

FCC & IC Test Report

No. 160502874SHA-004

Applicant : RAE Systems Inc.
3775 N. 1st St., San Jose, California USA 95134.

Manufacturer : RAE Systems Inc.
3775 N. 1st St., San Jose, California USA 95134.

Product Name : AreaRAE Pro, AreaRAE Plus

Type/Model : PGM-6560B(AreaRAE Pro),
PGM-6520B(AreaRAE Plus)

TEST RESULT : PASS

SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

47CFR Part 15 (2014): Radio Frequency Devices (Subpart C)

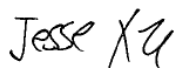
ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

RSS-210 Issue 8 (December 2010): Low-power Licence-exempt Radio communication Devices (All Frequency Bands): Category I Equipment

RSS-Gen Issue 4 (December 2014): General Requirements for Compliance of Radio Apparatus

Date of issue: June 08, 2016

Prepared by:



Jesse Xu (*Project Engineer*)

Reviewed by:



Daniel Zhao (*Reviewer*)



Description of Test Facility

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Content

SUMMARY.....	1
1 GENERAL INFORMATION	4
1.1 Description of Client.....	4
1.2 Identification of the EUT	4
1.3 Technical Specification.....	5
2 TEST SPECIFICATIONS.....	6
2.1 Standards or specification	6
2.2 Mode of operation during the test.....	6
2.3 Test software list	6
2.4 Test peripherals list	6
2.5 Instrument list	7
2.6 Test Summary	8
3 RADIATED EMISSION	9
3.1 Test limit	9
3.2 Test Configuration	9
3.3 Test procedure and test setup	10
3.4 Test protocol	11
4 ASSIGNED BANDWIDTH (20dB BANDWIDTH)	15
4.1 Limit.....	15
4.2 Test Configuration	15
4.3 Test procedure and test setup	15
4.4 Test protocol	16
5 POWER LINE CONDUCTED EMISSION	18
5.1 Limit.....	18
5.2 Test configuration	18
5.3 Test procedure and test set up	19
5.4 Test protocol	20

1 GENERAL INFORMATION

1.1 Description of Client

Applicant : RAE Systems Inc.
3775 N. 1st St., San Jose, California USA 95134.

Name of contact : James Pan

Tel : 408-952-8217

Fax : 408-952-8487

Email : Jungsyng.Pan@Honeywell.com

Manufacturer : RAE Systems Inc.
3775 N. 1st St., San Jose, California USA 95134.

1.2 Identification of the EUT

Product Name : AreaRAE Pro, AreaRAE Plus

Type/model : PGM-6560B(AreaRAE Pro),
PGM-6520B(AreaRAE Plus)

FCC ID : SU3-6560B
IC : 20969-6560B

1.3 Technical Specification

Operation Frequency : 2402~2480 MHz;

Band

Type of Modulation : GFSK

Protocol : Bluetooth BLE

Description of EUT : The EUT is a wireless device with BLE, Mesh, and freewave 2.4GHz function. The freewave module has got the certificate. Among this report, only BLE function was assessed. We tested the 2402CH, 2442CH and 2480CH and listed the worst data in this report. Only difference between PGM-6560B and PGM-6520B is the gas detector.

Antenna Designation : PCB antenna

Gain of Antenna : -1.5dBi

Rating : Switching Adapter supply: Model: EA11001A-120

Input: AC 100-240V, 50/60Hz, 2.5A

Output: DC 12V, 7.5A

Built-in battery 7.2V

internal battery: 1900mAh, 3.7V

EUT type : ☒ Table top

☐ Floor standing

Channel Description : 40 channels

Software applied : SSCOM3.2

Sample received date : April 08, 2016

Date of test : April 10, 2016 ~ May 25, 2016

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2014)
RSS-210 Issue 8 (December 2010):
RSS-Gen Issue 4 (December 2014)
ANSI C63.10 (2013)
KDB 558074 (v03r03)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
PC	HP ProBook 6450b	HP	-

2.5 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESCS 30	R&S	EC 2107	2015-10-21	2016-10-20
Test Receiver	ESIB 26	R&S	EC 3045	2015-10-20	2016-10-19
Test Receiver	ESCI 7	R&S	EC4501	2015-12-29	2016-12-28
Spectrum Analyzer	N9010	Agilent	EC4890	2015-10-21	2016-10-20
Spectrum Analyzer	E4446	Agilent	/	2015-10-21	2016-10-20
Power meter	ML 2495A	Anritsu	EC 4895	2015-10-21	2016-10-20
A.M.N.	ESH2-Z5	R&S	EC 3119	2016-1-9	2017-1-8
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2016-5-15	2017-5-14
Horn antenna	HF 906	R&S	EC 3049	2016-5-12	2017-5-11
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2016-4-11	2017-4-10
Pre-amplifier	Tpa0118-40	R&S	EC 4792-2	2016-4-11	2017-4-10
Log-period antenna	AT 1080	AR	EC 3044-7	2016-5-21	2017-5-20
Biconical antenna	3109PX	ETS	EC3564	2014-8-25	2015-8-24
Semi-anechoic chamber	-	Albatross project	EC 3048	2016-5-20	2017-5-19
Shielded room	-	Zhongyu	EC 2838	2016-1-12	2017-1-11
Shielded room	-	Zhongyu	EC 2839	2016-1-12	2017-1-11
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2016-2-1	2017-1-31
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2016-2-1	2017-1-31
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2016-2-1	2017-1-31
Band Reject Filter	WRCGV 2400/2483-2390/2493-35/10SS	Wainwright	EC4297-4	2016-2-1	2017-1-31
MXG Analog Signal Generator	N5181A	KEYSIGHT	EC5338-2	2015-11-7	2016-11-6
MXG Vector Signal Generator	N51812B	KEYSIGHT	EC5175	2015-12-30	2016-12-29
Power sensor	U2021XA	KEYSIGHT	EC5338-1	2015-10-2	2016-10-1
PXA Signal Analyzer	N9030A	KEYSIGHT	EC5338	2015-11-18	2016-11-17

