



Radio Test Report

FCC ID: H8GGN20

This report concerns (check one) : Original Grant Class II Change

Issued Date : Jun. 04, 2013
Project No. : 1304199
Equipment : 2.4G RF Dongle
Model Name : GN-20

Applicant : A-FOUR TECH CO., LTD.
Address : 6F., No.108, Min-Chuan Rd., Xindian
Dist., New Taipei City, Taiwan R.O.C.

Tested by: Neutron Engineering Inc. EMC Laboratory
Date of Receipt: Apr. 25, 2013
Date of Test: Apr. 25, 2013 ~ May 22, 2013

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Declaration

Neutron represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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Table of Contents

REPORT ISSUED HISTORY	6
1 CERTIFICATION	7
2 SUMMARY OF TEST RESULTS	8
2.1 TEST FACILITY	9
2.2 MEASUREMENT UNCERTAINTY	9
3 GENERAL INFORMATION	10
3.1 GENERAL DESCRIPTION OF EUT	10
3.2 DESCRIPTION OF TEST MODES	12
3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	13
3.4 DESCRIPTION OF SUPPORT UNITS	14
4 CONDUCTED EMISSION	15
4.1 LIMIT	15
4.2 MEASUREMENT INSTRUMENTS LIST	15
4.3 TEST PROCEDURES	16
4.4 TEST SETUP LAYOUT	16
4.5 DEVIATION FROM TEST STANDARD	16
4.6 EUT OPERATING CONDITIONS	17
4.7 TEST RESULTS	18
5 ANTENNA CONDUCTED SPURIOUS EMISSION	20
5.1 LIMIT	20
5.2 MEASUREMENT INSTRUMENTS LIST	20
5.3 TEST PROCEDURES	20
5.4 TEST SETUP LAYOUT	20
5.5 DEVIATION FROM TEST STANDARD	20
5.6 EUT OPERATING CONDITIONS	20
5.7 TEST RESULTS	21
6 6 DB BANDWIDTH	25
6.1 LIMIT	25
6.2 MEASUREMENT INSTRUMENTS LIST	25
6.3 TEST PROCEDURES	25
6.4 TEST SETUP LAYOUT	25
6.5 DEVIATION FROM TEST STANDARD	25
6.6 EUT OPERATING CONDITIONS	25
6.7 TEST RESULTS	26
7 MAXIMUM PEAK CONDUCTED OUTPUT POWER	28
7.1 LIMIT	28
7.2 MEASUREMENT INSTRUMENTS LIST	28
7.3 TEST PROCEDURES	28



Table of Contents

7.4	TEST SETUP LAYOUT	28
7.5	DEVIATION FROM TEST STANDARD	28
7.6	EUT OPERATING CONDITIONS	28
7.7	TEST RESULTS	29
8	RADIATED SPURIOUS EMISSION (9 KHZ TO 1 GHZ)	30
8.1	LIMIT	30
8.2	MEASUREMENT INSTRUMENTS LIST	31
8.3	MEASURING INSTRUMENTS SETTING	31
8.4	TEST PROCEDURES	32
8.5	DEVIATION FROM TEST STANDARD	32
8.6	TEST SETUP LAYOUT	32
8.7	EUT OPERATING CONDITIONS	33
8.8	TEST RESULTS	34
9	RADIATED SPURIOUS EMISSION (ABOVE 1 GHZ)	36
9.1	LIMIT	36
9.2	MEASUREMENT INSTRUMENTS LIST	37
9.3	MEASURING INSTRUMENTS SETTING	37
9.4	TEST PROCEDURES	38
9.5	DEVIATION FROM TEST STANDARD	38
9.6	TEST SETUP LAYOUT	38
9.7	EUT OPERATING CONDITIONS	39
9.8	TEST RESULTS	40
9.9	TEST RESULTS (RESTRICTED BANDS)	52
10	POWER SPECTRAL DENSITY	56
10.1	LIMIT	56
10.2	MEASUREMENT INSTRUMENTS LIST	56
10.3	TEST PROCEDURES	56
10.4	TEST SETUP LAYOUT	56
10.5	DEVIATION FROM TEST STANDARD	56
10.6	EUT OPERATING CONDITIONS	56
10.7	TEST RESULTS	57
11	RF EXPOSURE COMPLIANCE	59
11.1	LIMIT	59
11.2	MEASUREMENT INSTRUMENTS LIST	59
11.3	MPE CALCULATION METHOD	59
11.4	TEST SETUP LAYOUT	60
11.5	DEVIATION FROM TEST STANDARD	60
11.6	EUT OPERATING CONDITIONS	60



Table of Contents

11.7	TEST RESULTS	60
12	EUT TEST PHOTO	61



REPORT ISSUED HISTORY

Revised Version No.	Description	Issued Date
-	Initial Issue.	Jun. 04, 2013



1 CERTIFICATION

Equipment : 2.4G RF Dongle

Brand Name : bloody;  ; A4TECH

Model Name : GN-20

Applicant : A-FOUR TECH CO., LTD.

Date of Test : Apr. 25, 2013 ~ May 22, 2013

Standards : FCC Part 15, Subpart C: 2012
ANSI C63.4: 2009

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCP-1-1304199) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of TAF according to the ISO-17025 quality assessment standard and technical standard(s).



2. SUMMARY OF TEST RESULTS

Standard Clause	Test Item	Result
15.207	Conducted Emission	PASS
15.247 (c)	Antenna conducted Spurious Emission	PASS
15.247 (a)(2)	6dB Bandwidth	PASS
15.247 (b)	Maximum Peak Conducted Output Power	PASS
15.247 (c)	Radiated Spurious Emission	PASS
15.247 (d)(e)	Power Spectral Density	PASS
15.205	Restricted Bands	PASS
15.203	Antenna Requirement	PASS
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	PASS

NOTE:

- (1) N/A: denotes test is not applicable in this Test Report
- (2) Portable device; SAR report is required.



2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

Conducted emission Test:

C01: (VCCI RN: C-2918; FCC RN: 95335; FCC DN: TW1010)
No.132-1, Ln. 329, Sec. 2, Balian Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

Radiated emission Test (Below 1 GHz):

CB08: (FCC RN: 614388; FCC DN: TW1054; IC Assigned Code: 4428C-1)
1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

Radiated emission Test (Above 1 GHz):

CB08: (VCCI RN: G-91; FCC RN: 614388; FCC DN: TW1054; IC Assigned Code: 4428C-1)
1F., No. 61, Ln. 77, Sing-ai Rd., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)

2.2 MEASUREMENT UNCERTAINTY

The measurement uncertainty is not specified by FCC rules and for reference only.

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95%**.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

A. Conducted emission test:

Test Site	Measurement Frequency Range	U , (dB)	NOTE
C01	150 kHz ~ 30 MHz	1.94	

B. Radiated emission test:

Test Site	Item	Measurement Frequency Range	Uncertainty	NOTE	
CB08	Radiated emission at 3m	Horizontal Polarization	30 - 200MHz	3.35 dB	
			200 - 1000MHz	3.11 dB	
			1 - 18GHz	3.97 dB	
			18 - 40GHz	4.01 dB	
		Vertical Polarization	30 - 200MHz	3.22 dB	
			200 - 1000MHz	3.24 dB	
			1 - 18GHz	4.05 dB	
			18 - 40GHz	4.04 dB	

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our U_{lab} values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called U_{CISPR} , as follows:

- Conducted Disturbance (mains port) – 150 kHz – 30 MHz: 3.6 dB
- Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz: 5.2 dB

It can be seen that our U_{lab} values are smaller than U_{CISPR} .

If U_{lab} is less than or equal to U_{CISPR} , then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{CISPR} , then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{CISPR})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{CISPR})$, exceeds the disturbance limit.



3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	2.4G RF Dongle	
Brand Name	bloodY;  ; A4TECH	
Model Name	GN-20	
OEM Brand/Model Name	N/A	
Model Difference	N/A	
Product Description	The EUT is a 2.4G RF Dongle.	
	Operation Frequency	2407 MHz - 2473 MHz
	Modulation Type	GFSK
	Number Of Channel	Please refer to the Note 2.
	Antenna Designation	Please refer to the Note 3.
	Antenna Gain(Peak)	Please refer to the Note 3.
	Maximum Peak Conducted Output Power:	-11.27 dBm
	More details of EUT technical specification, please refer to the User's Manual.	
Power Source	Supplied from PC USB port.	
Power Rating	I/P: DC 5V	
Connecting I/O Port(s)	Please refer to the User's Manual	
Products Covered	1 * USB Extension Cable	
EUT Modification(s)	N/A	



NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2407	24	2430	47	2453
02	2408	25	2431	48	2454
03	2409	26	2432	49	2455
04	2410	27	2433	50	2456
05	2411	28	2434	51	2457
06	2412	29	2435	52	2458
07	2413	30	2436	53	2459
08	2414	31	2437	54	2460
09	2415	32	2438	55	2461
10	2416	33	2439	56	2462
11	2417	34	2440	57	2463
12	2418	35	2441	58	2464
13	2419	36	2442	59	2465
14	2420	37	2443	60	2466
15	2421	38	2444	61	2467
16	2422	39	2445	62	2468
17	2423	40	2446	63	2469
18	2424	41	2447	64	2470
19	2425	42	2448	65	2471
20	2426	43	2449	66	2472
21	2427	44	2450	67	2473
22	2428	45	2451		
23	2429	46	2452		

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	PSA	RFANT8010080A3T	Chip	Soldered	3.03



3.2 DESCRIPTION OF TEST MODES

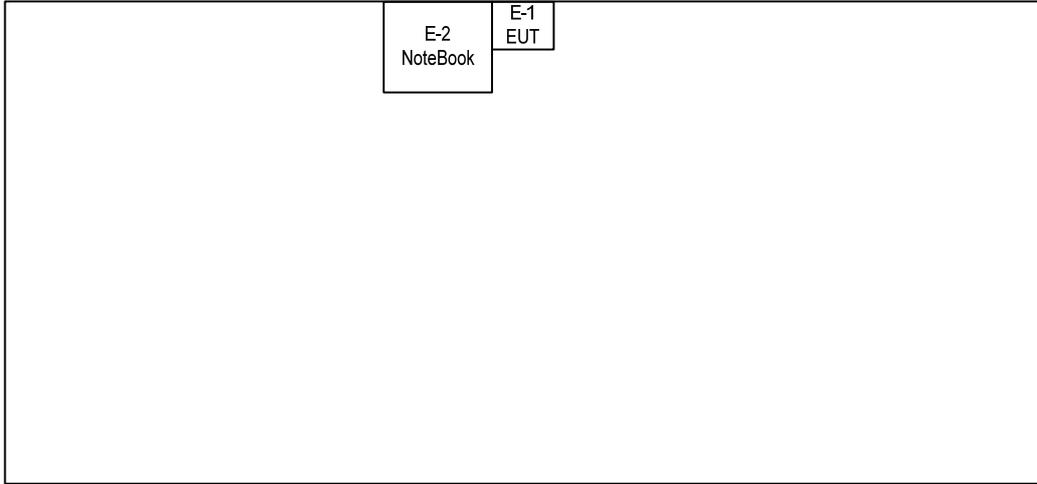
To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Items	Mode	Data Rate	Channel	Note
Conducted Emission	GFSK	500 Kbps	2437 MHz	
Antenna conducted Spurious Emission	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
6 dB Bandwidth	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Maximum Peak Conducted Output Power	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Radiated Spurious Emission (30 MHz to 1 GHz)	GFSK	500 Kbps	2437 MHz	
Radiated Spurious Emission (above 1 GHz)	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Restricted Bands	GFSK	500 Kbps	2407 MHz / 2437 MHz / 2473 MHz	
Antenna Requirement	-----	-----	-----	
RF Exposure Compliance	-----	-----	-----	

NOTE: The measurements are performed at the highest, middle, lowest available channels.



3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED





3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	2.4G RF Dongle	bloodY;  ; A4TECH	GN-20	H8GGN20	N/A	EUT
E-2	PC	DELL	D09M	DOC	54NJVBX	

Item	Shielded Type	Ferrite Core	Length	Note
N/A	-	-	-	-

NOTE: The support equipment was authorized by Declaration of Conformity (DOC).



4 CONDUCTED EMISSION

4.1 LIMIT

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 - 5.0	73.00	60.00	56.00	46.00
5.0 - 30.0	73.00	60.00	60.00	50.00

NOTE:

1. The tighter limit applies at the band edges.
2. The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
3. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
 Margin Level = Measurement Value – Limit Value

4.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	TWO-LINE V-NETWORK	R&S	ENV216	101050	Apr. 22, 2014
2	Test Cable	TIMES	LMR-400	C01	Aug. 16, 2013
3	EMI Test Receiver	R&S	ESCI	100082	Mar. 21, 2014
4	Measurement Software	EZ	EZ_EMCC (Version NB-03A)	N/A	N/A

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

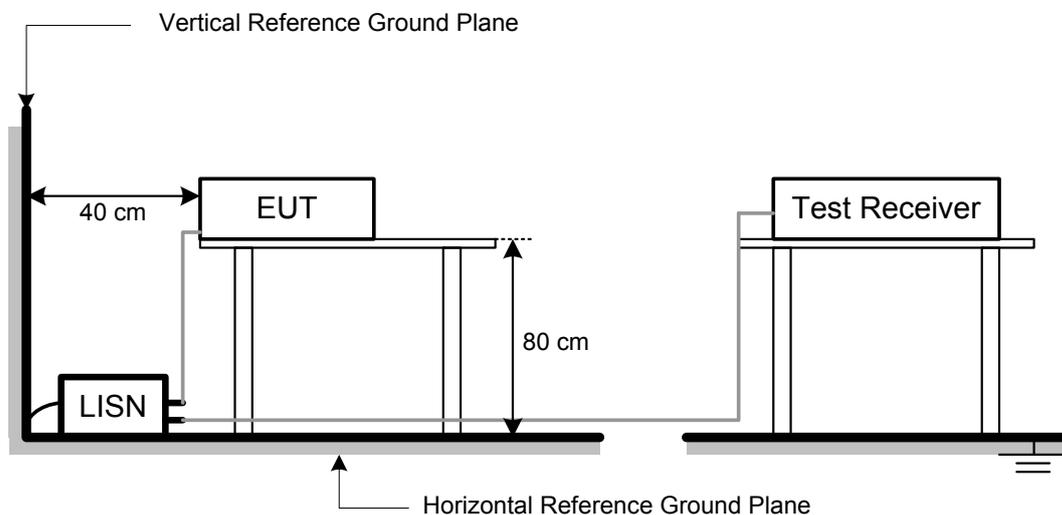
4.3 TEST PROCEDURES

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

NOTE:

- a. Reading in which marked as Peak, QP or AVG means measurements by using are Quasi-Peak or Average Mode with Detector BW=9 kHz (6 dB Bandwidth).
- b. All readings are Peak Mode value unless otherwise stated QP or AVG in column of Note. If the Peak or QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only Peak or QP Mode was measured, but AVG Mode didn't perform.

