TEST REPORT

Report Number		RAPA13-O-126
Type of Equipment		Keyless Entry System
Model Name		MA1000-2WAY2
FCC ID		VA5JA1000-2WSSL2
IC Number		7087A-2WA1000SSL2
Applicant	Name	SEGI LIMITED
	Logo	SEGI
	Address	1808, 18/F, Tower 2, Admiralty Centre, 18 Harcourt Rd., Admiralty, Hong Kong
Manufacturer	Name	SEGI ELECTRONICS CO., LTD.
	Address	Chenjiapucun, Liaobu Town Dongguan City, Guandong Province, 523-408, China
Test period		February 18, 2013 to March 03, 2013
Issuing date of report		March 07, 2013
Total page		25 pages (including this page)

SUMMARY

The equipment complies with FCC Part 15.247: Operation within the bands 902 MHz to 928 MHz, 2 400 MHz to 2 483.5 MHz, and 5 725 MHz to 5 850 MHz.

This test report contains only the results of a single test of the sample supplied for the examination.
It is not a general valid assessment of the features of the respective products of the mass-production.

Date : March 07, 2012

Prepared and tested by Chang Young Choi
Deputy General Manager /TCL of RAPA

Date : March 07, 2012

Reviewed by Sukil Park
Executive Managing Director/TCL of RAPA

CONTENTS

1. GENERAL DESCRIPTION

1.1 Applicant

• Company name	:	SEGI LIMITED
• Address	:	1808, 18/F, Tower 2, Admiralty Center, 18 Harcourt Rd., Admiralty, Hong kong
• Contact person	:	Eui Seok, Chung
• Phone/Fax	:	+82-32-623-5550 / +82-32-623-6667

1.2 Manufacturer

• Company name	:	SEGI ELECTRONICD CO., LTD
• Address	:	Chenjiapucun, Liaobu Town, Dongguan City, Guandong Province, 523-408, China
• Contact person		Eui Seok, Chung
• Phone/Fax	:	+82-32-623-5550 / +82-32-623-6667

1.3 Basic description of EUT

• Product name	:	Keyless Entry System
• Model name	:	MA1000-2WAY2
• Serial number	:	N/A
• Frequency	:	910.92 MHz ~ 919.08 MHz
• Output power	:	25 Channel
• Modulation method	:	FHSS
• FCC Rule Part(s)	:	FCC CFR47 Part 15 Subpart C Section 15.247
• IC Rule Part(s)	:	IC RSS-210 Issue8 Annex 8-2010
• FCC classification	:	DSS / Part 15 Spread Spectrum Transmitter (FHSS)
• IC classification	:	Annex 8 / Frequency Hopping and Digital Modulation Systems Operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz
• Test period	:	February 18, 2013 to March 03, 2013
• Issuing date of report	:	March 07, 2013
• Place of test	:	Head office 824, B104, Anyang Megavalley, 799, Gwanyang-dong, Dongan-gu, Anyang-si, Gyeonggi-do, 431-767, Korea Open area test site 80, Jeil-ri, Yangji-myun, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-825, Korea (FCC Registration Number : 337229) (IC Submission Number : 143881) (KCC Designation Number : KR0027)

1.4 Electrical specification

Item	Specifications
Type of Equipment	Keyless Entry System
Model Name	MA1000-2WAY2
Transmit Frequency	910.92 MHz ~ 919.08 MHz (25 CH / 340 kHz Step)
Modulation Method	FHSS
Power Source	DC 12 V
Size (mm)	77.0 x 32.4 x 14.8 (W x L x H)

2. General information of test

2.1 Standard for measurement methods

Applied Standard : FCC CFR47 Part 15 Subpart C, IC RSS-210 Issue8 Annex 8-2010				
FCC	**IC**	**Description of Test**	**Limit**	**Result**
15.209	RSS-210_2.2	Radiated Emission in Restricted Band	See 15.207	Pass
15.247(a)(1)	RSS-210_A8.1_B	Frequency Separation	≥ 20 dB Bandwidth	Pass
15.247(a)(1)(i)	RSS-210_A8.1_C	Number of Hopping Channels	≥ 25 CH	Pass
15.247(a)(1)(i)	RSS-210_A8.1_C	Occupied Bandwidth	≤ 500 kHz	Pass
15.247(a)(1)(i)	RSS-210_A8.1_C	Average Time of Occupancy	≤ 0.4 s within 10 s	Pass
15.247(b)(2)	RSS-210_A8.4_1	Maximum Peak Output Power	≤ 0.25 Watt	Pass
15.247(d)	RSS-210_A8.5	Conducted Emission & Band Edge	≥ 20 dBc	Pass

2.2 Description of EUT modification

During the test, there was no mechanical or circuitry modification to improve any RF specification including spurious characteristic, and any RF and spurious suppression device(s) were not added against the device tested.

2.3 Description of test system configuration

• Peripheral equipment used;

Description	Model name	Serial No.	Manufacturer	FCC ID	IC Number
EUT	MA1000-2WAY2	N/A	SEGI LIMITED	VA5JA1000-2WSSL2	7087A-2WA1000SSL2
JIG	OP500	N/A	SEGI LIMITED	-	-
DC Power supply	E3633A	SG40002272	Agilent	-	-

• Cables used

Device from	Device to	Type of cable	Type of connector	Length
EUT	JIG	Non-shielded	Wire	2.0 m
JIG	DC Power supply	Non-shielded	Wire	1.0 m

3. Measurement data

3.1 Radiated emission in restricted band

3.1.1 Definitions

A radiated emission is a emission from the equipment when transmitting into a non-radiating load on frequencies that are restricted band sufficient to ensure transmission of information of required quality for the class of communications desired.

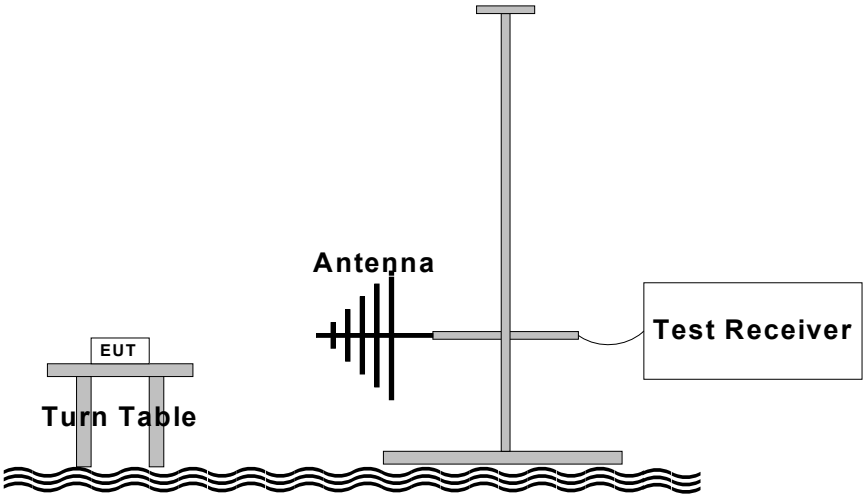
3.1.2 Specification

• FCC Rules Part 15 Subpart C Section 15.209
• IC Rules RSS-210 Section 2.2

3.1.3 Measurement method

• ANSI Standard C63.4-2003 8.3

3.1.4 Set-up



3.1.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI
JIG	OP500	SEGI
Test Receiver	ESCI 7	Rohde & Schwarz
Power supply	E3633A	Agilent
Loop antenna	EMCO 6502	EMCO
Bi-conical antenna	VHA9103	Schwarzbeck
Log periodic antenna	VULP9118A	Schwarzbeck
Horn Antenna	BBHA-9120D	Schwarzbeck
Pre-amplifier	SCU01	Rohde & Schwarz
Pre-amplifier	JS4-00102600-26-5P	MITEQ

3.1.6 Test procedure

The EUT is placed on a turntable, which is 0.8 meter high above ground.
The turntable rotates 360 degrees to determine the position of the maximum emission level.

EUT is set 3.0 meters away from the receiving antenna, broadband antenna, which is mounted on an antenna mast. The antenna moved up and down between 1 meter and 4 meters to find out the maximum emission level form the EUT. Both horizontal and vertical polarizations of the antenna are set on measurement.

In order to find out the maximum emission levels, all of the EUT location were manipulated according to ANSI 63.4 during the radiated emission measurement. The EUT was tested to 3 orthogonal planes.

The RBW of test receiver is 120 kHz between 30 to 1 000 MHz, and 1 MHz above 1 GHz.

