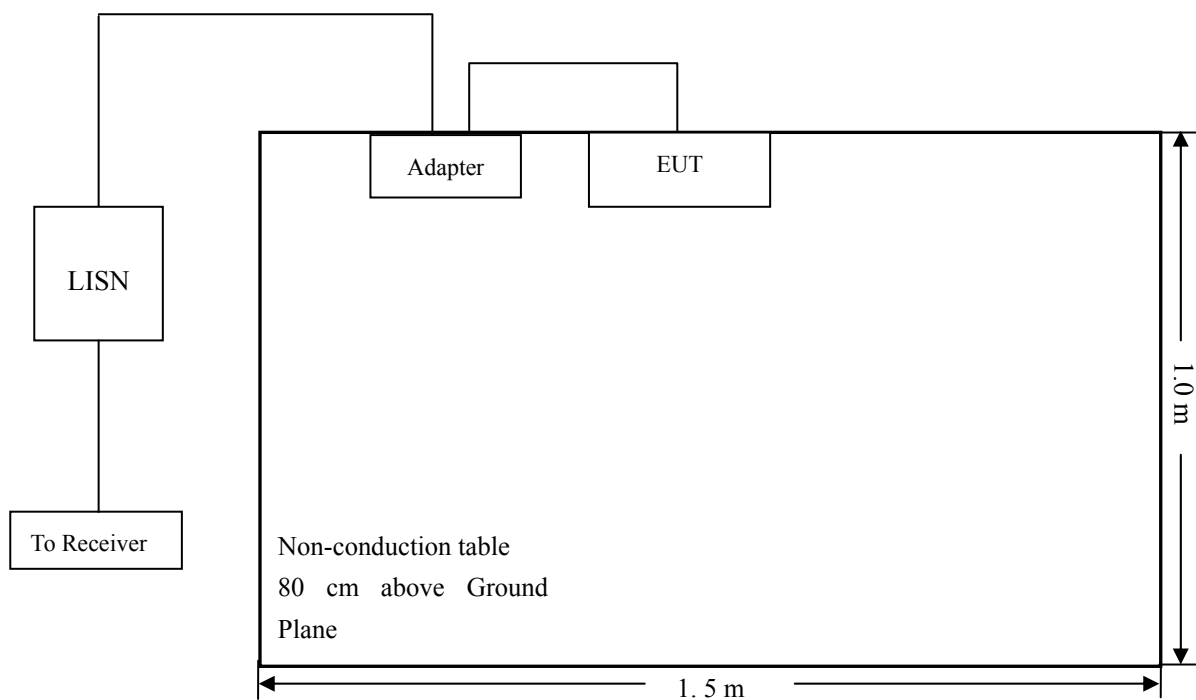
4. Conducted Emissions

4.1 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.

4.2 Basic Test Setup Block Diagram



4.3 Environmental Conditions

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

4.4 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

4.5 Summary of Test Results/Plots

According to the data in section 4.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