4.4 TEST SETUP LAYOUT



4.5 DEVIATION FROM TEST STANDARD

No deviation



4.6 EUT OPERATING CONDITIONS

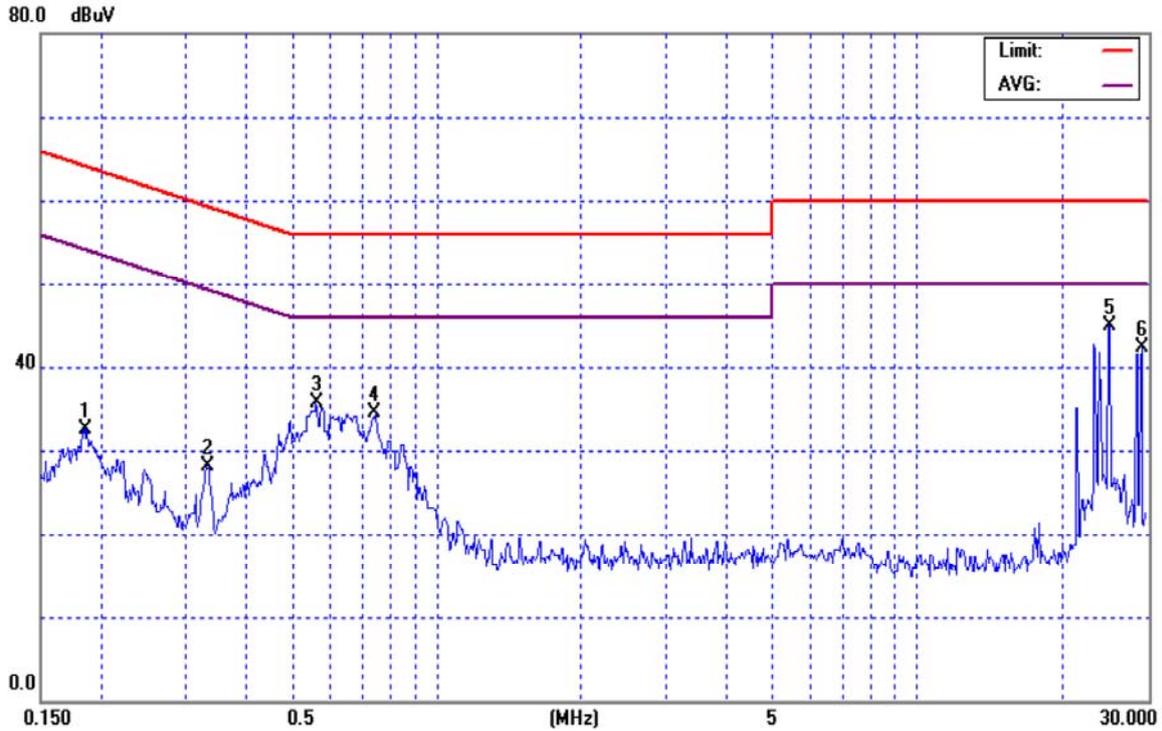
The EUT used during radiated and/or conducted emission measurement was designed to exercise in a manner similar to a typical use.



4.7 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	24°C	Relative Humidity	48%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Phase: Line

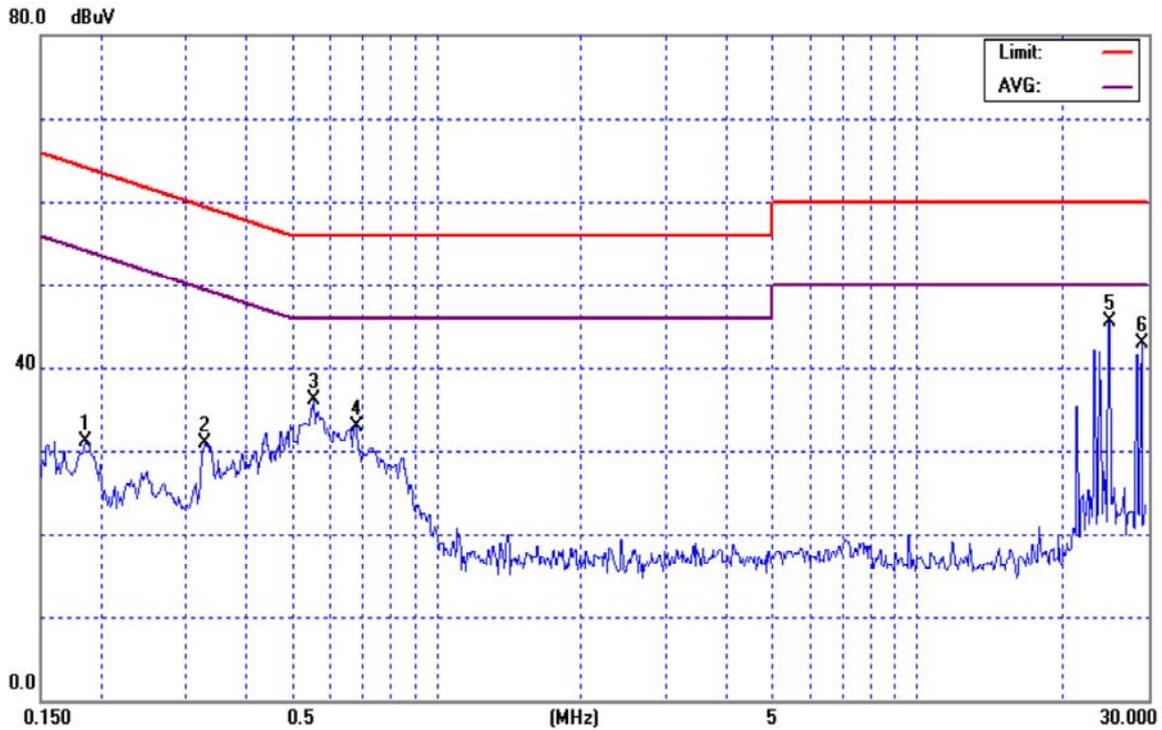


No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.1864	22.90	9.68	32.58	64.20	-31.62	peak	
2	0.3327	18.49	9.67	28.16	59.38	-31.22	peak	
3	0.5630	26.04	9.64	35.68	56.00	-20.32	peak	
4	0.7430	24.76	9.66	34.42	56.00	-21.58	peak	
5 *	25.1000	34.43	10.49	44.92	60.00	-15.08	peak	
6	29.3000	31.82	10.48	42.30	60.00	-17.70	peak	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	24°C	Relative Humidity	48%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Phase: Neutral



No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.1857	21.36	9.71	31.07	64.23	-33.16	peak	
2	0.3292	21.14	9.68	30.82	59.47	-28.65	peak	
3	0.5540	26.50	9.64	36.14	56.00	-19.86	peak	
4	0.6800	23.27	9.65	32.92	56.00	-23.08	peak	
5 *	25.1000	34.82	10.59	45.41	60.00	-14.59	peak	
6	29.3000	32.21	10.62	42.83	60.00	-17.17	peak	



5 ANTENNA CONDUCTED SPURIOUS EMISSION

5.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Antenna conducted Spurious Emission	30-25000	20 dB less than the peak value of fundamental frequency

5.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

5.3 TEST PROCEDURES

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting: RBW= 100KHz, VBW=100KHz, Sweep time = Auto.

5.4 TEST SETUP LAYOUT



5.5 DEVIATION FROM TEST STANDARD

No deviation

5.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.



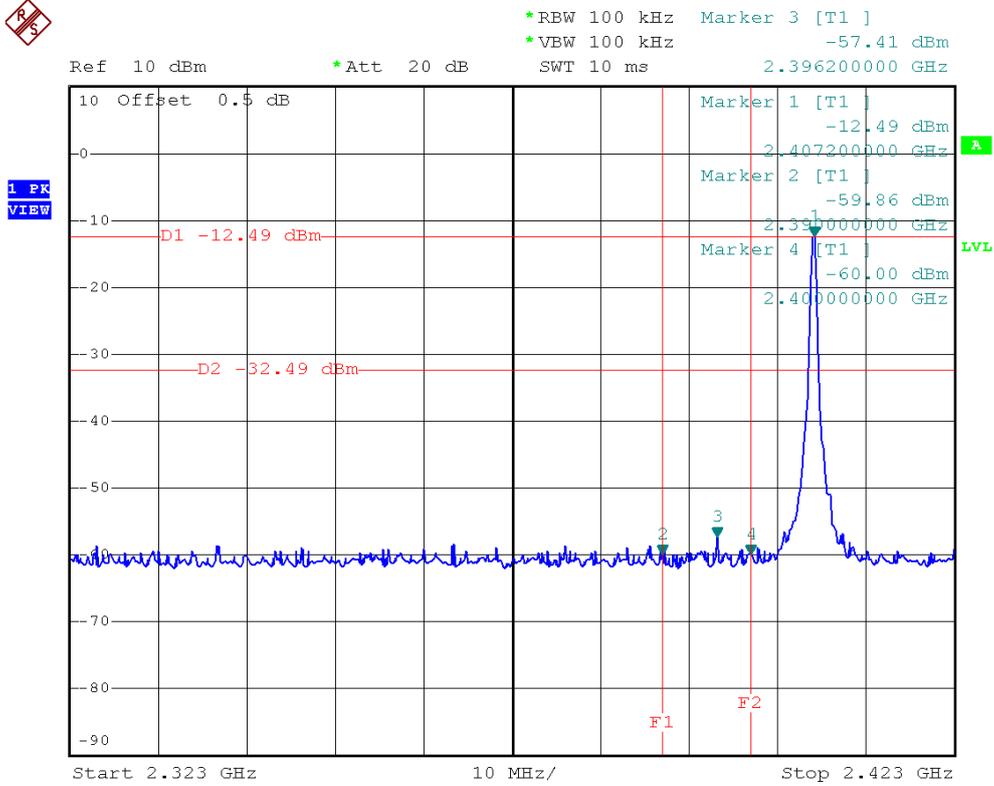
5.7 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz/2473 MHz		

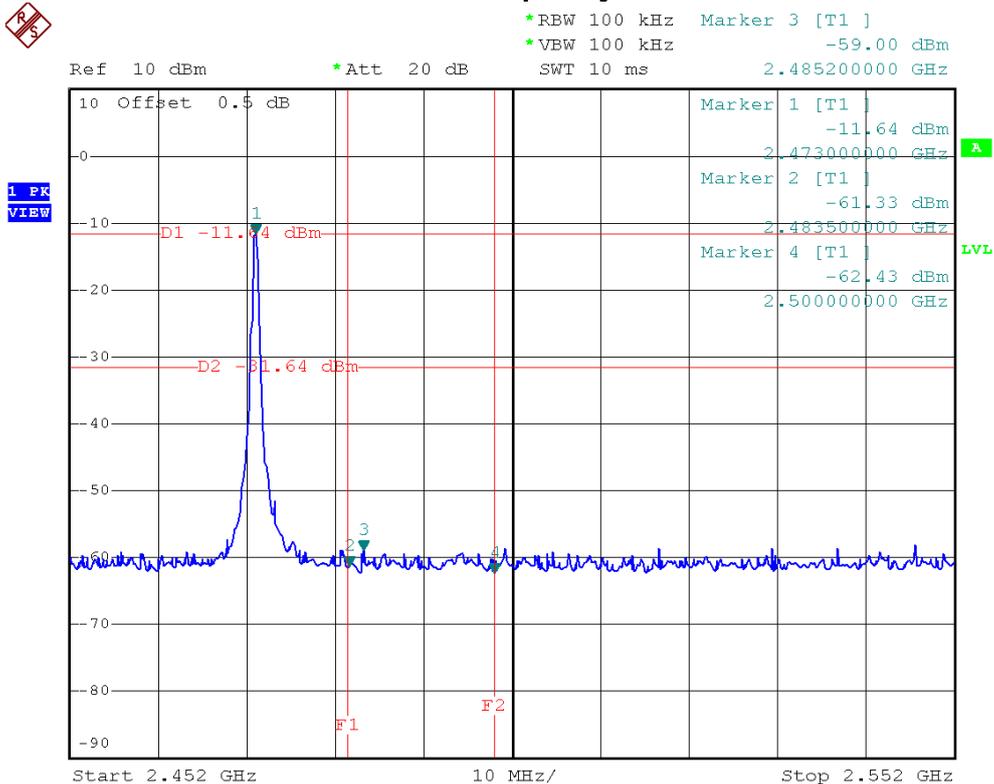
Channel of Worst Data			
The max. radio frequency power in any 100kHz bandwidth outside the frequency band		The max. radio frequency power in any 100 kHz bandwidth within the frequency band.	
FREQUENCY(MHz)	POWER(dBm)	FREQUENCY(MHz)	POWER(dBm)
2396.20	-57.41	2485.20	-59.00
Result			
In any 100kHz bandwidth outside the frequency band, the radio frequency power is at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.			