3.1.7 Test condition

- Test place : Open area test site
- Test environment : 5 °C, 34 % R.H.
- Test mode : Operation at single channel

3.1.8 Limit

Frequency [MHz]	Field Strength [μV/m]	Field Strength [dBμV/m]	Measurement Distance [m]
0.009 – 0.490	2 400 / F(kHz)	48.52 to 13.80	300
0.490 – 1.705	2 4000 / F(kHz)	33.80 to 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40.00	3
88 – 216	150	43.52	3
216 – 960	200	46.02	3
Above 470	500	53.98	3

Remark: Radiated emissions which fall in the restricted bands must also comply with the limits as this table.

3.1.9 Test result

• Operation frequency: 910.92 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dBμV]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dBμV]	Limit [dBμV]	Margin [dB]
910.92	H	Y	Peak	87.9	22.6	4.3	-	114.8	-	-
1821.84	H	Y	Peak	25.1	25.8	5.8	-	56.7	94.8	38.1
1821.84	V	Y	AVG	14.0	25.8	5.8	-	45.6	74.8	29.2
2732.76	H	Y	Peak	25.7	28.1	7.2	-	61.0	74.0	13.0
2732.76	H	Y	AVG	15.4	28.1	7.2	-	50.7	54.0	3.3
4554.60	H	Y	Peak	21.7	30.8	9.6	-	62.1	74.0	11.9
4554.60	H	Y	AVG	11.1	30.8	9.6	-	51.5	54.0	2.5
5465.52	V	Y	Peak	30.7	31.8	10.8	-	73.3	94.8	21.5
5465.52	H	Y	AVG	21.2	31.8	10.8	-	63.8	74.8	11.0

• Operation frequency: 915.00 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dBμV]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dBμV]	Limit [dBμV]	Margin [dB]
915.00	H	Y	Peak	87.8	22.6	4.3	-	114.7	-	-
5490.00	V	Y	Peak	31.2	31.8	10.9	-	73.9	94.7	20.8
5490.00	H	Y	AVG	20.6	31.8	10.9	-	63.3	74.7	11.4

• Operation frequency: 919.08 MHz

Frequency [MHz]	Pol. [H/V]	Plane [X/Y/Z]	Detect mode [Peak/AVG]	Reading [dBμV]	Antenna factor [dB/m]	Cable loss [dB]	Pre-amp gain [dB]	Emission level [dBμV]	Limit [dBμV]	Margin [dB]
919.08	H	Y	Peak	87.9	22.6	4.3	-	114.8	-	-
1838.16	H	Y	Peak	25.0	25.9	5.8	-	56.7	94.8	38.1
1838.16	H	Y	AVG	13.8	25.9	5.8	-	45.5	74.8	29.3
2757.24	H	Y	Peak	25.0	28.1	7.2	-	60.3	74.0	13.7
2757.24	H	Y	AVG	13.6	28.1	7.2	-	48.9	54.0	5.1
5514.48	H	Y	Peak	31.8	31.8	10.9	-	74.5	94.8	20.3
5514.48	H	Y	AVG	22.5	31.8	10.9	-	65.2	74.8	9.6

Remark: The other emissions were not detected.

3.2 Frequency separation

3.2.1 Definitions

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

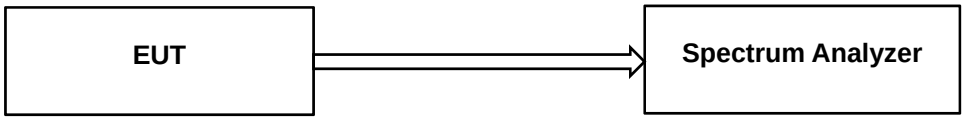
3.2.2 Specification

• FCC Rules Part 15 Subpart C Section 15.247(a)(1)
• IC Rules RSS-210 Issue8 Annex 8-2010 A8.1 B

3.2.3 Measurement method

• Public Notice “DA 00-705”

3.2.4 Set-up



3.2.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI
JIG	OP500	SEGI
Spectrum analyzer	N9020A	Agilent
Power supply	E3633A	Agilent

3.2.6 Test procedure

• The output of EUT was connected to the spectrum analyzer.
• The Hopping channel separation is defined as the channel is separated with next channel.

3.2.7 Test condition

• Test place : Test room
• Test environment : 17 °C, 33 % R.H.
• Test mode : Operation at full hopping

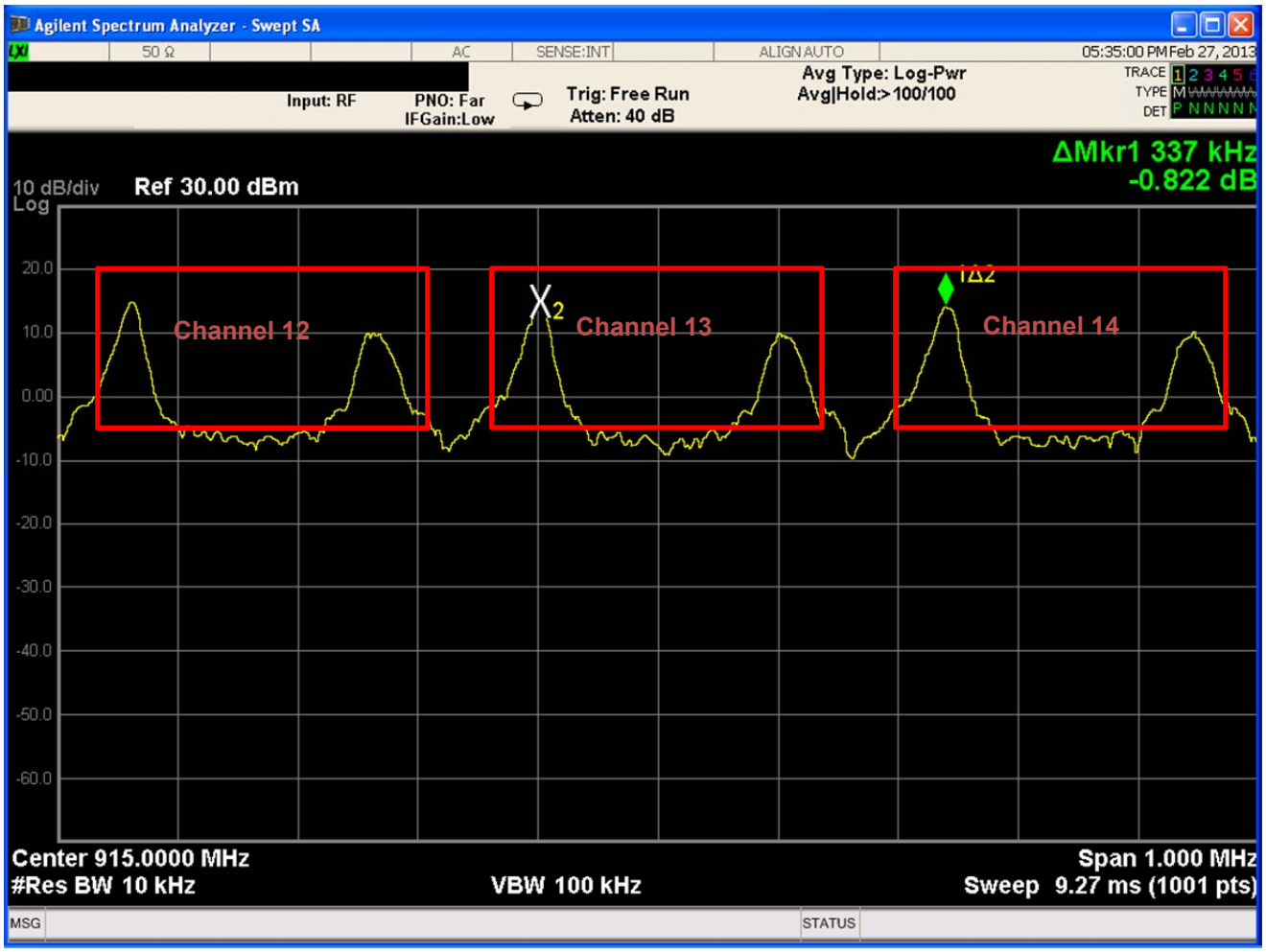
3.2.8 Test result

Channel	Frequency separation [kHz]	Limit [kHz]
Full hopping	337.0	≥ 268.2

3.2.9 Limit

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

3.2.10 Plots of frequency separation



Operating frequency :	**Full hopping**
RBW :	**10 kHz**
VBW :	**100 kHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Frequency separation :	**337 kHz**

3.3 Number of hopping channels

3.3.1 Definitions

Frequency hopping systems operating in the 902 MHz - 928 MHz should employ at least 25 hopping channels.

