

FCC Part 15C

Measurement and Test Report

For

Emay Technology Company Limited

2907, Huafeng Bld, 6006 Shennan mid Rd, Futian District, Shenzhen, China

FCC ID: PVUSC516171

FCC Rules:	<u>FCC Part 15.247</u>
Product Description:	<u>Bluetooth Keyboard</u>
Tested Model:	<u>IMY-SC51</u>
Report No.:	<u>STR12118356I</u>
Tested Date:	<u>2012-11-26 to 2012-12-01</u>
Issued Date:	<u>2012-12-03</u>
Tested By:	<u>Jack Li / Engineer</u>
Reviewed By:	<u>Lahm Peng / EMC Manager</u>
Approved & Authorized By:	<u>Jandy so / PSQ Manager</u>
Prepared By:	SEM.Test Compliance Service Co., Ltd 3/F, Jinbao Commerce Building, Xin'an Fanshen Road, Bao'an District, Shenzhen, P.R.C. (518101) Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permission by SEM.Test Compliance Service Co., Ltd

TABLE OF CONTENTS

1. GENERAL INFORMATION	4
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
1.2 TEST STANDARDS.....	5
1.3 TEST METHODOLOGY.....	5
1.4 TEST FACILITY	5
1.5 EUT SETUP AND TEST MODE.....	6
2. SUMMARY OF TEST RESULTS	7
3. ANTENNA REQUIREMENT	8
3.1 STANDARD APPLICABLE.....	8
3.2 EVALUATION INFORMATION	8
4. FREQUENCY HOPPING SYSTEM REQUIREMENTS	9
4.1 STANDARD APPLICABLE.....	9
4.2 FREQUENCY HOPPING SYSTEM.....	9
4.3 EUT PSEUDORANDOM FREQUENCY HOPPING SEQUENCE	10
5. QUANTITY OF HOPPING CHANNELS AND CHANNEL SEPARATION	11
5.1 STANDARD APPLICABLE.....	11
5.2 TEST EQUIPMENT LIST AND DETAILS	11
5.3 TEST PROCEDURE.....	11
5.4 ENVIRONMENTAL CONDITIONS	11
5.5 SUMMARY OF TEST RESULTS/PLOTS	12
6. DWELL TIME OF HOPPING CHANNEL.....	15
6.1 STANDARD APPLICABLE.....	15
6.2 TEST EQUIPMENT LIST AND DETAILS	15
6.3 TEST PROCEDURE.....	15
6.4 ENVIRONMENTAL CONDITIONS	15
6.5 SUMMARY OF TEST RESULTS/PLOTS	16
7. 20DB BANDWIDTH	22
7.1 STANDARD APPLICABLE.....	22
7.2 TEST EQUIPMENT LIST AND DETAILS	22
7.3 TEST PROCEDURE.....	22
7.4 ENVIRONMENTAL CONDITIONS	22
7.5 SUMMARY OF TEST RESULTS/PLOTS	22
8. RF OUTPUT POWER	25
8.1 STANDARD APPLICABLE.....	25
8.2 TEST EQUIPMENT LIST AND DETAILS	25
8.3 TEST PROCEDURE.....	25
8.4 ENVIRONMENTAL CONDITIONS	25
8.5 SUMMARY OF TEST RESULTS/PLOTS	26
9. FIELD STRENGTH OF SPURIOUS EMISSIONS	27
9.1 MEASUREMENT UNCERTAINTY	27
9.2 STANDARD APPLICABLE.....	27
9.3 TEST EQUIPMENT LIST AND DETAILS	27
9.4 TEST PROCEDURE.....	28
9.5 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	28
9.6 ENVIRONMENTAL CONDITIONS	28
9.7 SUMMARY OF TEST RESULTS/PLOTS	29
10. OUT OF BAND EMISSIONS.....	39
10.1 STANDARD APPLICABLE.....	39
10.2 TEST EQUIPMENT LIST AND DETAILS	39
10.3 TEST PROCEDURE.....	39
10.4 ENVIRONMENTAL CONDITIONS	40
10.5 SUMMARY OF TEST RESULTS/PLOTS	40
11. CONDUCTED EMISSIONS	44

11.1 MEASUREMENT UNCERTAINTY	44
11.2 TEST EQUIPMENT LIST AND DETAILS	44
11.3 TEST PROCEDURE.....	44
11.4 BASIC TEST SETUP BLOCK DIAGRAM.....	44
11.5 ENVIRONMENTAL CONDITIONS	45
11.6 TEST RECEIVER SETUP	45
11.7 SUMMARY OF TEST RESULTS/PLOTS	45
11.8 CONDUCTED EMISSIONS TEST DATA.....	45

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Emay Technology Company Limited
Address of applicant: 2907, Huafeng Bld, 6006 Shennan mid Rd, Futian District, Shenzhen, China
Manufacturer: Emay Technology Company Limited
Address of manufacturer: 2907, Huafeng Bld, 6006 Shennan mid Rd, Futian District, Shenzhen, China

General Description of EUT	
Product Name:	Bluetooth keyboard
Trade Name:	N/A
Model No.:	IMY-SC51
Adding Model(s):	IMY-SC52, IMY-SC53, IMY-SC61, IMY-SC62, IMY-SC63, IMY-SC71, IMY-SC72, IMY-SC73
Rated Voltage:	DC3.7V Li-ion Bttery
Power Adapter Model:	N/A
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The other model listed in the report has different appearance only of IMY-SC51 without circuit and electronic construction changed, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Support Standards:	Bluetooth: V3.0
Frequency Range:	2402-2480MHz
RF Output Power:	-3.60dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	79
Channel Separation:	1MHz
Antenna Type:	PCB Antenna
Antenna Gain:	0 dBi
Lowest Internal Frequency of EUT:	24MHz
Device Category:	Portable Device

1.2 Test Standards

The following report is prepared on behalf of the Emay Technology Company Limited in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The public notice DA 00-705 for frequency hopping spread spectrum systems shall be performed also.

1.4 Test Facility

- **FCC – Registration No.: 994117**

SEM.Test Compliance Services Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 994117.

- **Industry Canada (IC) Registration No.: 7673A**

The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

- **CNAS Registration No.: L4062**

Shenzhen SEM.Test Electronics Service Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 3/F, Jinbao Commerce Building, Xin'an Fanshen Road, Bao'an District, Shenzhen, P.R.C (518101)

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low Channel	2402MHz
TM2	Middle Channel	2441MHz
TM3	High Channel	2480MHz
TM4	Hopping	2402-2480MHz

Modulation Configure			
Modulation	Packet	Packet Type	Packet Size
GFSK	DH1	4	27
	DH3	11	183
	DH5	15	339
Normal mode: the Bluetooth has been tested on the modulation of GFSK			

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
USB Line	1.0	Shielded	Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
PC	ASUS	X50R	74N0AS297138

2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	Compliant
§ 15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.209(a)(f)	Radiated Supirous Emissions	Compliant
§ 15.247(a)(1)(iii)	Quantity of Hopping Channel	Compliant
§ 15.247(a)(1)	Channel Separation	Compliant
§ 15.247(a)(1)(iii)	Time of Occupancy (Dwell time)	Compliant
§ 15.247(a)	20dB Bandwidth	Compliant
§ 15.247(b)(1)	Power Output	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant
§ 15.247(a)(1)	Frequency Hopping Sequence	Compliant
§ 15.247(g), (h)	Frequency Hopping System	Compliant

N/A: not applicable

3. Antenna Requirement

3.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.2 Evaluation Information

This product has a permanent antenna, fulfill the requirement of this section.

4. Frequency Hopping System Requirements

4.1 Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

4.2 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with an bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements for DA 00-705 and FCC Part 15.247 rule.

4.3 EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:

Channel: 08, 24, 40, 56, 40, 56, 72, 09, 01, 09, 33, 41, 33, 41, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 42, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 55, 71, 08, 24, 08, 24, 40, 56, 40, 48, 72, 01, 72, 01, 25, 33, 12, 28, 44, 60, 42, 58, 74, 11, 05, 13, 37, 45 etc.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

5. Quantity of Hopping Channels and Channel Separation

5.1 Standard Applicable

According to FCC 15.247(a)(1), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, and frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

5.3 Test Procedure

According to the DA 00-705, the number of hopping frequencies test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = the frequency band of operation (2400MHz to 2483.5MHz)

RBW = 100kHz, VBW = 100kHz

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize, observed the band of 2400MHz to 2483.5MHz, than count it out the number of channels for comparing with the FCC rules.

The channel spacing test method as follows:

Set span = wide enough to capture the peaks of two adjacent channels

Other setting as above

Allow the trace to stabilize, Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

5.4 Environmental Conditions

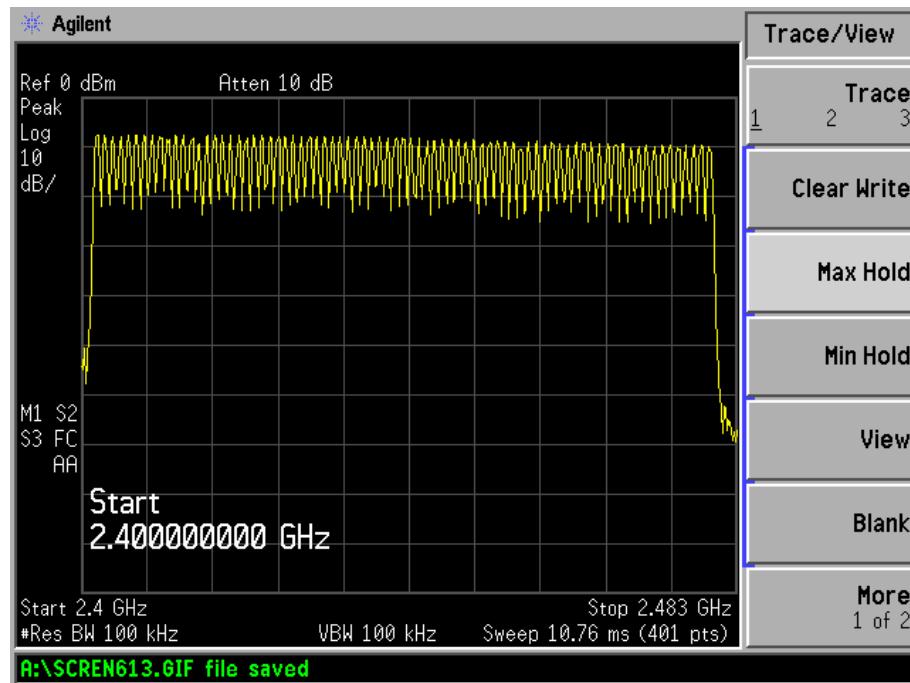
Temperature:	24 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.5 Summary of Test Results/Plots