The max. radio frequency power in any 100kHz bandwidth outside the frequency band



The max. radio frequency power in any 100 kHz bandwidth within the frequency band

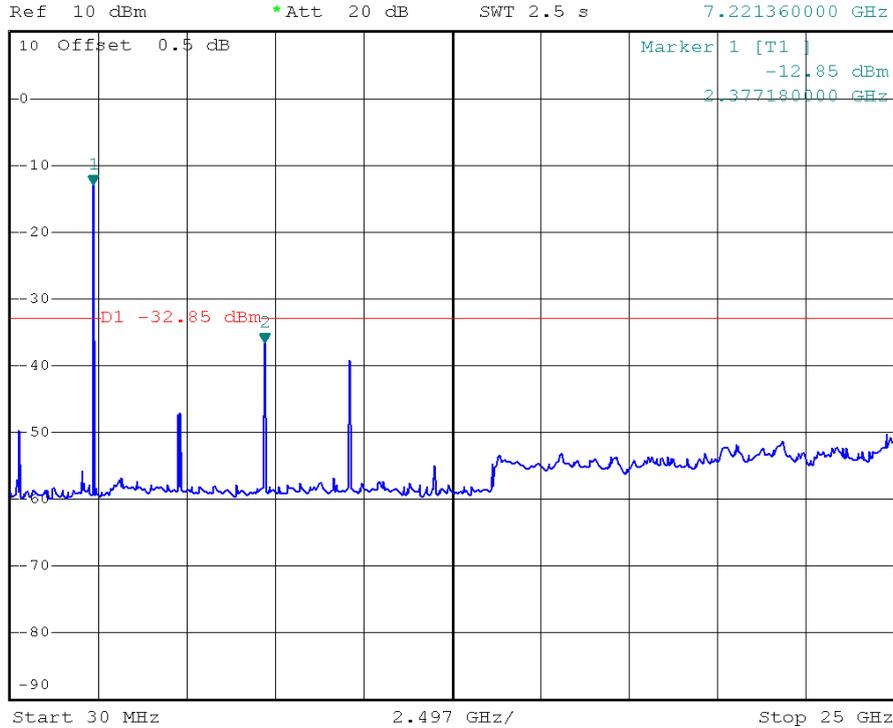




2407 MHz/10 Harmonic of the frequency



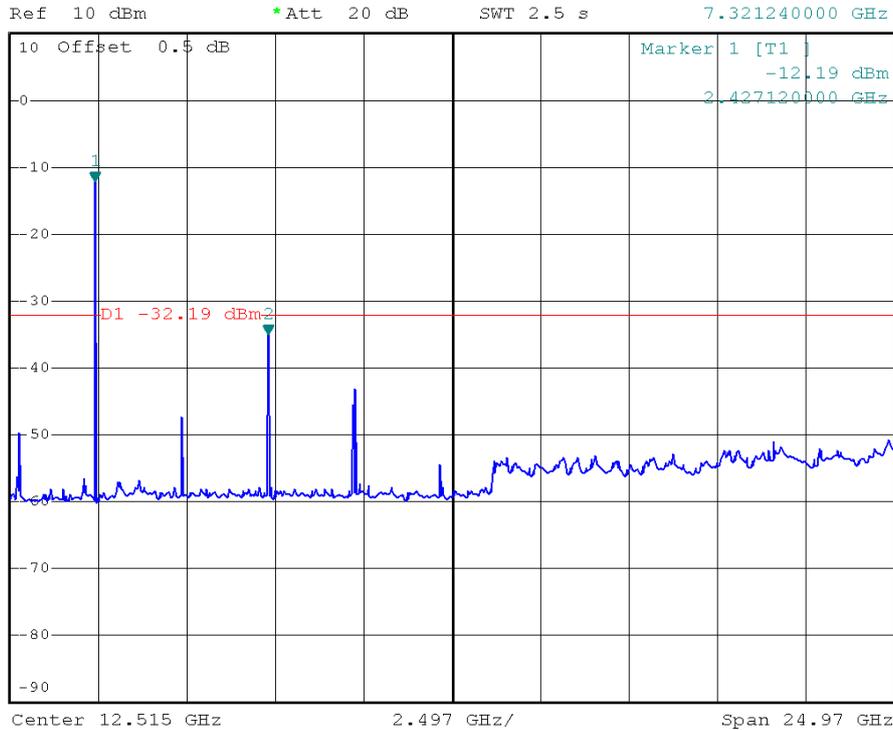
*RBW 100 kHz Marker 2 [T1]
*VBW 100 kHz -36.59 dBm
SWT 2.5 s 7.221360000 GHz



2437 MHz/10 Harmonic of the frequency



*RBW 100 kHz Marker 2 [T1]
*VBW 100 kHz -34.96 dBm
SWT 2.5 s 7.321240000 GHz





2473 MHz/10 Harmonic of the frequency

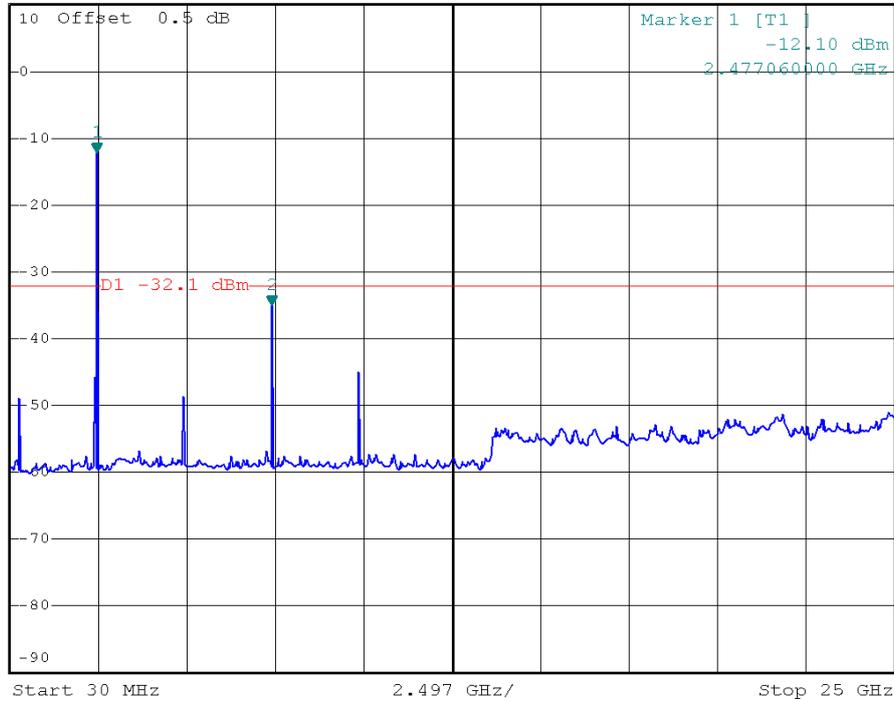


*RBW 100 kHz Marker 2 [T1]
*VBW 100 kHz -35.11 dBm
SWT 2.5 s 7.421120000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW





6.6 DB BANDWIDTH

6.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Bandwidth	2400-2483.5	≥ 500 kHz (6 dB bandwidth)

6.2 MEASUREMENT INSTRUMENTS LIST

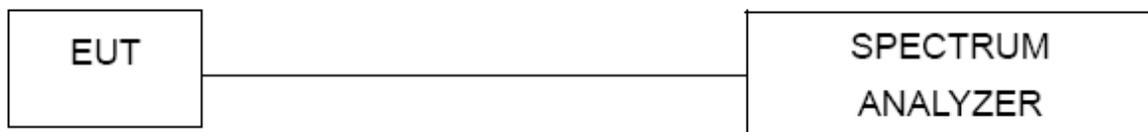
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

6.3 TEST PROCEDURES

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 100 kHz, VBW=100 kHz, Sweep time = Auto.

6.4 TEST SETUP LAYOUT



6.5 DEVIATION FROM TEST STANDARD

No deviation

6.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.6 Unless otherwise a special operating condition is specified in the follows during the testing.

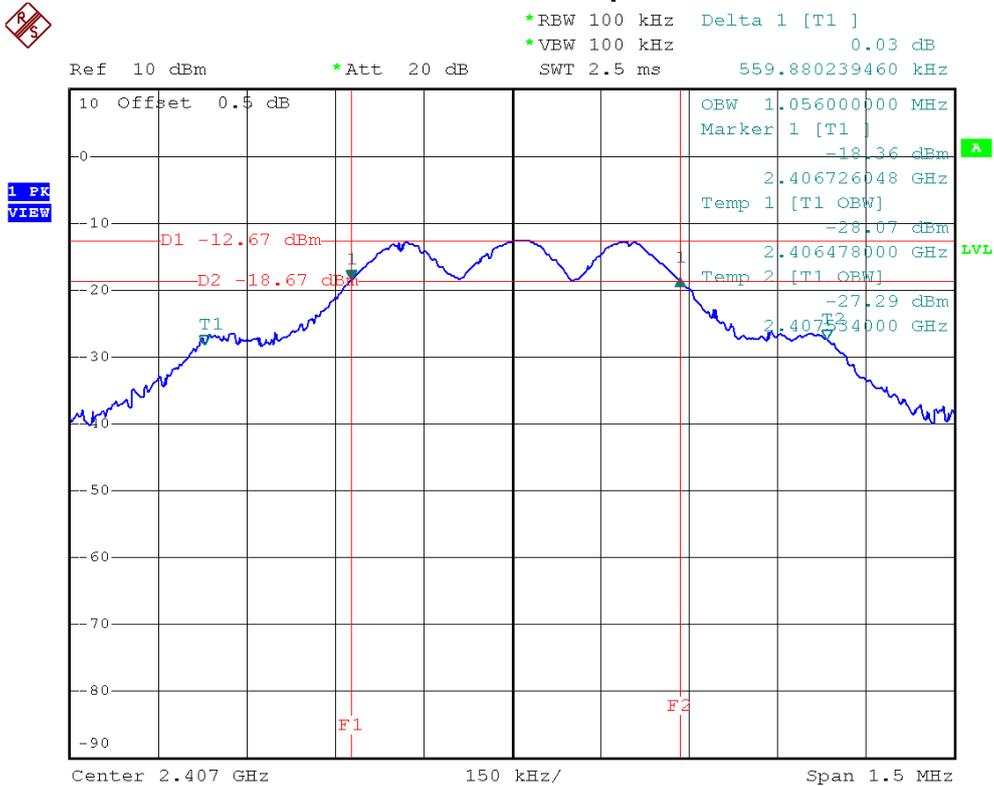


6.7 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Limit	Result
2407 MHz	0.56	1.06	≥ 500 kHz	PASS
2437 MHz	0.57	1.06	≥ 500 kHz	PASS
2473 MHz	0.57	1.05	≥ 500 kHz	PASS

2407 MHz/6 dB and 99% Occupied Bandwidth

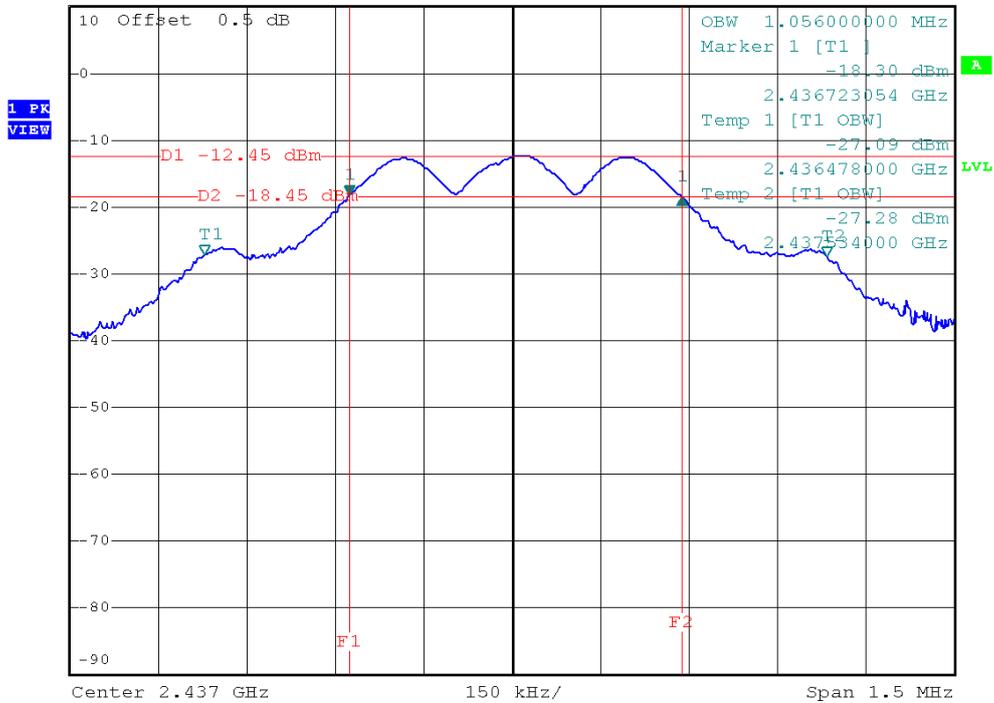




2437 MHz/6 dB and 99% Occupied Bandwidth



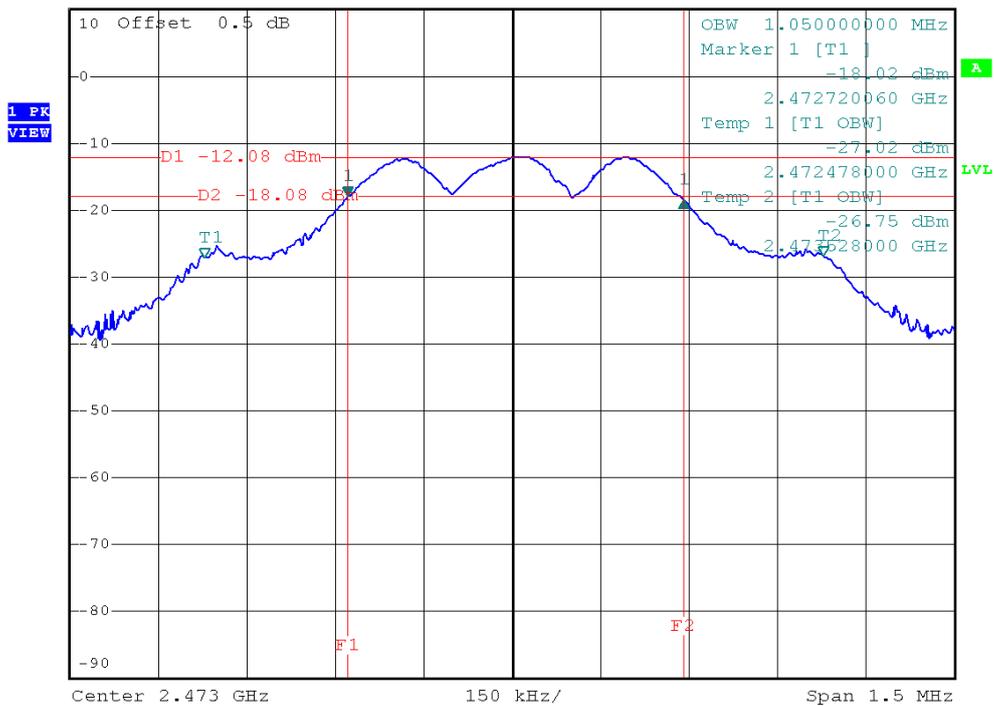
*RBW 100 kHz Delta 1 [T1]
 *VBW 100 kHz -0.28 dB
 Ref 10 dBm *Att 20 dB SWT 2.5 ms 565.868263410 kHz