2.6 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Radiated emission	15.249 & 15.205	RSS-210 Issue 8 Annex A2.9 &Clause 2.2	Pass
Assigned bandwidth (20dB bandwidth)	15.215(c)	-	Pass
Occupied bandwidth	-	RSS-Gen Issue 4 Clause 6.6	Tested
Power line conducted emission	15.207	RSS-Gen Issue 4 Clause 8.8	Pass

Notes: 1: NA =Not Applicable

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3 Radiated emission

Test result: Pass

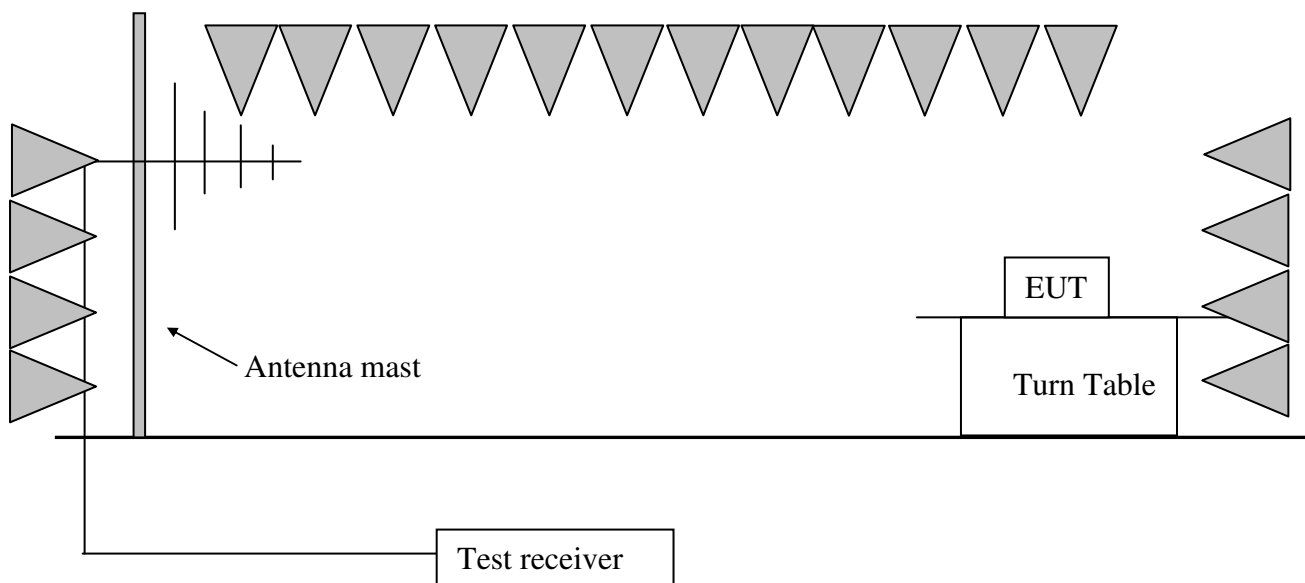
3.1 Test limit

Fundamental Frequency (MHz)	Fundamental limit (dBuV/m)	Harmonic limit (dBuV/m)
☐ 902 - 928	94	54
☒ 2400 - 2483.5	94	54
☐ 5725 - 5875	94	54
☐ 24000 - 24250	108	68

The radiated emissions which fall outside allocated band (2400-2483.5MHz), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

3.2 Test Configuration



3.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1 meter to 4 meters to find out the maximum emission level.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

