SGS-CSTC Standards Technical Services
(Shanghai) Co., Ltd.

588 West Jindu Road,Songjiang District,Shanghai,China
Telephone: +86 (0) 21 6191 5666
Fax: +86 (0) 21 6191 5678
ee.shanghai@sgs.com

1 Cover Page

RF Test Report

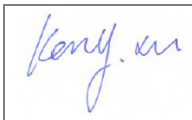
Application No.:	SHEM1405001164RF
Applicant:	Honeywell S.r.l.
FCC ID:	2ACDRVCU-04
IC:	573U-VCU04
Equipment Under Test (EUT): **NOTE:** The following sample(s) submitted was/were identified on behalf of the client as	
Product Name:	Tema-Voyager™ Compact
Model No.(EUT):	VCU-047015EN1N01
Standards:	FCC PART 15 Subpart C: 2013 RSS-210 Issue 8 (December 2010) RSS-Gen Issue 3 (December 2010)
Date of Receipt:	March 31, 2014
Date of Test:	April 28, 2014
Date of Issue:	May 21, 2014
Test Result:	**Pass***

*In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Tony Wu
E&E Section Manager
SGS-CSTC (Shanghai) Co., Ltd.

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		May 21, 2014		Original

Authorized for issue by:				
Engineer		Eddy Zong **Print Name**		
Clerk		Susie Liu **Print Name**		
Reviewer		Keny Xu **Print Name**		

3 Test Summary

Test Item	Test Requirement	IC Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	RSS-Gen 7.1.2	/	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	RSS-Gen Section 7.2.4	ANSI C63.10:2009 Section 6.2	PASS
20dB Bandwidth	47 CFR Part 15, Subpart C Section 15.215	RSS 210 A 8.1(a)	ANSI C63.10:2009 Section 6.9.1	PASS
Frequency tolerance	47 CFR Part 15, Subpart C Section 15.225(e)	RSS 210 A 8.1(b)	ANSI C63.10:2009 Section 6.8	PASS
Radiated Emissions	47 CFR Part 15, Subpart C Section 15.225)/15.209	RSS-Gen section 4.9	ANSI C63.10 (2009) Section 6.4&6.5&6.6	PASS
99% Occupied Bandwidth	---	RSS-Gen section 4.6.1	RSS-Gen Issue 3 Clause 4.6.1	PASS

4 Contents

5 General Information

5.1 Client Information

Applicant:	Honeywell S.r.l.
Address of Applicant:	Via PHILIPS 12, 20052, MONZA — ITALY
Manufacturer:	Honeywell S.r.l.
Address of Manufacturer:	Via PHILIPS 12, 20052, MONZA — ITALY
Factory:	Not supplied by the client.
Address of Factory:	Not supplied by the client.

5.2 General Description of E.U.T.

Product Description:	Equipment for fixed use

5.3 Technical Specifications:

Power Supply:	DC 12V supplied by PoE
Operation Frequency:	13.56MHz
Modulation Type:	FSK
Antenna Type:	Loop antenna
Antenna Gain:	0dBi
Test Voltage:	AC 120V 60Hz For PoE Switch

5.4 E.U.T Operation Mode

Reading mode:	Keep EUT at reading status.

5.5 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Supplied by
Labtop	Dell	E6400	Client
RFID card	HID	ProxCard II; iCLASS GL	Client
3Com OfficeConnect Managed Gigabie poE Switch	sankang	3CDSG10PWR	Client

5.6 Test Location

All tests were performed at:
SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab
No.588 West Jindu Road, Songjiang District, Shanghai, China. 201612.
Tel: +86 21 6191 5666
Fax: +86 21 6191 5678
No tests were sub-contracted.

5.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

  CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing. Date of expiry: 2014-07-26.

- **FCC – Registration No.: 402683**

  SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered and fully described in a report filed with the Federal Communications Commission (FCC). The acceptance letter from the FCC is maintained in our files. Registration No.: 402683, Expiry Date: 2015-02-22.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

  The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A. Expiry Date: 2014-09-20.

- **VCCI (Member No.: 3061)**

  The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868 and C-4336 respectively. Date of Registration: 2012-05-29. Date of Expiry: 2015-05-28.