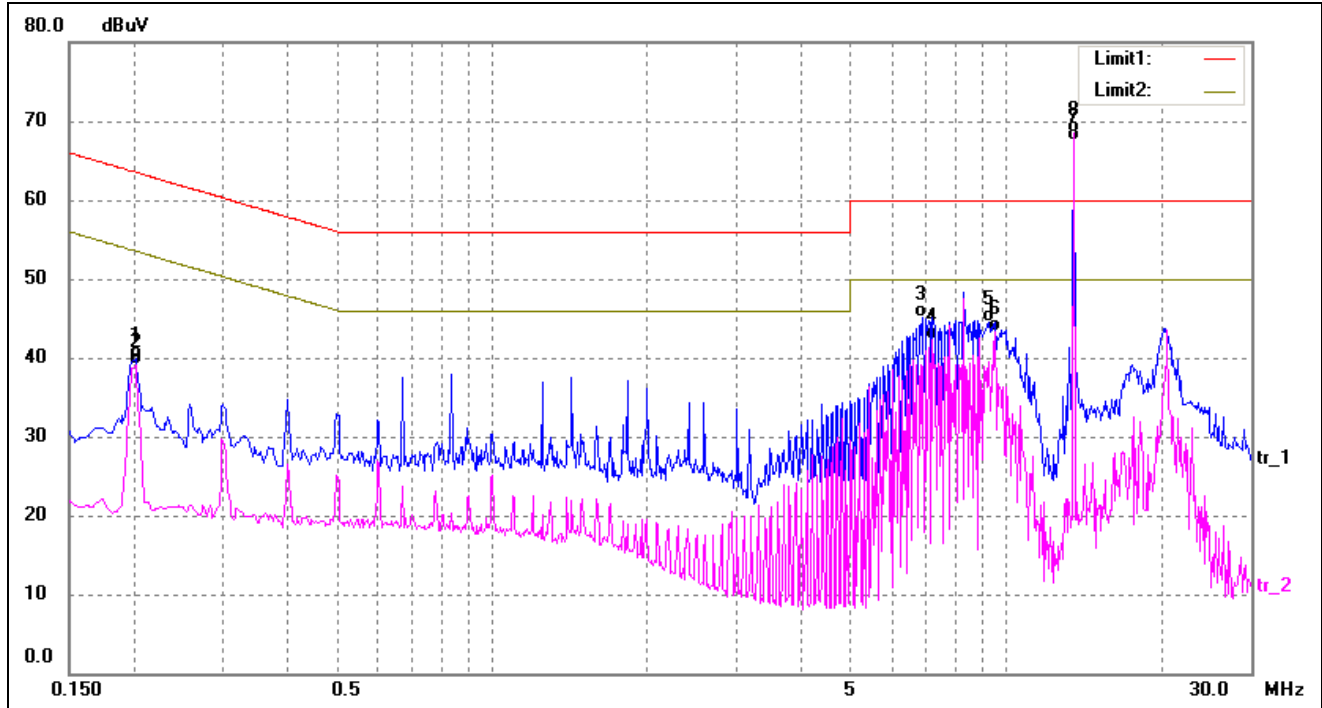
-1.99 dB at 8.3140 MHz in the **Line, Average** detector, 0.15-30MHz

4.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

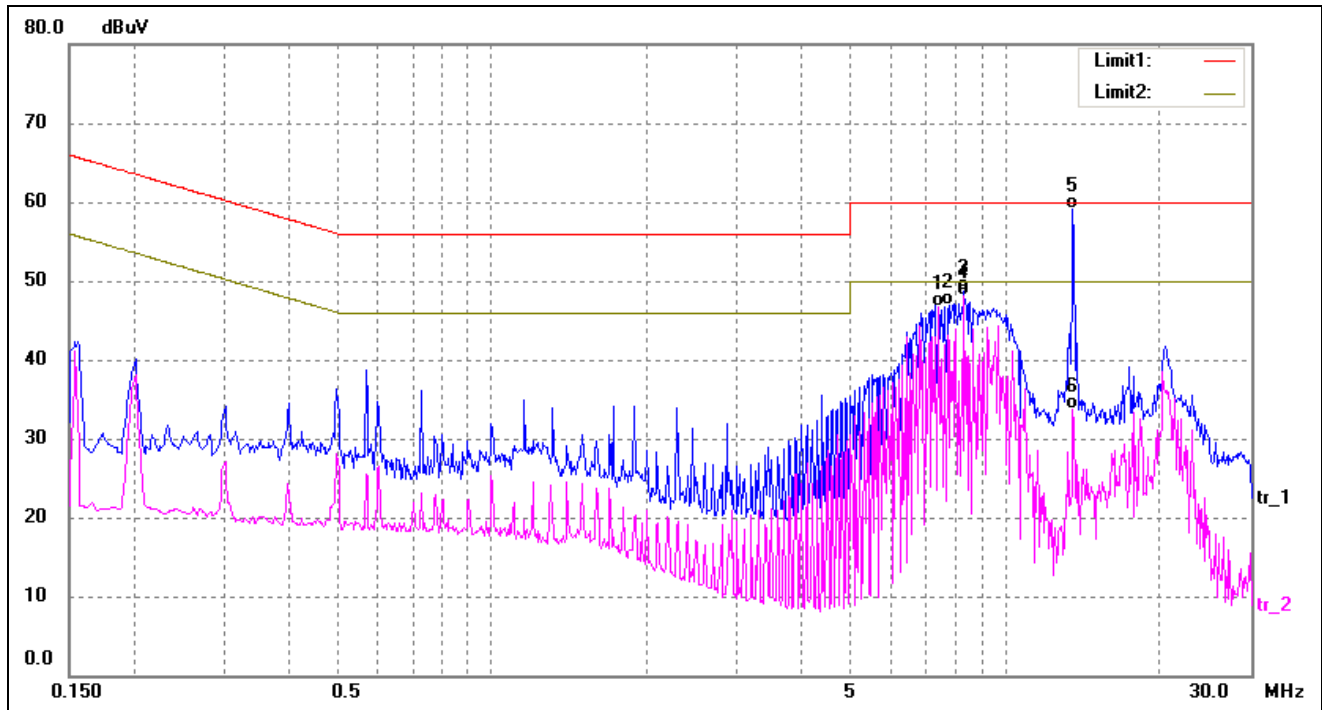
EUT: Tema-Voyager TM Compact
Tested Model: VCU-047015EN1N01
Operating Condition: Transmitting
Comment: AC 120V/60Hz; Power Supply DC 12V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.2020	30.38	9.50	39.88	63.52	-23.64	QP
2	0.2020	29.51	9.50	39.01	53.52	-14.51	AVG
3	6.9019	34.81	10.29	45.10	60.00	-14.90	QP
4	7.2057	32.07	10.29	42.36	50.00	-7.64	AVG
5	9.2979	34.17	10.34	44.51	60.00	-15.49	QP
6	9.5017	32.89	10.35	43.24	50.00	-6.76	AVG
7X	13.5579	57.10	10.40	67.50	/	/	Fundamental
8*	13.5579	58.13	10.40	68.53	/	/	