2473 MHz/6 dB and 99% Occupied Bandwidth



*RBW 100 kHz Delta 1 [T1]
 *VBW 100 kHz -0.40 dB
 Ref 10 dBm *Att 20 dB SWT 2.5 ms 571.856287370 kHz





7 MAXIMUM PEAK CONDUCTED OUTPUT POWER

7.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Maximum Peak Conducted Output Power	2400-2483.5	1 watt or 30 dBm

7.2 MEASUREMENT INSTRUMENTS LIST

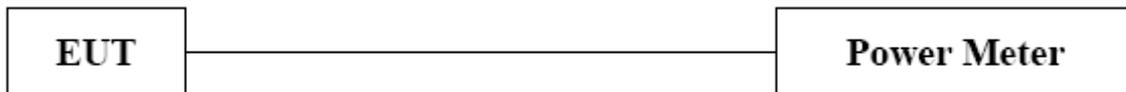
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Feb,26,2014
2	Power Meter Sensor	Anritsu	MA2411B	1126001	Feb,26,2014

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

7.3 TEST PROCEDURES

The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

7.4 TEST SETUP LAYOUT



7.5 DEVIATION FROM TEST STANDARD

No deviation

7.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.



7.7 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	Peak Output Power (dBm)	LIMIT (dBm)	Result
2407 MHz	-12.00	30	PASS
2437 MHz	-11.70	30	PASS
2473 MHz	-11.27	30	PASS



8 RADIATED SPURIOUS EMISSION (9 KHZ TO 1 GHZ)

8.1 LIMIT

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency Range: 9 kHz to 1 GHz		
FREQUENCY (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

Frequency Range: above 1 GHz				
FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
above 1 GHz	80	60	74	54

NOTE:

1. The limit for radiated test was performed according to FCC PART 15B.
2. The tighter limit applies at the band edges.
3. Emission level (dBuV/m)=20log Emission level (uV/m).
4. The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)
 Margin Level = Measurement Value – Limit Value



8.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013
2	Horn Antenna	Schwarzbeck	BBHA 9120	D-325	Apr. 15, 2014
3	Microwave Pre_amplifier	Agilent	8449B	3008A01714	Apr. 16, 2014
4	Microflex Cable	N/A	27478LL142	1m	May. 14, 2014
5	Microflex Cable	AISI	S104-SMAP-1	8m	May. 14, 2014
6	Microflex Cable	N/A	27478LL142	3m	May. 14, 2014
7	Test Cable	N/A	LMR-400	966_12m	May. 14, 2014
8	Test Cable	N/A	LMR-400	966_3m	May. 14, 2014
9	Pre-Amplifier	EMC	EMC-330	980001	Jul. 07, 2013
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 12, 2013

Remark: "N/A" denotes No Model Name, No Serial No. or No Calibration specified.

8.3 MEASURING INSTRUMENTS SETTING

EMI Test Receiver	Parameter Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP



8.4 TEST PROCEDURES

- a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1 GHz. For frequencies above 1 GHz, any suitable measuring distance may be used.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m Semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.
- g. The testing follows the guidelines in ANSI C63.4 and FCC Public Notice DA 00-705 Measurement Guidelines. In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

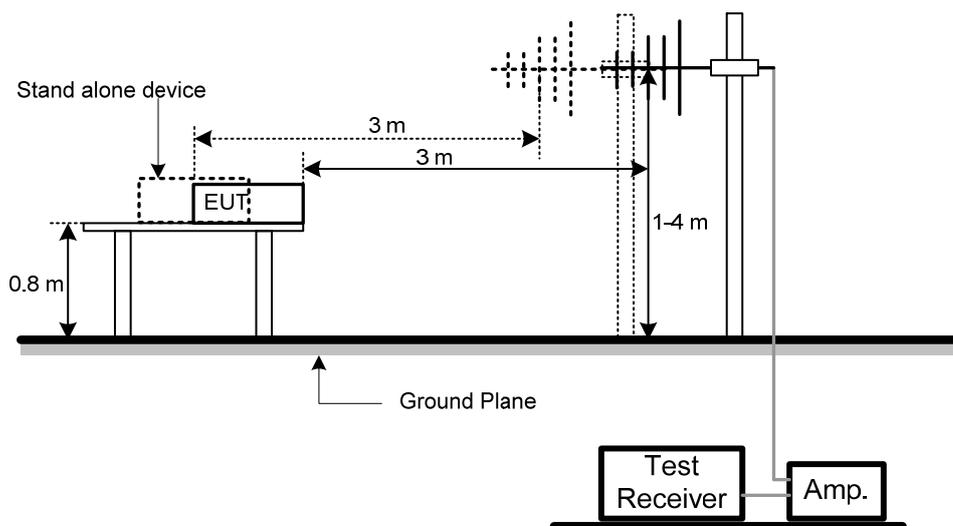
NOTE:

- a. Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode with Detector BW=120 kHz; SPA setting in RBW=100 kHz, VBW =100 kHz, Swp. Time = 0.3 sec./ MHz.
- b. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.

8.5 DEVIATION FROM TEST STANDARD

No deviation

8.6 TEST SETUP LAYOUT





8.7 EUT OPERATING CONDITIONS

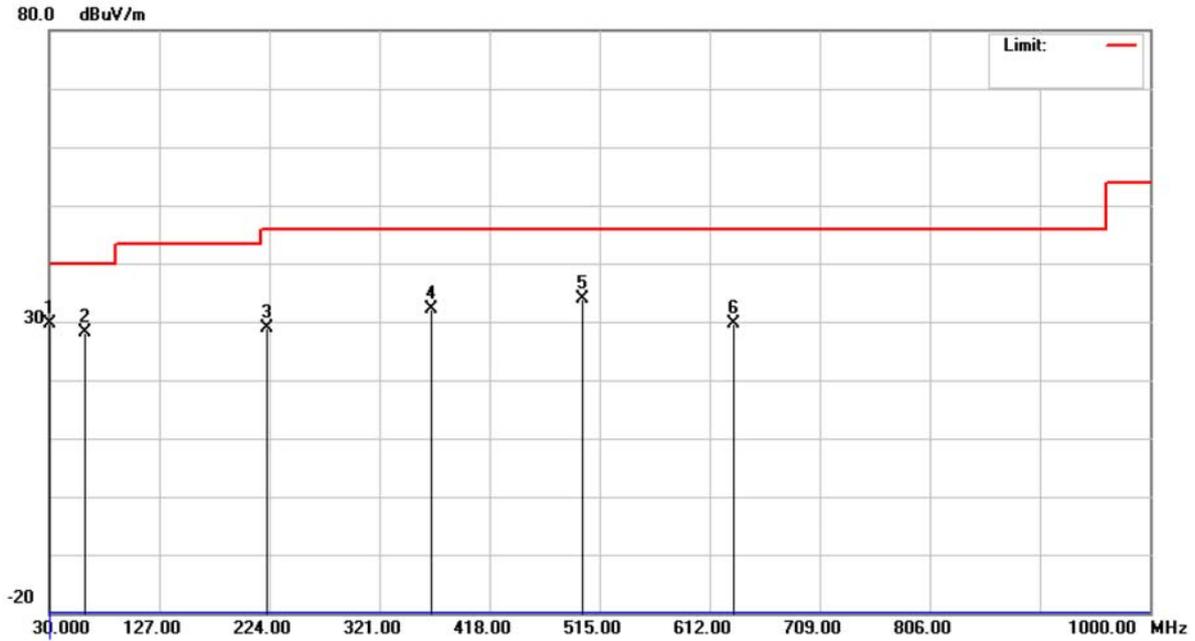
The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.



8.8 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Vertical

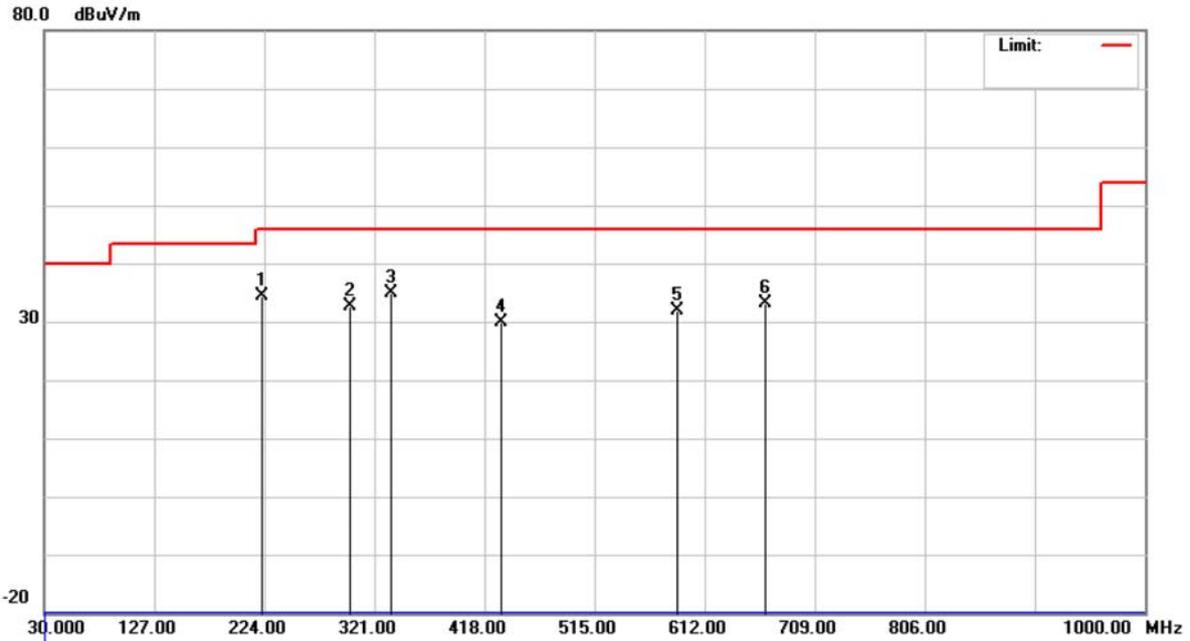


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	30.0000	49.43	-19.79	29.64	40.00	-10.36	peak	
2		61.5250	47.38	-19.30	28.08	40.00	-11.92	peak	
3		221.5749	50.29	-21.36	28.93	46.00	-17.07	peak	
4		367.0750	48.86	-16.64	32.22	46.00	-13.78	peak	
5		500.4500	47.44	-13.54	33.90	46.00	-12.10	peak	
6		633.8250	40.19	-10.49	29.70	46.00	-16.30	peak	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		221.5749	55.71	-21.36	34.35	46.00	-11.65	peak	
2		299.1749	50.80	-18.08	32.72	46.00	-13.28	peak	
3	*	335.5499	52.17	-17.40	34.77	46.00	-11.23	peak	
4		432.5499	44.88	-14.95	29.93	46.00	-16.07	peak	
5		587.7500	43.32	-11.39	31.93	46.00	-14.07	peak	
6		665.3499	43.38	-10.16	33.22	46.00	-12.78	peak	



9 RADIATED SPURIOUS EMISSION (ABOVE 1 GHz)

9.1 LIMIT

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency Range: 9 kHz to 1 GHz		
FREQUENCY (MHz)	Field Strength (micровolts/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

Frequency Range: above 1 GHz				
FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
above 1 GHz	80	60	74	54

NOTE:

- (1) The limit for radiated test was performed according to FCC PART 15B.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)
 Margin Level = Measurement Value – Limit Value



9.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013
2	Horn Antenna	Schwarzbeck	BBHA 9120	D-325	Apr. 15, 2014
3	Microwave Pre_amplifier	Agilent	8449B	3008A01714	Apr. 16, 2014
4	Microflex Cable	N/A	27478LL142	1m	May. 14, 2014
5	Microflex Cable	AISI	S104-SMAP-1	8m	May. 14, 2014
6	Microflex Cable	N/A	27478LL142	3m	May. 14, 2014
7	Test Cable	N/A	LMR-400	966_12m	May. 14, 2014
8	Test Cable	N/A	LMR-400	966_3m	May. 14, 2014
9	Pre-Amplifier	EMC	EMC-330	980001	Jul. 07, 2013
10	Log-Bicon Antenna	Schwarzbeck	VULB9168-352	9168-352	Jun. 12, 2013

Remark: "N/A" denotes No Model Name, No Serial No. or No Calibration specified.