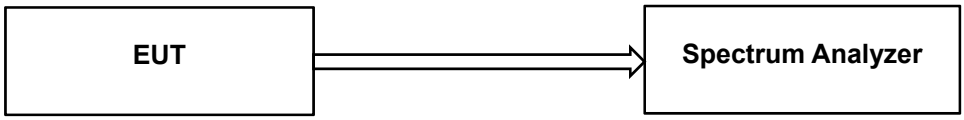
3.3.2 Specification

• FCC Rules Part 15 Subpart C Section 15.247(a)(1)(i)
• IC Rules RSS-210 Issue8 Annex 8-2010 A8.1 C

3.3.3 Measurement method

• Public Notice “DA 00-705”

3.3.4 Set-up



3.3.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI LIMITED
JIG	OP500	SEGI LIMITED
Spectrum analyzer	N9020A	Agilent
Power supply	E3633A	Agilent

3.3.6 Test procedure

• The output of EUT was connected to the spectrum analyzer.
• Minimum hopping channels using Spectrum analyzer.
• With the analyzer set to max hold readings were taken for 1 ~ 2 minutes in each band.

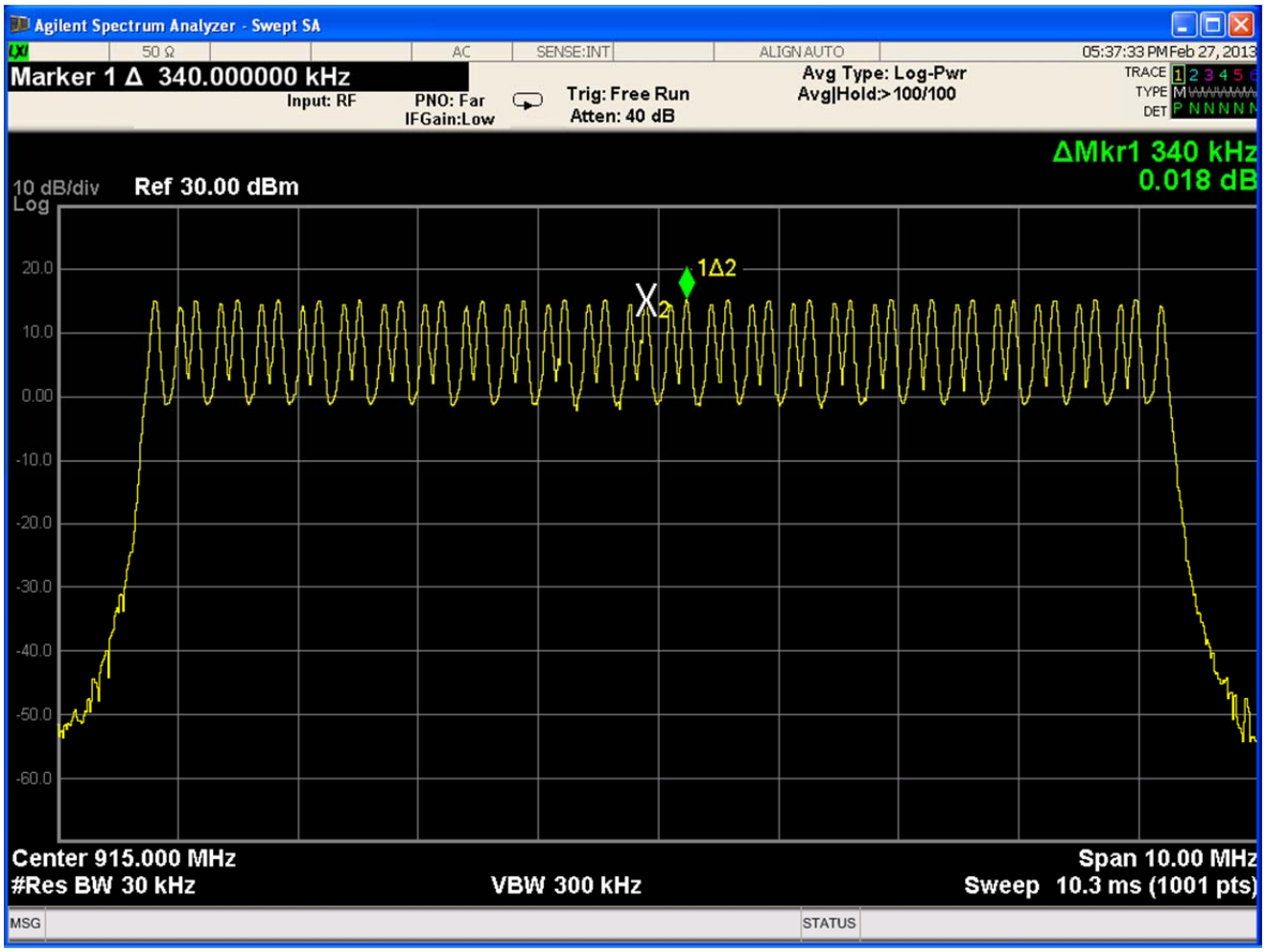
3.3.7 Test condition

• Test place : Test room
• Test environment : 17 °C, 33 % R.H.
• Test mode : Operation at full hopping

3.3.8 Test result

Channel	Number of hopping channels	Limit
Full hopping	25	≥ 25 Channels

3.3.10 Plots of number of hopping channels



Operating frequency :	**Full hopping**
RBW :	**30 kHz**
VBW :	**300 kHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**

Number of hopping channels : **25**

3.4 Occupied bandwidth

3.4.1 Definitions

A occupied bandwidth is width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each lower 20 dB of the total mean power of a given emission.

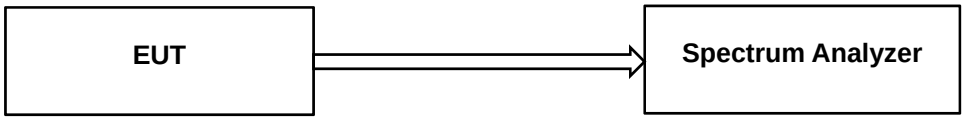
3.4.2 Specification

• FCC Rules Part 15 Subpart C Section 15.247(a)(1)(i)
• IC Rules RSS-210 Issue8 Annex 8-2010 A8.1 C

3.4.3 Measurement method

• Public Notice “DA 00-705”

3.4.4 Set-up



3.4.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI
JIG	OP500	SEGI
Spectrum analyzer	N9020A	Agilent
Power supply	E3633A	Agilent

3.4.6 Test procedure

• The output of EUT was connected to the spectrum analyzer.
• Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level.

3.4.7 Test condition

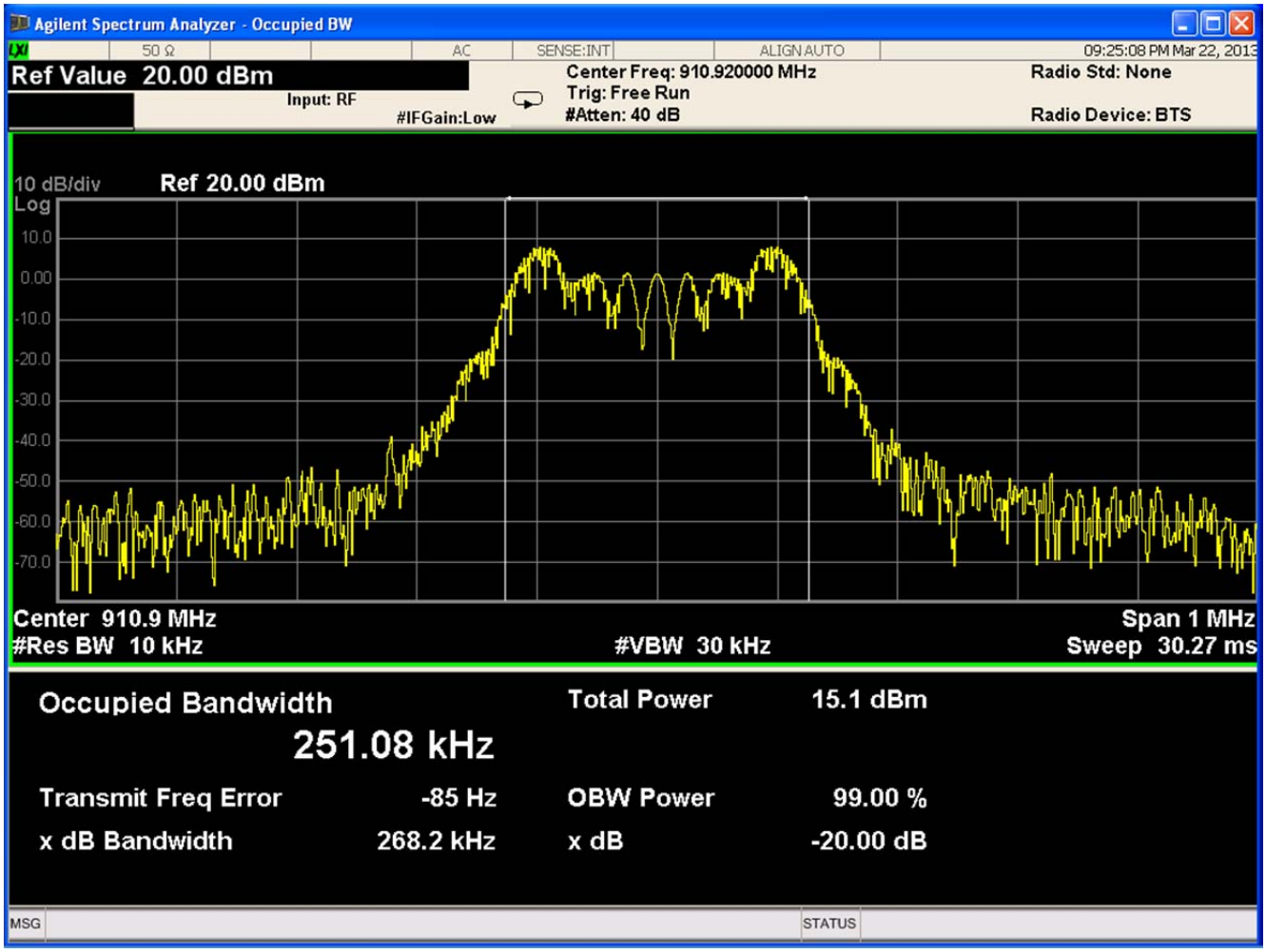
• Test place : Test room
• Test environment : 17 °C, 33 % R.H.
• Test mode : Operation at single channel