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	7.4019	36.31	10.30	46.61	50.00	-3.39	AVG
2	7.7979	36.62	10.31	46.93	60.00	-13.07	QP
3	8.3139	38.37	10.32	48.69	60.00	-11.31	QP
4	8.3139	37.69	10.32	48.01	50.00	-1.99	AVG
5	13.5457	48.75	10.40	59.15	/	/	Fundamental
6	13.5457	23.41	10.40	33.81	/	/	

5. Radiated Emissions

5.1 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.

Frequency of emission [MHz]	Field strength [microvolts/meter]	Measurement distance [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
Above 960	500	3

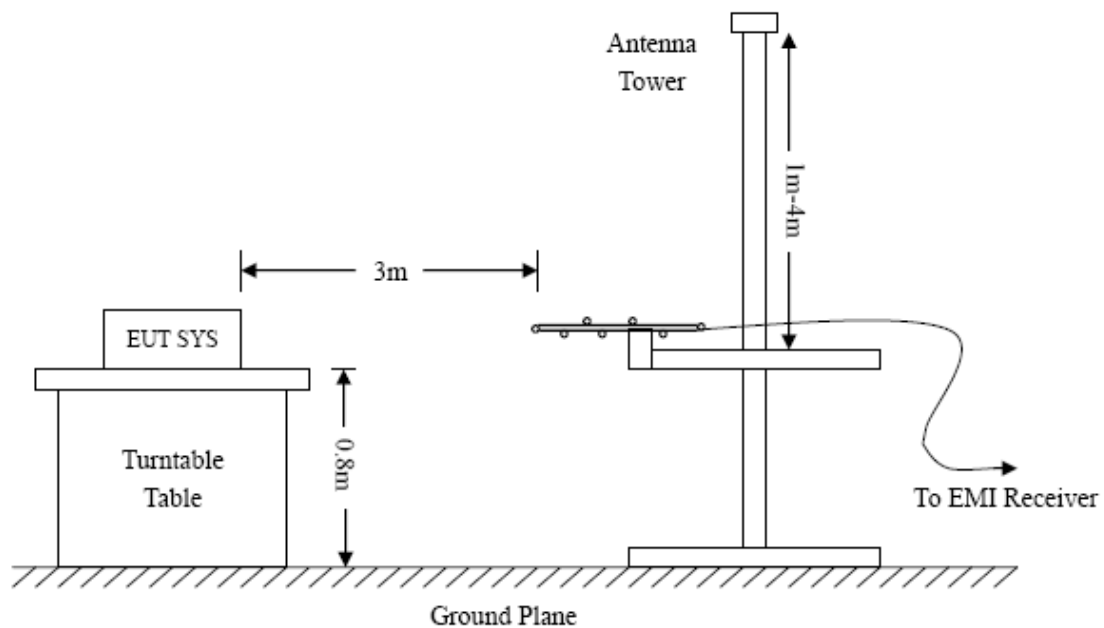
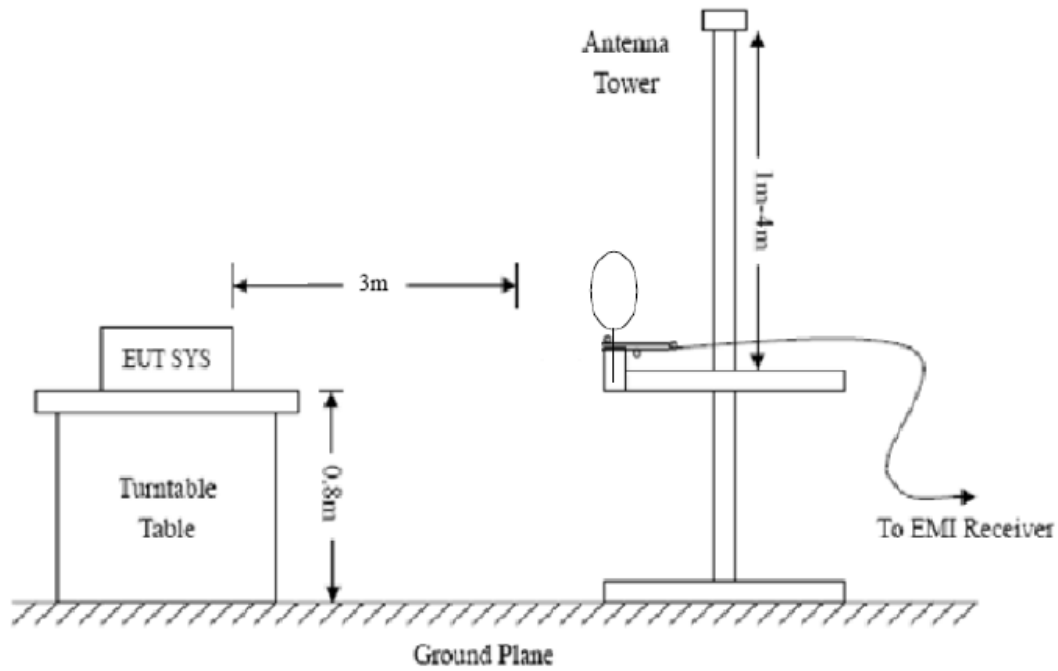
Note: Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

5.2 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

5.3 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 -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

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

5.4 Environmental Conditions

Temperature:	26° C
Relative Humidity:	52%
ATM Pressure:	1022 mbar

5.5 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:

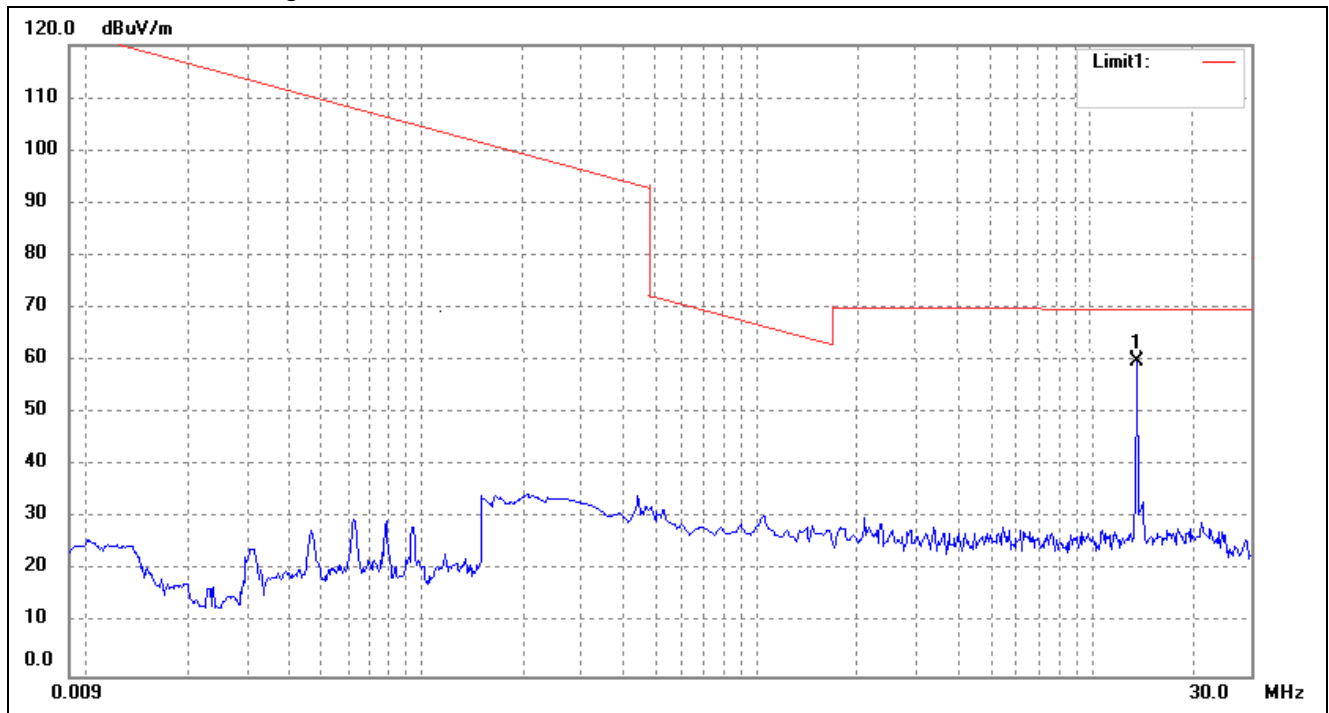
-3.73 dB at 374.6225 MHz in the Vertical polarization, 9 kHz to 1 GHz, 3Meters