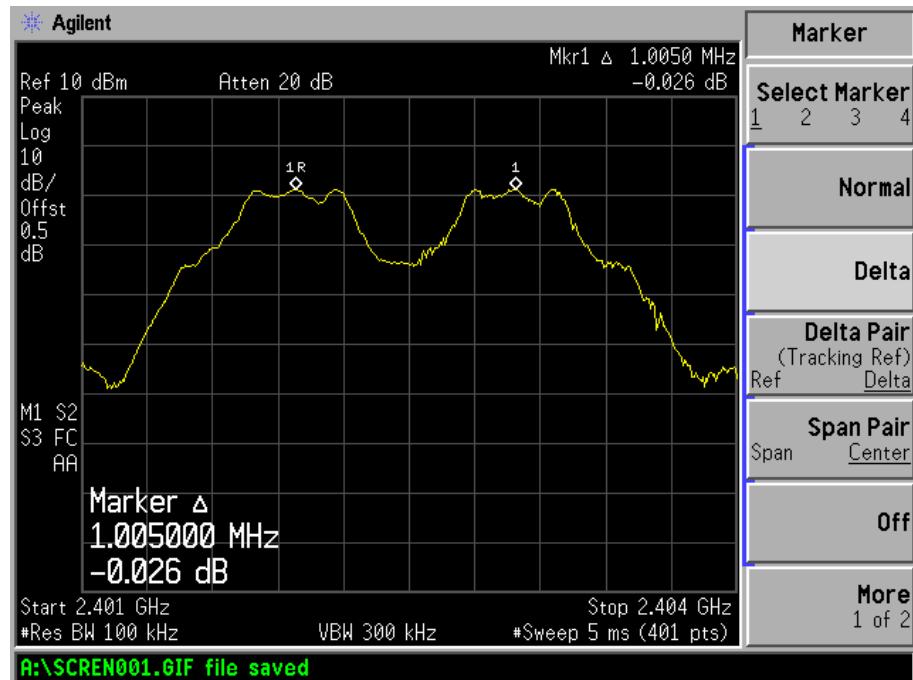
Test mode: GFSK DH5

No. of Channel = 79

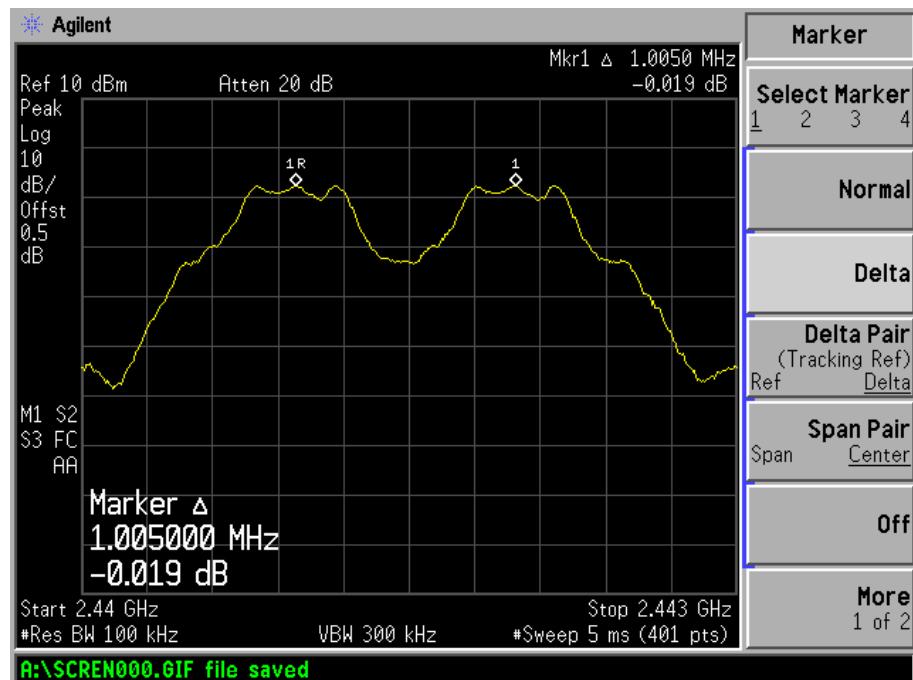
2402-2480MHz



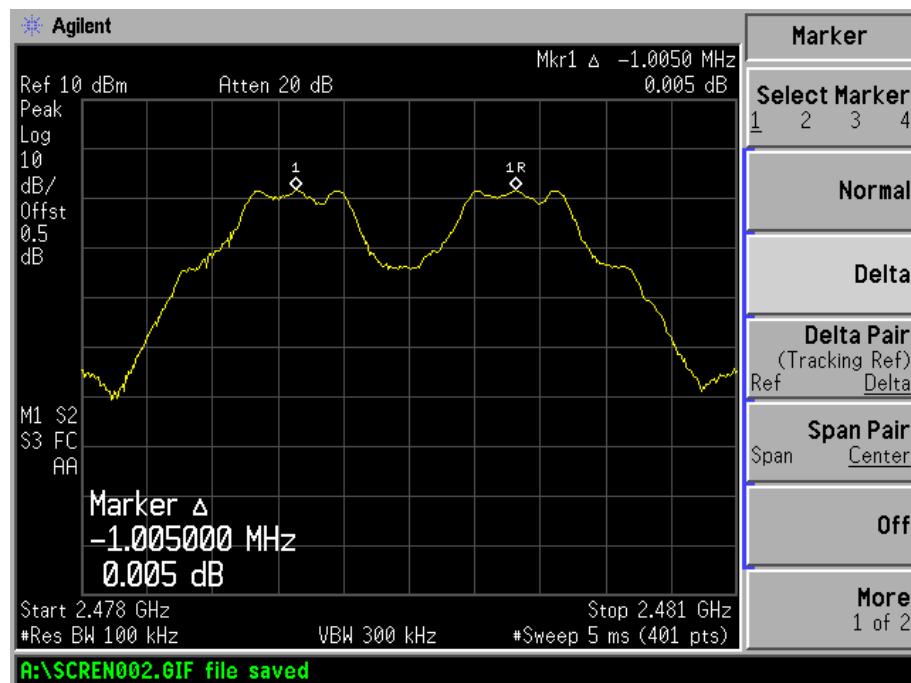
Channel Spacing (Low CH=1MHz)



Channel Spacing (Middle CH=1MHz)



Channel Spacing (High CH=1MHz)



6. Dwell Time of Hopping Channel

6.1 Standard Applicable

According to 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

6.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

6.3 Test Procedure

According to the DA 00-705, the dwell time of a hopping channel test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = zero span, centered on a hopping channel

RBW = 1MHz, VBW = 1MHz

Sweep = auto

Detector function = peak

Trace = max hold

Use the marker-delta function to determine the dwell time

6.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

6.5 Summary of Test Results/Plots

The dwell time within a period in data mode is independent from the packet type (packet length). Test data is corrected with the worse case, which the packet length is DH1, DH3, DH5.

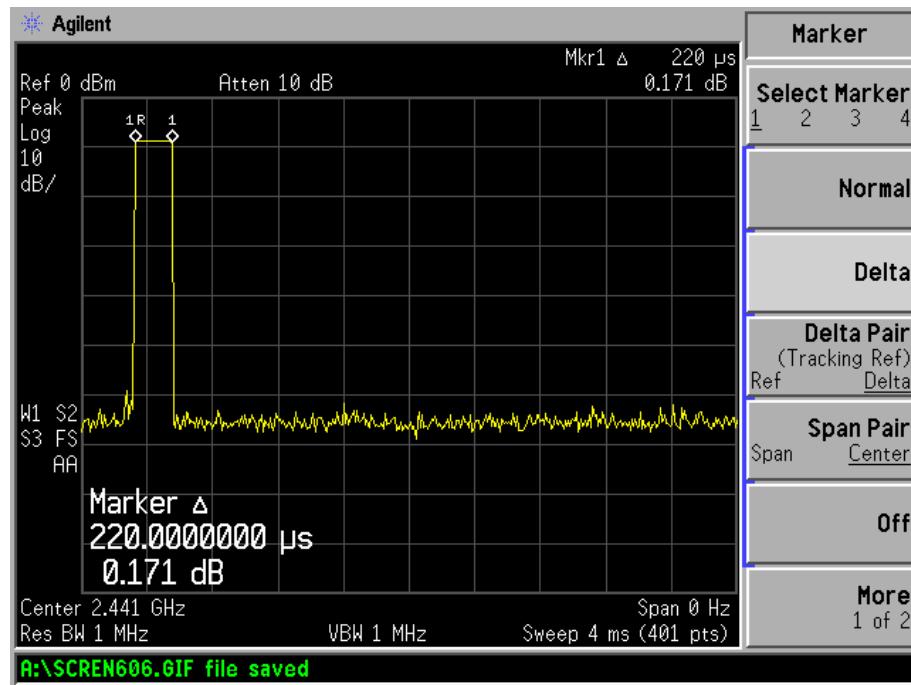
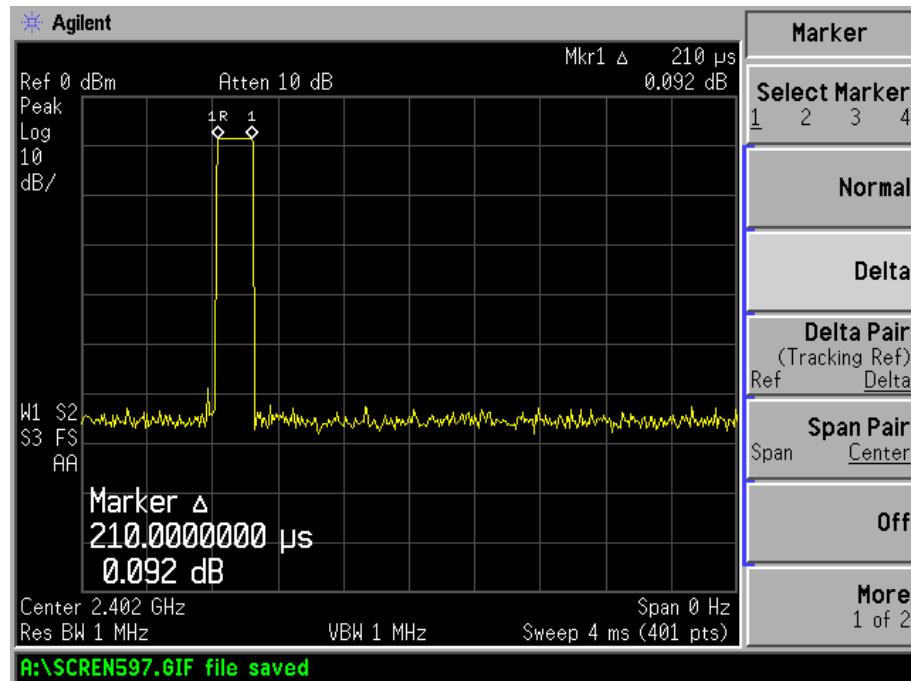
The test period: $T = 0.4 \text{ Second} * 79 \text{ Channel} = 31.6 \text{ s}$

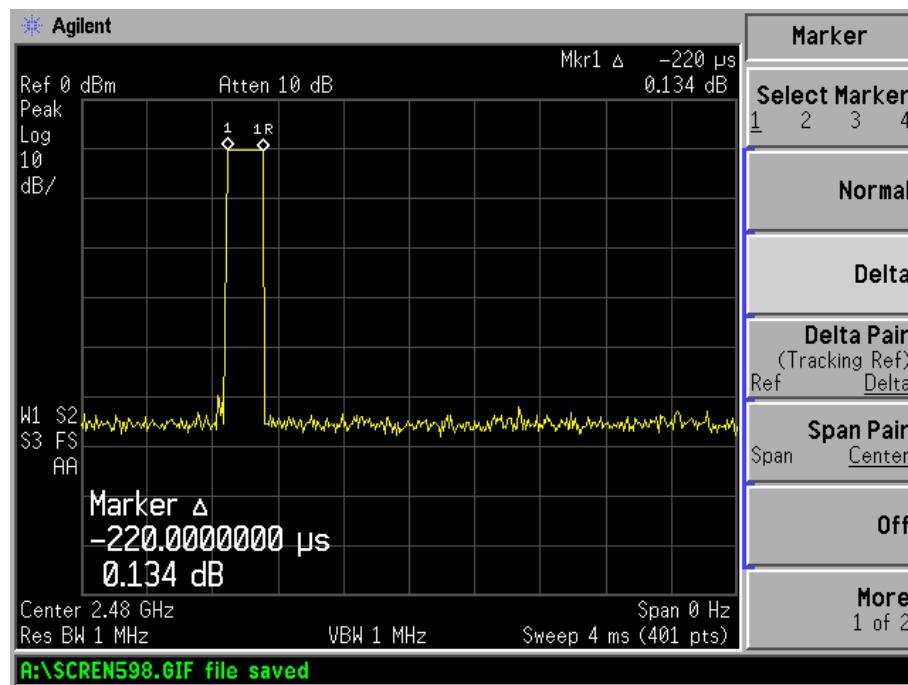
Dwell time = time slot length * (Hopping rate / Number of hopping channels) * Period

Modulation	Test Channel	Packet	Time Slot Length	Dwell Time	Limit
			ms	ms	ms
GFSK	2402MHz	DH1	0.21	67.200	400
		DH3	0.21	33.600	400
		DH5	0.21	22.400	400
	2441MHz	DH1	0.22	70.400	400
		DH3	0.22	35.200	400
		DH5	0.22	23.467	400
	2480MHz	DH1	0.22	70.400	400
		DH3	0.22	35.200	400
		DH5	0.22	23.467	400

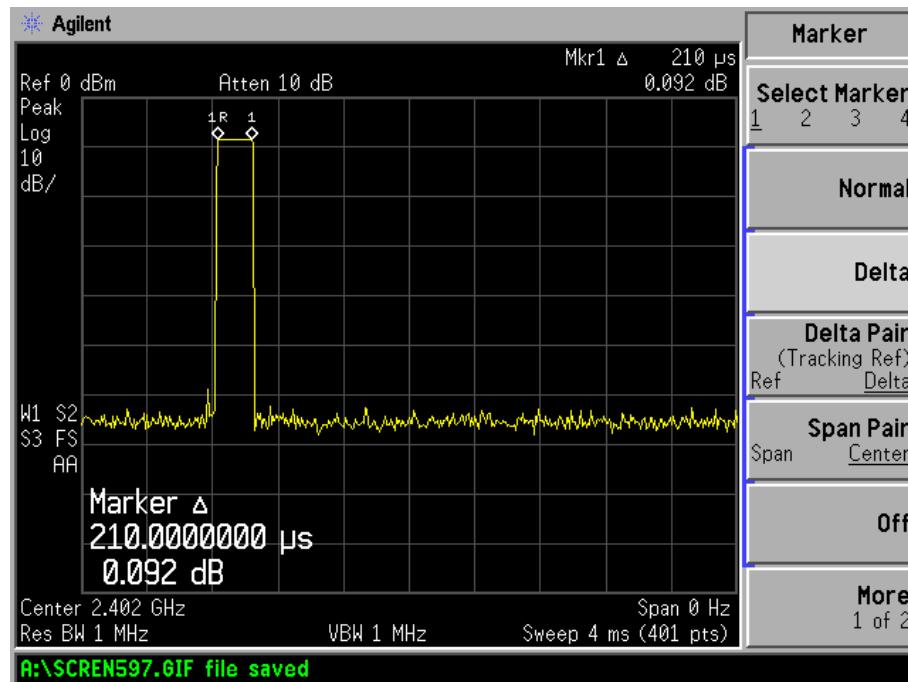
Please refer to the test plots as below:

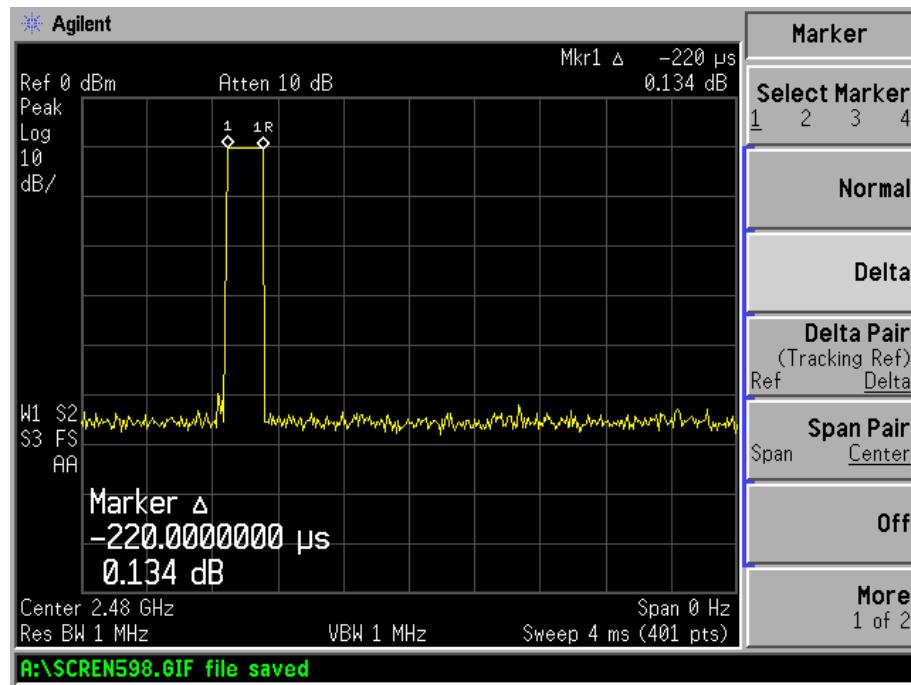
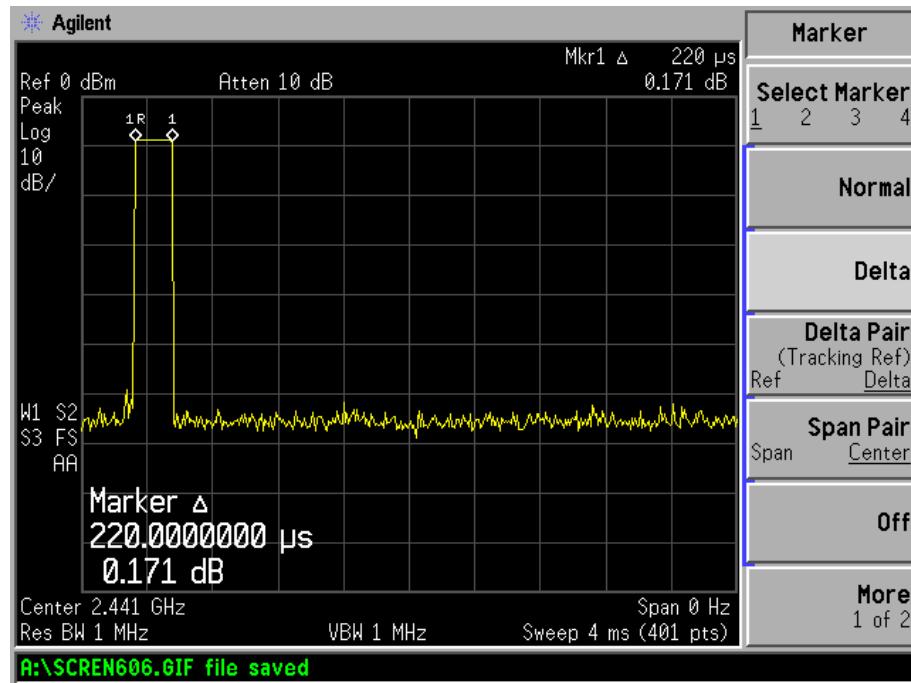
DH1 time slot (Low, Middle, High Channels)



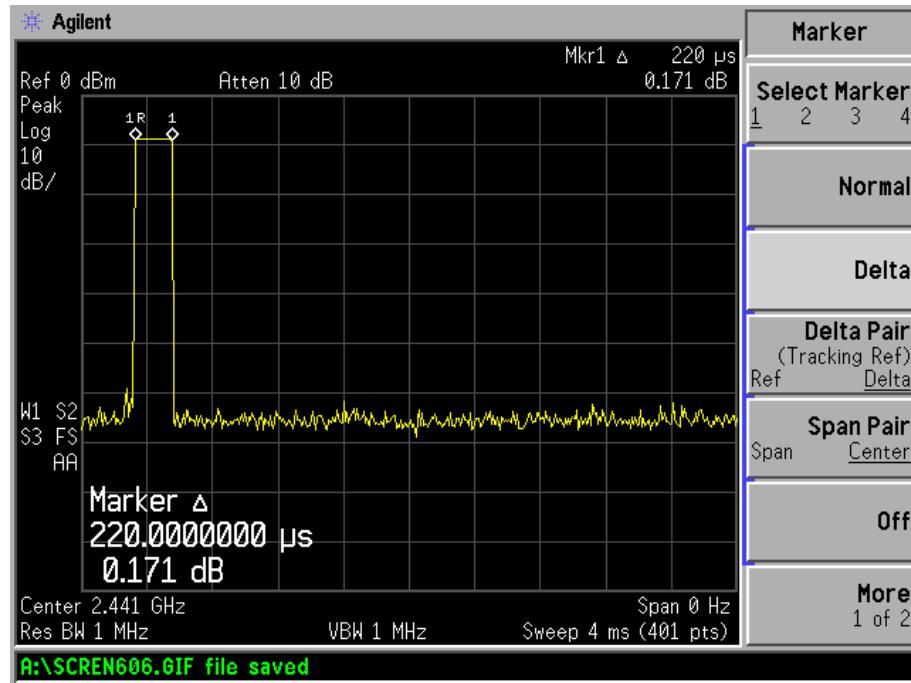
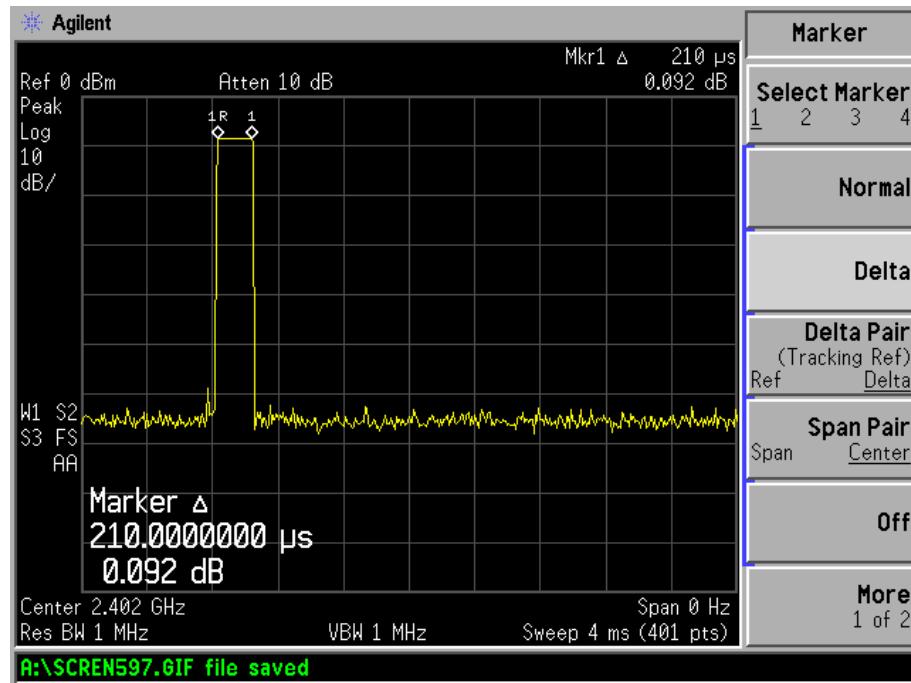


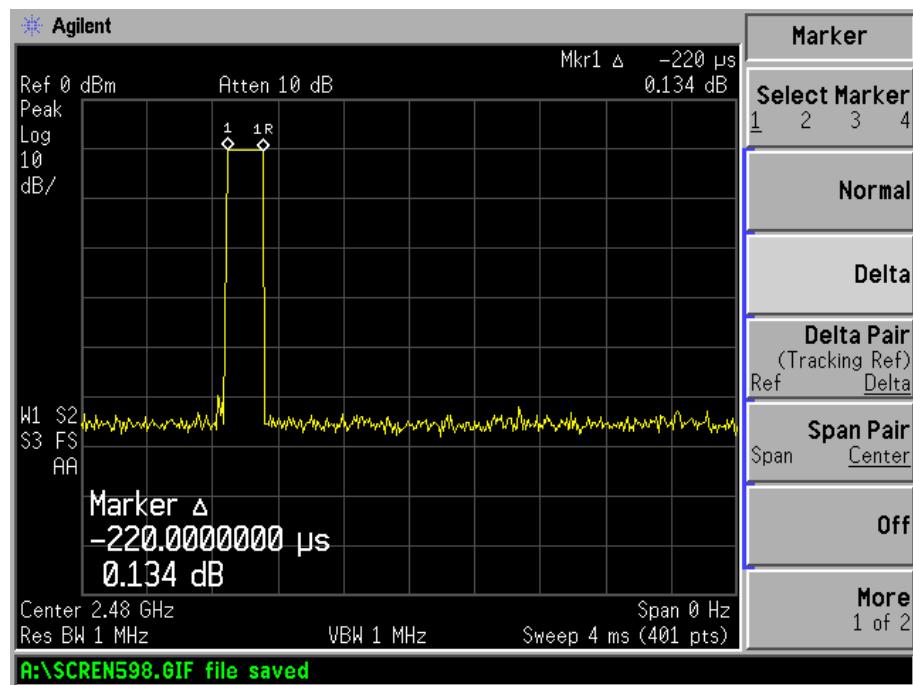
DH3 time slot (Low, Middle, High Channels)





DH5 time slot (Low, Middle, High Channels)





7. 20dB Bandwidth

7.1 Standard Applicable

According to 15.247(a)(1)(iii). For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

7.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

7.3 Test Procedure

According to the DA 00-705, the 20dB bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 2MHz, centered on a hopping channel

RBW \geq 1% 20dB Bandwidth, VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down bandwidth of the emission.

7.4 Environmental Conditions

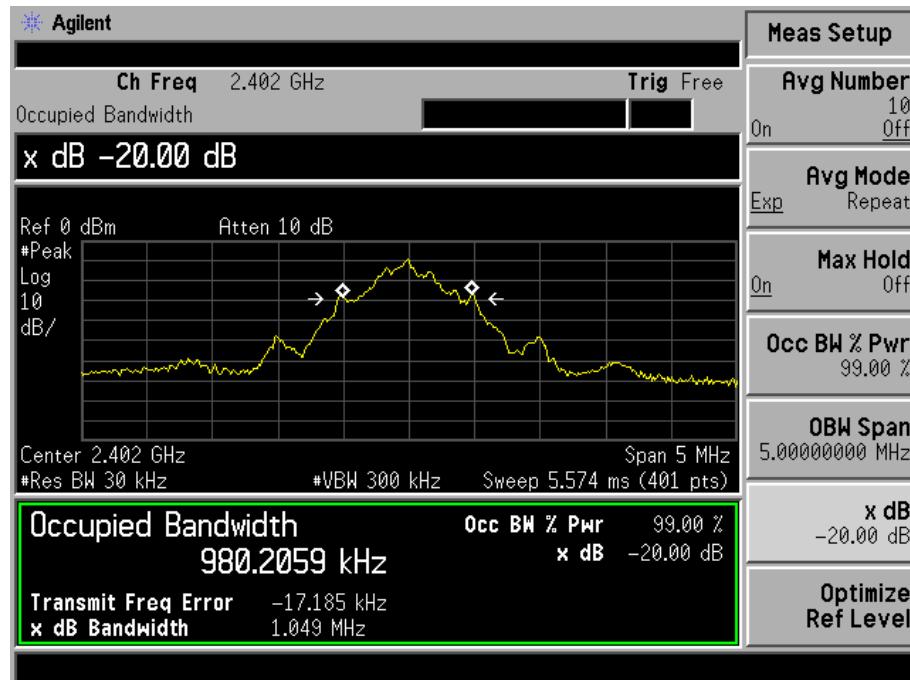
Temperature:	25 °C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