3.4.8 Test result

Frequency [MHz]	20 dB Bandwidth [MHz]	99% Bandwidth [MHz]
910.92	268.2	251.1
915.00	264.6	250.0
919.08	264.5	250.0

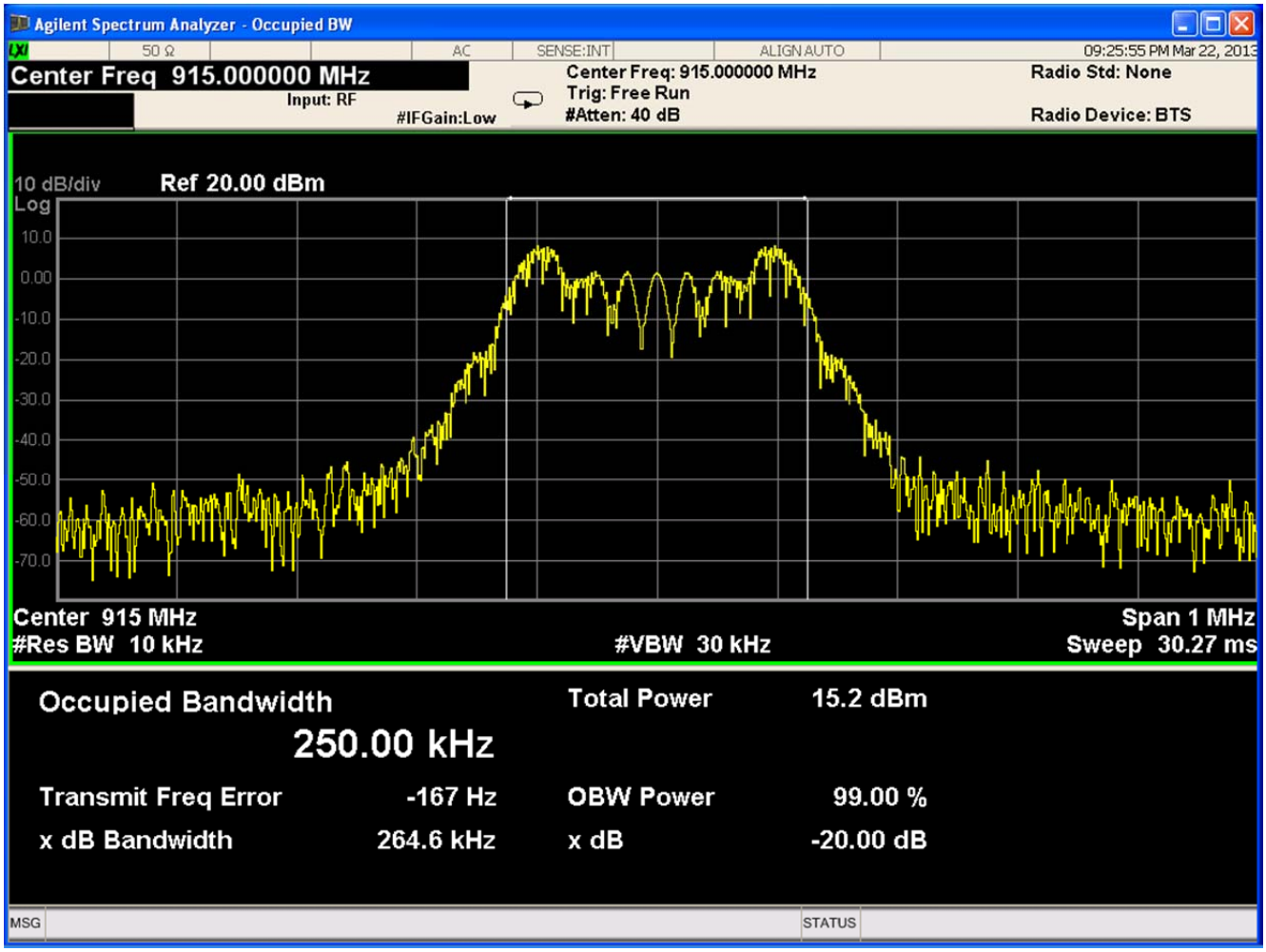
3.4.9 Plots of occupied bandwidth

3.4.9.1 Channel 1



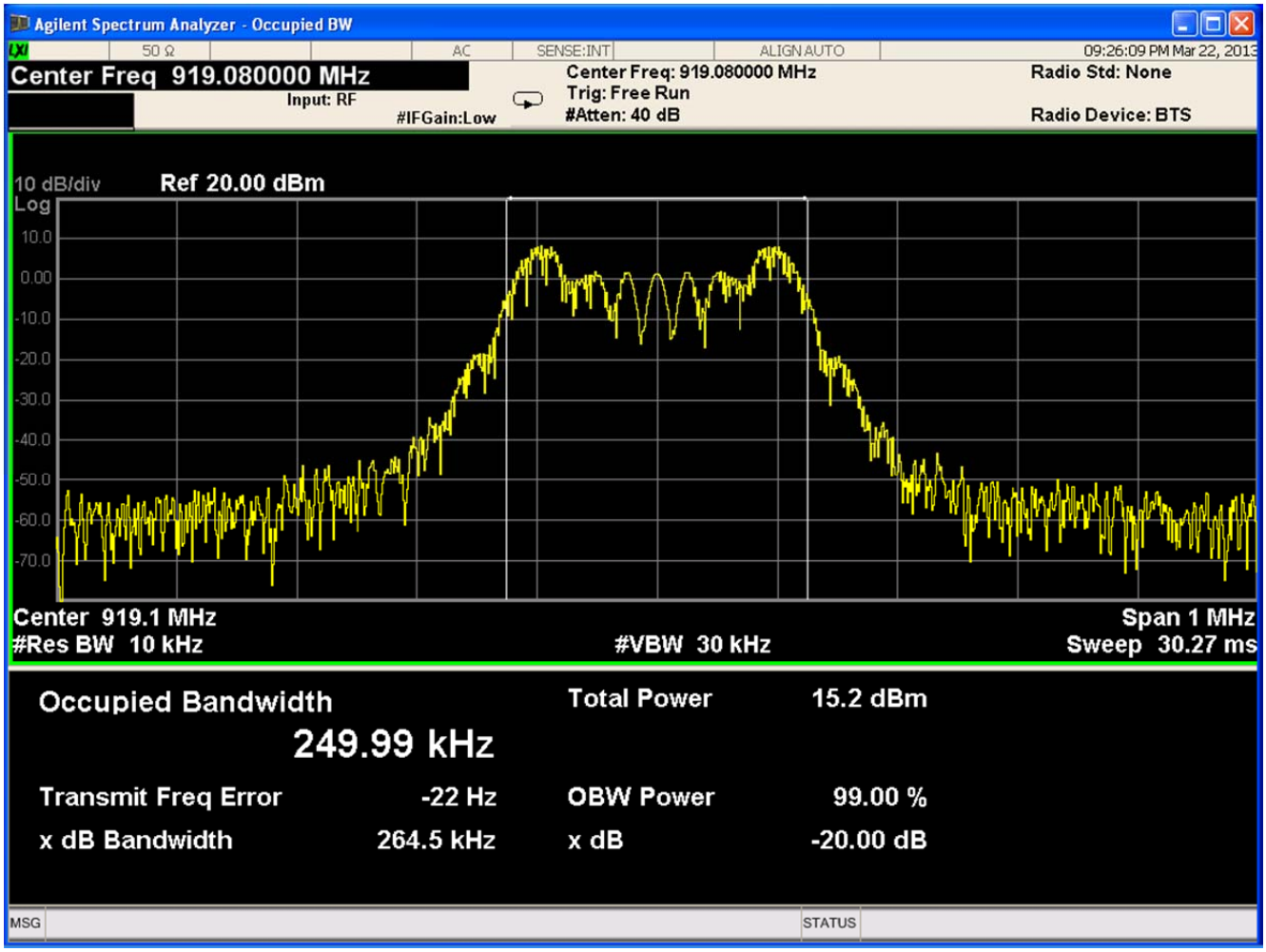
Operating frequency :	**910.92 MHz**
RBW :	**10 kHz**
VBW :	**30 kHz**
Detector mode :	**Sample**
Trace mode :	**N/A**
Sweep time :	**Auto**
20 dB bandwidth :	**268.2 MHz**
99 % bandwidth :	**251.08 MHz**