9.3 MEASURING INSTRUMENTS SETTING

Spectrum Analyzer	Parameter Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (other emission)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

9.4 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m Semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- c. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- d. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.
- f. The testing follows the guidelines in ANSI C63.4 and FCC Public Notice DA 00-705 Measurement Guidelines. In case the emission is fail due to the used RBW/VBW is too wide, marker-delta method of FCC Public Notice DA 00-705 will be followed.

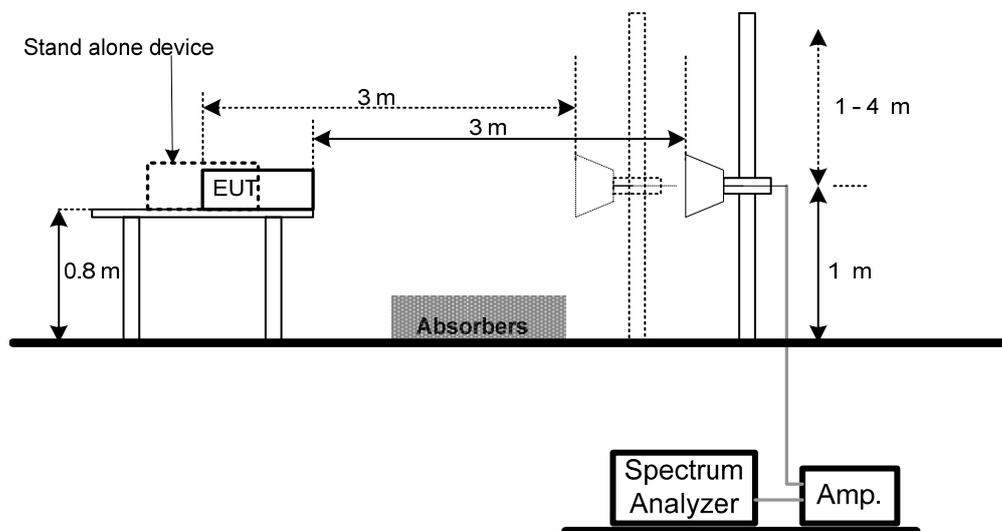
NOTE:

- a. Reading in which marked as Peak means measurements by using are Peak Mode with instrument setting in RBW= 1 MHz, VBW= 1 MHz, Swp. Time = Auto.
Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW= 1 MHz, VBW= 10 Hz, Swp. Time = Auto.
- b. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform.

9.5 DEVIATION FROM TEST STANDARD

No deviation

9.6 TEST SETUP LAYOUT





9.7 EUT OPERATING CONDITIONS

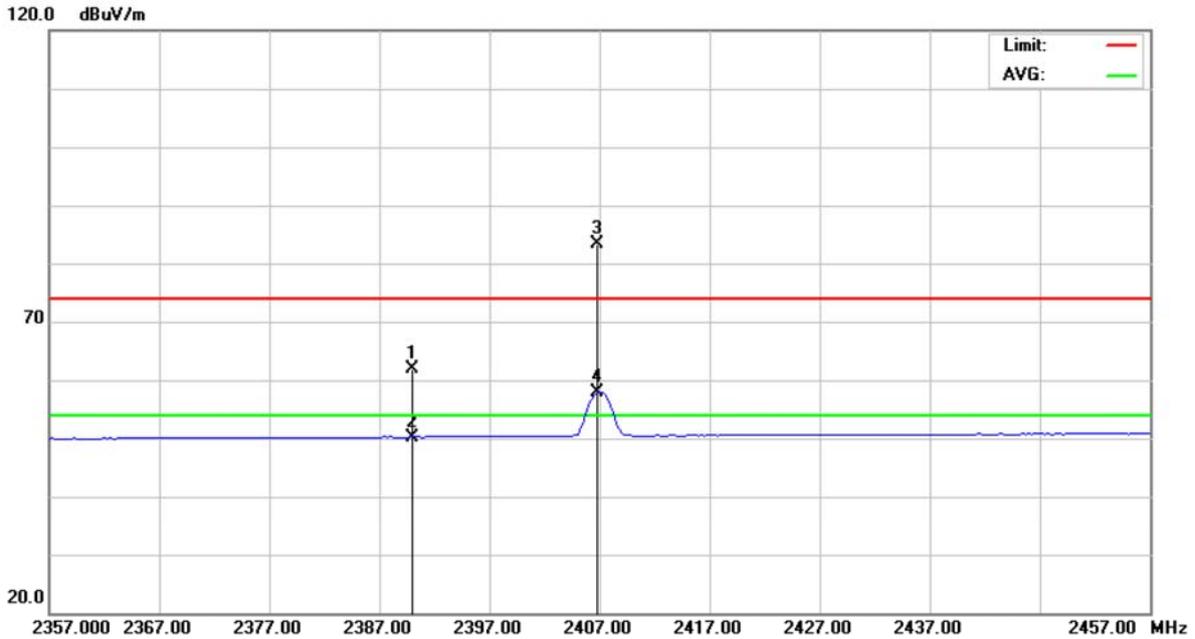
The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.



9.8 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Vertical

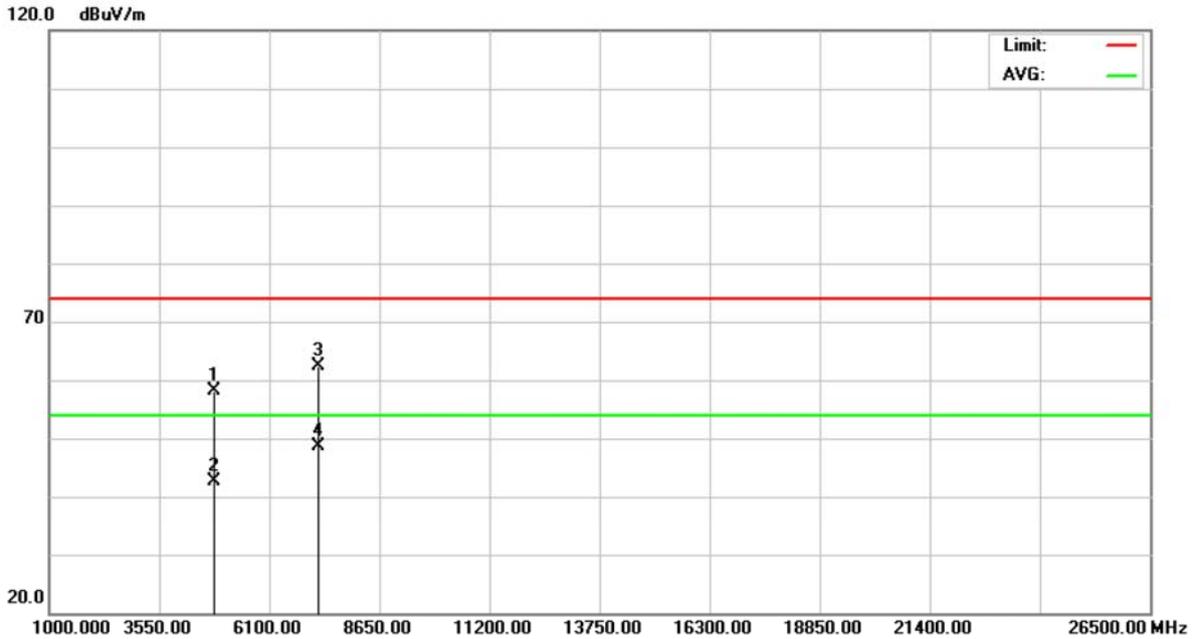


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	27.93	33.90	61.83	74.00	-12.17	peak	
2		2390.000	16.35	33.90	50.25	54.00	-3.75	AVG	
3	*	2406.750	49.50	33.98	83.48	74.00	9.48	peak	
4	X	2406.750	23.98	33.98	57.96	54.00	3.96	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Vertical

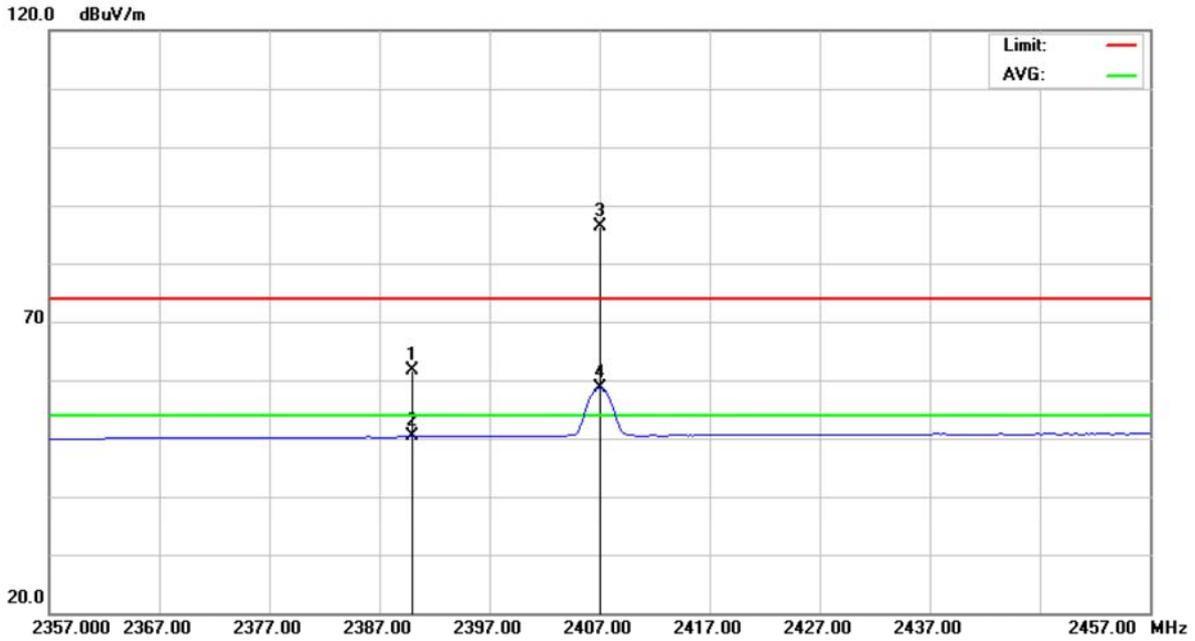


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4813.987	48.17	9.89	58.06	74.00	-15.94	peak	
2		4813.987	32.68	9.89	42.57	54.00	-11.43	AVG	
3		7220.913	44.76	17.66	62.42	74.00	-11.58	peak	
4	*	7220.913	31.01	17.66	48.67	54.00	-5.33	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Horizontal

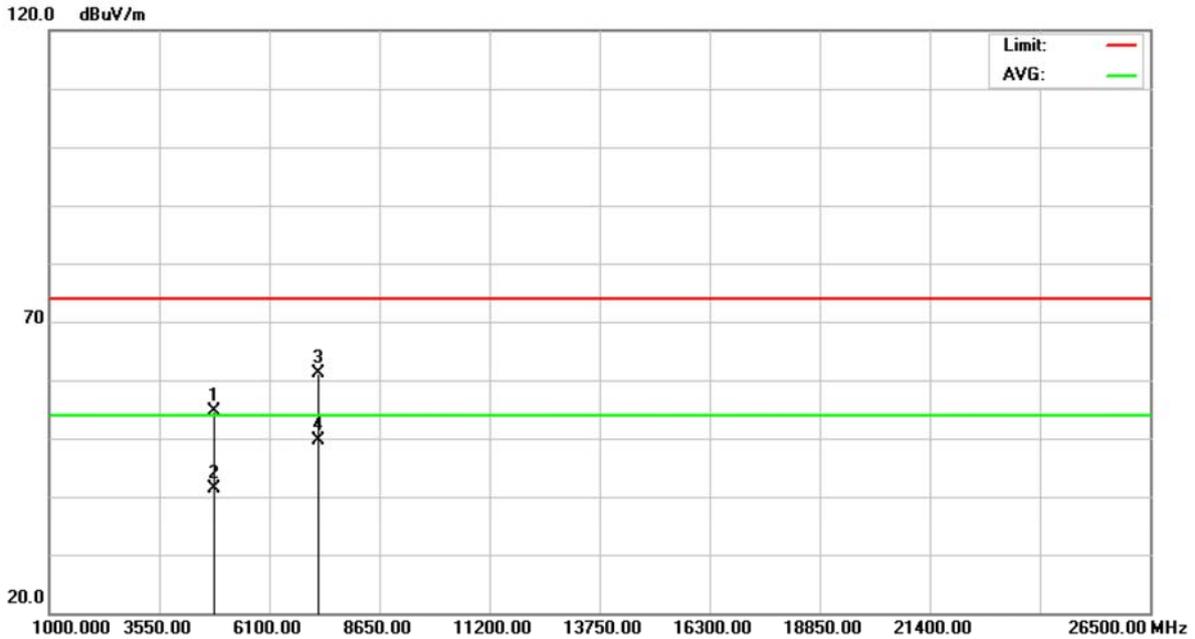


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		2390.000	27.85	33.90	61.75	74.00	-12.25	peak	
2		2390.000	16.38	33.90	50.28	54.00	-3.72	AVG	
3	*	2407.000	52.52	33.98	86.50	74.00	12.50	peak	
4	X	2407.000	24.73	33.98	58.71	54.00	4.71	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		