7.5 Summary of Test Results/Plots

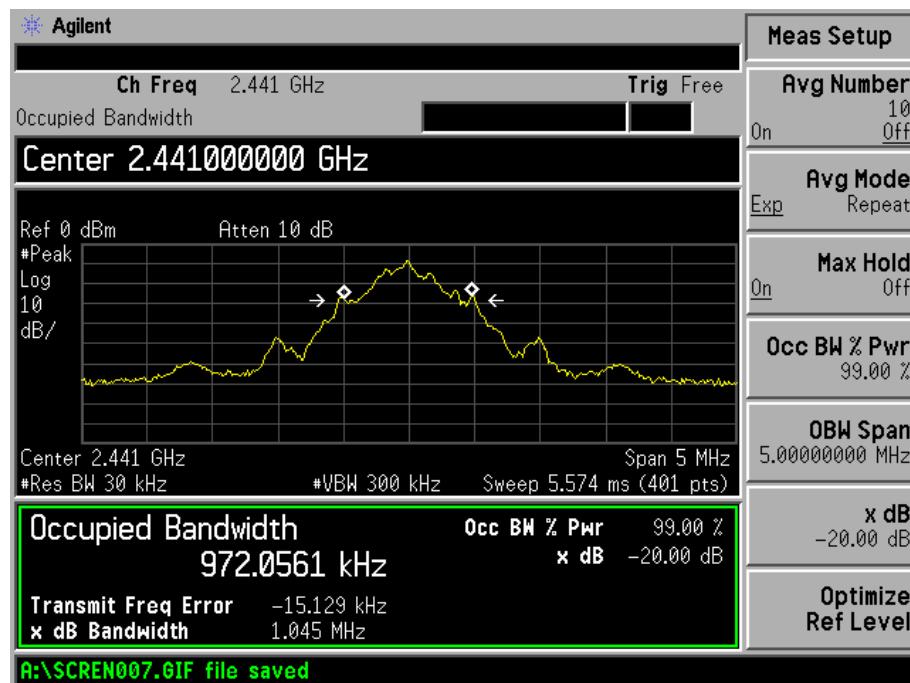
Channel	Frequency MHz	20dB Bandwidth (GFSK) kHz	20dB Bandwidth (8DPSK) kHz
Low Channel	2402	1049	/
Middle Channel	2441	1045	/
High Channel	2480	1044	/

GFSK Mode

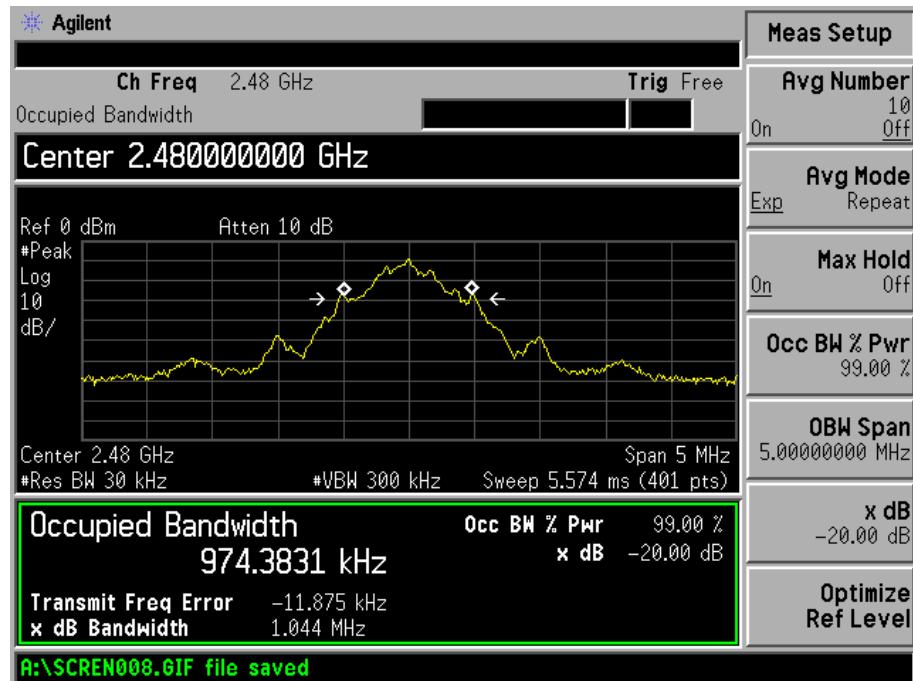
Low Channel:



Middle Channel:



High Channel:



8. RF Output Power

8.1 Standard Applicable

According to 15.247(b)(1). For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

8.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

8.3 Test Procedure

According to the DA 00-705, the peak output power test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 5MHz, centered on a hopping channel

RBW = 1MHz, VBW = 1MHz

Sweep = auto

Detector function = peak

Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, the indicated level is the peak output power (the external attenuation and cable loss shall be considered).

8.4 Environmental Conditions

Temperature:	24 °C
Relative Humidity:	55%
ATM Pressure:	1011 mbar

8.5 Summary of Test Results/Plots

DH5(GFSK)

Channel	Frequency MHz	Measured Value dBm	Output Power mW	Limit mW
Low Channel	2402	-3.601	0.4364	1000
Middle Channel	2441	-3.980	0.3999	1000
High Channel	2480	-5.310	0.2944	1000

Note: the antenna gain of 0dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.

9. Field Strength of Spurious Emissions

9.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is ± 5.10 dB.

9.2 Standard Applicable

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

9.3 Test Equipment List and Details

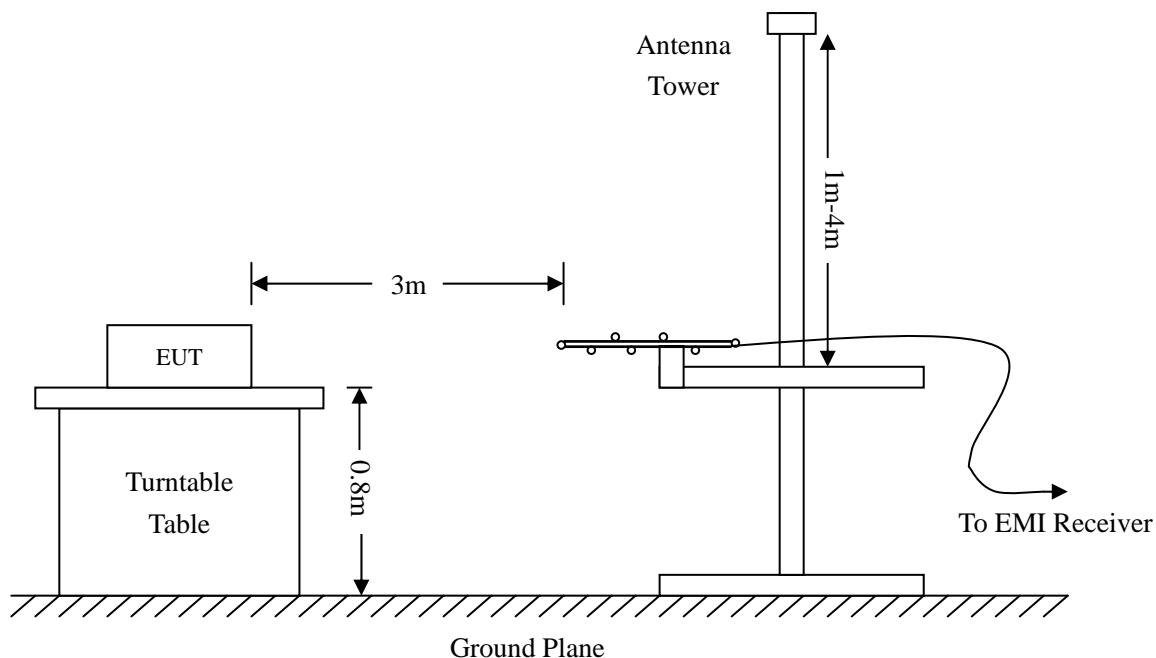
Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2012-03-28	2013-03-27
EMI Test Receiver	R&S	ESVB	825471/005	2012-03-28	2013-03-27
Pre-amplifier	Agilent	8447F	3113A06717	2012-03-28	2013-03-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2012-03-28	2013-03-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2012-02-25	2013-02-24
Horn Antenna	ETS	3117	00086197	2012-02-25	2013-02-24
Horn Antenna	ETS	3116B	00088203	2012-02-25	2013-02-24
Loop Antenna	SCHWARZECK	HFRA 5165	9365	2012-02-25	2013-02-24

9.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



9.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB μ V means the emission is 6dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

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

9.6 Environmental Conditions

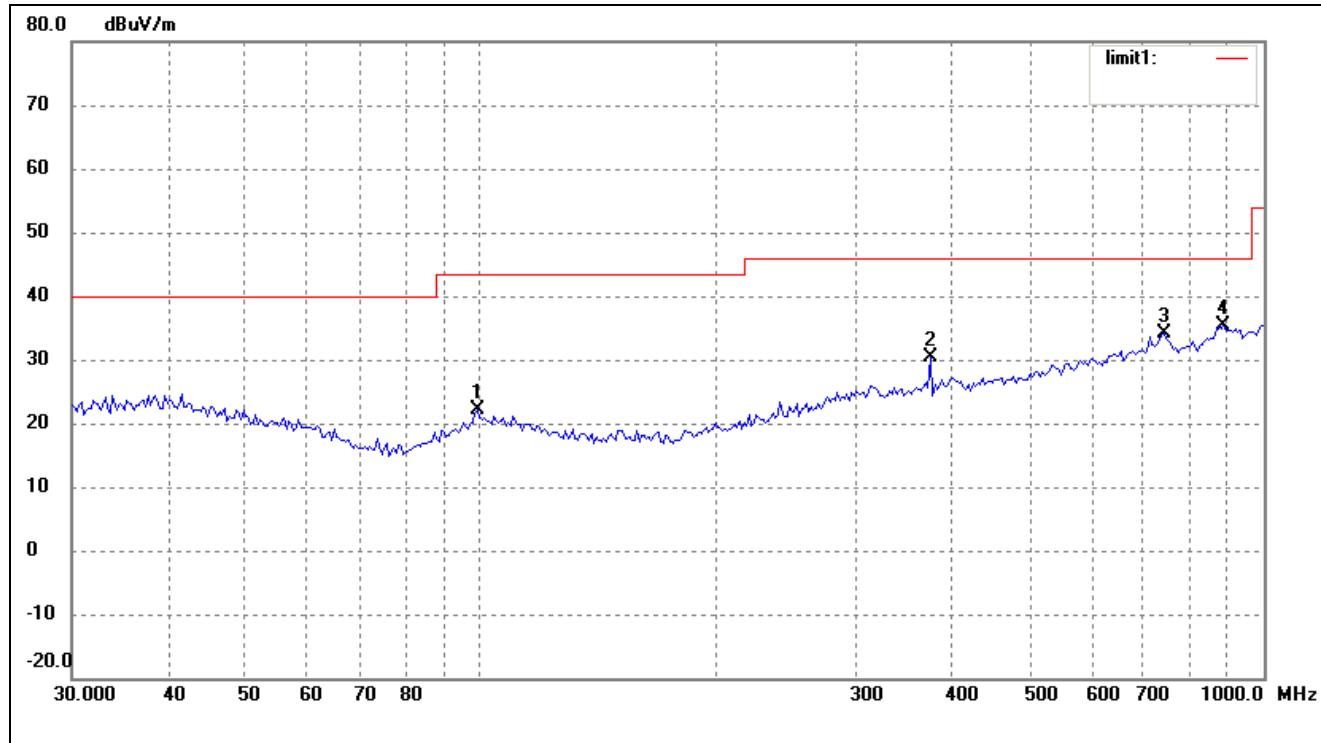
Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

9.7 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst margin of:

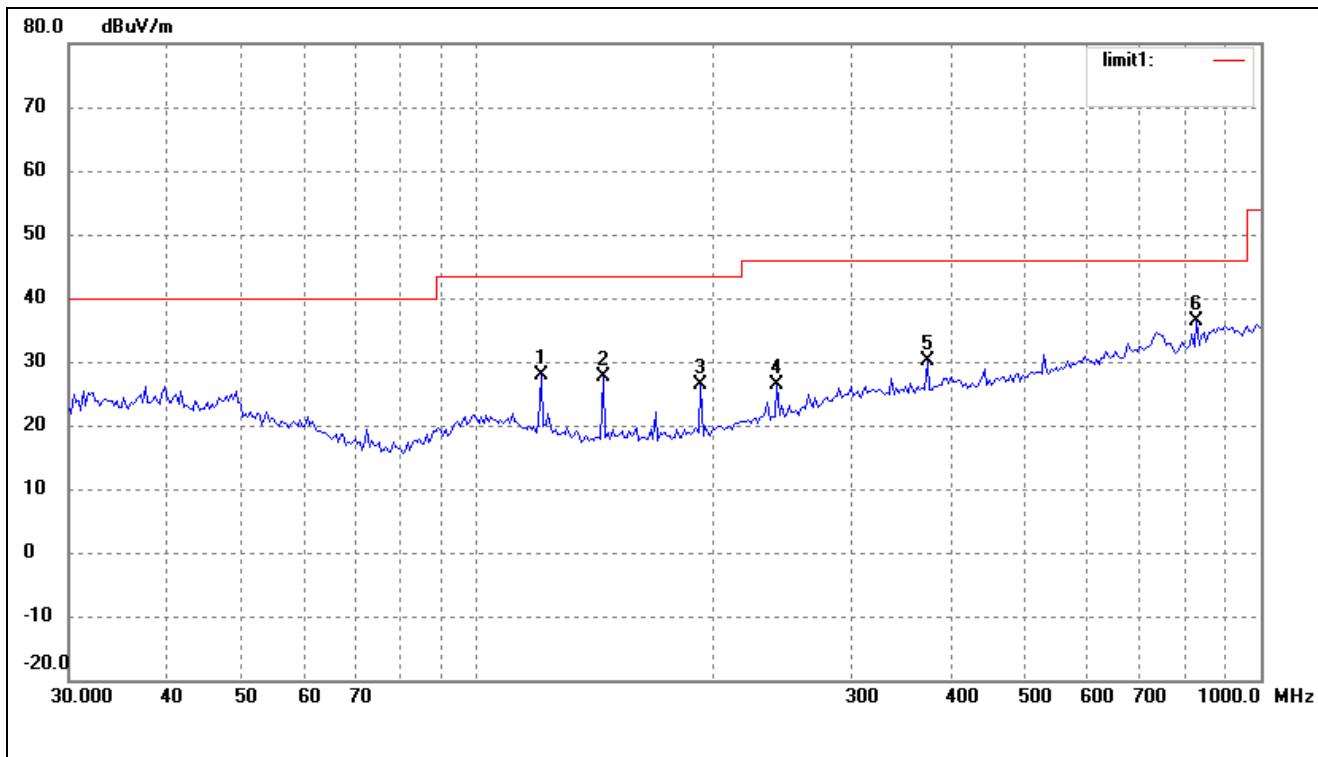
-9.67 dB μ V at 827.4934 MHz in the **Vertical** polarization for **Charging Mode, 9 kHz to 1 GHz, 3 Meters**
-3.26 dB μ V at 144.3348 MHz in the **Vertical** polarization for **Middle Channel, 9kHz to 25 GHz, 3 Meters**

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

Plot of Radiated Emissions Test Data (30MHz to 1GHz)EUT: *Bluetooth keyboard*Tested Model: *IMY-SC51*Operating Condition: *Charging*Comment: *DC5V USB*Test Specification: *Horizontal*

No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	98.8326	15.47	6.55	22.02	43.50	-21.48	360	100	peak
2	374.6225	19.75	10.64	30.39	46.00	-15.61	360	100	peak
3	744.8661	16.14	17.94	34.08	46.00	-11.92	360	100	peak
4	887.6099	16.25	19.15	35.40	46.00	-10.60	360	100	peak

Test Specification: Vertical

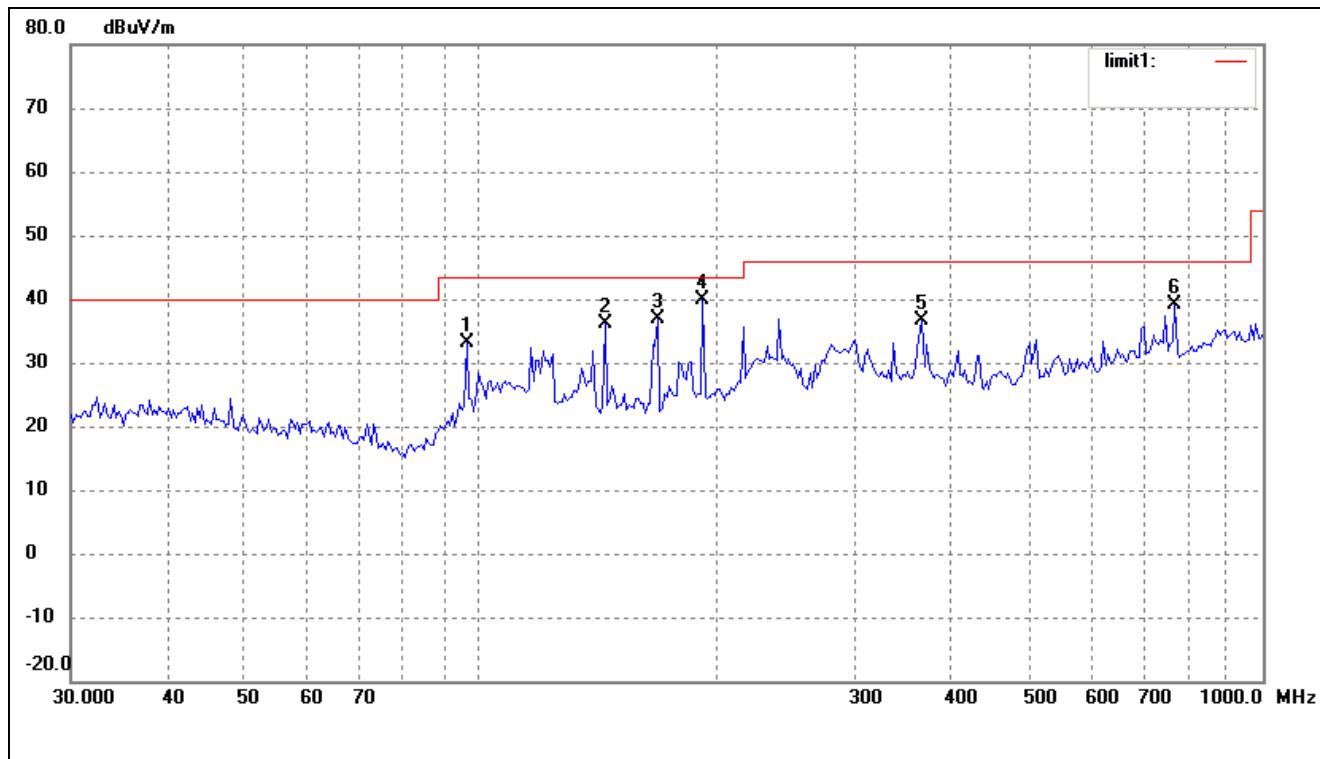


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	120.2766	23.00	4.85	27.85	43.50	-15.65	360	100	peak
2	144.3348	24.14	3.46	27.60	43.50	-15.90	360	100	peak
3	192.4186	22.19	4.31	26.50	43.50	-17.00	360	100	peak
4	240.8304	19.25	7.02	26.27	46.00	-19.73	360	100	peak
5	374.6225	19.45	10.64	30.09	46.00	-15.91	360	100	peak
6	827.4934	19.35	16.98	36.33	46.00	-9.67	360	100	peak

Operating Condition: Transmitting Low Channel (2402MHz)

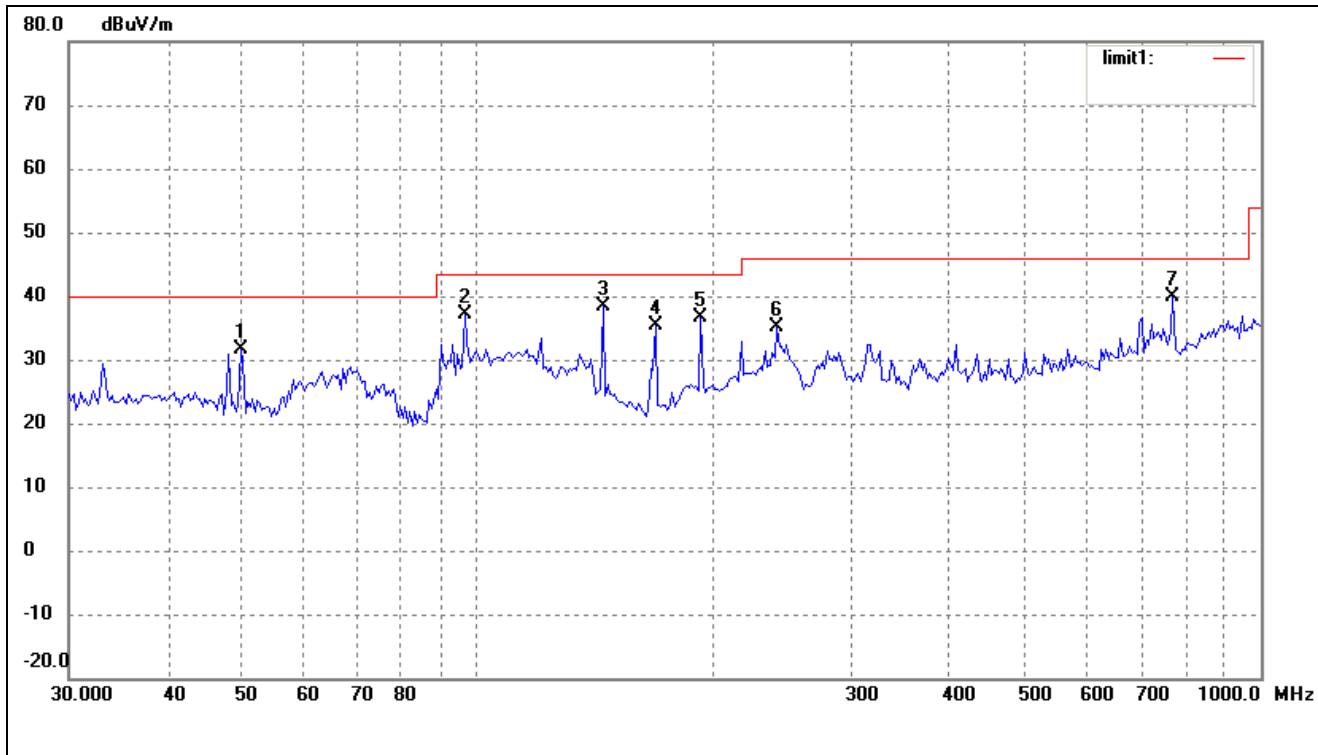
Comment:

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	96.0986	27.30	5.87	33.17	43.50	-10.33	360	100	peak
2	144.3348	32.69	3.46	36.15	43.50	-7.35	360	100	peak
3	168.4138	33.21	3.69	36.90	43.50	-6.60	360	100	peak
4	192.4186	35.63	4.31	39.94	43.50	-3.56	360	100	peak
5	366.8231	26.01	10.67	36.68	46.00	-9.32	360	100	peak
6	771.4486	22.81	16.37	39.18	46.00	-6.82	360	100	peak

Test Specification: Vertical

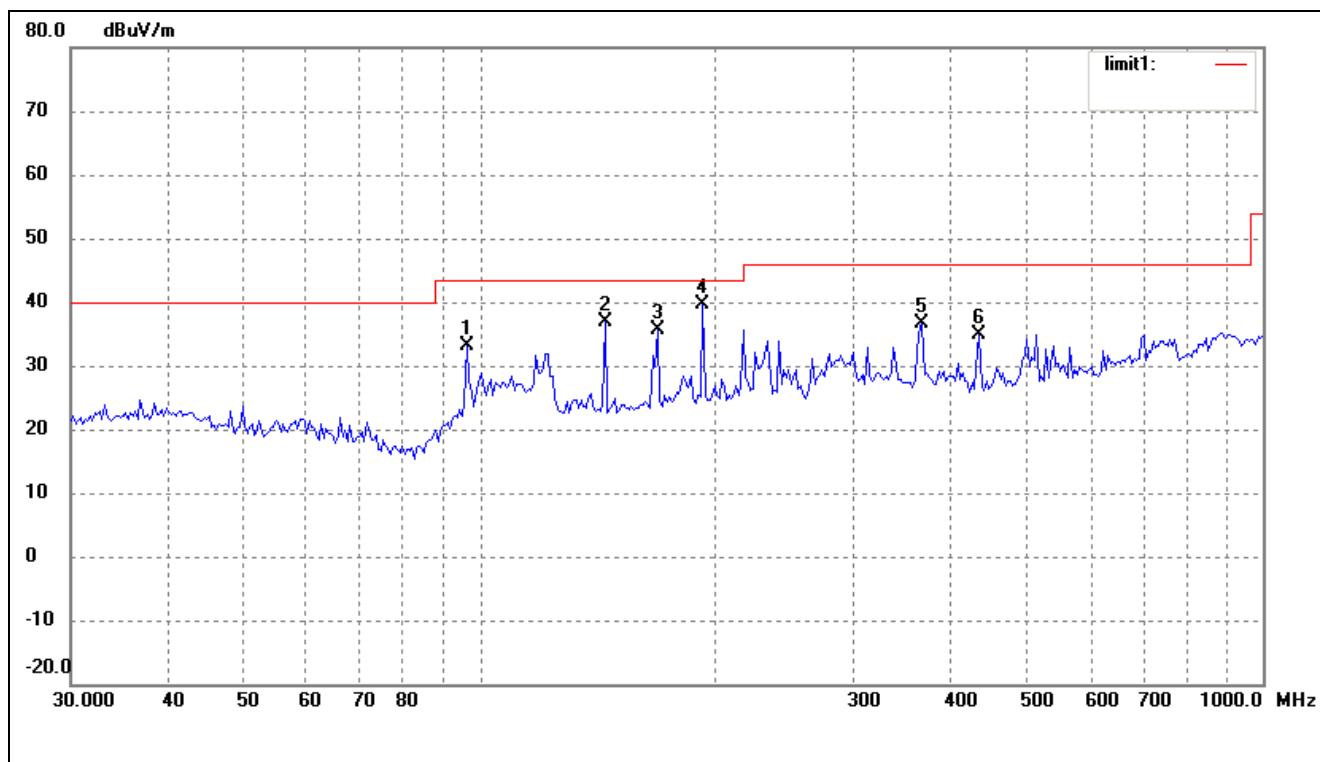


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	49.7068	24.82	6.70	31.52	40.00	-8.48	360	100	peak
2	96.0986	31.14	5.87	37.01	43.50	-6.49	360	100	peak
3	144.3348	34.81	3.46	38.27	43.50	-5.23	360	100	peak
4	168.4138	31.58	3.69	35.27	43.50	-8.23	360	100	peak
5	192.4186	32.27	4.31	36.58	43.50	-6.92	360	100	peak
6	240.8304	28.05	7.02	35.07	46.00	-10.93	360	100	peak
7	771.4486	23.45	16.37	39.82	46.00	-6.18	360	100	peak