3.4.9.2 Channel 13



Operating frequency :	**915.00 MHz**
RBW :	**10 kHz**
VBW :	**30 kHz**
Detector mode :	**Sample**
Trace mode :	**N/A**
Sweep time :	**Auto**
20 dB bandwidth :	**264.6 MHz**
99 % bandwidth :	**250.00 MHz**

3.4.9.3 Channel 25



Operating frequency : 919.08 MHz
RBW : 10 kHz
VBW : 30 kHz
Detector mode : Sample
Trace mode : N/A
Sweep time : Auto

20 dB bandwidth : 264.5 MHz
99 % bandwidth : 249.99 MHz

3.5 Average time of occupancy

3.5.1 Definitions

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10 second period.

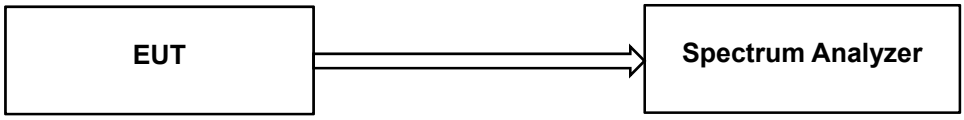
3.5.2 Specification

• FCC Rules Part 15 Subpart C Section 15.247(a)(1)(i)
• IC Rules RSS-210 Issue8 Annex 8-2010 A8.1 C

3.5.3 Measurement method

• Public Notice “DA 00-705”

3.5.4 Set-up



3.5.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI
JIG	OP500	SEGI
Spectrum analyzer	N9020A	Agilent
Power supply	E3633A	Agilent

3.5.6 Test procedure

• The output of EUT was connected to the spectrum analyzer.
• RBW 1 MHz, VBW 1 MHz, Max hold

3.5.7 Test condition

• Test place : Test room
• Test environment : 17 °C, 33 % R.H.
• Test mode : Operation at full hopping

3.5.8 Test result

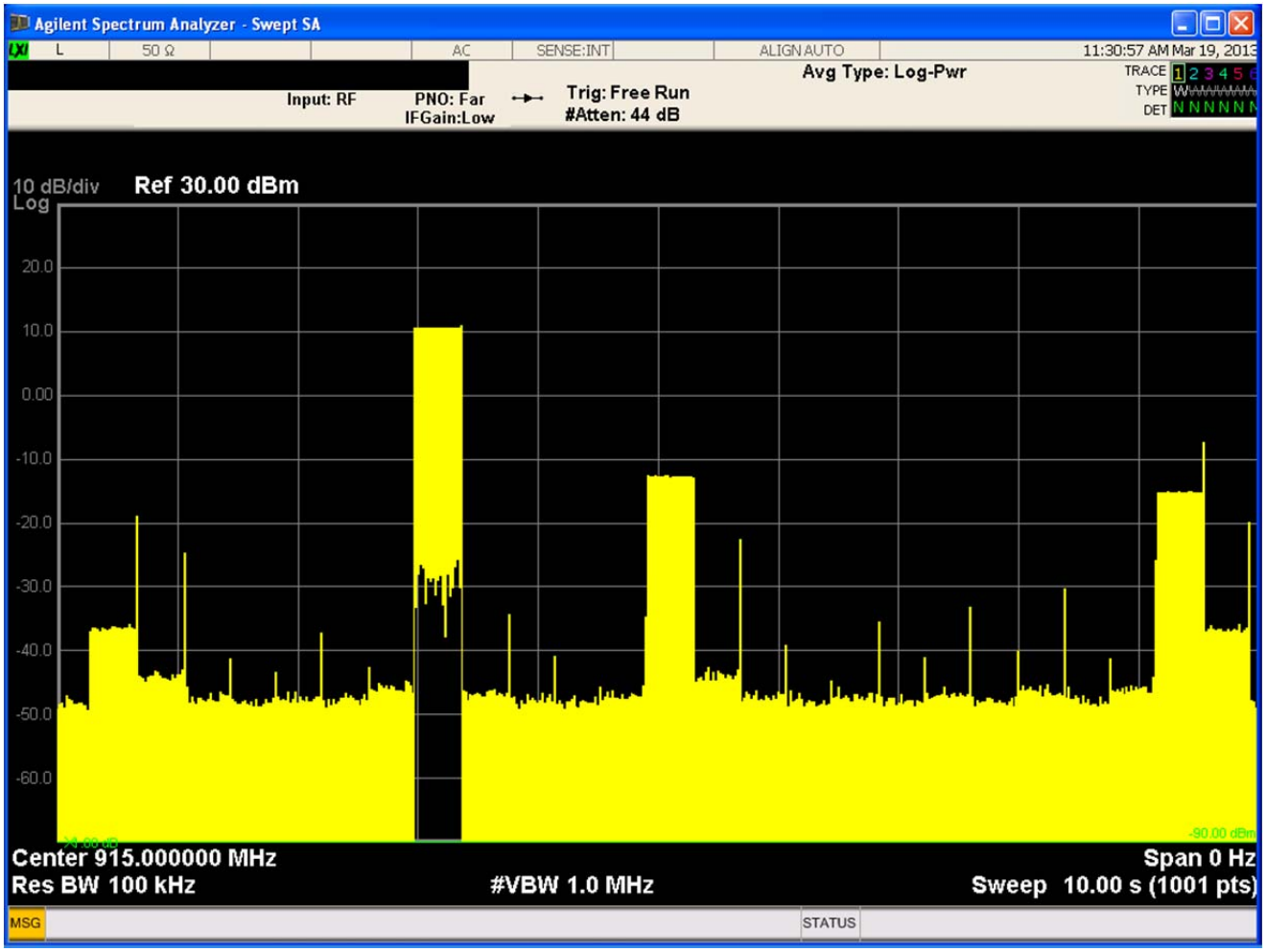
Dwell time [ms]	Limit [ms]
382	400

3.5.9 Limit

Less than 0.4 seconds within 10 seconds period.

