



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

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Report No.: SHEM110800100704
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TEST REPORT

Application No. : SHEM110800100704
Applicant: Honeywell srl
FCC ID: HS9VCU-03
IC: 573U-VCU03
Fundamental Frequency : 13.56MHz
Equipment Under Test (EUT):
Marking: Honeywell
Name: Tema-Voyager™
Model No.: VCU-037015EN1N00, VCU-037015EN1N01
VCU-037015EN1N01 is the typical model base on the worse case at the emission test.
Standards: FCC PART 15 SUBPART C, Section 15.225
RSS-210 Issue 8 (December 2010)
RSS-Gen Issue 3 (December 2010)
Date of Receipt: Sep. 15, 2011
Date of Test: Sep. 15, 2011 to Oct 25, 2011
Date of Issue: Oct 26, 2011
Test Result : **PASS ***

* In the configuration tested, the EUT complied with the standards specified above.

Jim Xu
E&E Section Head
SGS-CSTC(Shanghai) Co., Ltd.

Neil Zhang
E&E Project Engineer
SGS-CSTC(Shanghai) Co., Ltd.

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2 Test Summary

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Field Strength of Fundamental and Radiated Emission	15.225(a)(b)(c)(d) & 15.209	RSS-210 Issue 8 Section 2	Pass
Power Line Conducted Emission	15.207	RSS-Gen Issue 8 Section 7.2.4	Pass
Receiver Spurious Emission	-	RSS-Gen Issue 3 Section 4.10	Pass
Occupied Bandwidth	15.215(c)	RSS-Gen Issue 3 Section 4.6.1	Tested
Frequency Tolerance	15.225(e)	RSS-Gen Issue 3 Section 4.7	Pass
Antenna Requirement	15.203	-	Compliance

Noted: “-” means not require in the rules.



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4 General Information

4.1 Client Information

Applicant :	Honeywell srl
Applicant Address:	VIA PHILIPS 12 – 20052 MONZA – MI – ITALY
Manufacturer:	Honeywell srl
Manufacturer Address:	VIA PHILIPS 12 – 20052 MONZA – MI – ITALY

4.2 Details of E.U.T.

Marking:	Honeywell
Name:	Tema-Voyager™
Model No.:	VCU-037015EN1N00, VCU-037015EN1N01 VCU-037015EN1N01 is the typical model base on the worse case at the emission test.
Power Supply:	DC 12V / 0.4A
Hardware Version and Software Version:	Module number is integrated with hardware and software version. VCU-037015EN1N00 VCU-037015EN1N01
Frequency	125KHz 13.56MHz
Modulation Type:	125KHz: FSK 13.56MHz: ASK, BPSK

4.3 Description of Support Units

Name	Model No.	Remark
TIGER POWER SUPPLY	TGS15-2	Input: AC: 100~240V 50/60Hz 0.5A Output: DC +12V 1.25A
ThinkCentre	6137	PC
Display	LZ850A60684	Display
Keyboard	KU-0225	Keyboard
Mouse	M028UOL	Mouse
Laptop	ThinkPad X100e	N/A



4.4 Test Location

Tests were performed at:

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

No.588 West Jindu Road, Songjiang District, Shanghai, China. 201612.

Tel: +86 21 6191 5666 Fax: +86 21 6191 5655

No tests were sub-contracted.

4.5 Other Information Requested by the Customer

None.

4.6 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: 2012-03-17.

- **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-3172 and C-3514 respectively. Date of Registration: 2009-11-30. Date of Expiry: 2012-03-17.



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Test Results

4.7 Test Instruments

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due date
1	EMI test receiver	Rohde & Schwarz	ESU40	100109	2011-6-3	2012-6-1
2	Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-679	2011-6-3	2012-6-1
3	Horn Antenna	Rohde & Schwarz	HF906	100284	2011-3-12	2012-3-10
4	ANTENNA	SCHWARZBECK	VULB9168	9168-313	2011-6-3	2012-6-1
5	Ultra broadband antenna	Rohde & Schwarz	HL562	100227	2010-11-9	2011-11-8
6	Atmosphere pressure meter	Shanghai ZhongXuan Electronic Co;Ltd	BY—2009P	--	2011-01-15	2012-01-14
7	CLAMP METER	FLUKE	316	86080010	2011-04-22	2012-04-20
8	Thermo-Hygrometer	ZHICHEN	ZC1-2	01050033	2010-10-15	2011-10-14
9	High-low temperature cabinet	Shanghai YuanZhen	GW2050	--	2011-6-17	2012-6-16
11	Tunable Notch Filter	Wainwright instruments Gmbh	WRCT1800.0/2000.0-0.2/40-5SSK	11	2011-1-26	2012-1-25
12	Tunable Notch Filter	Wainwright instruments Gmbh	WRCT800.0/80.0-0.2/40-5SSK	9	2011-1-26	2012-1-25
13	High pass Filter	FSCW	HP 12/2800-5AA2	19A45-02	2011-4-8	2012-4-7
14	Low noise amplifier	TESEQ	LNA6900	70133	2011-7-5	2012-7-4
15	EMI test receiver	Rohde & Schwarz	ESCS30	100086	2011-06-04	2012-06-03