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

Test plot

Spurious Emission Below 30MHz

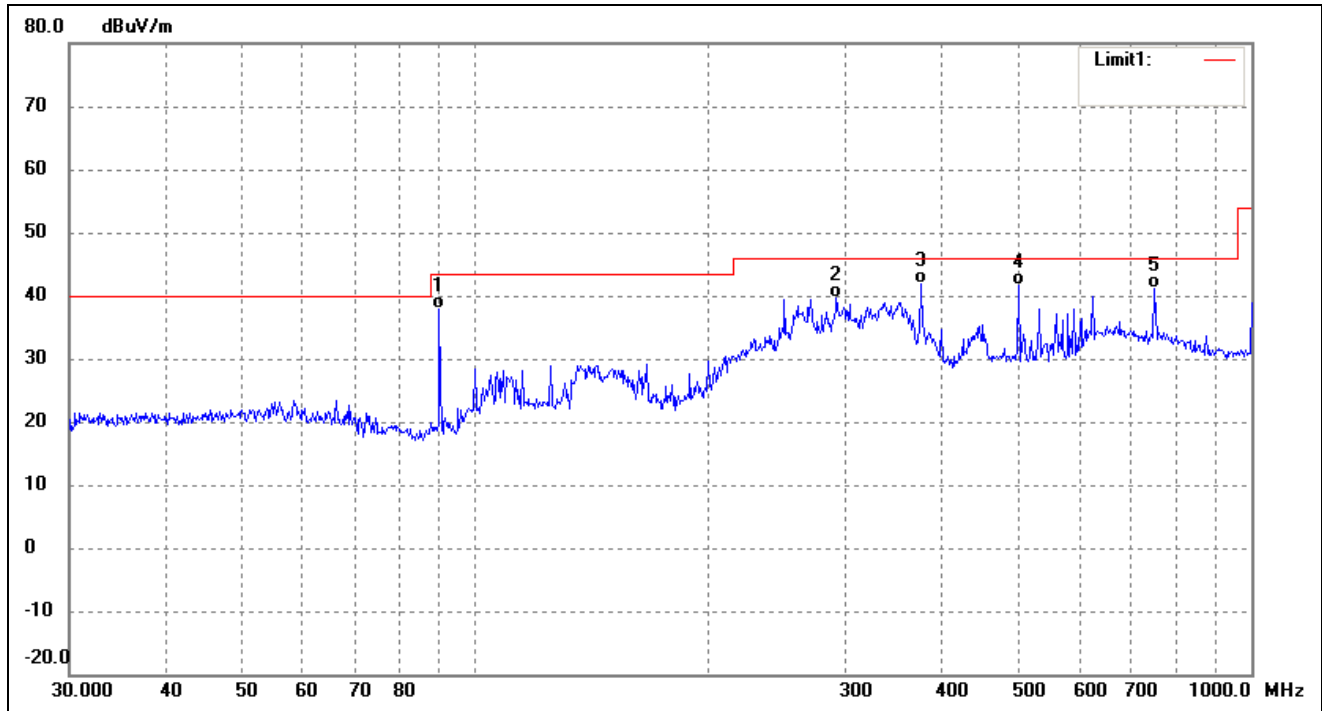
Test Mode: Transmitting mode



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	13.5525	61.55	-2.53	59.02	69.54	-10.52	53	100	QP

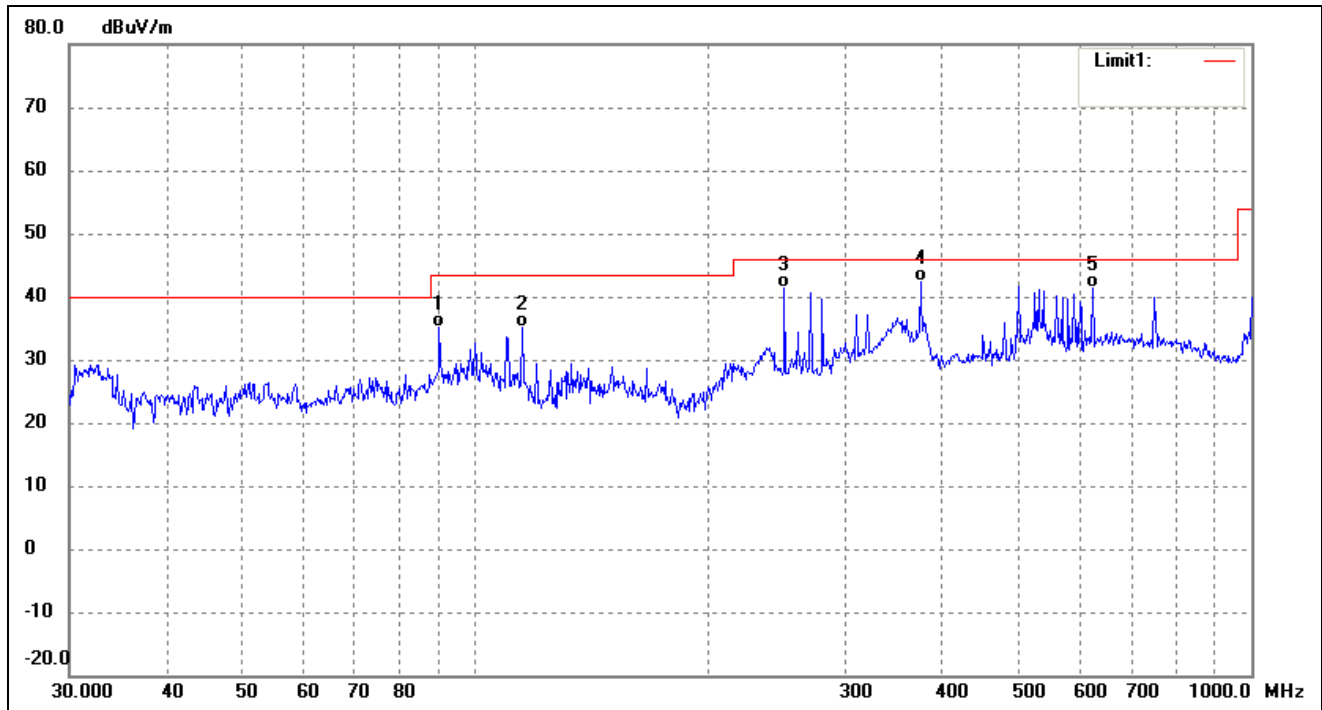
Plot of Radiated Emissions Test Data

EUT: Tema-Voyager TM Compact
 Tested Model: VCU-047015EN1N01
 Operating Condition: AC 120V/60Hz; Power Supply DC12V
 Comment: TM1
 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	89.9047	34.47	3.38	37.85	43.50	-5.65	191	100	QP
2	292.0582	28.09	11.65	39.74	46.00	-6.26	96	100	QP
3	375.9384	30.12	11.81	41.93	46.00	-4.07	145	100	QP
4	501.1789	28.31	13.37	41.68	46.00	-4.32	118	100	QP
5	750.1082	22.49	18.58	41.07	46.00	-4.93	268	100	QP