Operating Condition: Transmitting Middle Channel (2441MHz)

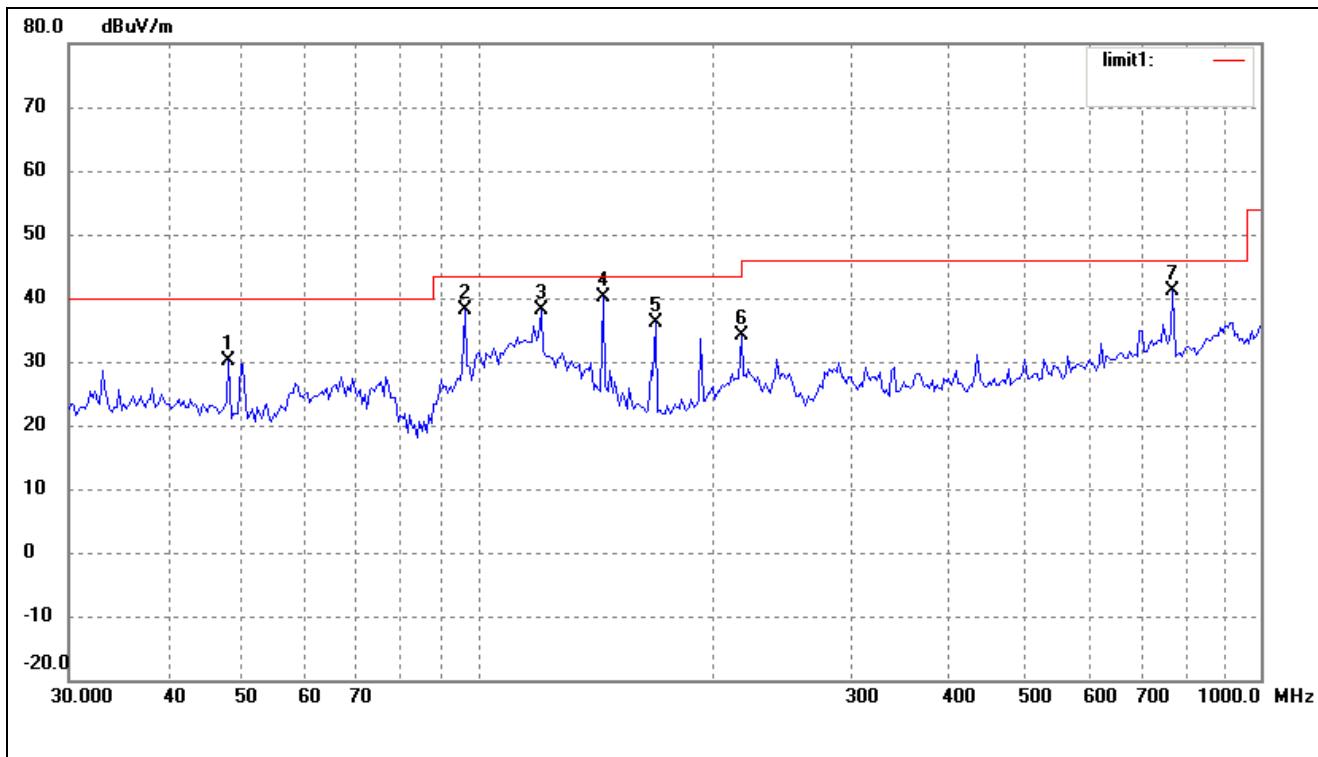
Comment:

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	96.0986	27.35	5.87	33.22	43.50	-10.28	360	100	peak
2	144.3348	33.52	3.46	36.98	43.50	-6.52	360	100	peak
3	168.4138	31.97	3.69	35.66	43.50	-7.84	360	100	peak
4	192.4186	35.26	4.31	39.57	43.50	-3.93	360	100	peak
5	366.8231	25.96	10.67	36.63	46.00	-9.37	360	100	peak
6	434.0651	23.85	11.10	34.95	46.00	-11.05	360	100	peak

Test Specification: Vertical

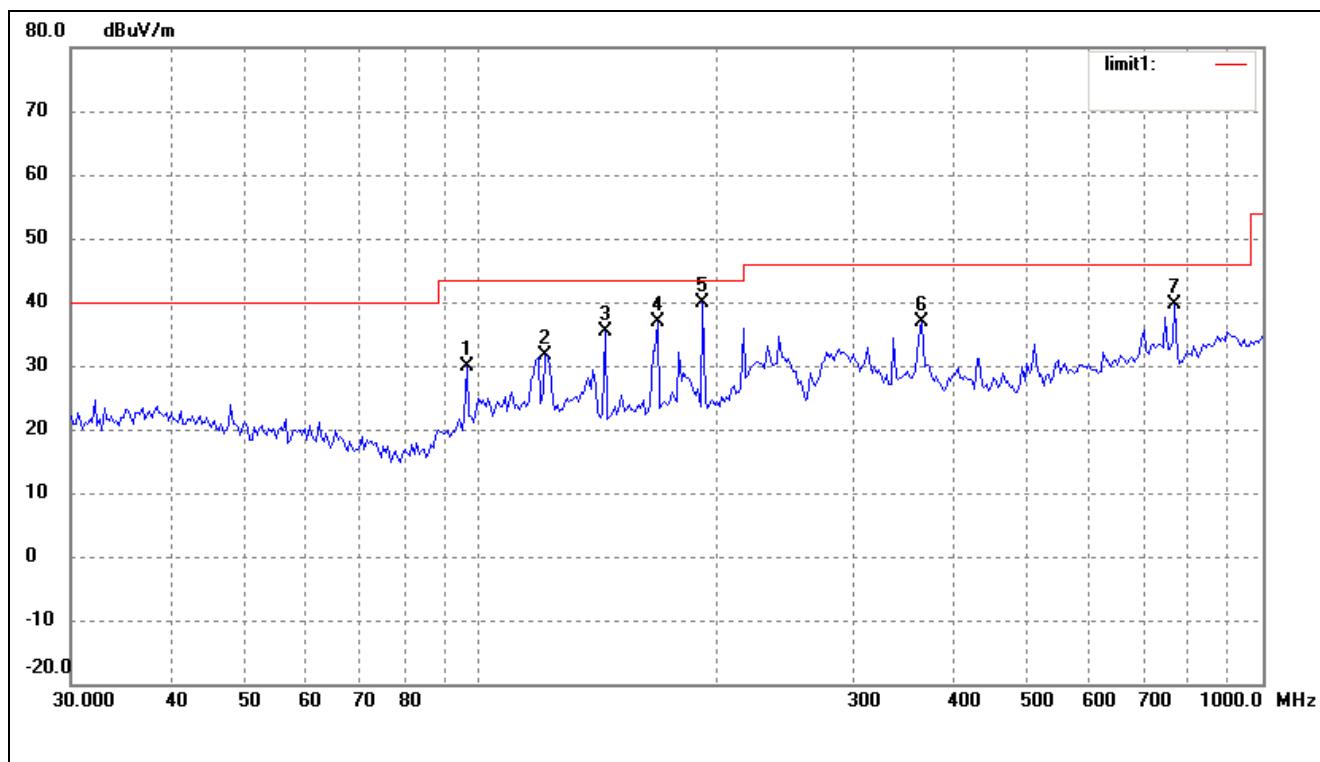


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	47.9940	22.95	7.23	30.18	40.00	-9.82	360	100	peak
2	96.0986	32.36	5.87	38.23	43.50	-5.27	360	100	peak
3	120.2766	33.38	4.85	38.23	43.50	-5.27	360	100	peak
4	144.3348	36.78	3.46	40.24	43.50	-3.26	360	100	peak
5	168.4138	32.48	3.69	36.17	43.50	-7.33	360	100	peak
6	216.7828	28.52	5.72	34.24	46.00	-11.76	360	100	peak
7	771.4486	24.67	16.37	41.04	46.00	-4.96	360	100	peak

Operating Condition: Transmitting High Channel (2480MHz)

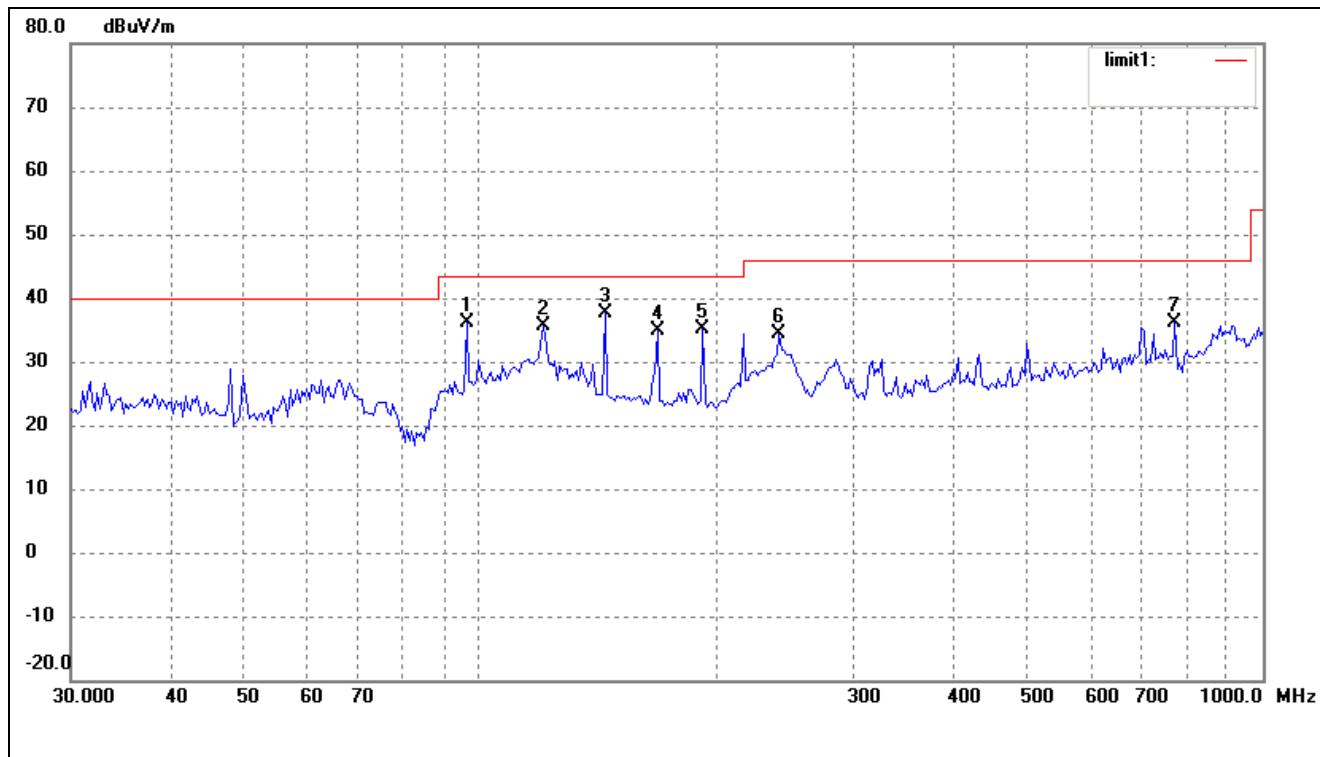
Comment:

Test Specification: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	(•)	(cm)	
1	96.0986	24.04	5.87	29.91	43.50	-13.59	360	100	peak
2	121.1231	26.93	4.78	31.71	43.50	-11.79	360	100	peak
3	144.3348	31.88	3.46	35.34	43.50	-8.16	360	100	peak
4	168.4138	33.09	3.69	36.78	43.50	-6.72	360	100	peak
5	192.4186	35.63	4.31	39.94	43.50	-3.56	360	100	peak
6	366.8231	26.18	10.67	36.85	46.00	-9.15	360	100	peak
7	771.4486	23.33	16.37	39.70	46.00	-6.30	360	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (•)	Height (cm)	Remark
1	96.0986	30.33	5.87	36.20	43.50	-7.30	360	100	peak
2	120.2766	30.89	4.85	35.74	43.50	-7.76	360	100	peak
3	144.3348	34.05	3.46	37.51	43.50	-5.99	360	100	peak
4	168.4138	31.26	3.69	34.95	43.50	-8.55	360	100	peak
5	192.4186	30.84	4.31	35.15	43.50	-8.35	360	100	peak
6	240.8304	27.30	7.02	34.32	46.00	-11.68	360	100	peak
7	771.4486	19.69	16.37	36.06	46.00	-9.94	360	100	peak