3.5.10 Plots of channel occupation

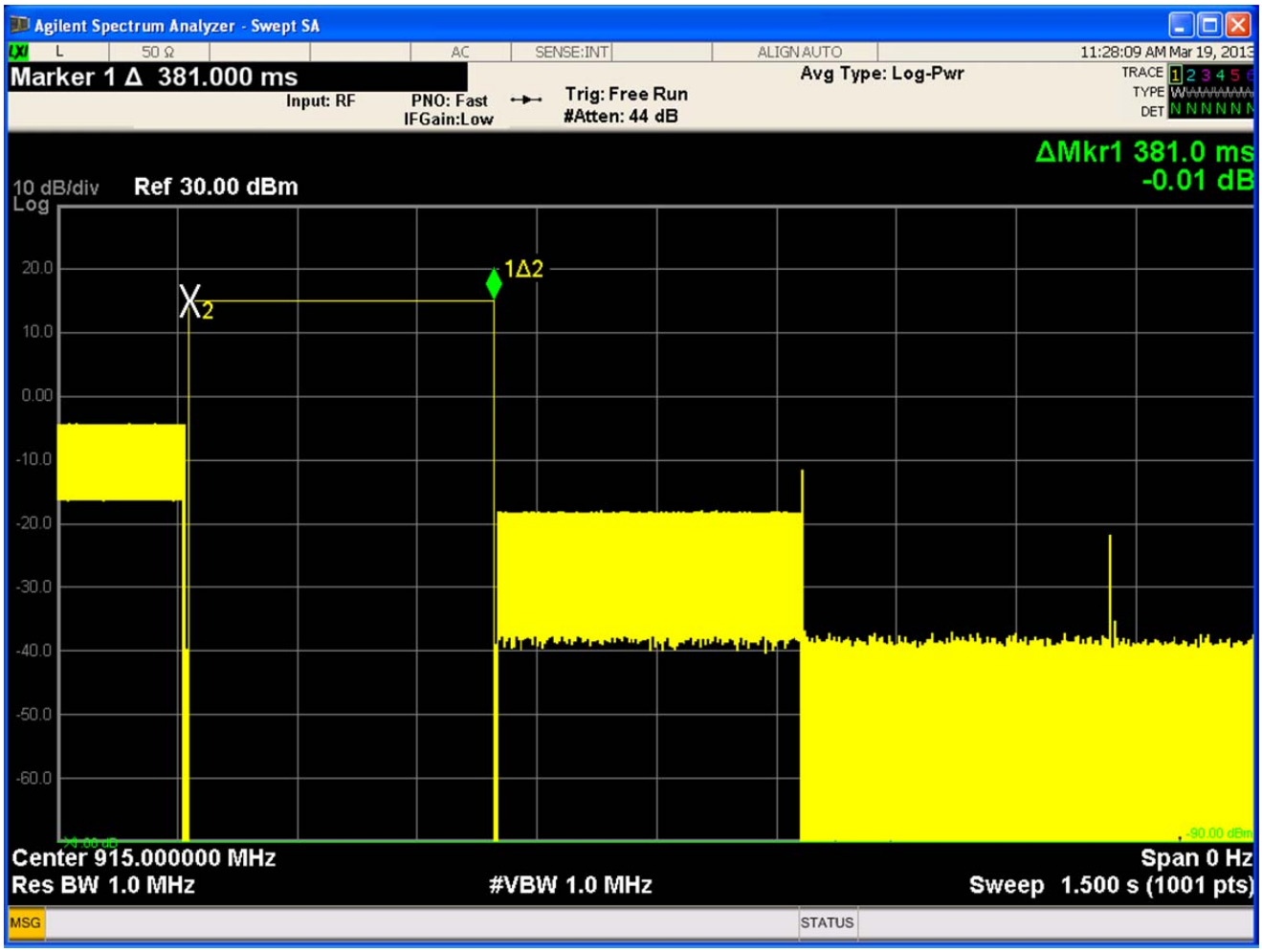
3.5.10.1 Within 10 seconds period



Operating frequency :	**Full hopping**
RBW :	**100 kHz**
VBW :	**1 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**

Number of channel within 10 s : 1

3.5.10.2 Dwell time



Operating frequency :	**Full hopping**
RBW :	**1 MHz**
VBW :	**1 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Dwell time :	**381 ms**

3.6 Maximum peak output power

3.6.1 Definitions

Maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

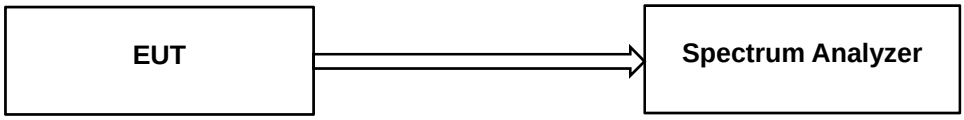
3.6.2 Specification

• FCC Rules Part 15 Subpart C Section 15.247(b)(2)
• IC Rules RSS-210 Issue8 Annex 8-2010 A8.4

3.6.3 Measurement method

• Public Notice “DA 00-705”

3.6.4 Set-up



3.6.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI
JIG	OP500	SEGI
Spectrum analyzer	N9020A	Agilent
Power supply	E3633A	Agilent

3.6.6 Test procedure

• The output of EUT was connected to the spectrum analyzer.
• RBW 1 MHz, VBW 50 MHz, Max hold

3.6.7 Test condition

• Test place : Test room
• Test environment : 17 °C, 33 % R.H.
• Test mode : Operation at full hopping

3.6.8 Test result

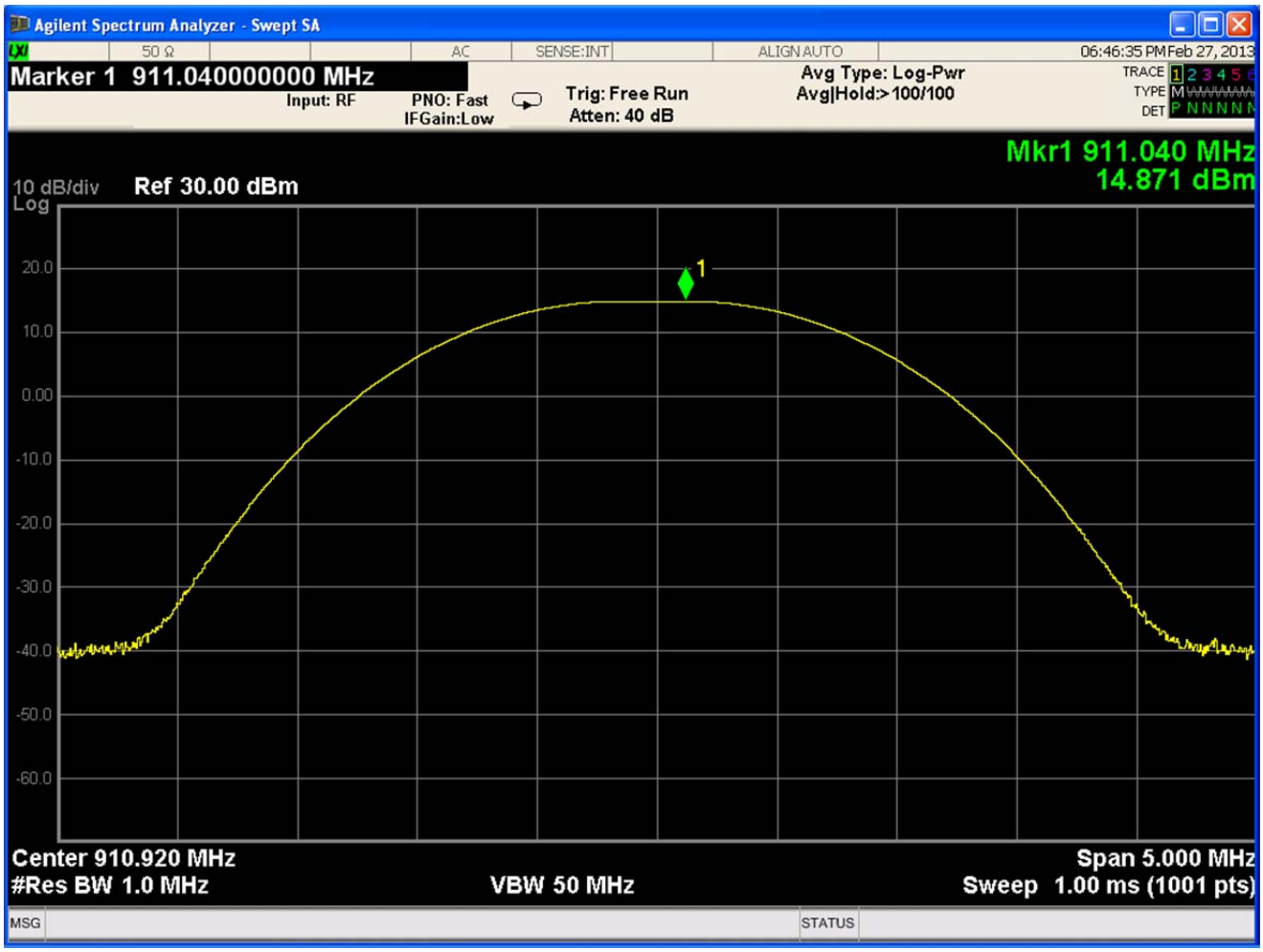
Frequency [MHz]	Peak Output Power [mW]	Limit [mW]
910.92	30.7	250.0
915.00	30.9	250.0
919.08	31.4	250.0

3.6.9 Limit

Less than 0.25 Watts.