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ()	Height (cm)	Remark
1	89.9047	31.78	3.38	35.16	43.50	-8.34	136	100	QP
2	114.9167	30.16	4.85	35.01	43.50	-8.49	253	100	QP
3	250.3010	32.12	9.32	41.44	46.00	-4.56	88	100	QP
4	374.6225	30.44	11.83	42.27	46.00	-3.73	111	100	QP
5	625.0778	23.88	17.55	41.43	46.00	-4.57	96	100	QP

6. OUT OF BAND EMISSIONS

6.1 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.

6.2 Test Procedure

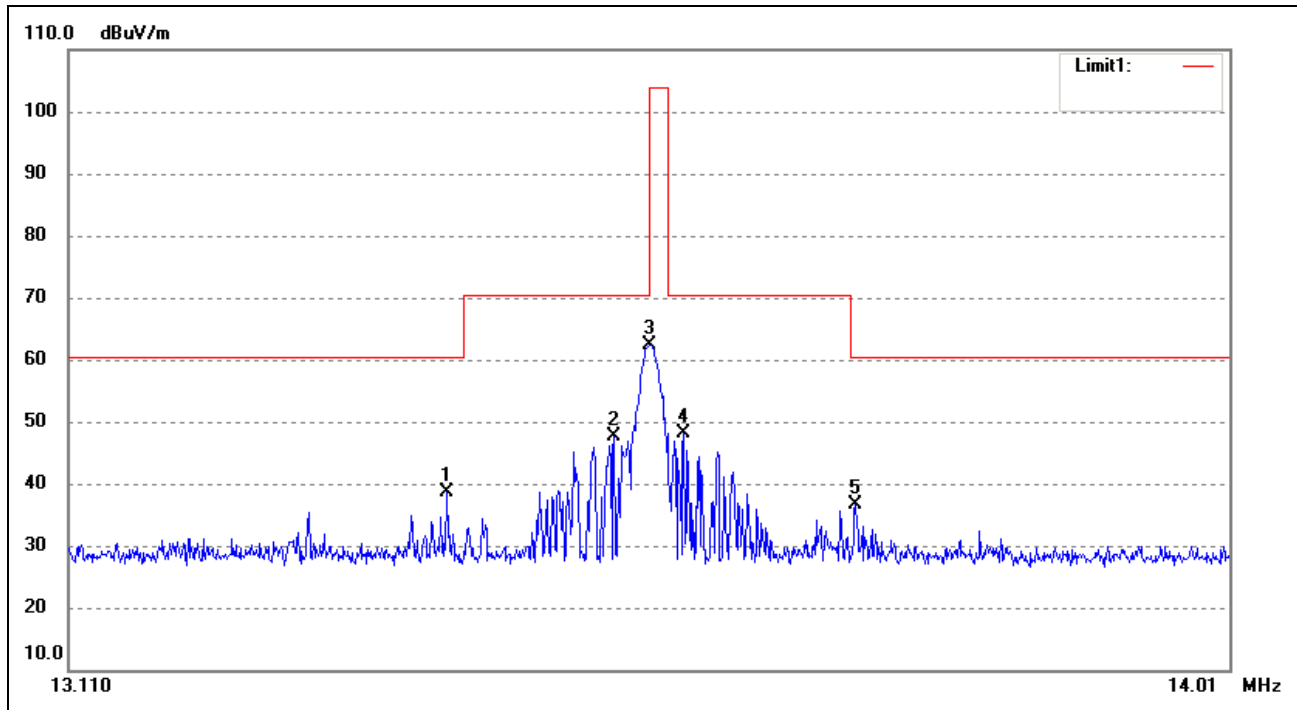
As the radiation test, set the RBW=10kHz VBW=30kHz, observed the outside band of 13.11MHz to 14.01MHz, than mark the higher-level emission for comparing with the FCC rules.