6 Equipments List

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due date
1	Power meter	Rohde & Schwarz	NRP	101641	2014-02-14	2015-02-13
2	Power Sensor	Rohde & Schwarz	NRP-Z22	1137.7506.02	2013-11-21	2014-11-20
3	Spectrum Analyzer	Rohde & Schwarz	FSP-30	270512100 9	2014-02-14	2015-02-13
4	EMI test receiver	Rohde & Schwarz	ESU40	100109	2014-02-14	2015-02-13
5	Horn Antenna (1GHz to 18GHz)	SCHWARZBECK	BBHA9120D	9120D-679	2014-02-14	2015-02-13
6	Horn Antenna (14GHz to 40GHz)	SCHWARZBECK	BBHA 9170	BBHA9170 373	2014-02-14	2015-02-13
7	ANTENNA (25MHz to 2GHz)	SCHWARZBECK	VULB9168	9168-313	2014-02-14	2015-02-13
8	Ultra broadband antenna (30MHz to3GHz)	Rohde & Schwarz	HL562	100227	2013-10-09	2014-10-08
9	Horn Antenna (1GHz to 18GHz)	Rohde & Schwarz	HF906	100284	2014-02-14	2015-02-13
10	Active Loop Antenna (9kHz to 30MHz)	Rohde & Schwarz	FMZB 1519	1519-034	2013-07-28	2014-07-27
11	High-low temperature cabinet	Suzhou Zhihe	TL-40	50110050	2014-04-13	2015-04-12
12	Tunable Notch Filter	Wainwright instruments Gmbh	WRCT800.0/ 880.0-0.2/40-5SSK	9	2013-06-02	2014-06-01
13	High pass Filter	FSCW	HP 12/2800-5AA2	19A45-02	2013-06-02	2014-06-01
14	Low noise amplifier	TESEQ	LNA6900	70133	2014-02-14	2015-02-13
15	AC power stabilizer	WOCEN	6100	51122	2013-06-02	2014-06-01
16	DC power	QJE	QJ30003SII	611145	2013-06-02	2014-06-01

7 Test results and Measurement Data

7.1 Antenna Requirement

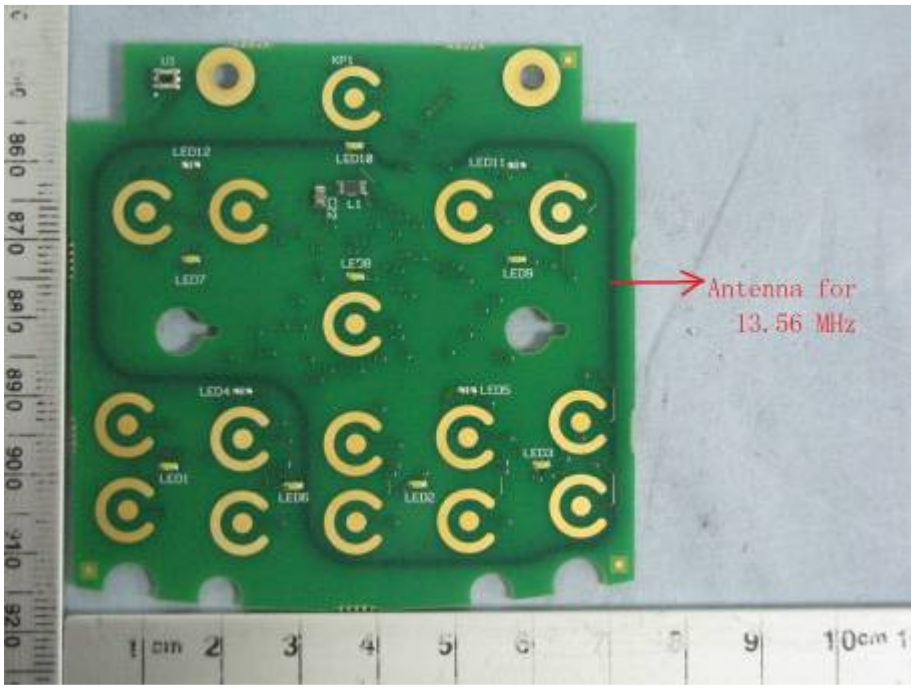
Standard requirement: 47 CFR Part 15C Section 15.203

15.203 Requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement.

Antenna Configuration:



7.2 Conducted Emissions

Test Frequency Range: 150kHz to 30MHz

Limit:

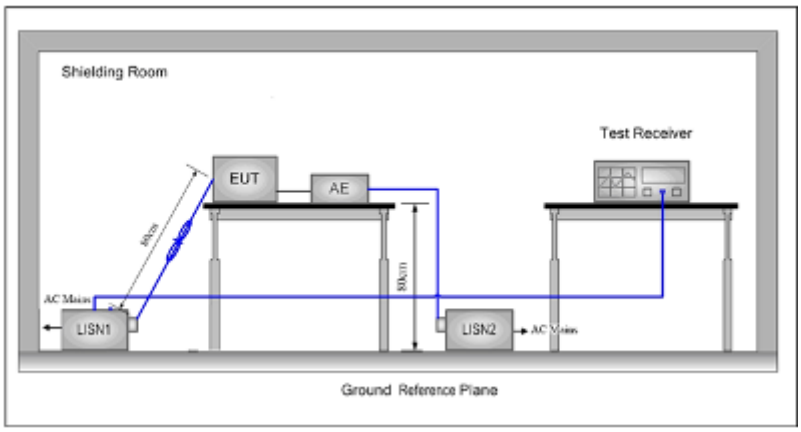
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Procedure:

1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) 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: 2009 on conducted measurement.