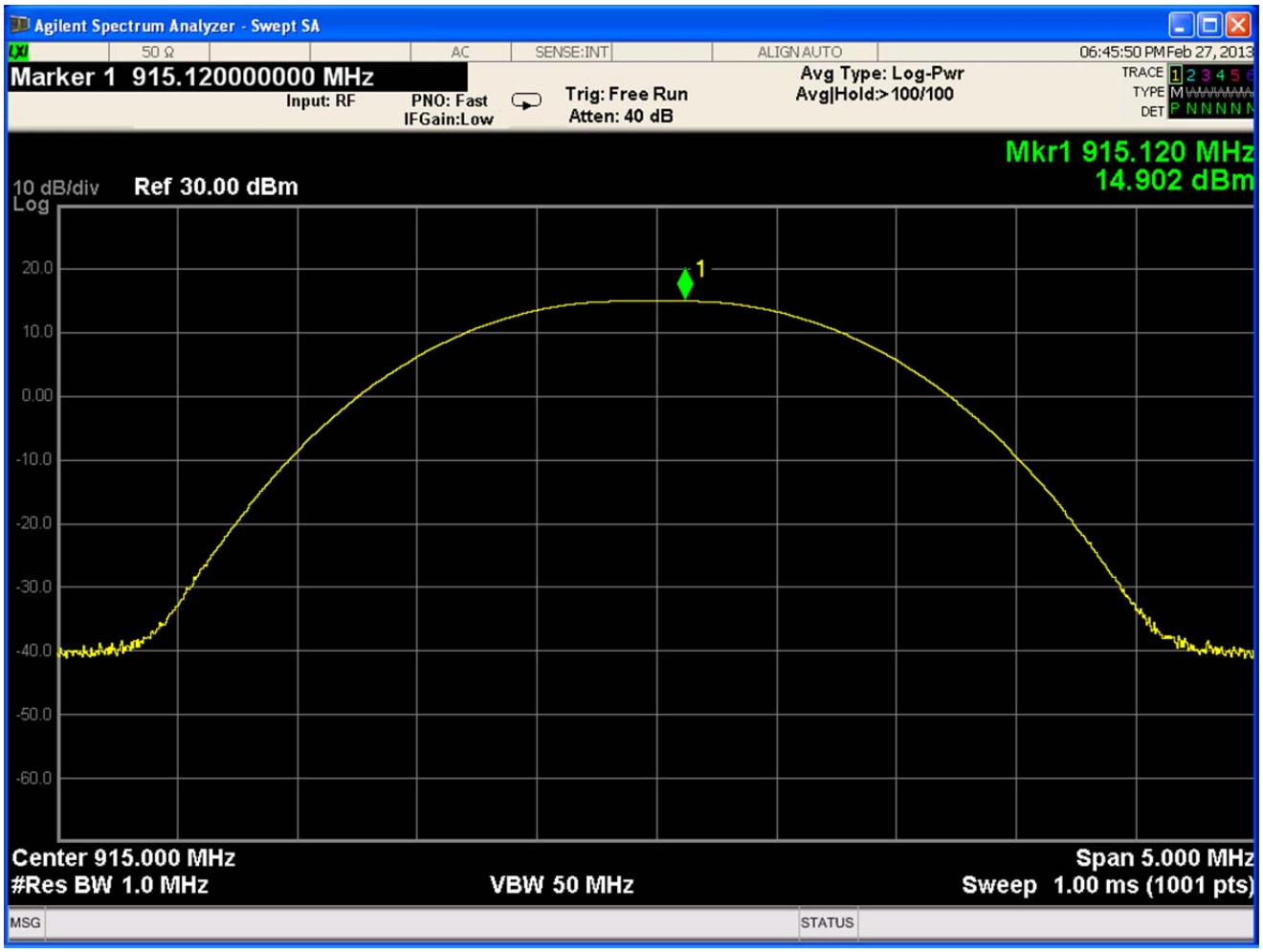
3.6.10 Plots of peak output power

3.6.10.1 Channel 1



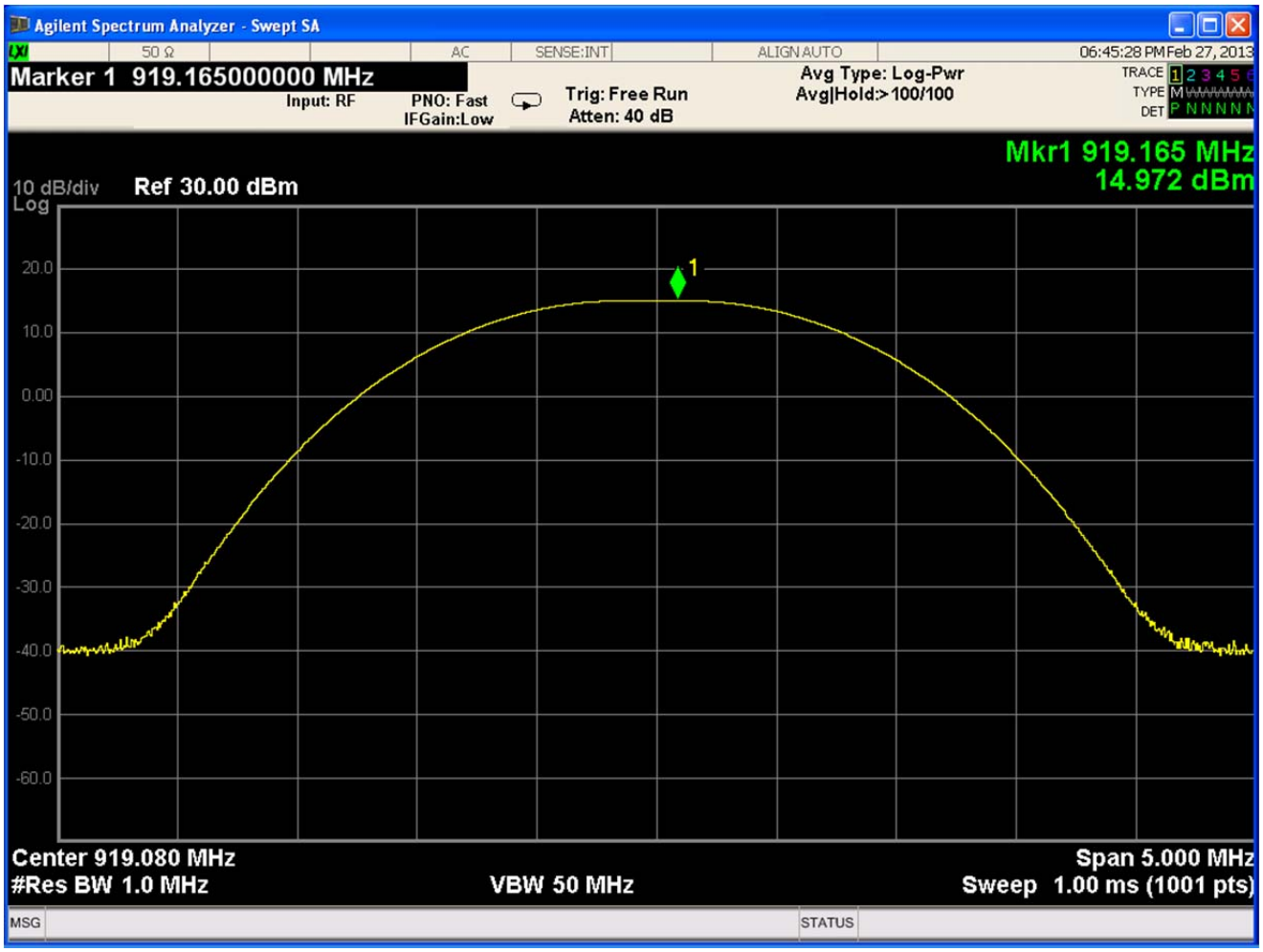
Operating frequency :	**910.92 MHz**
RBW :	**1 MHz**
VBW :	**50 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Output power :	**14.871 dBm (=30.70 mW)**

3.6.10.2 Channel 13



Operating frequency :	**915.00 MHz**
RBW :	**1 MHz**
VBW :	**50 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Output power :	**14.902 dBm (=30.92 mW)**

3.6.10.3 Channel 25



Operating frequency :	**919.08 MHz**
RBW :	**1 MHz**
VBW :	**50 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Output power :	**14.972 dBm (=31.42 mW)**

3.7 Conducted emission and band edge

3.7.1 Definitions

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 RF conducted measurement.