6.3 Environmental Conditions

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

6.4 Summary of Test Results/Plots

Out of band emission



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (°)	Height (cm)	Remark
1	13.3969	26.13	12.57	38.70	60.50	-21.80	351	100	peak
2	13.5256	35.16	12.56	47.72	70.50	-22.78	351	100	peak
3	13.5534	49.89	12.56	62.45	104.00	-41.55	351	100	peak
4	13.5796	35.69	12.56	48.25	70.50	-22.25	351	100	peak
5	13.7137	24.19	12.55	36.74	60.50	-23.76	351	100	peak

7. Frequency Stability

7.1 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.

7.2 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure.

7.3 Environmental Conditions

Relative Humidity:	55%
ATM Pressure:	1015 mbar

7.4 Summary of Test Results/Plots

Reference Frequency: 13.56MHz, Limit: 100ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Error	
		Error (Hz)	Error (ppm)
50	12	160	11.7994
40	12	154	11.3569
30	12	125	9.2183
20	12	126	9.2920
10	12	95	7.0059
0	12	85	6.2684
-10	12	66	4.8673
-20	12	58	4.2773

Reference Frequency: 13.56MHz, Limit: 100ppm			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Error	
		Error (Hz)	Error (ppm)
20	10.8	122	8.9971
	12	126	9.2920
	13.2	129	9.5133

8. EMISSION BANDWIDTH

8.1 Applicable Standard

According to FCC 15.225 (b), the upper and lower frequency limits of the emission bandwidth shall at all times remain within the operating frequency limits, and the maximum emission bandwidth is no restricted.

8.2 Test Procedure

Test is conducting under the description of §15.225

8.3 Environmental Conditions

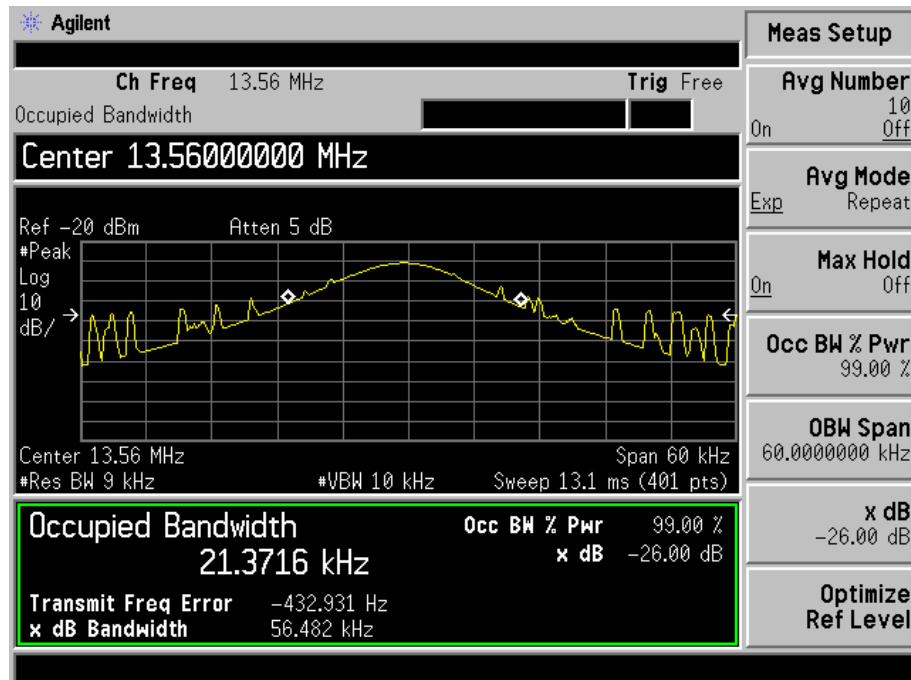
Temperature:	26 °C
Relative Humidity:	45%
ATM Pressure:	1019 mbar

8.4 Summary of Test Results/Plots

Tx Frequency	99% Emission bandwidth
13.56MHz	21.3716kHz

Please refer to the test plots as below:

13.56 MHz



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