Spurious Emissions Above 1GHz

Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar H/V	Detector
Low Channel-2402MHz							
4804.000	45.62	-3.94	41.68	74.00	-32.32	H	PK
4832.823	35.15	-3.85	31.30	54.00	-22.70	H	AV
7192.335	34.41	0.94	35.35	54.00	-18.65	H	PK
7206.000	45.48	1.00	46.48	74.00	-27.52	H	AV
4804.000	46.12	-3.94	42.18	74.00	-31.82	V	PK
4832.823	35.22	-3.85	31.37	54.00	-22.63	V	AV
7206.000	46.58	1.00	47.58	74.00	-26.42	V	PK
7264.181	34.57	1.26	35.83	54.00	-18.17	V	AV
Middle Channel-2441MHz							
4882.000	46.92	-3.71	43.21	74.00	-30.79	H	PK
4929.857	35.29	-3.57	31.72	54.00	-22.28	H	AV
7323.000	46.65	1.52	48.17	74.00	-25.83	H	PK
7373.297	34.86	1.74	36.60	54.00	-17.40	H	AV
4882.000	46.64	-3.71	42.93	74.00	-31.07	V	PK
4929.857	35.45	-3.57	31.88	54.00	-22.12	V	AV
7323.000	46.30	1.52	47.82	74.00	-26.18	V	PK
7336.744	34.91	1.59	36.50	54.00	-17.50	V	AV
High Channel-2480MHz							
4960.000	46.01	-3.48	42.53	74.00	-31.47	H	PK
4979.103	34.36	-3.43	30.93	54.00	-23.07	H	AV
7410.032	35.40	1.91	37.31	54.00	-16.69	H	PK
7440.000	46.84	2.04	48.88	74.00	-25.12	H	AV
4960.000	46.52	-3.48	43.04	74.00	-30.96	V	PK
4979.103	34.43	-3.43	31.00	54.00	-23.00	V	AV
7440.000	46.90	2.04	48.94	74.00	-25.06	V	PK
7446.950	35.20	2.07	37.27	54.00	-16.73	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz are not recorded.

10. Out of Band Emissions

10.1 Standard Applicable

According to §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

10.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2012-03-28	2013-03-27
EMI Test Receiver	R&S	ESVB	825471/005	2012-03-28	2013-03-27
Pre-amplifier	Agilent	8447F	3113A06717	2012-03-28	2013-03-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2012-03-28	2013-03-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2012-02-25	2013-02-24
Horn Antenna	ETS	3117	00086197	2012-02-25	2013-02-24
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

10.3 Test Procedure

According to the DA 00-705, the band-edge radiated test method as follows.

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2410MHz for low bandedge, 2470MHz to 2500MHz for the high bandedge)

RBW = 1MHz, VBW = 1MHz for peak value measured

RBW = 1MHz, VBW = 10Hz for average value measured

Sweep = auto; Detector function = peak; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205.

According to the DA 00-705, the band-edge conducted test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2380MHz to 2410MHz for low bandedge, 2470MHz to 2500MHz for the high bandedge)

RBW = 100kHz, VBW = 300kHz

Sweep = auto; Detector function = peak; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the limit specified in this section (at least 20dB attenuation).

10.4 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

10.5 Summary of Test Results/Plots

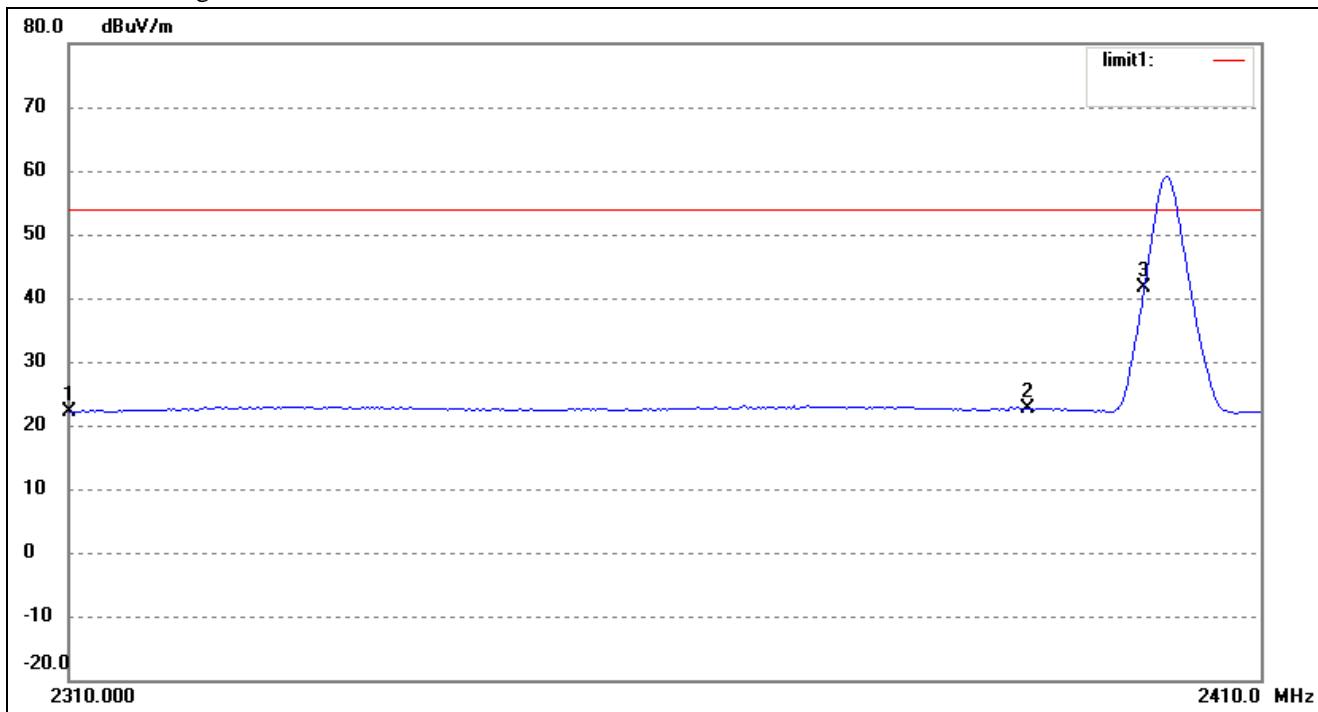
Test mode	Frequency	Limit	Result
	MHz	dBuV / dBc	
Lowest	2310.00	<54 dBuV	Pass
	2390.00	<54 dBuV	Pass
	2400.00	<54 dBuV	Pass
Highest	2483.50	<54 dBuV	Pass
	2500.00	<54 dBuV	Pass

The edge emissions are below the FCC 15.209 Limits or complies with the 15.247(d) requirements.

Please refer to the test plots as below.

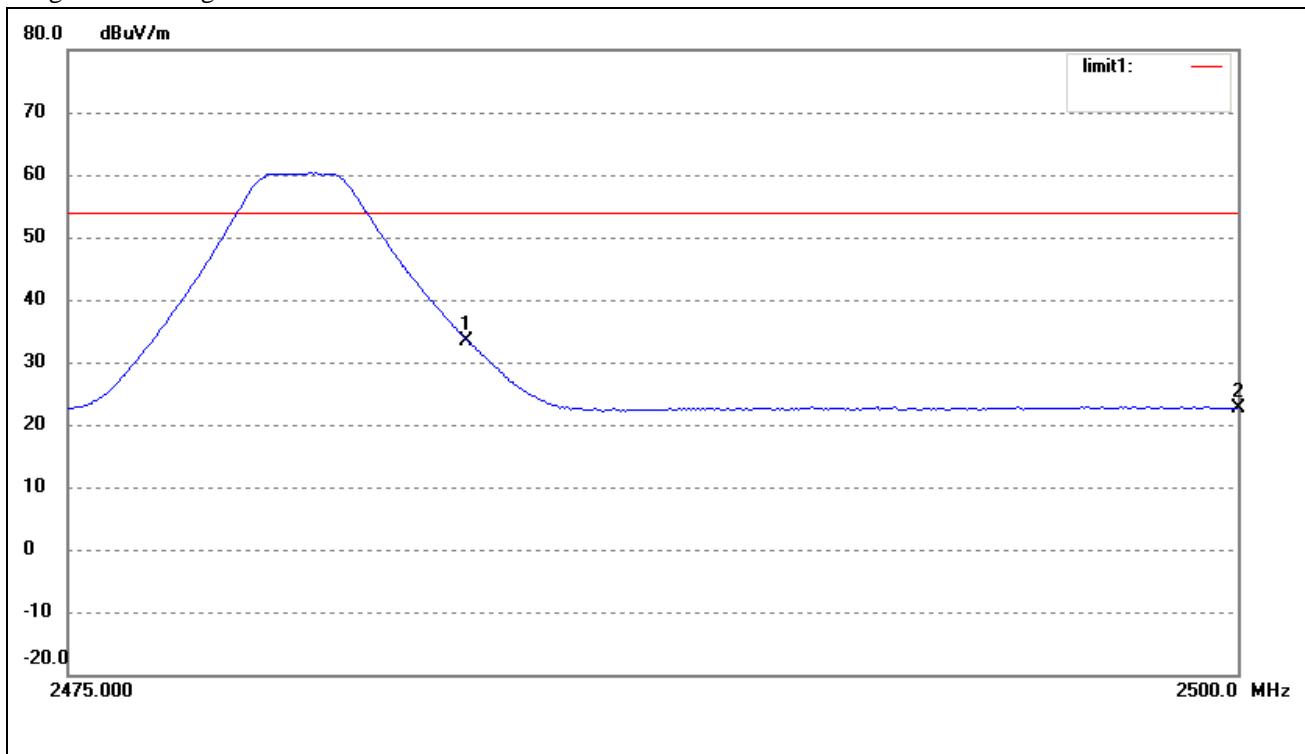
Bandedge (Radiated)

Lowest Bandedge



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	33.89	-11.72	22.17	54.00	-31.83	Average Detector
	2310.000	47.74	-11.72	36.02	74.00	-37.98	Peak Detector
2	2390.000	34.34	-11.75	22.59	54.00	-31.41	Average Detector
	2390.000	48.26	-11.75	36.51	74.00	-37.49	Peak Detector
3	2400.000	53.35	-11.75	41.60	54.00	-12.40	Average Detector
	2400.000	63.82	-11.75	52.07	74.00	-21.93	Peak Detector