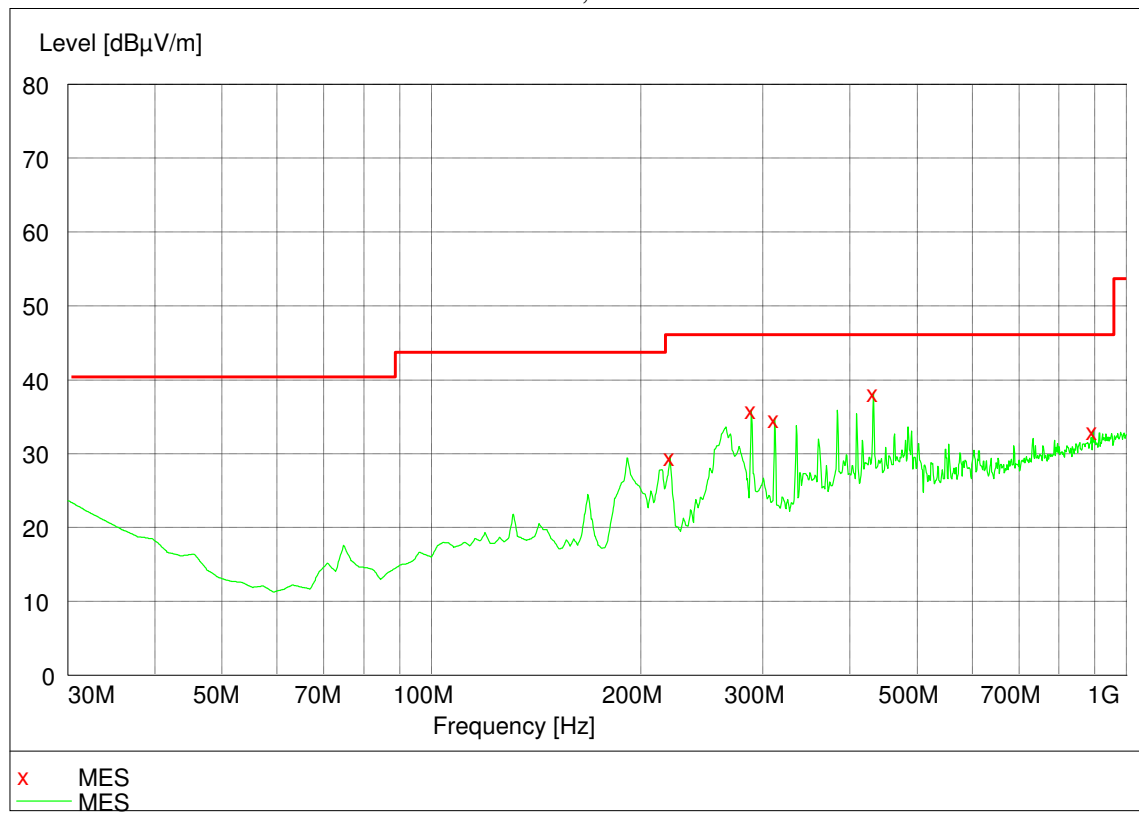
RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);
RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

3.4 Test protocol

Temperature : 23 °C
Relative Humidity : 55 %

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

30MHz~1GHz, Horizontal

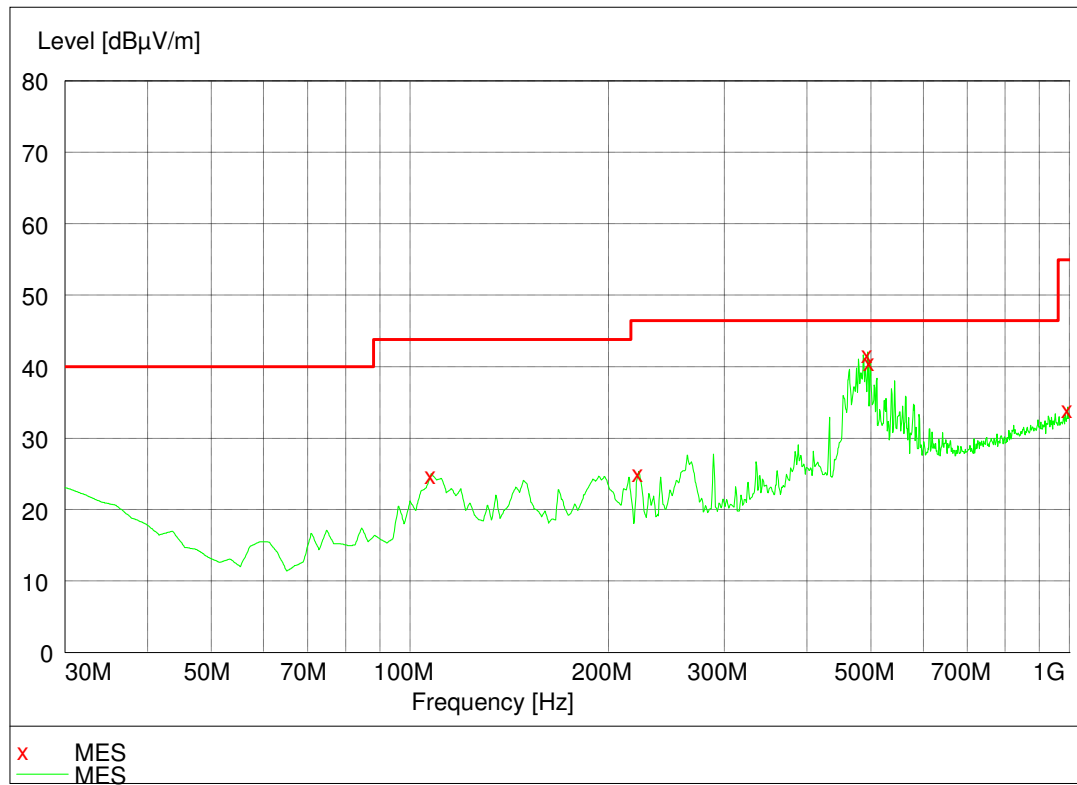


Test data:

Frequency (MHz)	Emission level (dBμV/m)	Limits (dBμV/m)	Margin (dBμV/m)	Azimuth (Degrees)	Height (cm)	Polarization (H/V)
30.00	*	40.00	*	180	100	H
80.54	*	40.00	*	180	100	H
285.53	36.00	46.00	10.00	270	200	H
317.69	*	46.00	*	270	400	H
422.64	38.15	46.00	7.85	270	200	H
665.65	*	46.00	*	270	400	H

Note: * means the emission level 10dB lower than the relevant limit.

30MHz~1GHz, Vertical


Test data:

Frequency (MHz)	Emission level (dBμV/m)	Limits (dBμV/m)	Margin (dBμV/m)	Azimuth (Degrees)	Height (cm)	Polarization (H/V)
32.00	*	40.00	*	180	100	V
49.08	*	40.00	*	180	100	V
50.11	*	40.00	*	270	200	V
317.69	*	46.00	*	270	400	V
492.64	40.92	46.00	5.08	270	200	V
665.65	*	46.00	*	270	400	V

Note: * means the emission level 15dB lower than the relevant limit.

Test data:

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2401.79	34.30	82.30	94.00	11.70	PK
	H	2400.00	-33.21	40.20	54.00	13.80	PK
	H	4803.60	-3.60	36.60	54.00	17.40	PK
	V	2401.79	34.30	84.70	94.00	9.30	PK
	V	2400.00	-33.21	43.00	54.00	31.00	PK
	V	4803.55	-3.53	36.20	54.00	17.80	PK
M	H	2442.86	35.10	81.93	94.00	12.07	PK
	H	4883.20	-3.20	36.88	54.00	17.12	PK
	V	2442.86	35.10	83.69	94.00	10.31	PK
	V	4883.20	-3.20	37.12	54.00	16.88	PK
H	H	2480.92	25.88	83.43	94.00	9.57	PK
	H	2485.40	24.11	41.22	54.00	12.78	PK
	H	4961.84	-12.10	36.32	54.00	17.68	PK
	V	2480.92	25.88	76.70	94.00	17.30	PK
	V	4961.84	-12.10	38.38	54.00	15.62	PK

Test mode: with Freewave 2.4GHz connected

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2401.79	34.30	82.30	94.00	11.70	PK
	H	2400.00	-33.21	40.20	54.00	13.80	PK
	H	4803.60	-3.60	37.11	54.00	16.89	PK
	V	2401.79	34.30	84.70	94.00	9.30	PK
	V	2400.00	-33.21	43.00	54.00	31.00	PK
	V	4803.55	-3.53	37.45	54.00	16.55	PK
M	H	2442.86	35.10	81.93	94.00	12.07	PK
	H	4883.20	-3.20	36.88	54.00	17.12	PK
	V	2442.86	35.10	83.69	94.00	10.31	PK
	V	4883.20	-3.20	37.12	54.00	16.88	PK
H	H	2480.92	25.88	83.43	94.00	9.57	PK
	H	2485.40	24.11	41.22	54.00	12.78	PK
	H	4961.84	-12.10	39.11	54.00	14.89	PK
	V	2480.92	25.88	76.70	94.00	17.30	PK
	V	4961.84	-12.10	38.38	54.00	15.62	PK

Remark:

1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed);
2. Corrected Reading = Original Receiver Reading + Correct Factor;
3. Margin = Limit – Corrected Reading;
4. If the PK Corrected reading is lower than AV limit, the AV test can be elided;

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
 Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV,
 Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m,
 Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m,
 Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m,
 Then Margin = 54 -10.20 = 43.80dBuV/m.

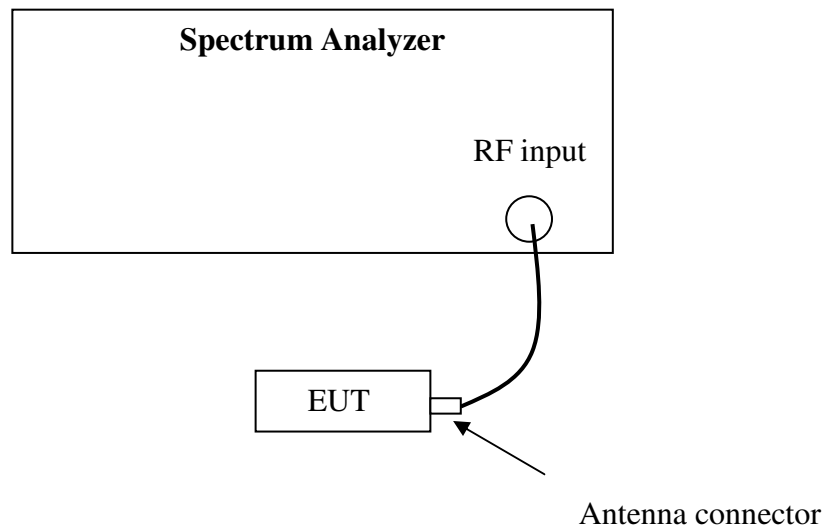
4 Assigned bandwidth (20dB bandwidth)

Test result: Pass

4.1 Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emission is contained within the allocated frequency band as clause 3.1 shows. 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.