Test Setup:



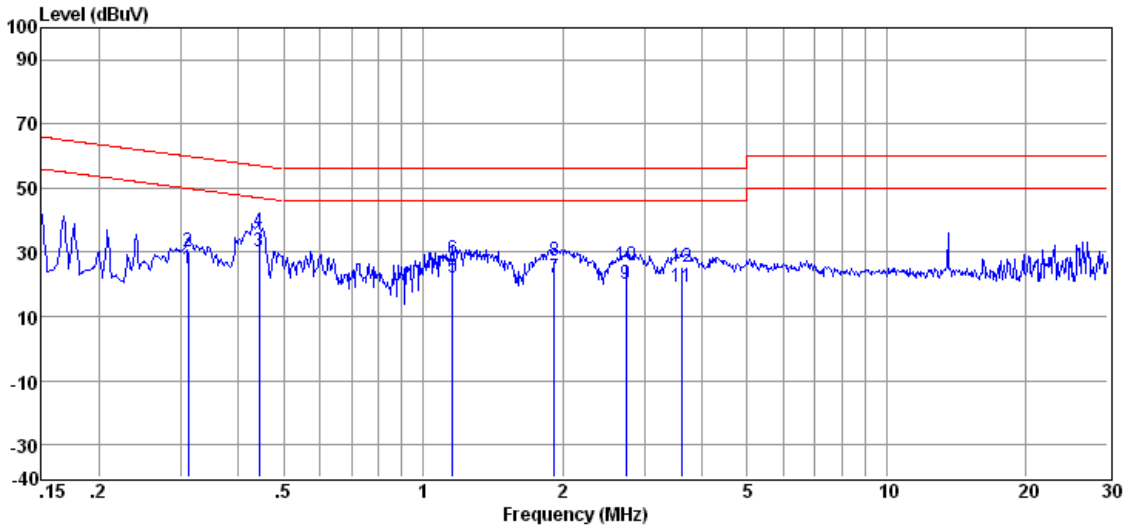
Test Results: Pass

Measurement Data:

An initial pre-scan was performed on the live and neutral lines with peak detector.

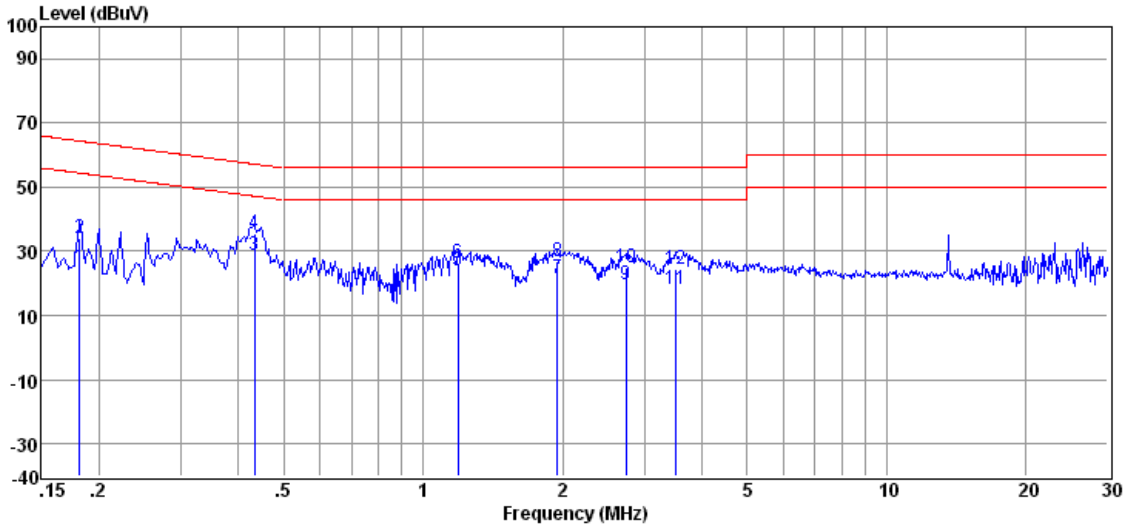
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live Line:



Item	Freq.	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBµV)	(dB)	(dB)	(dBµV)	(dBµV)	(dB)	
1	0.312	24.39	0.26	0.10	24.75	49.93	-25.18	Average
2	0.312	29.92	0.26	0.10	30.28	59.93	-29.65	QP
3	0.442	29.75	0.25	0.10	30.10	47.02	-16.92	Average
4	0.442	36.07	0.25	0.10	36.42	57.02	-20.60	QP
5	1.160	21.98	0.21	0.10	22.29	46.00	-23.71	Average
6	1.160	27.31	0.21	0.10	27.62	56.00	-28.38	QP
7	1.918	21.60	0.35	0.10	22.05	46.00	-23.95	Average
8	1.918	26.97	0.35	0.10	27.42	56.00	-28.58	QP
9	2.736	19.75	0.37	0.13	20.25	46.00	-25.75	Average
10	2.736	25.47	0.37	0.13	25.97	56.00	-30.03	QP
11	3.603	18.62	0.38	0.16	19.16	46.00	-26.84	Average
12	3.603	25.02	0.38	0.16	25.56	56.00	-30.44	QP

Neutral Line:



Item	Freq.	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBµV)	(dB)	(dB)	(dBµV)	(dBµV)	(dB)	
1	0.182	24.31	0.31	0.10	24.72	54.42	-29.70	Average
2	0.182	33.85	0.31	0.10	34.26	64.42	-30.16	QP
3	0.433	28.51	0.30	0.10	28.91	47.20	-18.29	Average
4	0.433	35.24	0.30	0.10	35.64	57.20	-21.56	QP
5	1.191	23.39	0.42	0.10	23.91	46.00	-22.09	Average
6	1.191	25.74	0.42	0.10	26.26	56.00	-29.74	QP
7	1.949	20.65	0.97	0.10	21.72	46.00	-24.28	Average
8	1.949	25.73	0.97	0.10	26.80	56.00	-29.20	QP
9	2.736	18.72	0.80	0.13	19.65	46.00	-26.35	Average
10	2.736	23.96	0.80	0.13	24.89	56.00	-31.11	QP
11	3.509	17.33	0.65	0.16	18.14	46.00	-27.86	Average
12	3.509	23.87	0.65	0.16	24.68	56.00	-31.32	QP

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

7.3 Radiated Emissions

Test frequency range: 9KHz – 1GHz

Test Site: Measurement Distance: 3m (Semi-Anechoic Chamber)

Receiver Setup:

Frequency (MHz)	RBW	VBW	Detector
0.009-0.015	200Hz	1KHz	Quasi-peak
0.015-30	9kHz	30KHz	Quasi-peak
30-1000	120 kHz	300KHz	Quasi-peak

Note: The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector. For the frequency bands 9~90 kHz, 110~490 kHz and above 1000 MHz, the radiated emission limits are based on measurements employing an average detector.

Limit:

Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)	Limit @3m (dBμV/m)
0.009-0.490	2400/F(kHz)	300	128.5 ~ 93.8
0.490-1.705	24000/F(kHz)	30	73.8 ~63.0
1.705-30	30	30	69.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
960-1000	500	3	54.0

NOTE:

(1) For test distance other than what is specified, but fulfilling the requirements of section 15.31(f) (2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade (inverse linear distance for field strength measurements).

So the Distance Extrapolation Factor in dB is 40*log (D_{TEST} / D_{SPEC}) where D_{TEST} = Test Distance and D_{SPEC} = Specified Distance.

Field strength limit (dBμV/m)@test distance= Field strength limit (dBμV/m)@specified distance -Distance Extrapolation Factor

(2) The lower limit shall apply at the transition frequencies.

Test Procedure:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified

Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The radiation measurements are performed in X, Y, Z axis positioning. And found the Z axis positioning which it is worse case, only the test worst case mode is recorded in the report.

Test Setup:

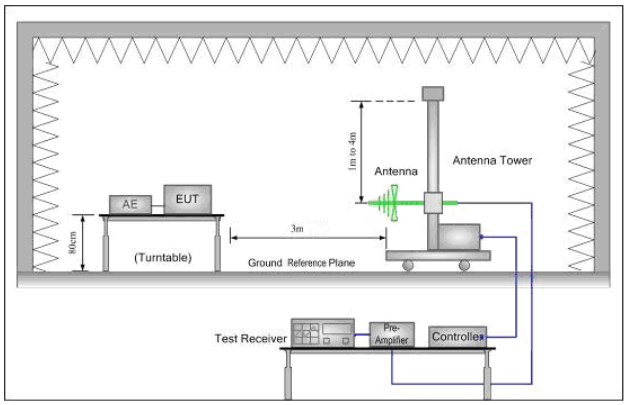


Figure 1. Below 30MHz

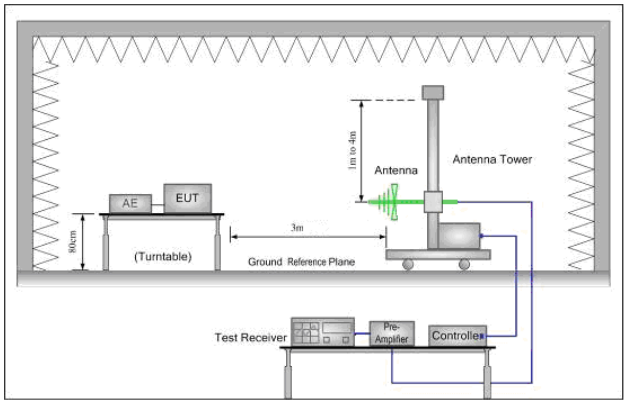
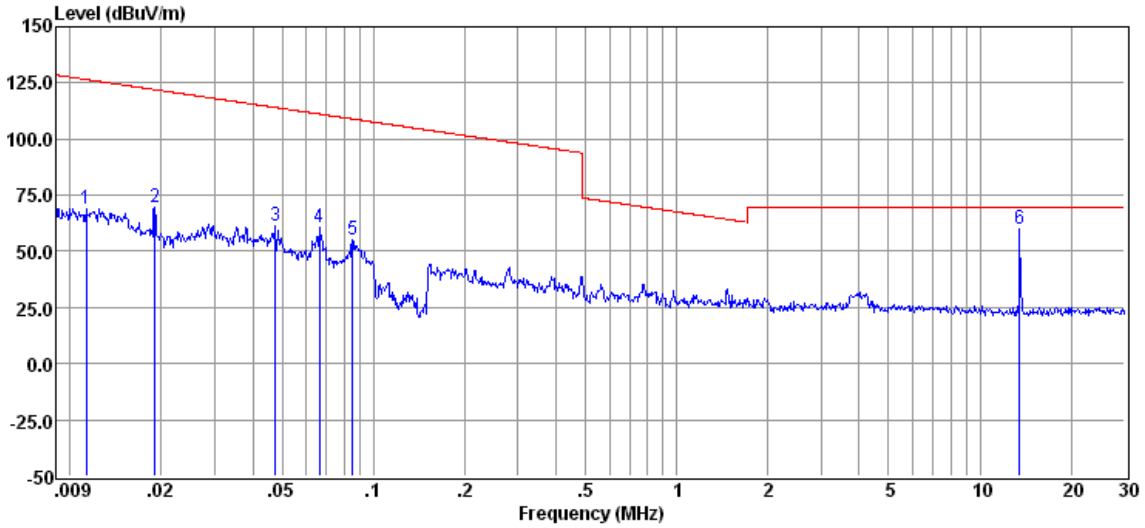


Figure 2. 30MHz to 1GHz

Test Results: Pass

Z:

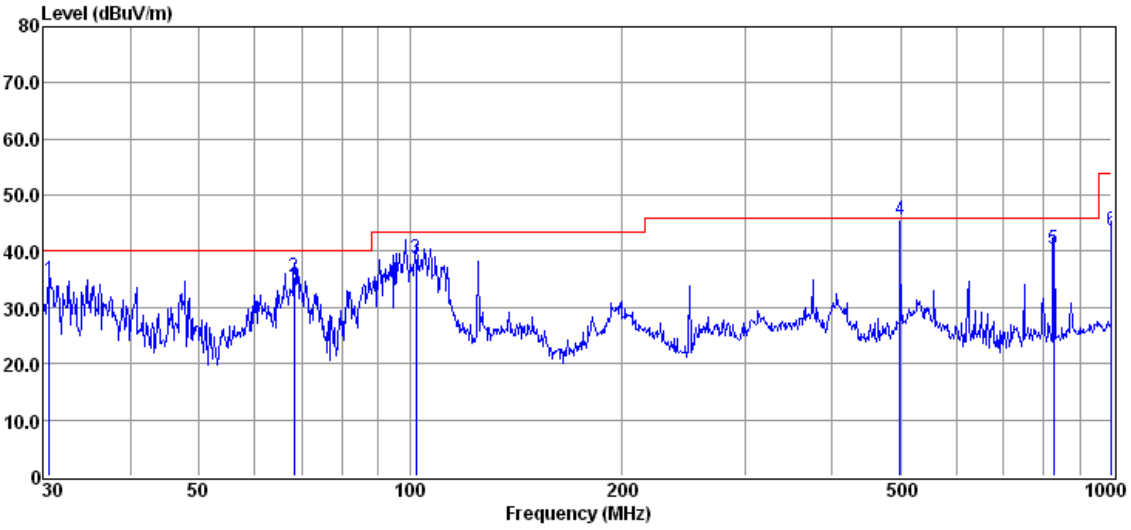


Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.011	122.44	-31.86	23.66	2.27	69.19	126.53	-57.34	QP
2	0.019	124.80	-31.78	23.65	0.45	69.82	122.02	-52.20	QP
3	0.047	113.97	-31.66	23.63	2.83	61.51	114.06	-52.55	QP
4	0.066	113.41	-31.80	23.62	2.37	60.36	111.18	-50.82	QP
5	0.085	107.97	-31.74	23.61	2.20	54.82	108.99	-54.17	QP
6	13.560	115.13	-31.70	23.76	0.16	59.83	N/A	Operating frequency	

Measurement Data

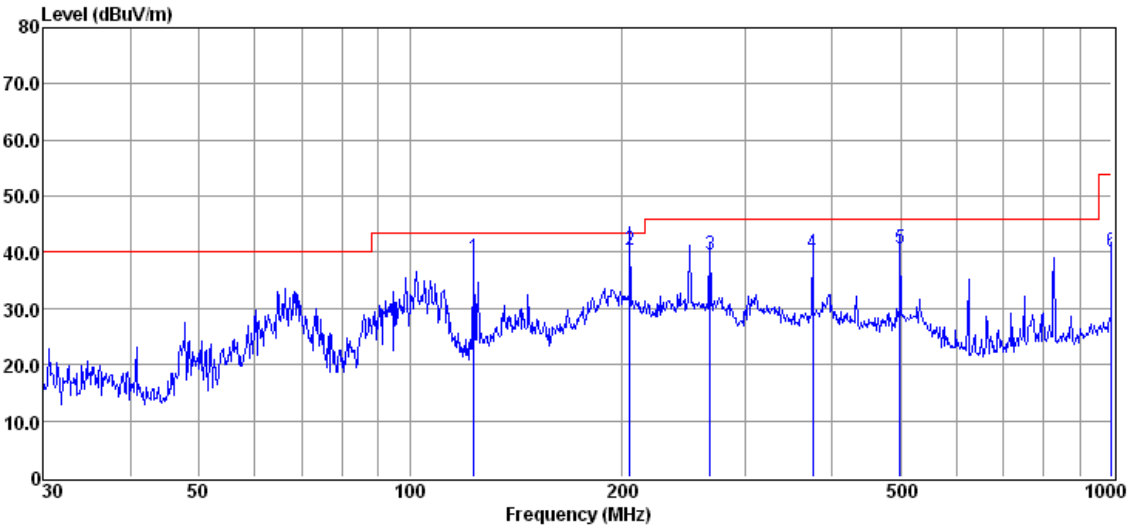
30MHz-1GHz:

Vertical



Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	
1	30.638	46.29	12.14	23.72	0.12	34.83	40.00	-5.17	QP
2	68.391	47.62	11.03	23.68	0.58	35.55	40.00	-4.45	QP
3	102.001	52.13	9.38	23.66	0.93	38.78	43.50	-4.72	QP
4	499.425	50.48	16.50	23.73	2.43	45.68	46.00	-0.32	QP
5	827.493	38.59	22.42	23.93	3.26	40.34	46.00	-5.66	QP
6	1000.000	39.69	24.30	23.94	3.71	43.76	54.00	-10.24	QP

Horizontal



Item	Freq.	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Result Level	Limit Line	Over Limit	Detector
(Mark)	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
1	123.266	50.47	11.17	23.65	1.05	39.04	43.50	-4.46	QP
2	205.675	53.46	9.19	23.62	1.41	40.44	43.50	-3.06	QP
3	267.546	50.84	10.86	23.66	1.67	39.71	46.00	-6.29	QP
4	374.623	47.51	14.10	23.70	2.06	39.97	46.00	-6.03	QP
5	499.425	45.87	16.20	23.73	2.43	40.77	46.00	-5.23	QP
6	1000.000	35.92	24.50	23.94	3.71	40.19	54.00	-13.81	QP

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

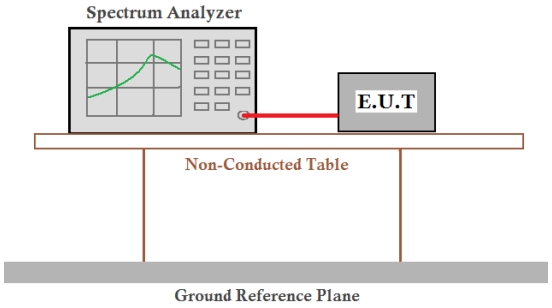
7.4 Frequency tolerance

Frequency Range: Operation within the band 13.110-14.010 MHz

Requirements: 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.