Polarization: Horizontal

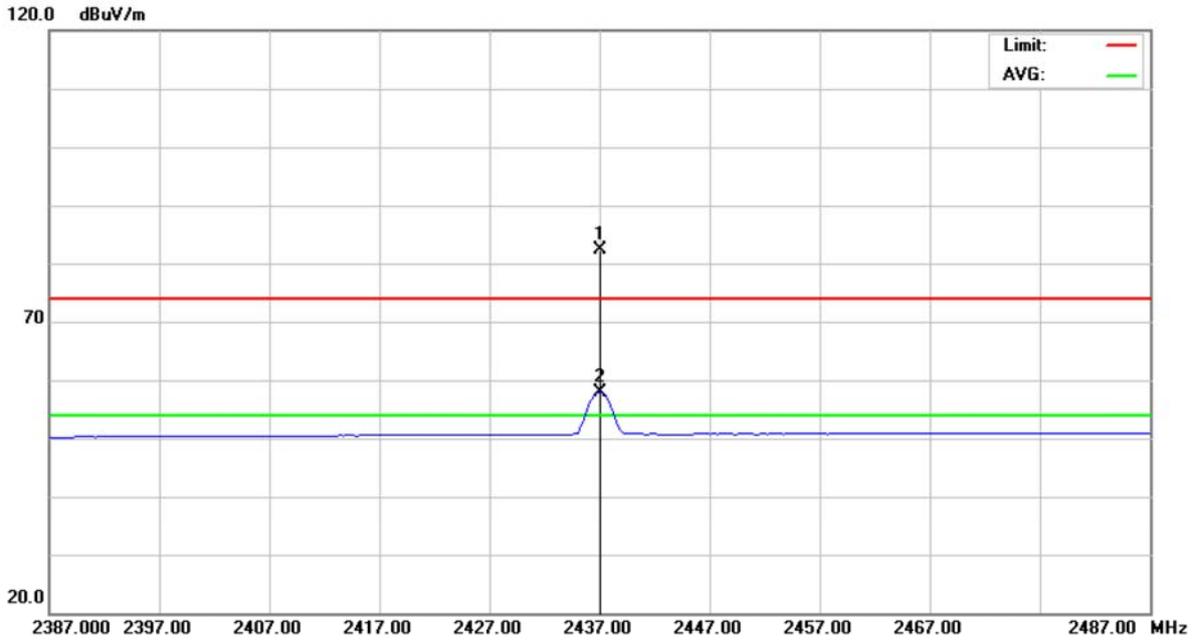


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4814.000	44.64	9.89	54.53	74.00	-19.47	peak	
2		4814.000	31.58	9.89	41.47	54.00	-12.53	AVG	
3		7220.487	43.40	17.66	61.06	74.00	-12.94	peak	
4	*	7220.487	31.85	17.66	49.51	54.00	-4.49	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Vertical

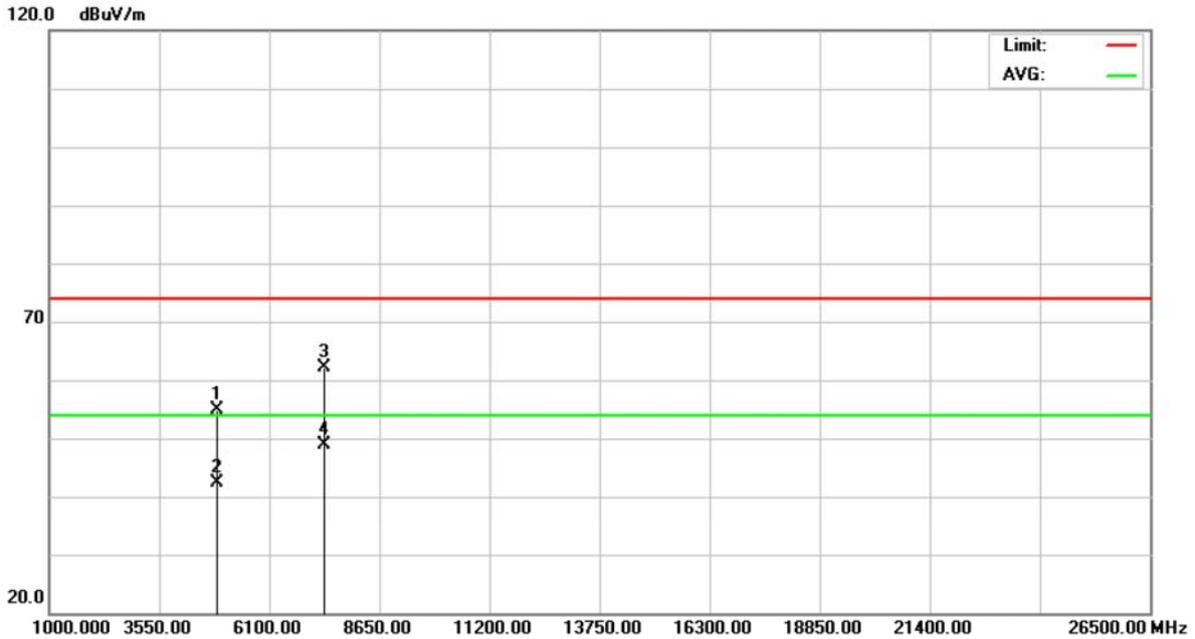


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2437.000	48.38	34.11	82.49	74.00	8.49	peak	
2	X	2437.000	23.82	34.11	57.93	54.00	3.93	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Vertical

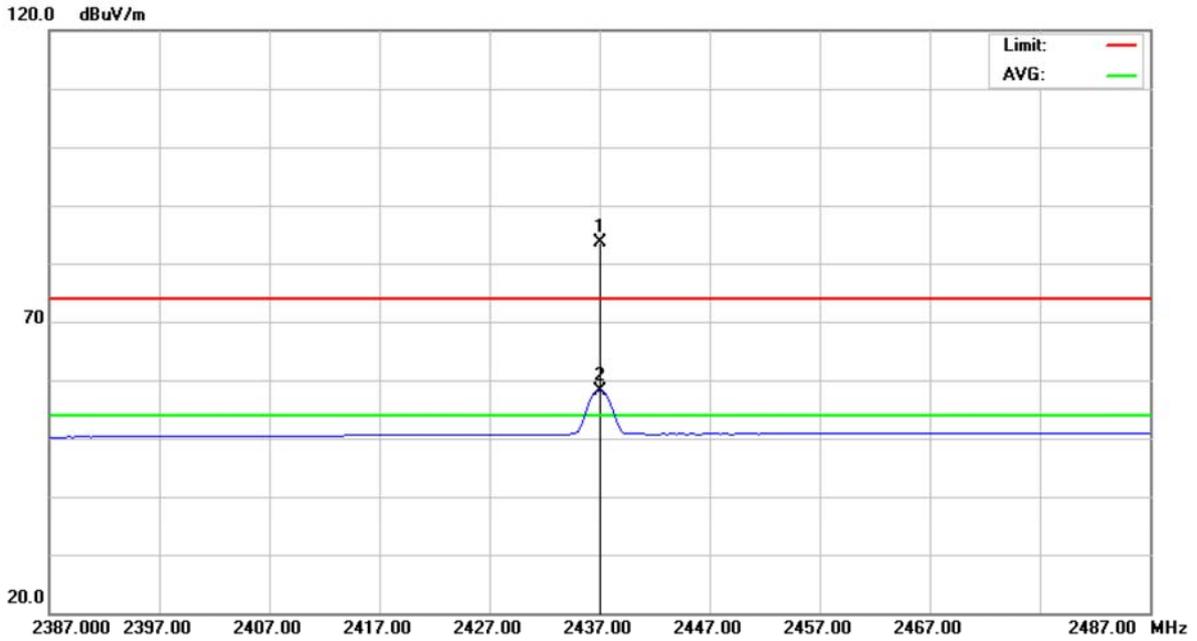


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4873.900	44.85	9.94	54.79	74.00	-19.21	peak	
2		4873.900	32.49	9.94	42.43	54.00	-11.57	AVG	
3		7311.487	44.00	18.16	62.16	74.00	-11.84	peak	
4	*	7311.487	30.67	18.16	48.83	54.00	-5.17	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Horizontal

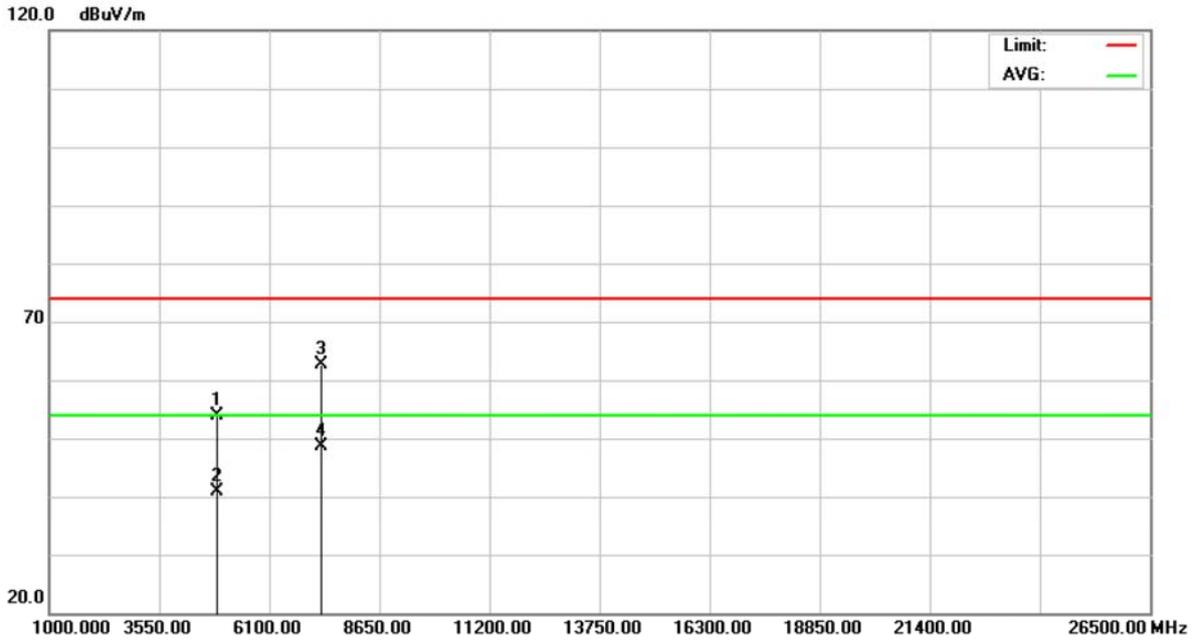


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2437.000	49.54	34.11	83.65	74.00	9.65	peak	
2	X	2437.000	24.12	34.11	58.23	54.00	4.23	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2437 MHz		

Polarization: Horizontal

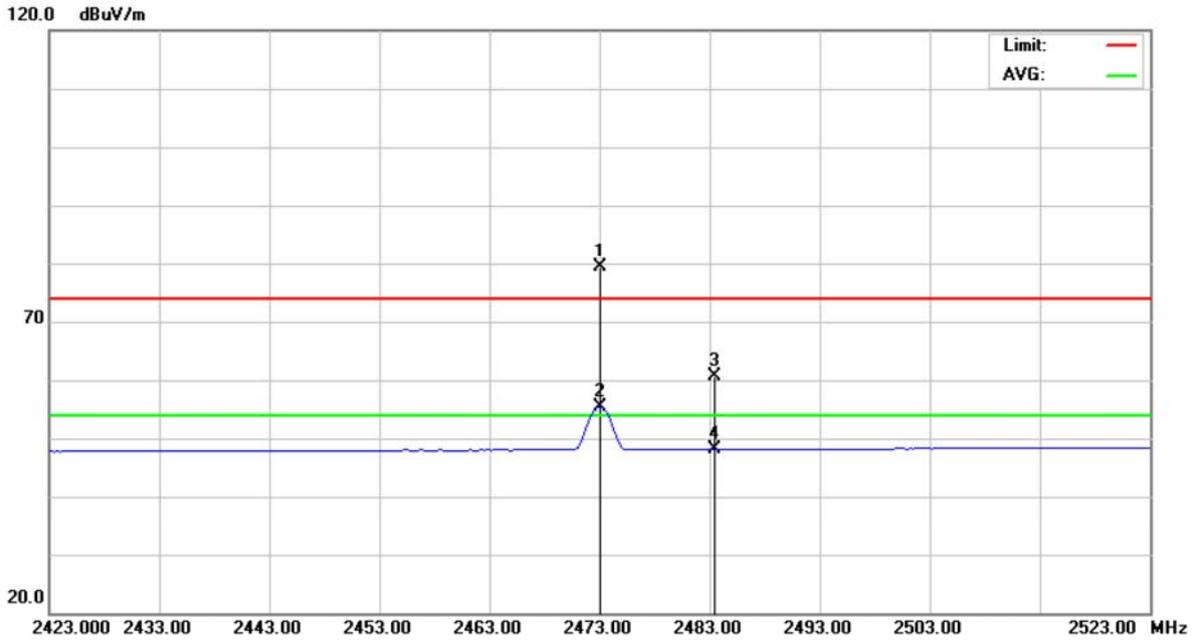


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4873.875	43.89	9.94	53.83	74.00	-20.17	peak	
2		4873.875	30.87	9.94	40.81	54.00	-13.19	AVG	
3		7310.237	44.43	18.15	62.58	74.00	-11.42	peak	
4	*	7310.237	30.43	18.15	48.58	54.00	-5.42	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Vertical

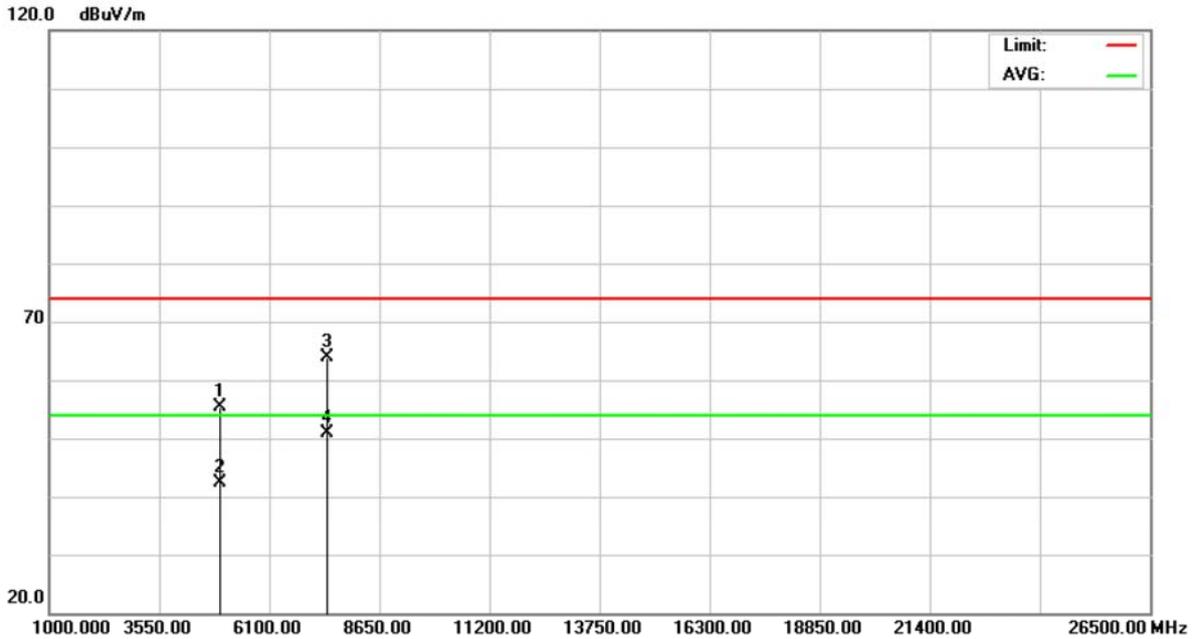


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2473.000	45.01	34.27	79.28	74.00	5.28	peak	
2	X	2473.000	21.12	34.27	55.39	54.00	1.39	AVG	
3		2483.500	26.25	34.32	60.57	74.00	-13.43	peak	
4		2483.500	13.78	34.32	48.10	54.00	-5.90	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Vertical