4.2 Test Configuration



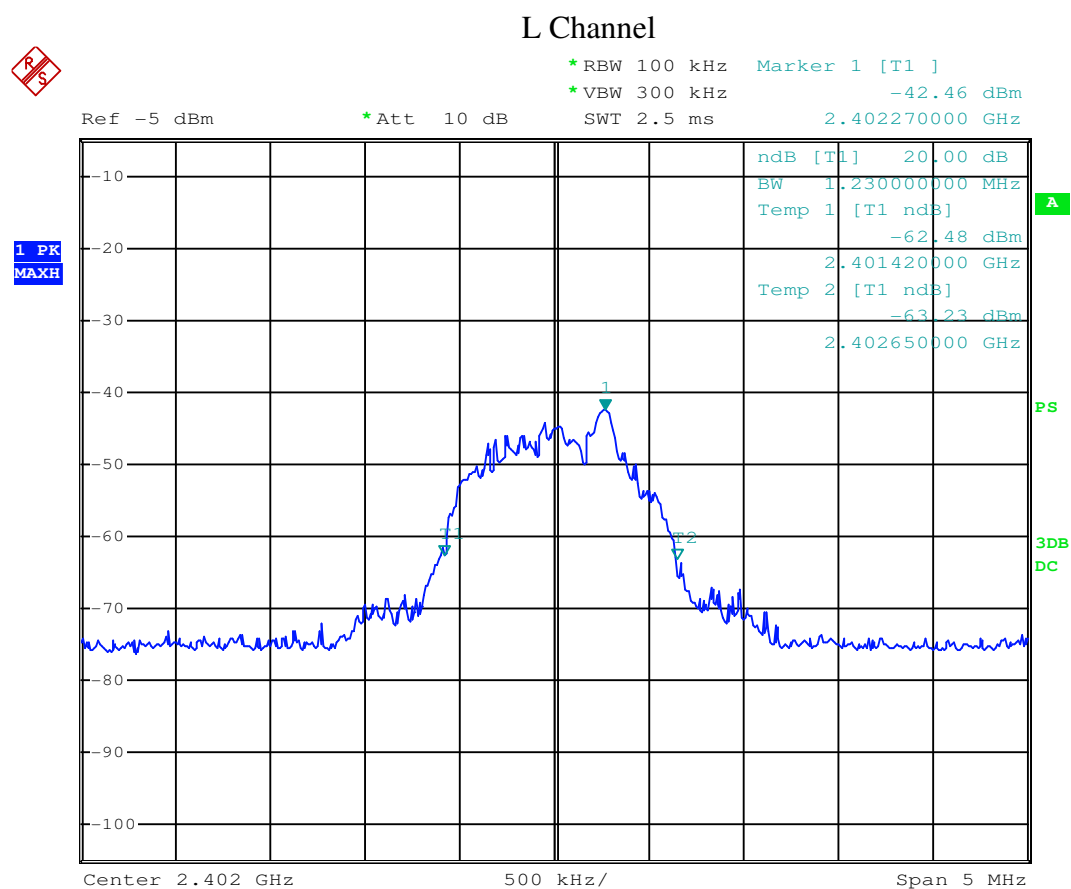
4.3 Test procedure and test setup

The 20dB Bandwidth per FCC § 15.215(c) is measured using the Spectrum Analyzer. Set Span = 2 to 3 times the 20 dB bandwidth, RBW = approximately 1% of the 20 dB bandwidth, VBW > RBW, Sweep = auto, Detector = peak, Trace = max hold. The test was performed at 3 channels (lowest, middle and highest channel).

4.4 Test protocol

Temperature : 23 °C
Relative Humidity : 55 %

20dB bandwidth (MHz)	permitted band (MHz)	Result
2401.42 ~ 2480.61	2400 ~ 2483.5	Pass