Method of Measurement: The EUT was placed in an environmental test chamber and powered such that control element received normal voltage and the transmitter provided maximum RF output.

Test setup:



Test Result: Pass

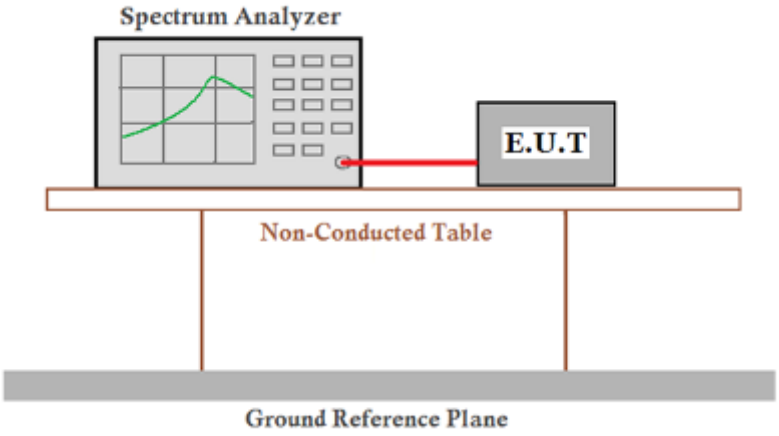
Test Data:

Nominal Operation Frequency: 13.56MHz

Test Conditions		Test Result (MHz)	Deviation (kHz)	Limit (kHz)	Result
Temp (℃)	Volt (V AC)				
T_{nom} (25)	V_{nom} (120)	13.56075	0.75	±0.01% (1.3560kHz)	Pass
T_{max} (50)	V_{min} (102)	13.56080	0.80		Pass
	V_{max} (138)	13.56078	0.78		Pass
T_{max} (40)	V_{min} (102)	13.56073	0.73		Pass
	V_{max} (138)	13.56074	0.74		Pass
T_{max} (30)	V_{min} (102)	13.56079	0.79		Pass
	V_{max} (138)	13.56077	0.77		Pass
T_{max} (20)	V_{min} (102)	13.56072	0.72		Pass
	V_{max} (138)	13.56081	0.81		Pass
T_{max} (10)	V_{min} (102)	13.56071	0.71		Pass
	V_{max} (138)	13.56080	0.80		Pass
T_{max} (0)	V_{min} (102)	13.56069	0.69		Pass
	V_{max} (138)	13.56082	0.82		Pass
T_{max} (-10)	V_{min} (102)	13.56068	0.68		Pass
	V_{max} (138)	13.56067	0.67		Pass
T_{min} (-20)	V_{min} (102)	13.56084	0.84		Pass
	V_{max} (138)	13.56078	0.78		Pass

Note: Deviation (kHz) = (Test Result-13.56MHz)*1000

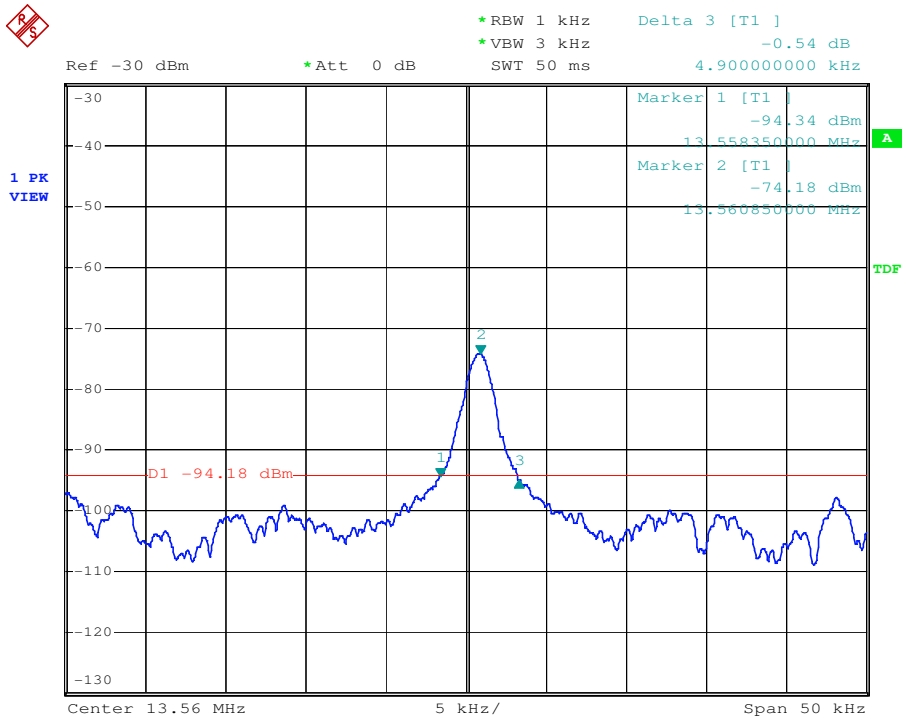
7.5 20dB Bandwidth

Test Setup:	
Frequency Range:	Operation within the band 13.110 – 14.010 MHz
Requirements:	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 is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB 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 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.
Test Result:	Pass