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16	Line impedance stabilization network	SCHWARZBECK	NSLK8127	8127-490	2011-05-07	2012-05-06
17	Loop Antenna	Rohde & Schwarz	HFH2-Z2	--	2011-6-3	2012-6-3

Permitted Frequency Tolerance

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due date
18	Spectrum Analyzer	Agilent	E7405	MY45106600	2011-03-22	2012-03-21
19	Temperature and Humidity Test Chamber	TECRCHY	MHU-150L	850811	2011-03-12	2012-03-11

4.8 E.U.T. Operation

Input voltage: 12V DC

Operating Environment:

Temperature: 25.0 °C

Humidity: 45 % RH

Atmospheric Pressure: 1010 mbar

EUT Operation: The EUT has been tested under operating condition: connect with laptop with network cable, and use software: Honeywell EBI R410.2 installed at laptop to do the data transmitter.

4.9 Test Procedure & Measurement Data



4.9.1 Field Strength of Fundamental and Radiated Emission

Test Requirement: FCC §15.225 , §15.209
Test date: Sep. 15, 2011
Standard Applicable ANSI C63.4:2009

Test Procedures

1. Test Procedures for emission from 9 kHz to 30 MHz

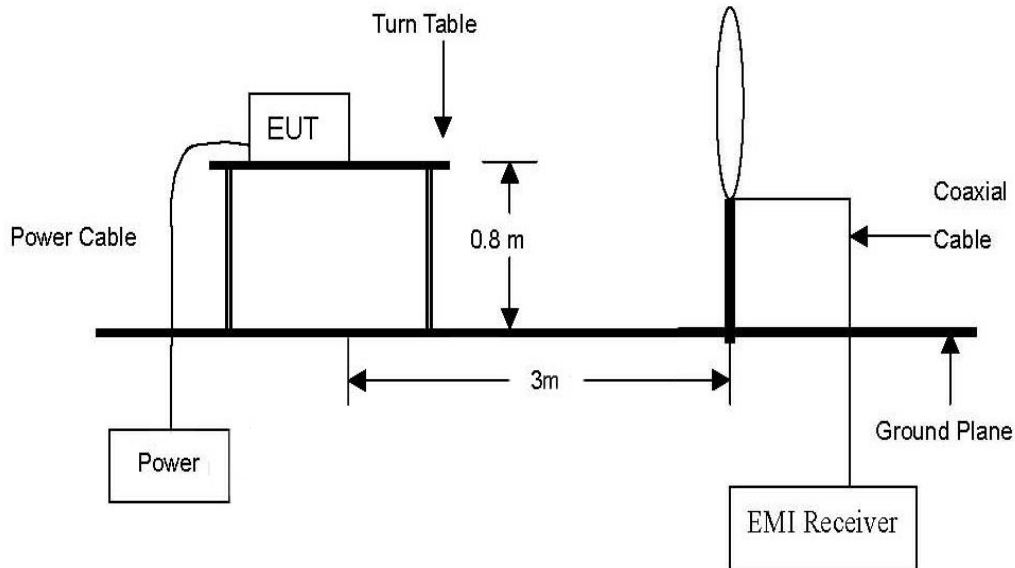
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
- c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- d. The test-receiver system was set to Peak and Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

2. Test Procedures for emission from 30 MHz to 1000 MHz

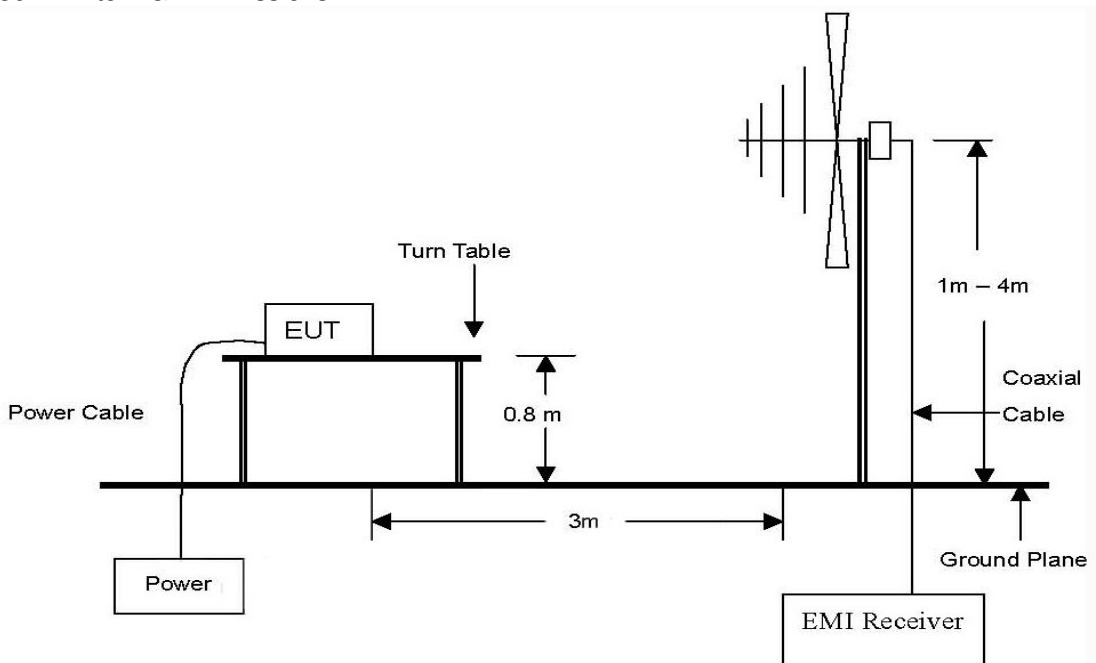
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 meter away from the interference-receiving antenna.
- c. The antenna is a broadband antenna, and its 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 and the 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 10 dB 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 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