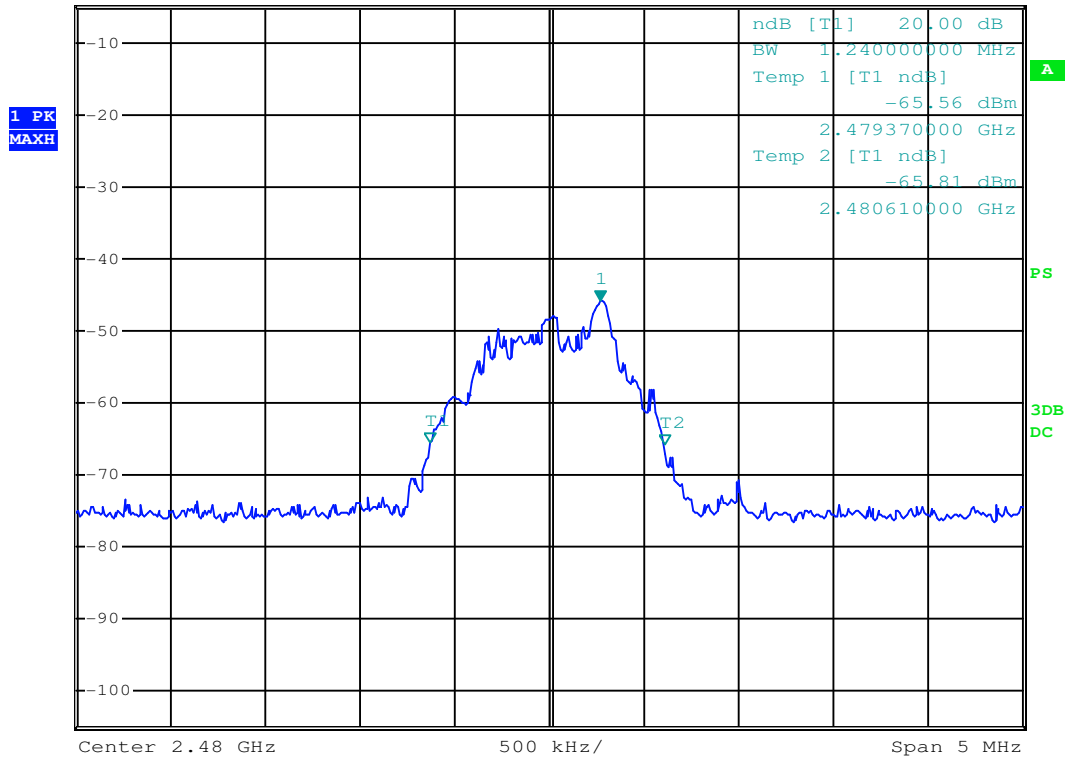


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H Channel



*RBW 100 kHz Marker 1 [T1]
 *VBW 300 kHz -45.78 dBm
 Ref -5 dBm *Att 10 dB SWT 2.5 ms 2.480270000 GHz



Date: 25.MAY.2016 14:31:06

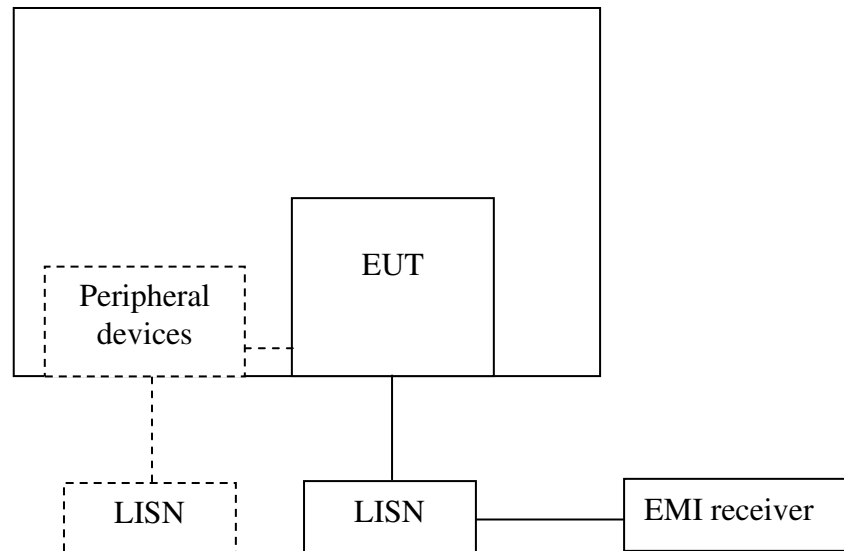
5 Power line conducted emission

Test result: Pass

5.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
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.		

5.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

5.3 Test procedure and test set up

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

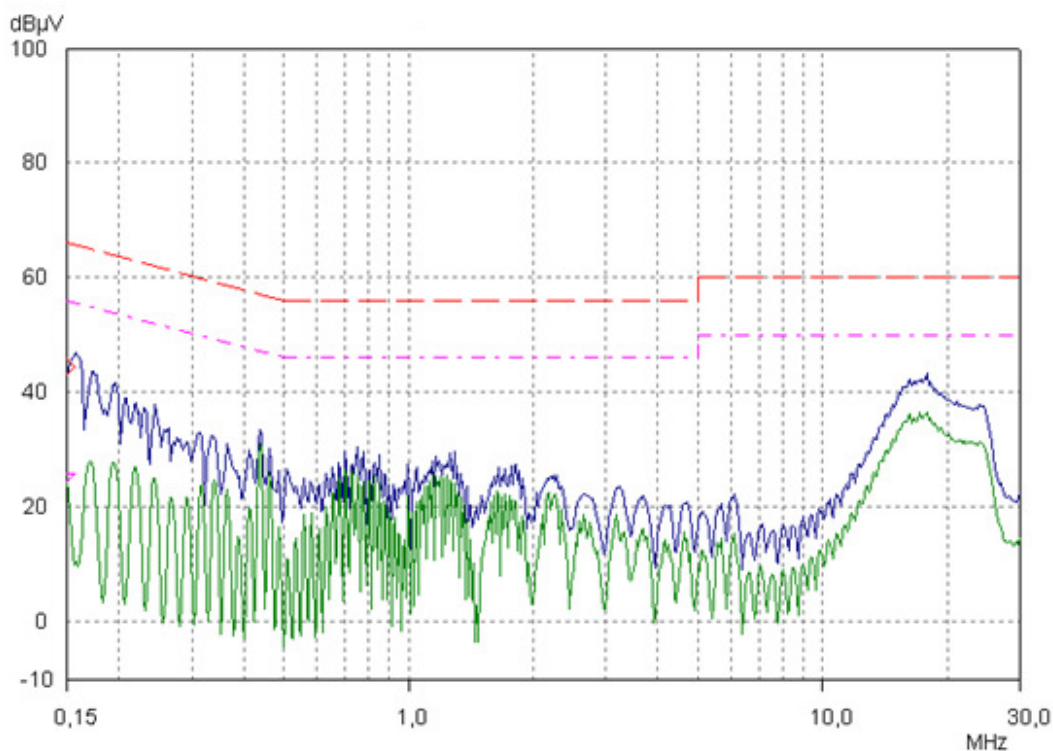
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