Measurement Data:

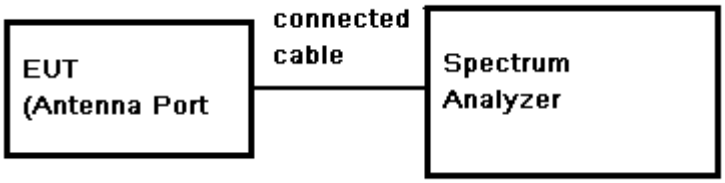
20dB bandwidth (kHz)	Result
4.90	Pass

Test plot as follows:



7.6 99% Occupied Bandwidth Test

Test Configuration:



Test Procedure:

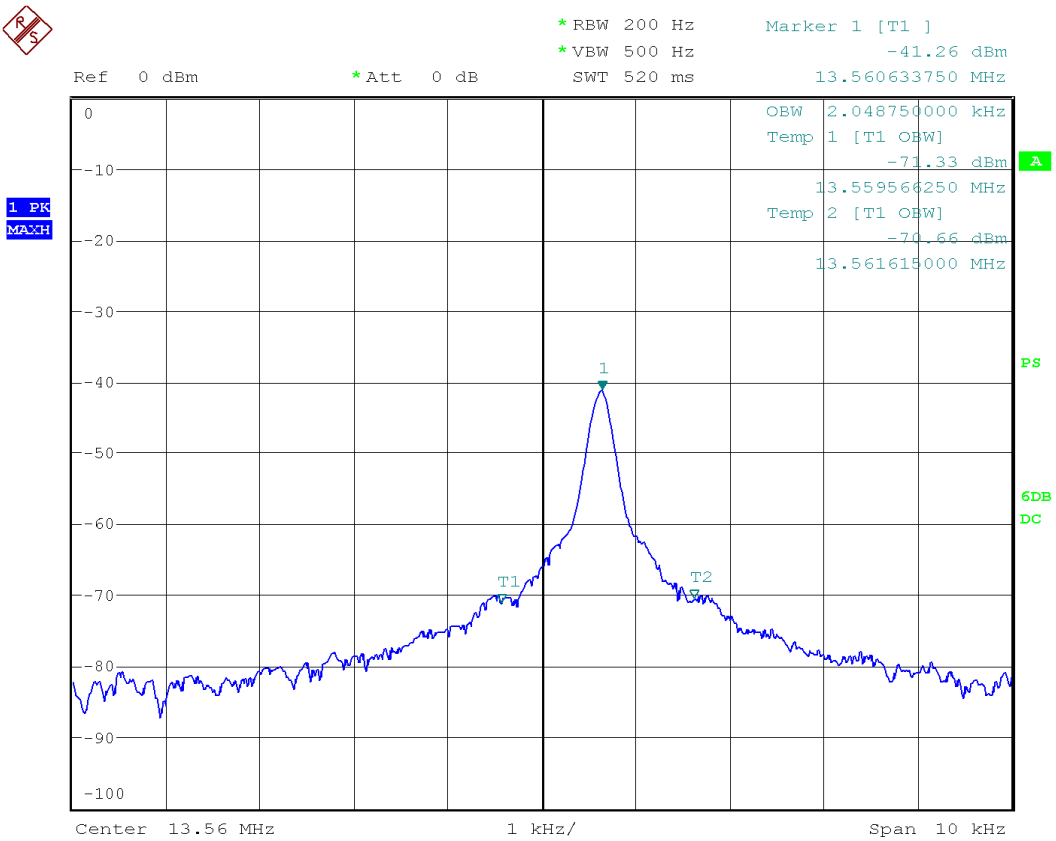
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centred on the hopping channel;
3. Set the spectrum analyzer: RBW >= 1% of the selected span (set 30 kHz). VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and 99% bandwidth points.

Test Result: Pass

Test Data:

Frequency (MHz)	Bandwidth (KHz)
13.56	2.04875

Test plot as follows:



8 Test Setup Photographs

Refer to the < VCU-047015ENIN01_Test Setup Photos-FCC >

9 EUT Constructional Details

Refer to the < VCU-047015ENIN01_External Photos-FCC> & < VCU-047015ENIN01_Internal Photos-FCC>.

--End of the Report--