EUT Setup:

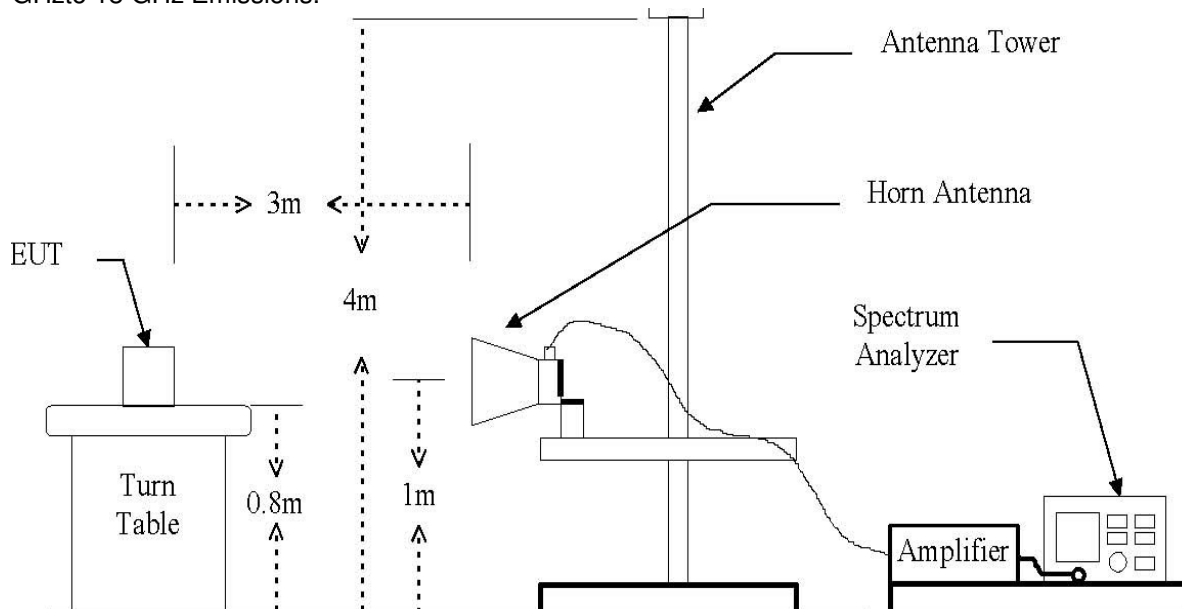
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30MHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



Measurement Result

Radiated Spurious Emissions Limits

Frequency (MHz)	Limit (μV/m)	Rule Part Reference
13.553 - 13.567	15,848 (@ 30m)	§15.225(a)
13.410 - 13.553	334 (@ 30m)	§15.225(b)
13.567 - 13.710	334 (@ 30m)	§15.225(b)
13.110 - 13.410	106 (@ 30m)	§15.225(c)
13.710 - 14.010	106 (@ 30m)	§15.225(c)
1.705 - 13.110 14.010 - 30.0	30 (@ 30m)	§15.225(d), §15.209
30.00 - 88.00	100 (@ 3m)	§15.225(d), §15.209
88.00 - 216.00	150 (@ 3m)	§15.225(d), §15.209
216.00 - 960.00	200 (@ 3m)	§15.225(d), §15.209
Above 960	500 (@ 3m)	§15.225(d), §15.209



Radiated Emission Test Data, Fundamental Frequency

15.225 Operation within the band 13.110 – 14.010 MHz.

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (= 83.9 dBuV/m) at 30 meters.