5.4 Test protocol

Temperature : 23 °C
Relative Humidity : 56 %

L line

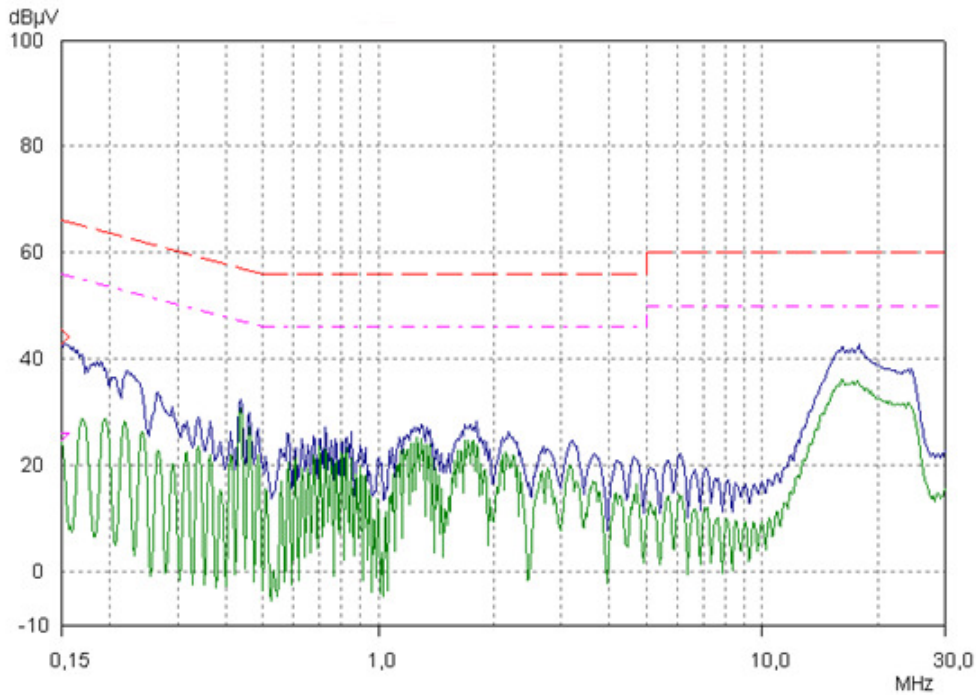


Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.45	*	56.85	*	*	46.85	*
0.55	*	56.00	*	*	46.00	*
0.72	*	56.00	*	*	46.00	*
16.86	*	60.00	*	*	50.00	*
21.45	*	60.00	*	*	50.00	*
28.56	*	60.00	*	*	50.00	*

Note: * means the emission level 10dB lower than the relevant limit.

N line



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)
0.54	42.93	56.00	13.07	31.74	46.00	14.26
0.78	40.29	56.00	15.71	27.94	46.00	18.06
17.90	42.97	60.00	17.03	29.08	50.00	20.92
*	*	*	*	*	*	*
*	*	*	*	*	*	*
*	*	*	*	*	*	*

Note: * means the emission level 10dB lower than the relevant limit.

6 Occupied Bandwidth

Test Status: Tested

6.1 Test limit

None

6.2 Test Configuration

See clause 3.2.

6.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 4 Clause 4.6.1 was measured using the Spectrum Analyzer.