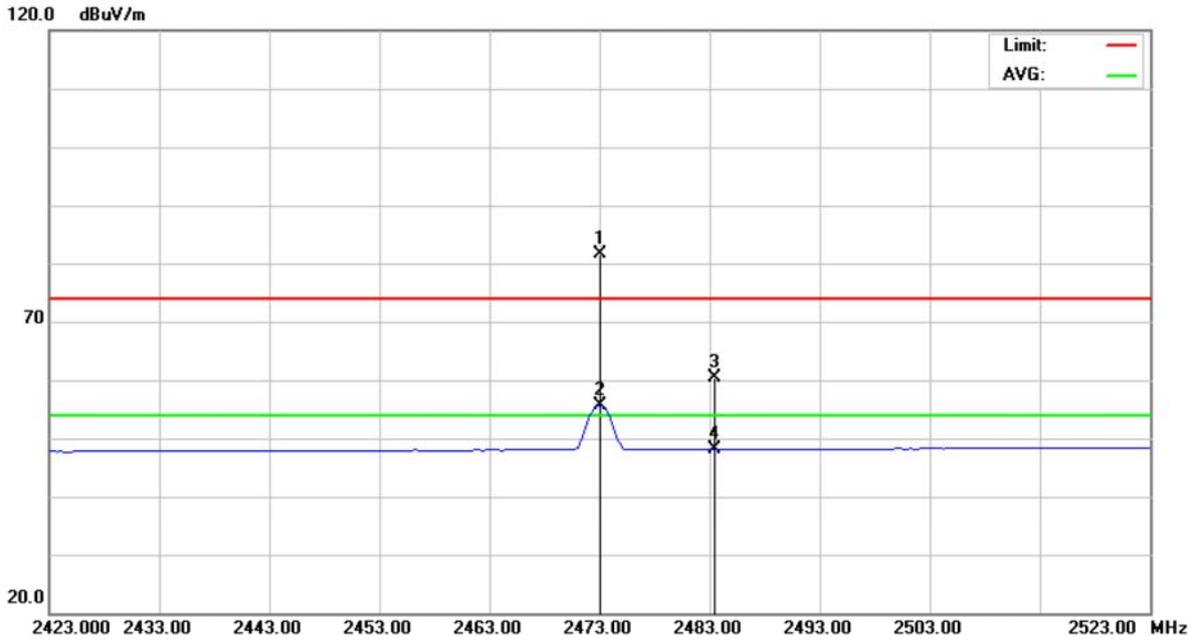


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4945.950	45.47	10.00	55.47	74.00	-18.53	peak	
2		4945.950	32.31	10.00	42.31	54.00	-11.69	AVG	
3		7419.513	45.15	18.75	63.90	74.00	-10.10	peak	
4	*	7419.513	32.10	18.75	50.85	54.00	-3.15	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Horizontal

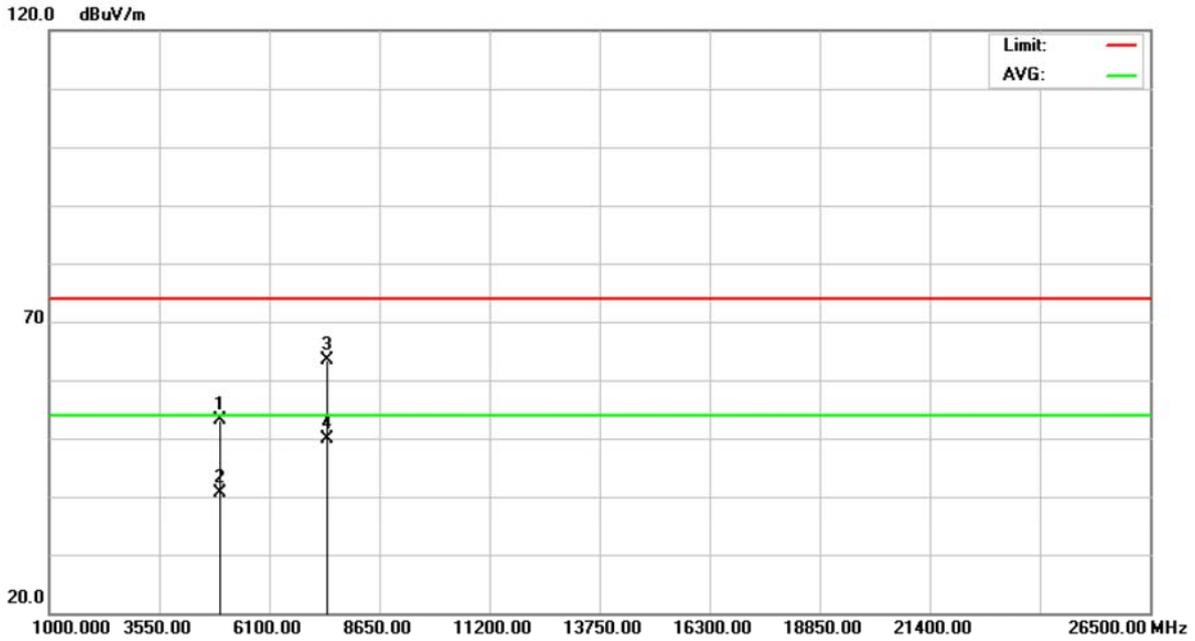


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	*	2473.000	47.38	34.27	81.65	74.00	7.65	peak	
2	X	2473.000	21.46	34.27	55.73	54.00	1.73	AVG	
3		2483.500	25.95	34.32	60.27	74.00	-13.73	peak	
4		2483.500	13.79	34.32	48.11	54.00	-5.89	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		

Polarization: Horizontal



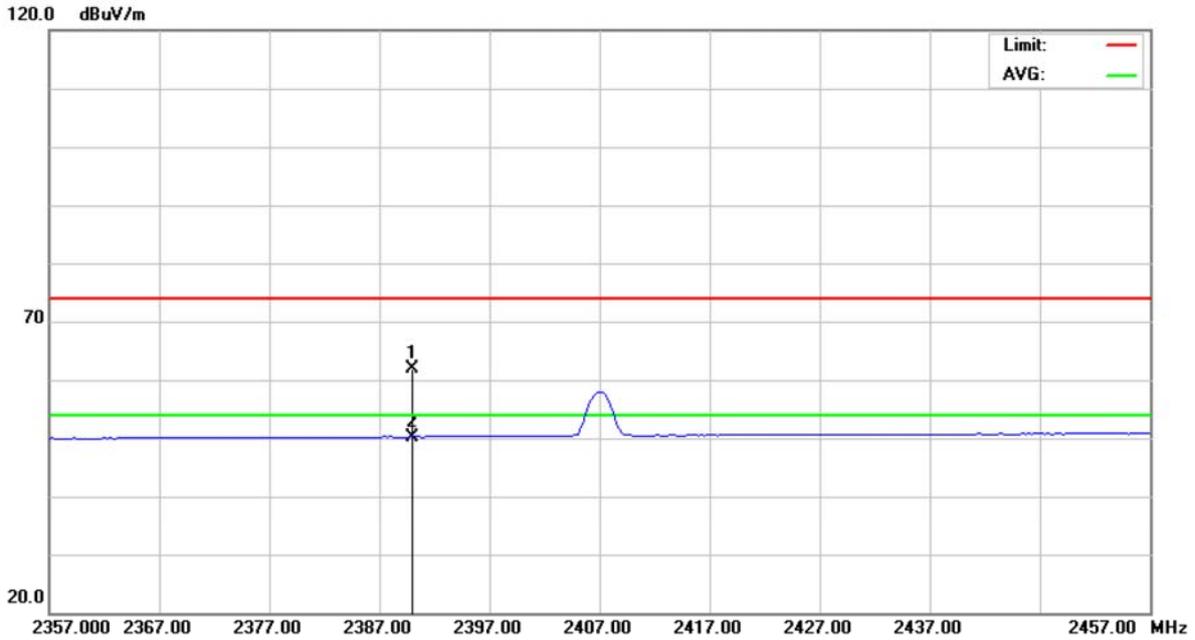
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1		4945.938	43.03	10.00	53.03	74.00	-20.97	peak	
2		4945.938	30.64	10.00	40.64	54.00	-13.36	AVG	
3		7418.987	44.61	18.75	63.36	74.00	-10.64	peak	
4	*	7418.987	31.13	18.75	49.88	54.00	-4.12	AVG	



9.9 TEST RESULTS (RESTRICTED BANDS)

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	24°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		
NOTE	The transmitter was setup to transmit at the lowest channel and the field strength was measured at 2310-2390 MHz.		

Polarization: Vertical

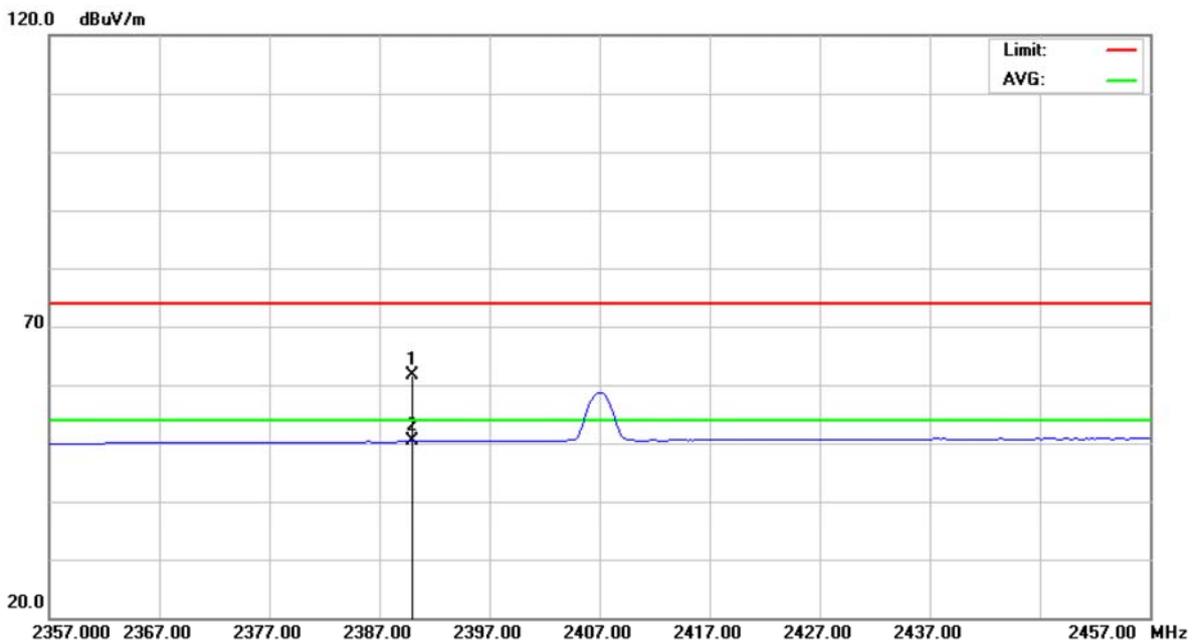


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		2390.000	27.93	33.90	61.83	74.00	-12.17	peak	
2	*	2390.000	16.35	33.90	50.25	54.00	-3.75	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	24°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz		
NOTE	The transmitter was setup to transmit at the lowest channel and the field strength was measured at 2310-2390 MHz.		

Polarization: Horizontal

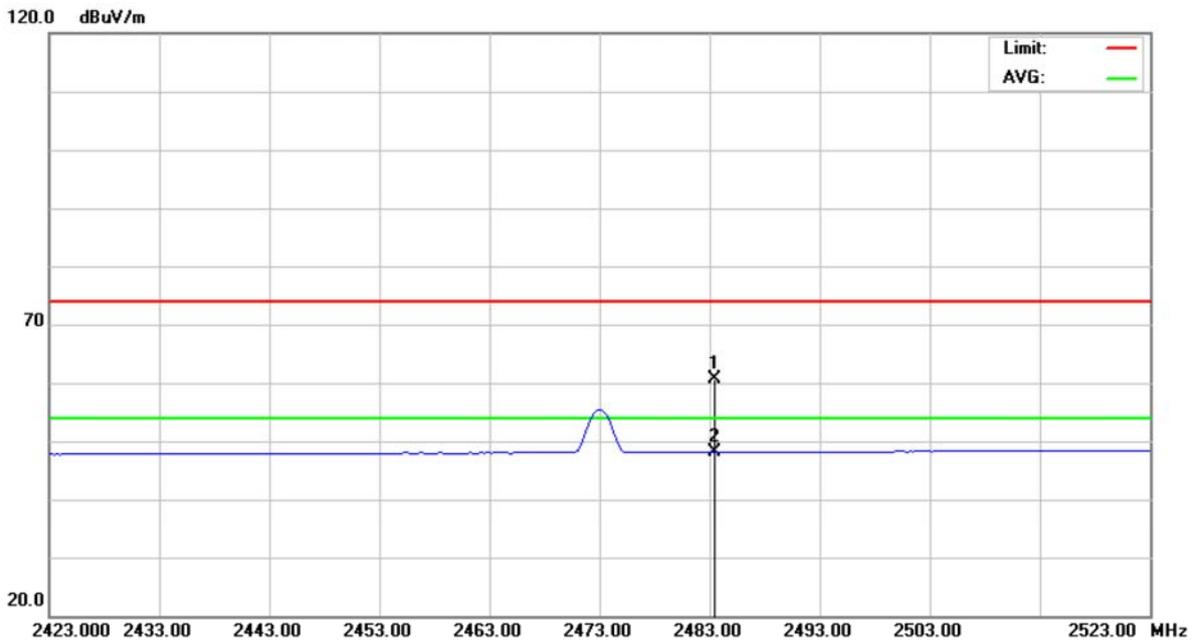


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		2390.000	27.85	33.90	61.75	74.00	-12.25	peak	
2	*	2390.000	16.38	33.90	50.28	54.00	-3.72	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	24°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		
NOTE	The transmitter was setup to transmit at the highest channel and the field strength was measured at 2483.5-2500 MHz.		