Measurement Result

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Radiated Emissions			Ant	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant.(dB/m)	Emission Level (dB V/m)	3M Limit (dBuV/m)	Margin (dB)
13.56	94.79	Peak	H	-18.3	76.49	123.9	47.41
13.56	91.52	Peak	V	-18.3	73.22	123.9	50.68

Emission Level=Reading value + Correction Factors

Radiated Emissions		Ant	Duty Cycle	Total	FCC Limit	
Frequency (MHz)	Peak Result (dBuV/m)	Pol.	(dB)	Avg Result (dBuV/m)	Average Limit 3m (dBuV/m)	Margin (dB)
13.56	76.49	H	-19.7	56.79	103.9	47.11
13.56	73.22	V	-19.7	53.52	103.9	50.38

Average Result=Peak Result + Duty Cycle

1. A Peak limit is 20 dB above the average limit.
2. Correction Factors=Antenna Factor + Cable Factor –Preamplifier Factor
3. 3m Limit(dBuV/m) = $20\log(15848)+40\log(30/3)$
= $83.9+40\log(30/3)$
= $83.9+40$
= 123.9

Remark:

EUT is fix device, test at the stand up location.

Radiated Emission

(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 (=50.5dBuV/m) at 30 meters.



Radiated Emissions			Ant	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant.(dB/m)	Emission Level (dB V/m)	3M Limit (dBuV/m)	Margin (dB)
13.483	58.16	QP	H	-18.3	39.86	90.5	50.64
13.483	54.09	QP	V	-18.3	35.79	90.5	54.71
13.630	57.76	QP	H	-18.3	39.46	90.5	51.04
13.682	51.83	QP	V	-18.3	33.53	90.5	56.97

(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 (=40.5 dBuV/m) at 30 meters.

Radiated Emissions			Ant	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant.(dB/m)	Emission Level (dB V/m)	3M Limit (dBuV/m)	Margin (dB)
13.210	49.54	QP	H	-18.3	31.24	80.5	49.26
13.368	52.05	QP	V	-18.3	33.75	80.5	46.75
13.820	47.22	QP	H	-18.3	28.92	80.5	51.58
13.715	47.41	QP	V	-18.3	29.41	80.5	51.09

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

Remark:

EUT is fix device, test at the stand up location.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.



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9KHz~30MHz

Radiated Emissions			Ant	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant.(dB/m)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0.720	66.38	QP	H	-20.93	45.45	86.53	41.08
15.301	61.83	QP	H	-19.51	42.32	50.44	8.12
0.720	63.62	QP	V	-20.93	42.69	86.53	43.84
8.743	59.65	QP	V	-19.51	40.14	50.44	10.30

Correction Factors=Antenna Factor + Cable Factor –Preamplifier Factor

30MHz~1GHz

Radiated Emissions			Ant	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant.(dB/m)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
108.48	50.2	QP	H	-11.5	38.7	43.5	4.8
375.00	49.0	QP	H	-6.7	42.3	46	3.7
217.01	48.0	QP	V	-11.4	36.6	46	9.4

Remark:

EUT is fix device, test at the stand up location.

Note:

1. Other Spurious Emission Frequencies were not detected up to 1000 MHz.

Duty cycle

Measurement Result:

Ton = 10.4ms

Tp = 100.0ms

Factor = $20 \cdot \log(Ton/Tp) = 20 \cdot \log(10.4/100.0) = -19.7\text{dB}$

Test Plot:

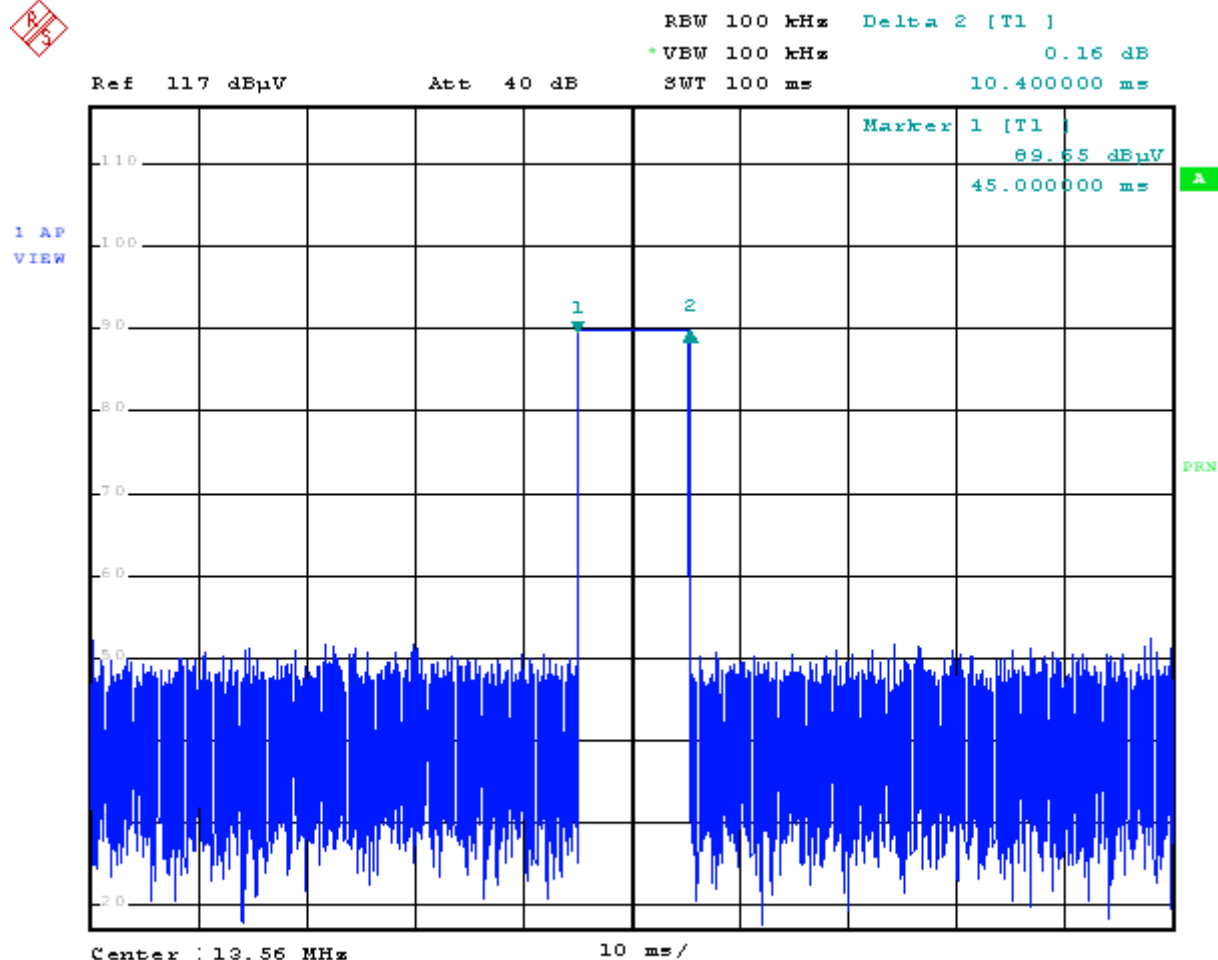
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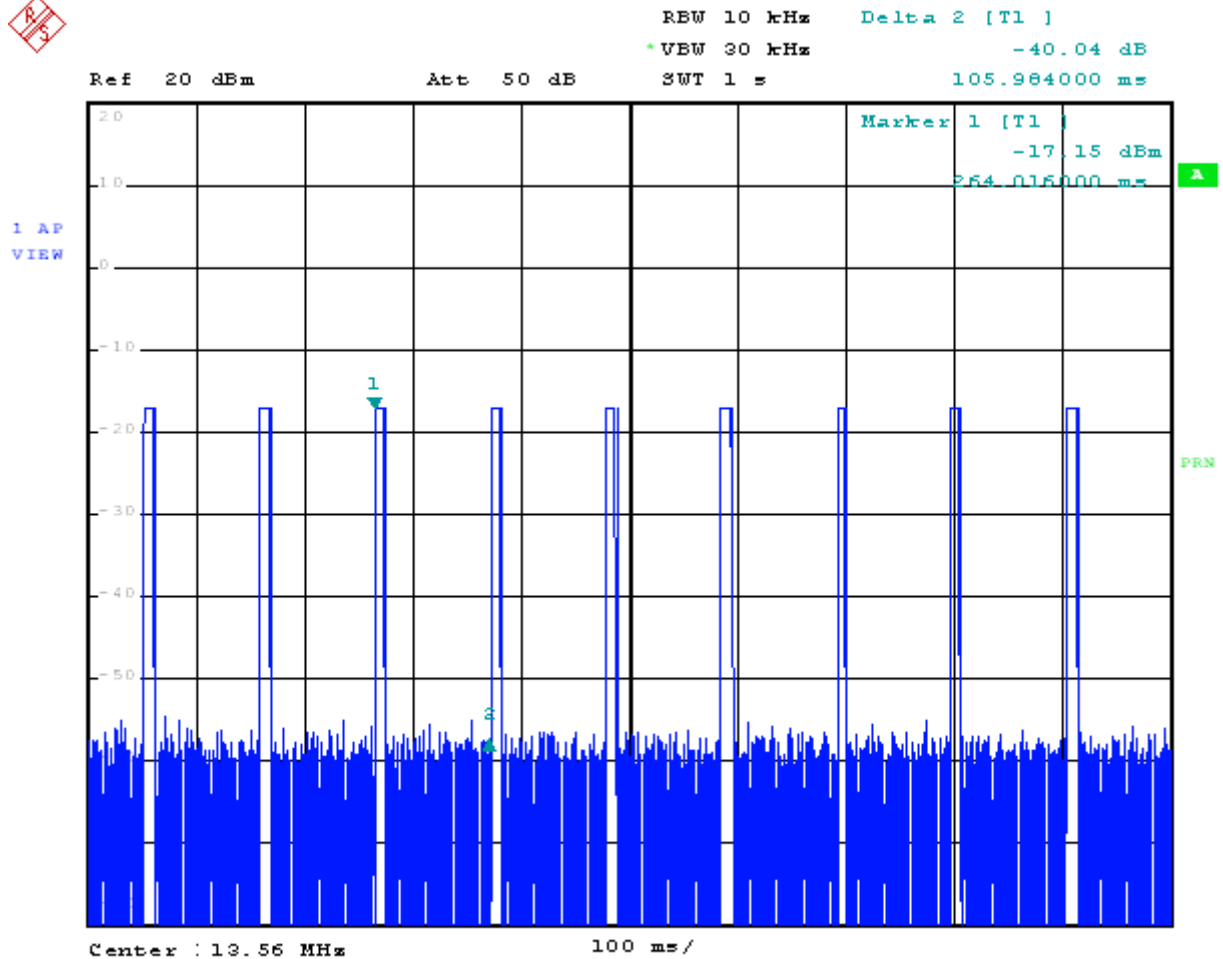
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4.9.2 Receiver Spurious Emission (Radiated)