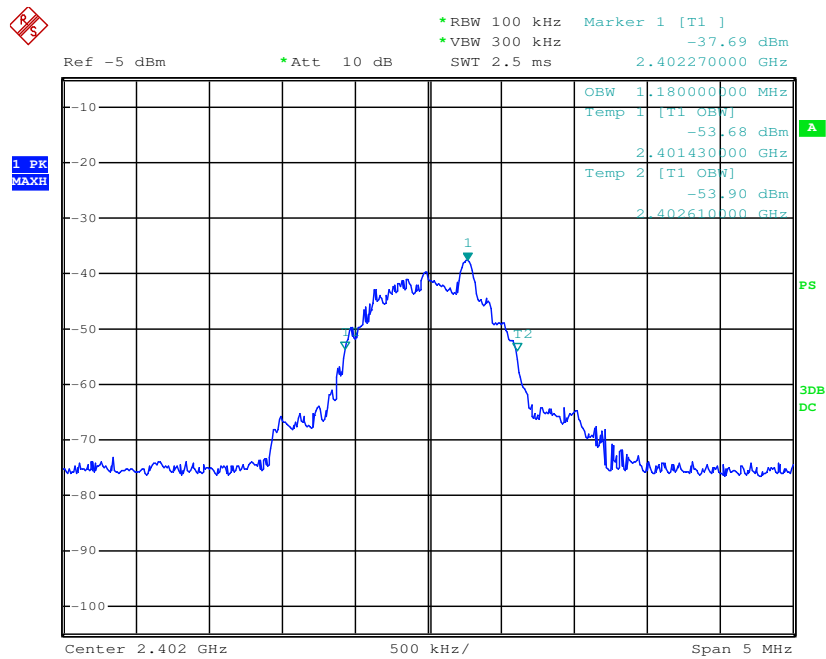
6.4 Test protocol

Temperature :23 °C
Relative Humidity :55 %

Channel	Occupied Bandwidth (KHz)	Max. Value (KHz)
L	1180	1180
M	1190	1190
H	1250	1250

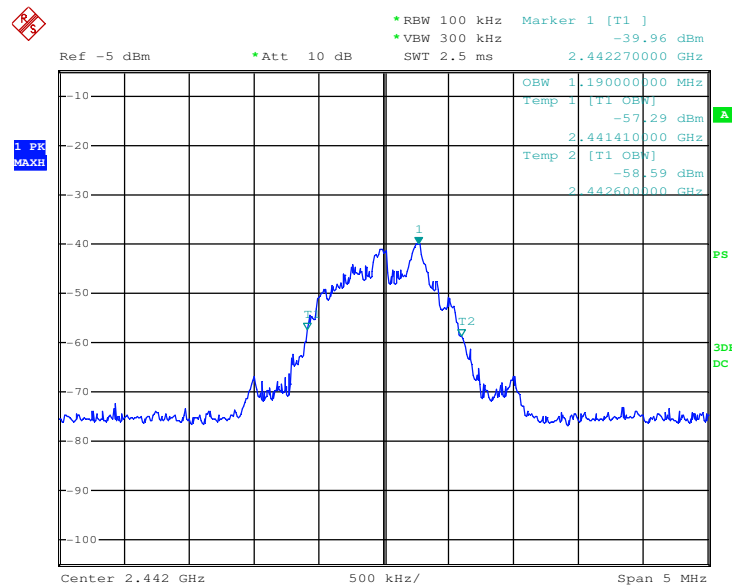
Remark: “Max. Value” is the maximum test result of all the measured occupied bandwidth.

L Channel



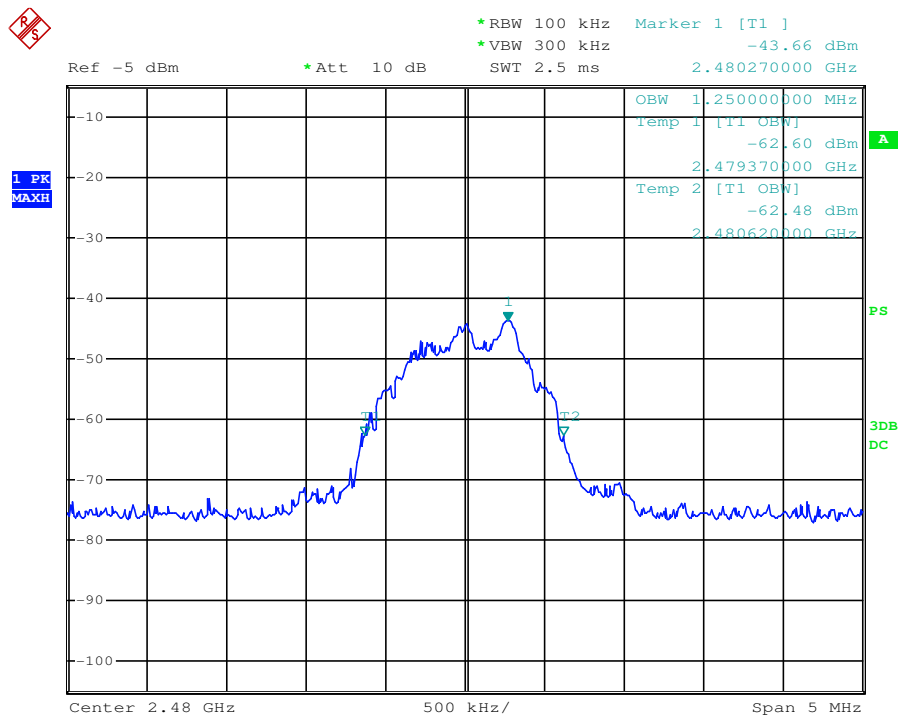
Date: 25.MAY.2016 14:26:36

M Channel



Date: 25.MAY.2016 14:30:07

H Channel



Date: 25.MAY.2016 14:31:50