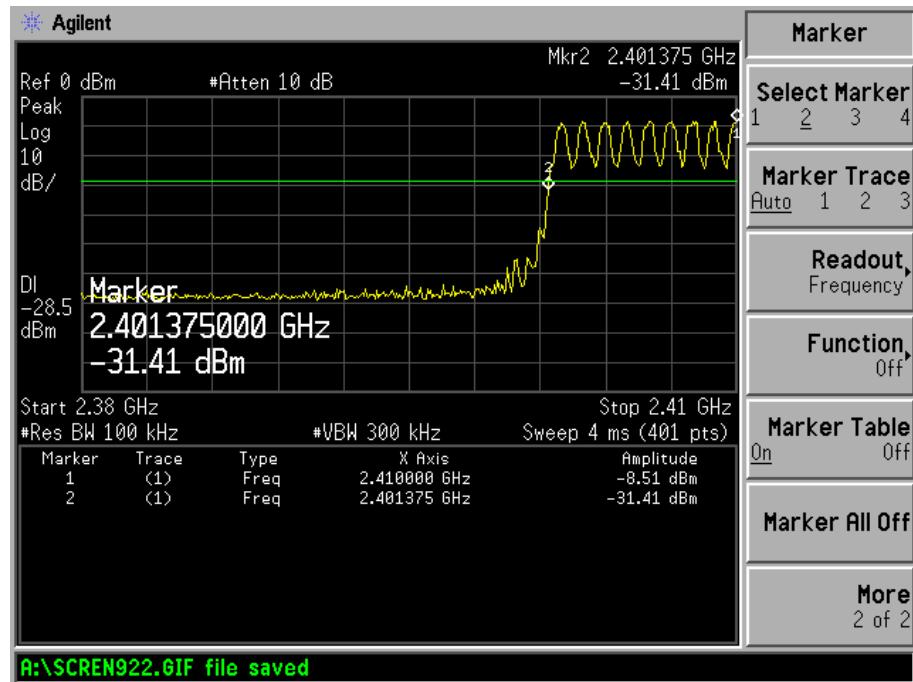
Highest Bandedge



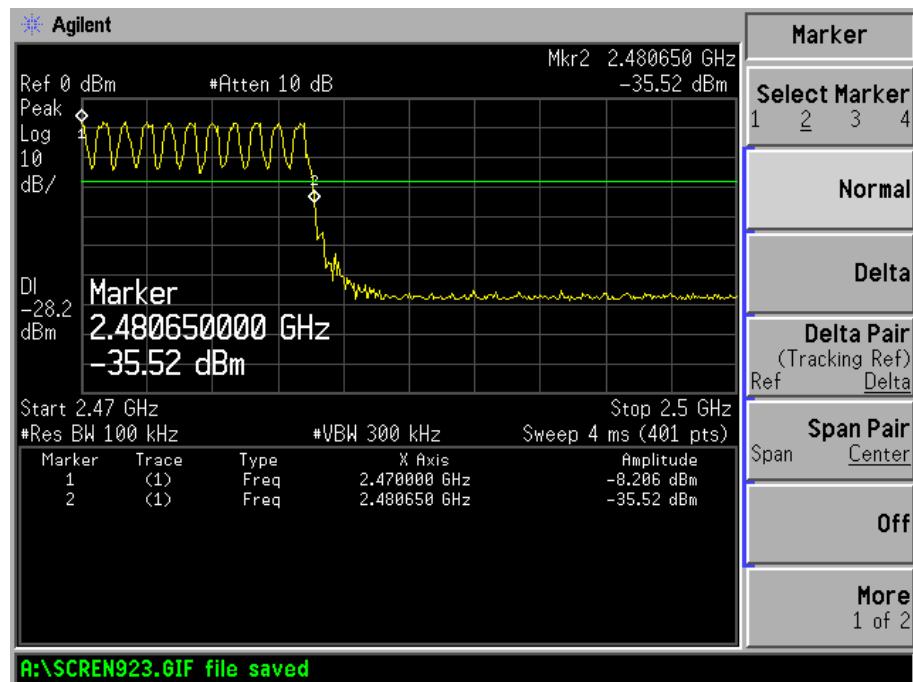
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	45.19	-11.78	33.41	54.00	-20.59	Average Detector
	2483.500	53.73	-11.78	41.95	74.00	-32.05	Peak Detector
2	2500.000	34.32	-11.78	22.54	54.00	-31.46	Average Detector
	2500.000	48.23	-11.78	36.45	74.00	-37.55	Peak Detector

Bandedge (Conducted)

Lowest Bandedge



Highest Bandedge



11. Conducted Emissions

11.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

11.2 Test Equipment List and Details

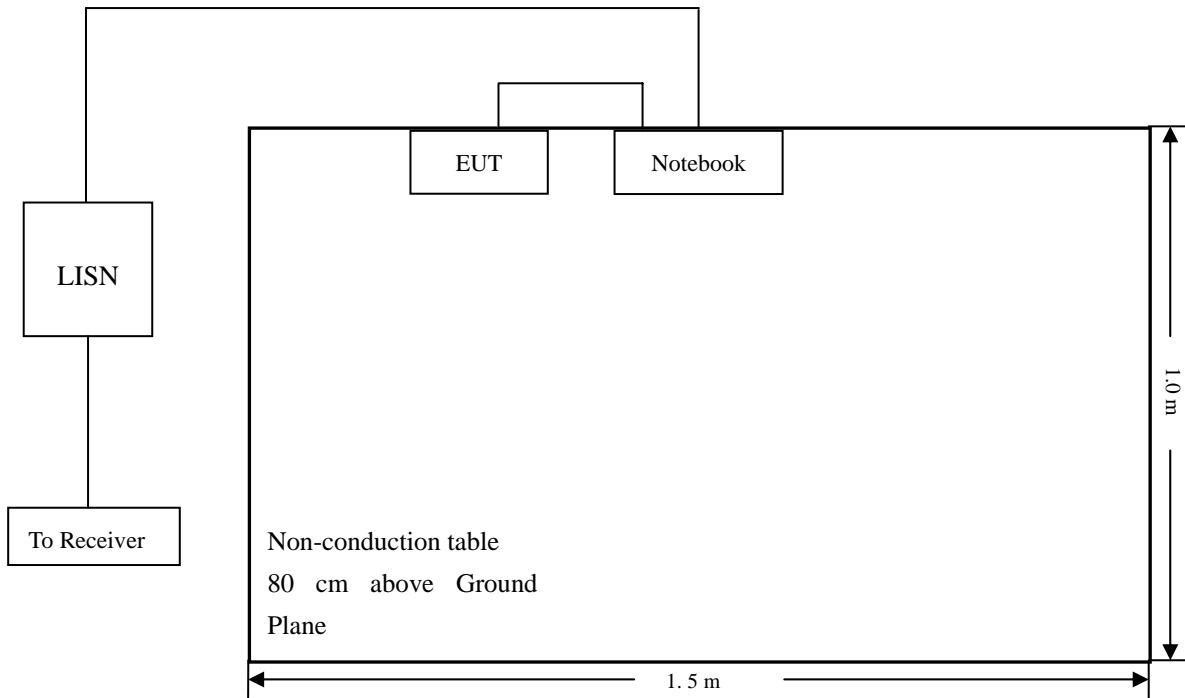
Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2012-03-28	2013-03-27
L.I.S.N	Schwarz beck	NSLK8126	8126-224	2012-03-28	2013-03-27
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2012-03-28	2013-03-27

11.3 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

11.4 Basic Test Setup Block Diagram



11.5 Environmental Conditions

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

11.6 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

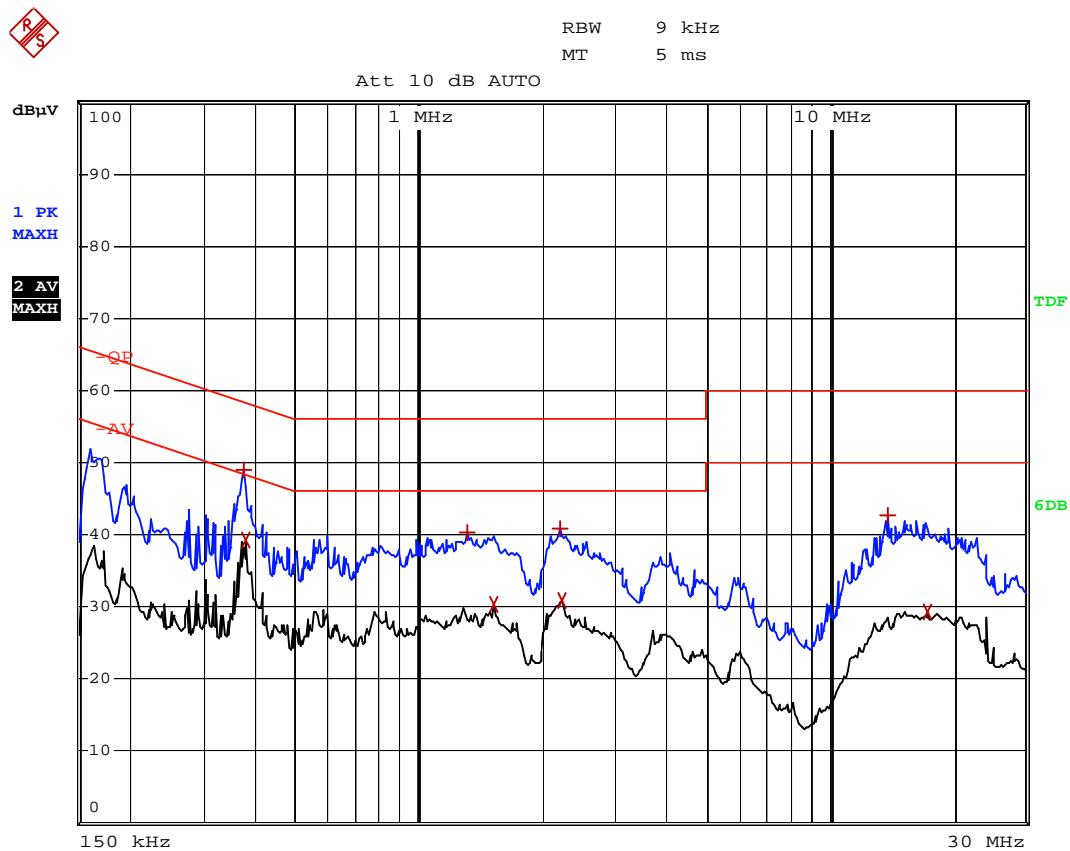
Start Frequency 150 kHz
Stop Frequency..... 30 MHz
Sweep Speed Auto
IF Bandwidth..... 10 kHz
Quasi-Peak Adapter Bandwidth 9 kHz
Quasi-Peak Adapter Mode Normal

11.7 Summary of Test Results/Plots

According to the data in section 3.8, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

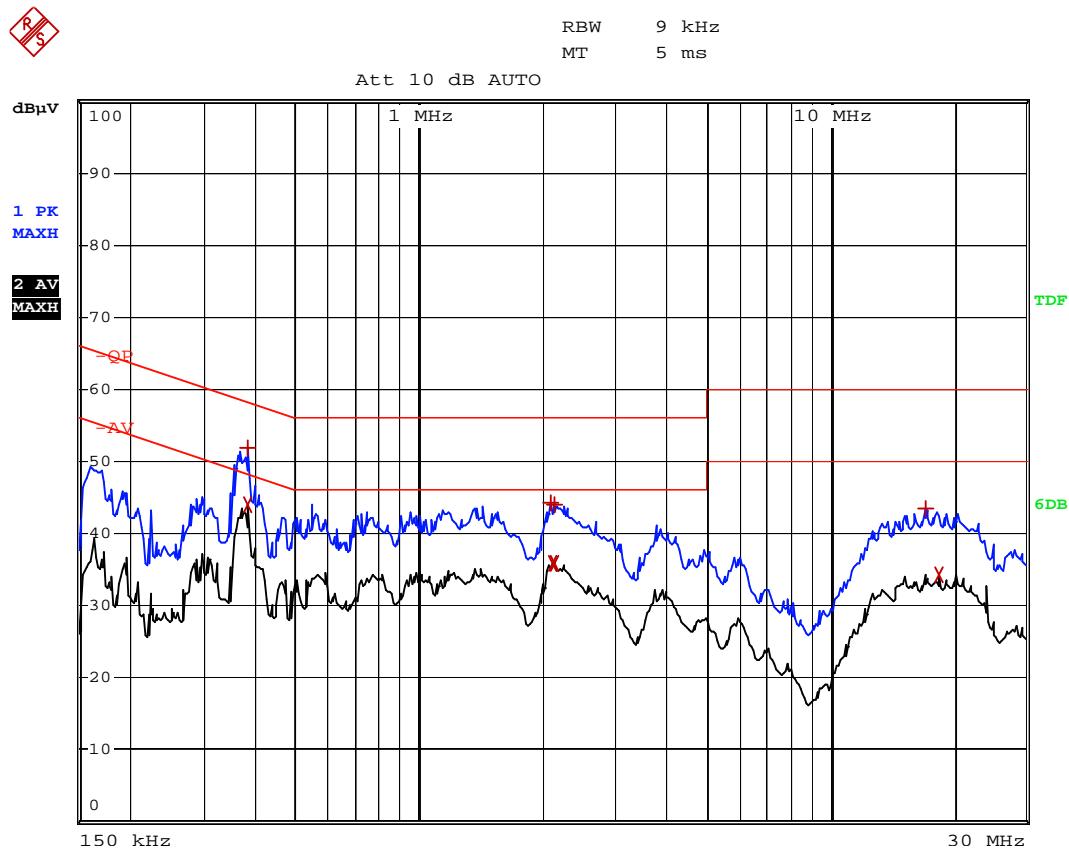
-4.27 dB μ V at 0.382 MHz in the Line mode, Average detector, 0.15-30MHz

11.8 Conducted Emissions Test Data

Plot of Conducted Emissions Test DataEUT: *Bluetooth keyboard*Tested Model: *IMY-SC51*Operating Condition: *Charging*Comment: *DC5V USB*Test Specification: *Neutral*

EDIT PEAK LIST (Prescan Results)				
Trace1:	-QP			
Trace2:	-AV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dB μ V	DELTA	LIMIT dB
1 Max Peak	374 kHz	48.83	-	-9.58
2 Average	378 kHz	39.33	-	-8.99
1 Max Peak	1.314 MHz	40.23	-	-15.77
2 Average	1.522 MHz	30.34	-	-15.65
1 Max Peak	2.218 MHz	40.75	-	-15.24
2 Average	2.234 MHz	30.92	-	-15.07
1 Max Peak	13.782 MHz	42.52	-	-17.47
2 Average	17.206 MHz	29.38	-	-20.61

Test Specification: Line



EDIT PEAK LIST (Prescan Results)				
Trace1:	-QP			
Trace2:	-AV			
Trace3:	---			
TRACE	FREQUENCY	LEVEL dB μ V	DELTA	LIMIT dB
1 Max Peak	382 kHz	51.78	-6.44	
2 Average	382 kHz	43.96	-4.27	
1 Max Peak	2.102 MHz	44.15	-11.84	
2 Average	2.114 MHz	35.79	-10.20	
1 Max Peak	2.142 MHz	44.02	-11.97	
2 Average	2.142 MHz	35.70	-10.29	
1 Max Peak	17.094 MHz	43.31	-16.68	
2 Average	18.338 MHz	34.25	-15.74	

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