Test Requirement: RSS-Gen Issue 3 Section 4.10
Test date: Sep. 15, 2011
Standard Applicable: ANSI C63.4:2009
Measurement Procedure: Same as section 4.9.1 of this report

Measurement Result:

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical

Radiated Emissions			Ant	Correction Factors	Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Ant.(dB/m)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
499.87	45.70	Quasi Peak	H	-11.4	34.30	46	11.70
499.87	46.23	Quasi Peak	V	-11.4	34.83	46	11.17

Remark:

EUT is fix device, test at the stand up location.

Note:

1. Other spurious frequencies were not detected up to 1000 MHz.



4.9.3 Conducted Emission Test

Test Requirement: FCC Part15 15.207

Test date: Aug. 28, 2011

Standard Applicable According to section 15.207, frequency 150KHz to 30MHz shall not exceed the limit table as blew.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

EUT Setup

1.The conducted emission tests were performed in the test site,using the setup in accordance with the ANSI C63.10-2009.

2.EUT is charged with PC.The AC Power adaptor of PC was plug-in LISN.The rear of the EUT and periphearals were placed flushed with the rear of the tabletop.

3.The LISN was connected with 120V AC/60Hz power source.

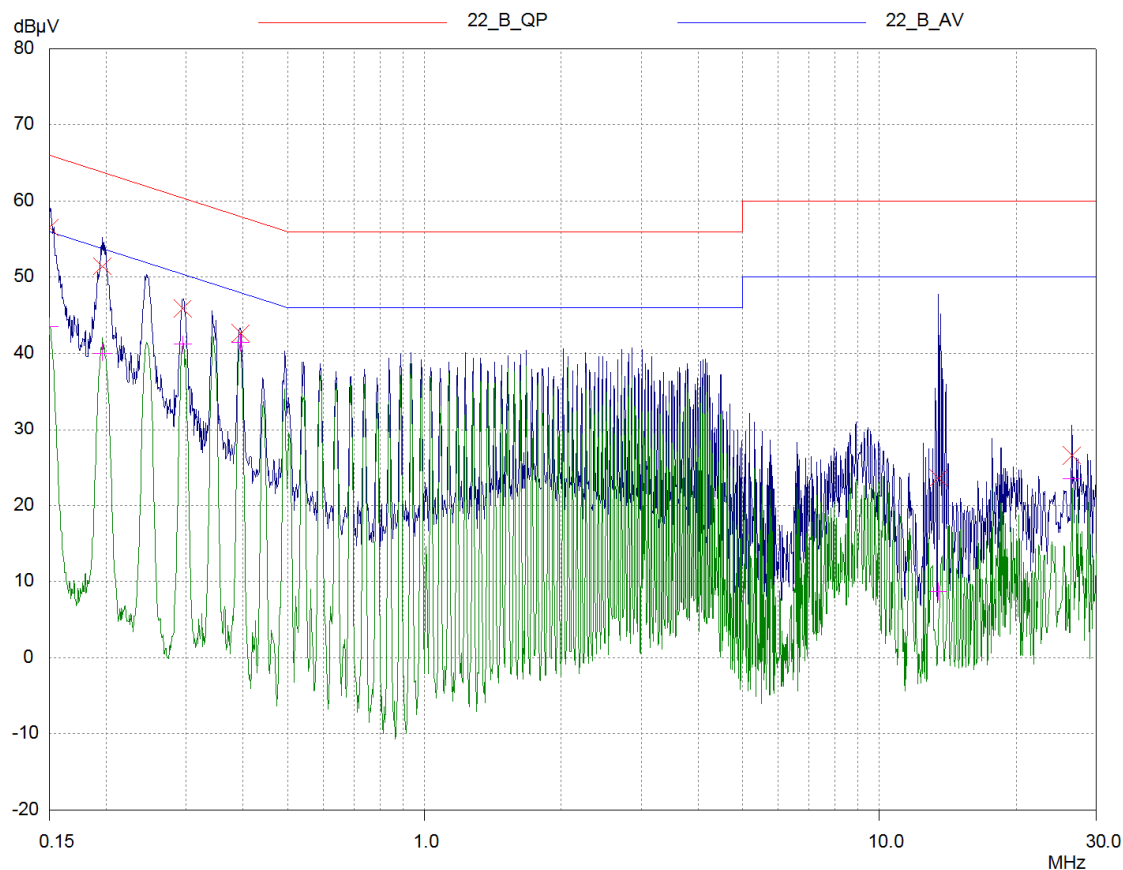
Measurement Result

Operation mode:Normal Link Mode with Laptop through the reticle

Note:All test modes have been tested.