Polarization: Vertical

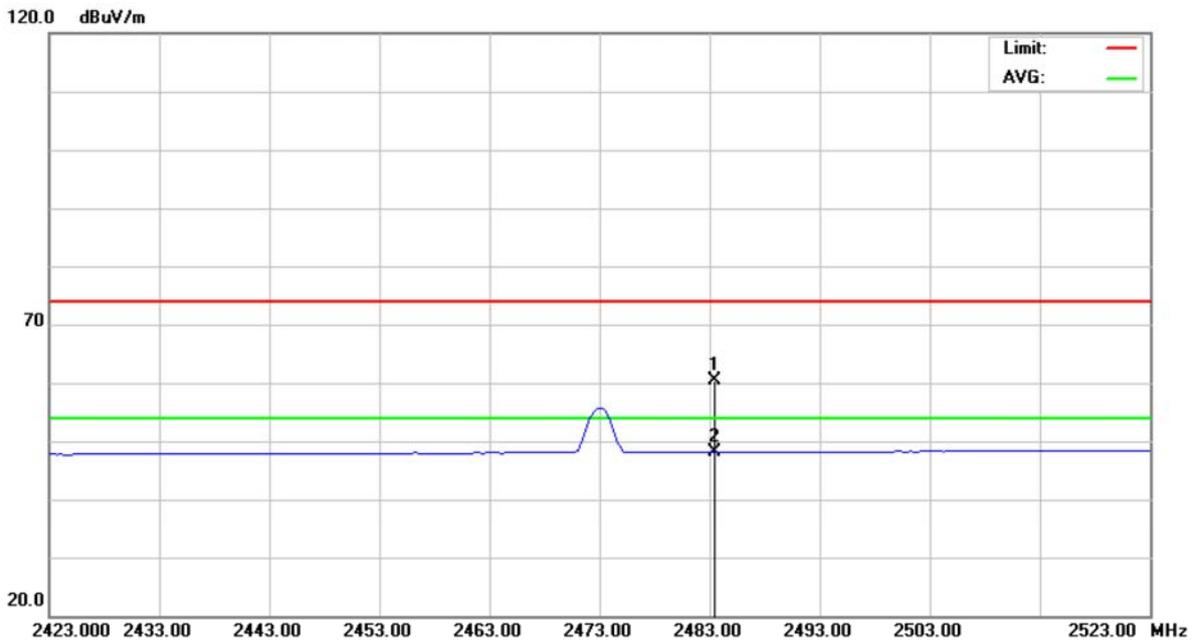


No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV/m	Limit dBuV/m	Over dB	Detector	Comment
1	2483.500	26.25	34.32	60.57	74.00	-13.43	peak	
2 *	2483.500	13.78	34.32	48.10	54.00	-5.90	AVG	



E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	24°C	Relative Humidity	46%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2473 MHz		
NOTE	The transmitter was setup to transmit at the highest channel and the field strength was measured at 2483.5-2500 MHz.		

Polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB		
1		2483.500	25.95	34.32	60.27	74.00	-13.73	peak	
2	*	2483.500	13.79	34.32	48.11	54.00	-5.89	AVG	



10 POWER SPECTRAL DENSITY

10.1 LIMIT

Test Item	Frequency Range (MHz)	Limit
Power Spectral Density	2400-2483.5	8 dBm (in any 3 kHz)

10.2 MEASUREMENT INSTRUMENTS LIST

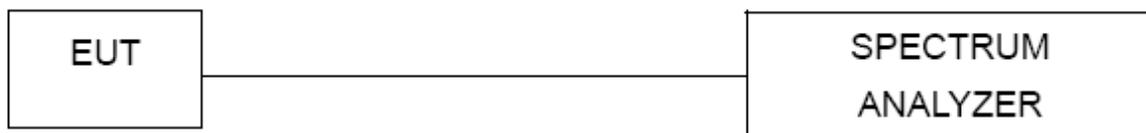
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP-40	100129	Oct. 01, 2013

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

10.3 TEST PROCEDURES

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW=3 kHz, VBW=30 kHz, Sweep time = 500s.

10.4 TEST SETUP LAYOUT



10.5 DEVIATION FROM TEST STANDARD

No deviation

10.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.

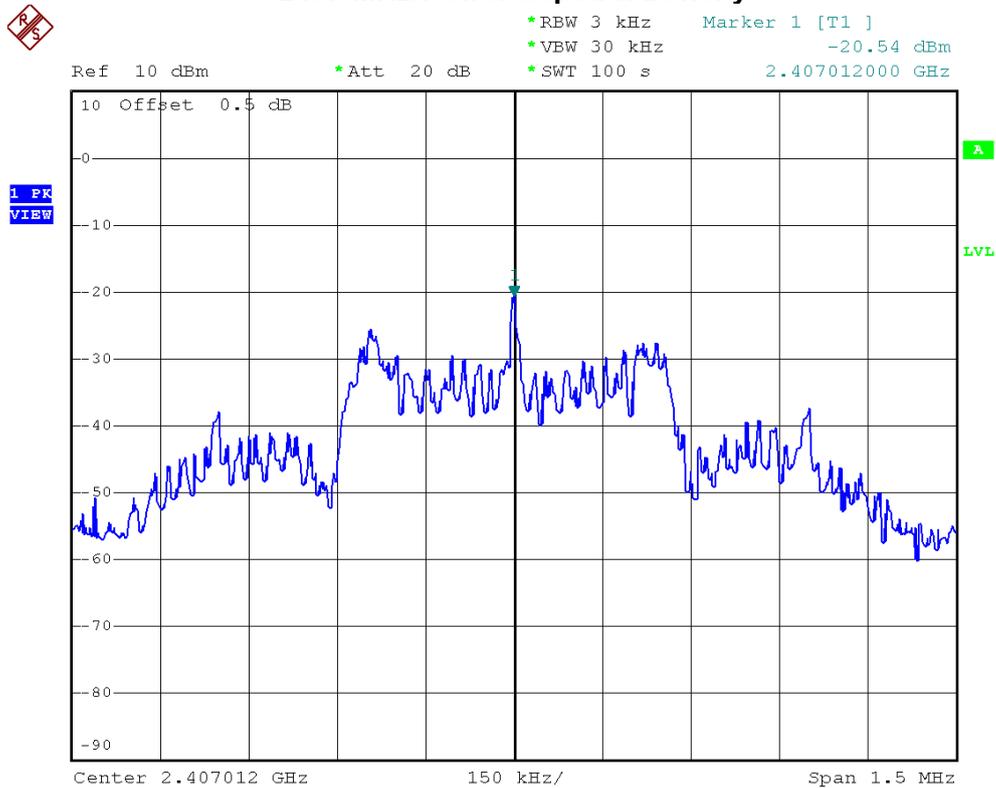


10.7 TEST RESULTS

E.U.T	2.4G RF Dongle	Model Name	GN-20
Temperature	26°C	Relative Humidity	60%
Test Voltage	AC 120V/60Hz (System)		
Test Mode	2407 MHz, 2437 MHz, 2473 MHz		

Frequency	Power Density (dBm)	Limit (dBm)	Result
2407 MHz	-20.54	8	PASS
2437 MHz	-20.14	8	PASS
2473 MHz	-19.78	8	PASS

2407 MHz/Power Sepctral Density





2437 MHz/Power Sepctral Density

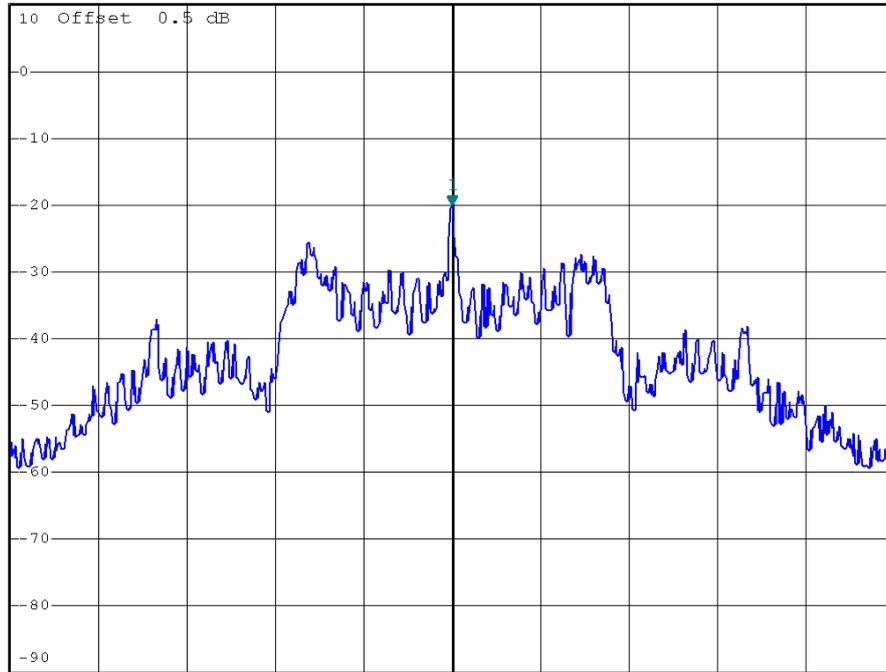


*RBW 3 kHz Marker 1 [T1]
*VBW 30 kHz -20.14 dBm
*SWT 100 s 2.437012000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Center 2.437012 GHz

150 kHz/

Span 1.5 MHz

2473 MHz/Power Sepctral Density

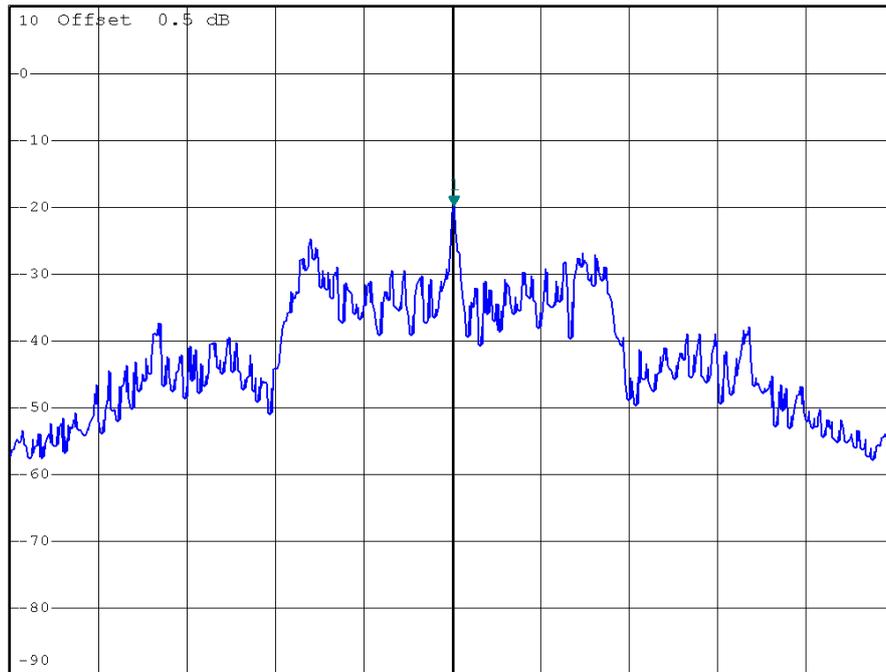


*RBW 3 kHz Marker 1 [T1]
*VBW 30 kHz -19.78 dBm
*SWT 100 s 2.473011000 GHz

Ref 10 dBm

*Att 20 dB

1 PK
VIEW



Center 2.473008 GHz

150 kHz/

Span 1.5 MHz



11 RF EXPOSURE COMPLIANCE

11.1 LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

NOTE: f = frequency in MHz ; *Plane-wave equivalent power density.

11.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2495A	1128008	Feb,26,2014
2	Power Meter Sensor	Anritsu	MA2411B	1126001	Feb,26,2014

NOTE: **N/A**: denotes No Model Name, No Serial No. or No Calibration specified.

11.3 MPE CALCULATION METHOD

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

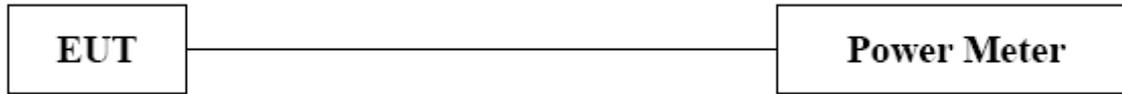
The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained



11.4 TEST SETUP LAYOUT



11.5 DEVIATION FROM TEST STANDARD

No deviation

11.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 5.6 Unless otherwise a special operating condition is specified in the follows during the testing.

11.7 TEST RESULTS

The power is too low, so no RF calculations are needed.