L line:



Final Measurement Results

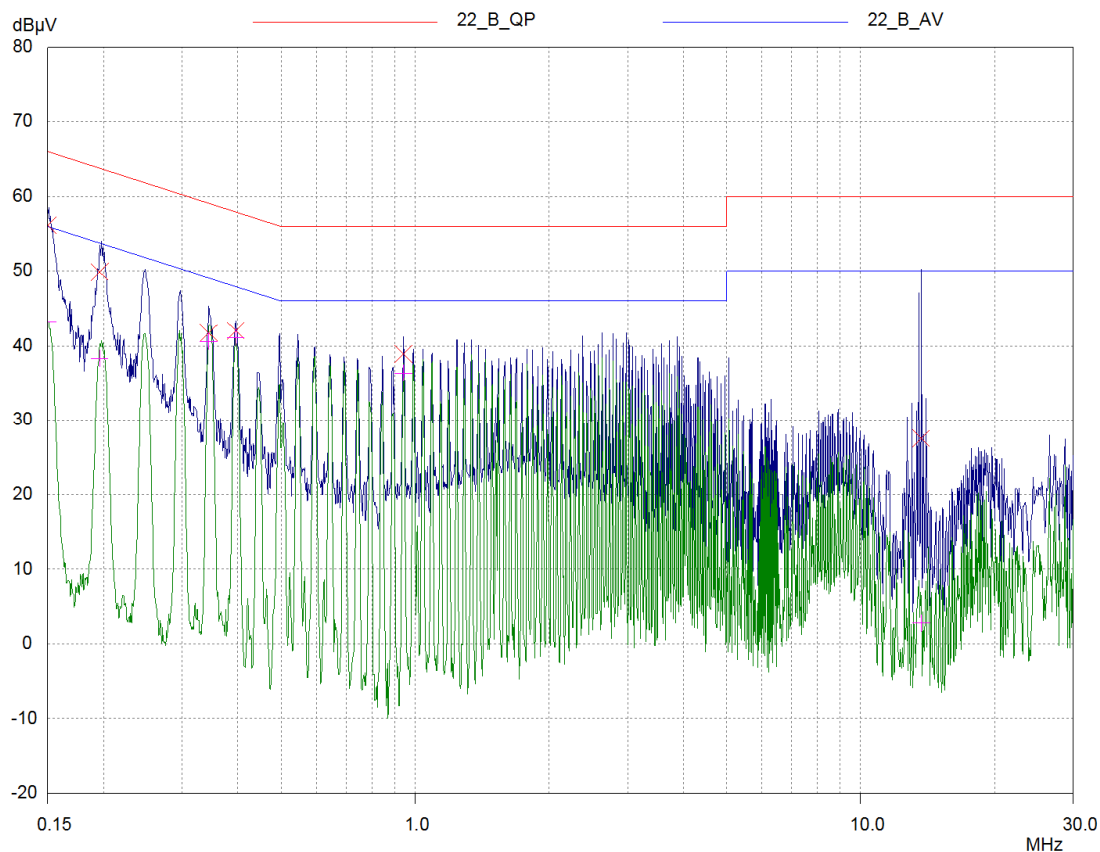
Frequency MHz	QP Level dBμV	QP Limit dBμV	QP Delta dB
0.15	56.53	66.00	9.47
0.19599	51.47	63.78	12.31
0.2945	45.93	60.40	14.47
0.39413	42.67	57.98	15.31
13.48918	23.55	60.00	36.45
26.48396	26.56	60.00	33.44

Frequency MHz	AV Level dBμV	AV Limit dBμV	AV Delta dB
0.15	43.54	56.00	12.46
0.19599	40.06	53.78	13.72
0.2945	41.20	50.40	9.20
0.39413	41.43	47.98	6.55
13.48918	8.68	50.00	41.32
26.48396	23.43	50.00	26.57

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N Line:



Final Measurement Results

Frequency MHz	QP Level dBμV	QP Limit dBμV	QP Delta dB
0.15	56.13	66.00	9.87
0.19599	49.91	63.78	13.87
0.34411	41.81	59.10	17.29
0.39571	42.07	57.94	15.87
0.94102	38.94	56.00	17.06
13.65169	27.55	60.00	32.45

Frequency MHz	AV Level dBμV	AV Limit dBμV	AV Delta dB
0.15	43.23	56.00	12.77
0.19599	38.32	53.78	15.46
0.34411	40.63	49.10	8.47
0.39571	41.12	47.94	6.82
0.94102	36.37	46.00	9.63
13.65169	2.77	50.00	47.23

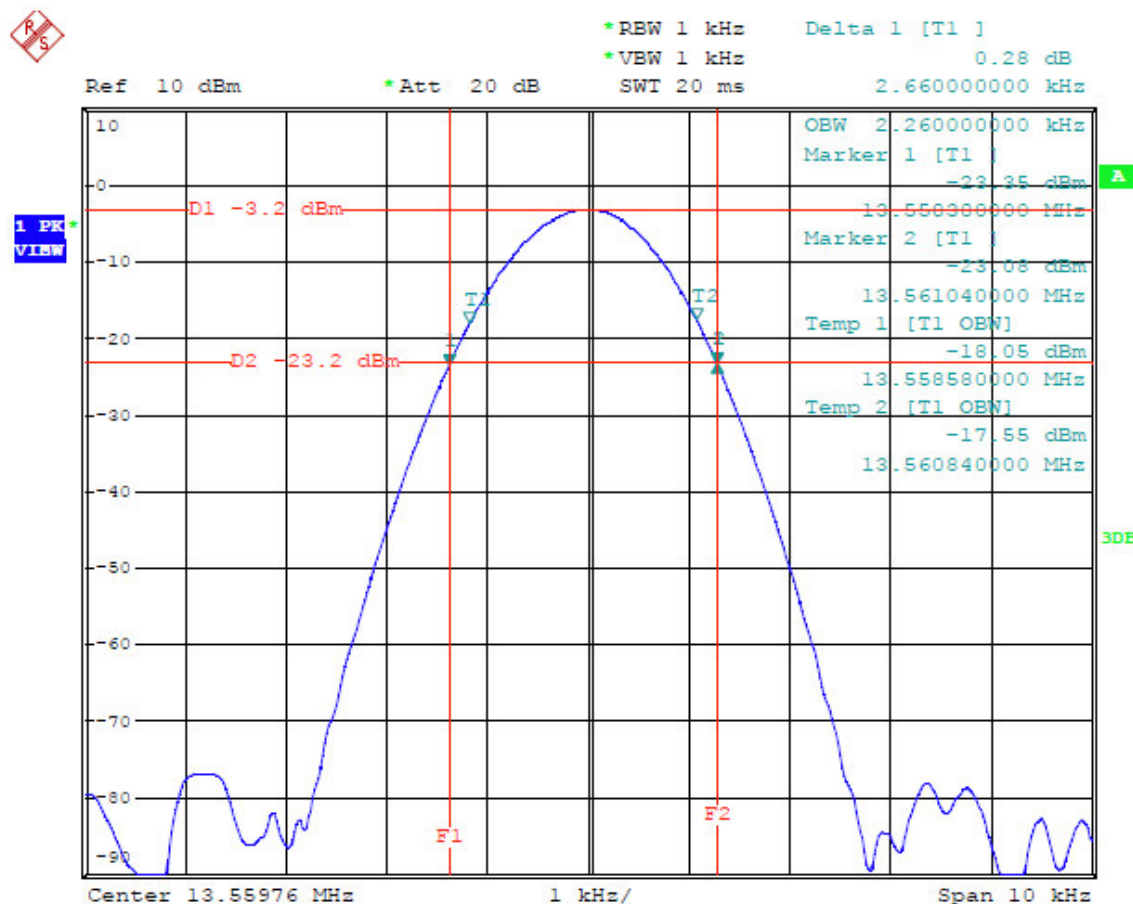
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4.9.4 Occupied Bandwidth Test

Test Requirement:	RSS-Gen Issue 3 Section 4.6.1
Test date:	Oct. 11, 2011
Standard Applicable	According to the section RSS-Gen Issue 3 Section 4.6.1
EUT Setup	<ol style="list-style-type: none"> 1. The transmitter output is connected to the spectrum analyzer. 2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=1 kHz, VBW=1 kHz and Span=100 kHz. 3. The bandwidth of fundamental frequency was measured and recorded.

Measurement Result:

Carrier Frequency (MHz)	20dB Bandwidth (KHz)	99% Bandwidth (KHz)
13.5600	2.66	2.26





4.9.5 Frequency Tolerance

Test Requirement: FCC Part15 15.225(a)
Test date: Oct. 12, 2011
Standard Applicable According to FCC Part15 15.225(a)
EUT Setup

Limit

15.225 Operation within the band 13.110 – 14.010 MHz.

(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.

Measurement Result:

Temp. (°C)	P/S Voltage (VAC)	Frequency (MHz)	Limit (±Hz)	Offset from the CF (Hz)	Limit (%)	Error (%)
Center Freq.		13.5600MHz				
20	120	13.56001	1356.12	10	0.01	0.00
20	102	13.56001		10		0.00
20	138	13.56001		10		0.00
-20	120	13.56004		40		0.00
55	120	13.56005		50		0.00



4.9.6 Antenna Requirement

Test Requirement: FCC Part15 15.203

5.3.7.1 Standard 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 shall be considered sufficient to comply with the provisions of this Section. 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.

5.3.7.2 Antenna Connected Construction

The antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

5.3.7.3 Result

The EUT antenna is integral Antenna. It comply with the standard requirement.

End of Report