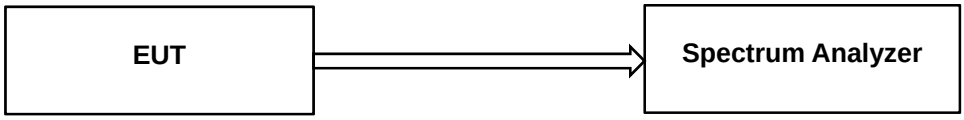
3.7.2 Specification

• FCC Rules Part 15 Subpart C Section 15.247(d)
• IC Rules RSS-210 Issue8 Annex 8-2010 A8.5

3.7.3 Measurement method

• Public Notice “DA 00-705”

3.7.4 Set-up



3.7.5 Test equipment list

Equipment	Model name	Manufacturer
EUT	MA1000_2WAY2	SEGI
JIG	OP500	SEGI
Spectrum analyzer	N9020A	Agilent
Power supply	E3633A	Agilent

3.7.6 Test procedure

• The output of EUT was connected to the spectrum analyzer.
• RBW 100 kHz, VBW 1 MHz, Max hold

3.7.7 Test condition

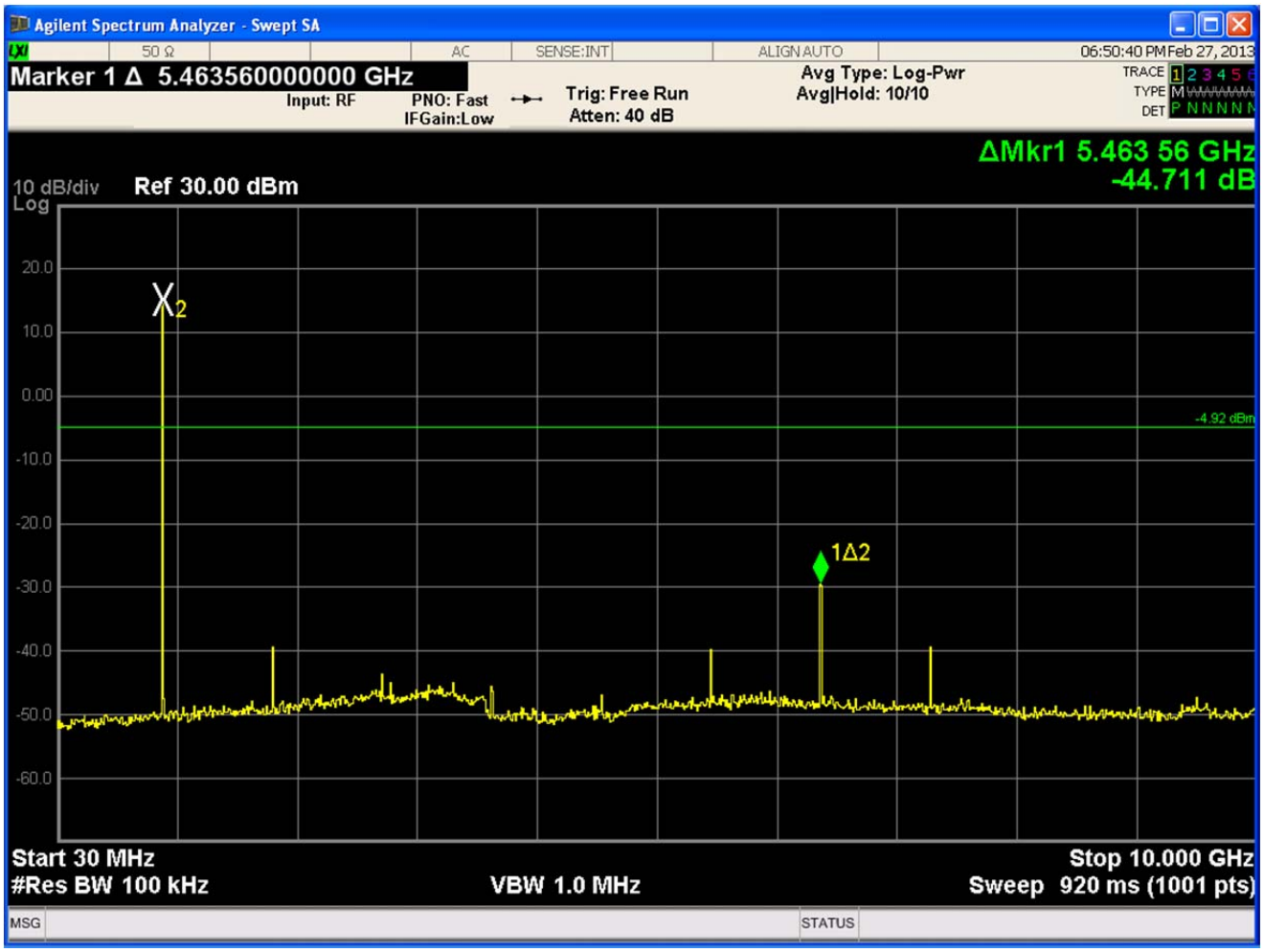
• Test place : Test room
• Test environment : 17 °C, 33 % R.H.
• Test mode : Operation at full hopping

3.7.8 Limit

Less than 20 dBc.

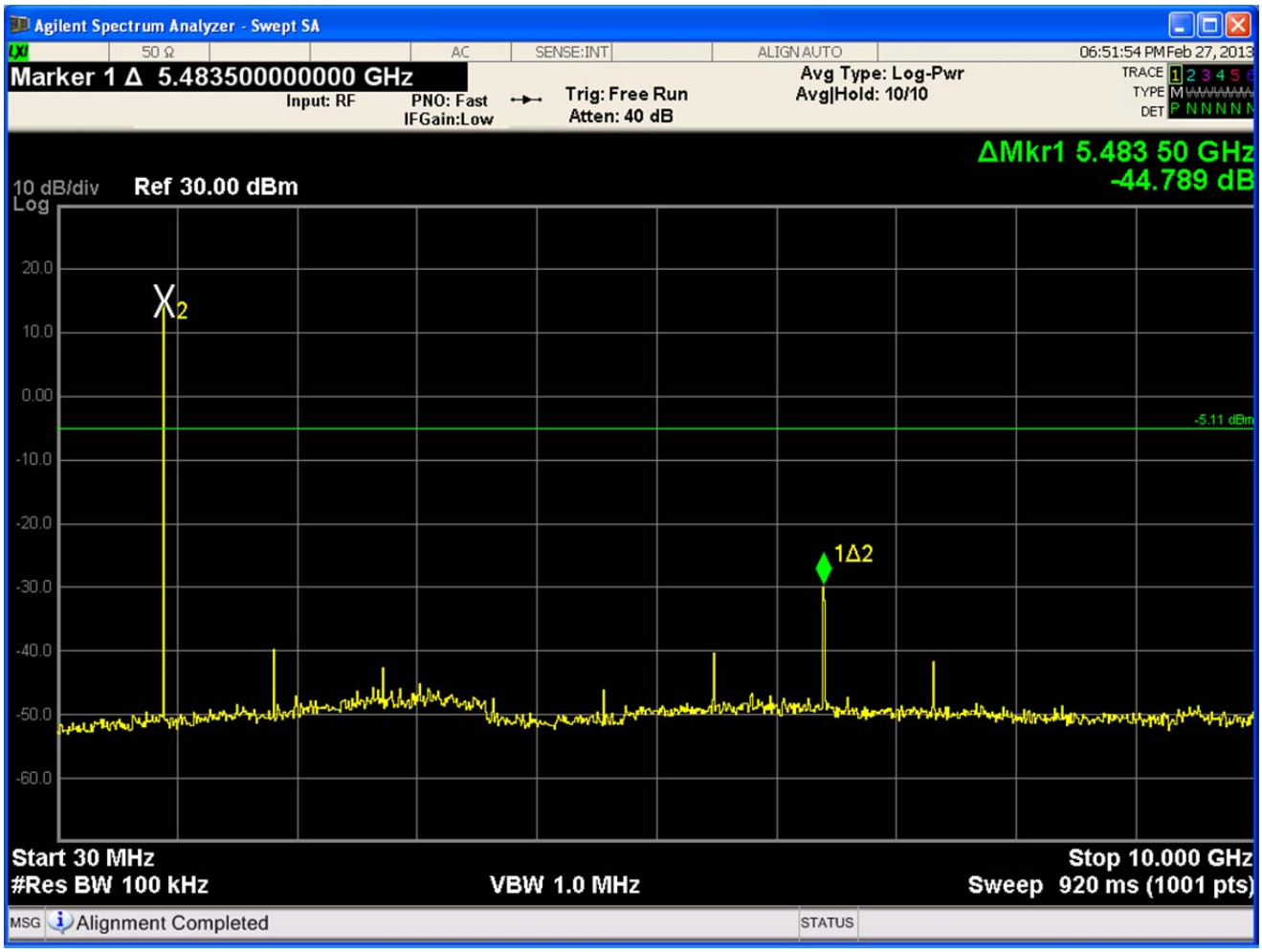
3.7.9 Plots of conducted emission & band edge

3.7.10.1 Channel 1



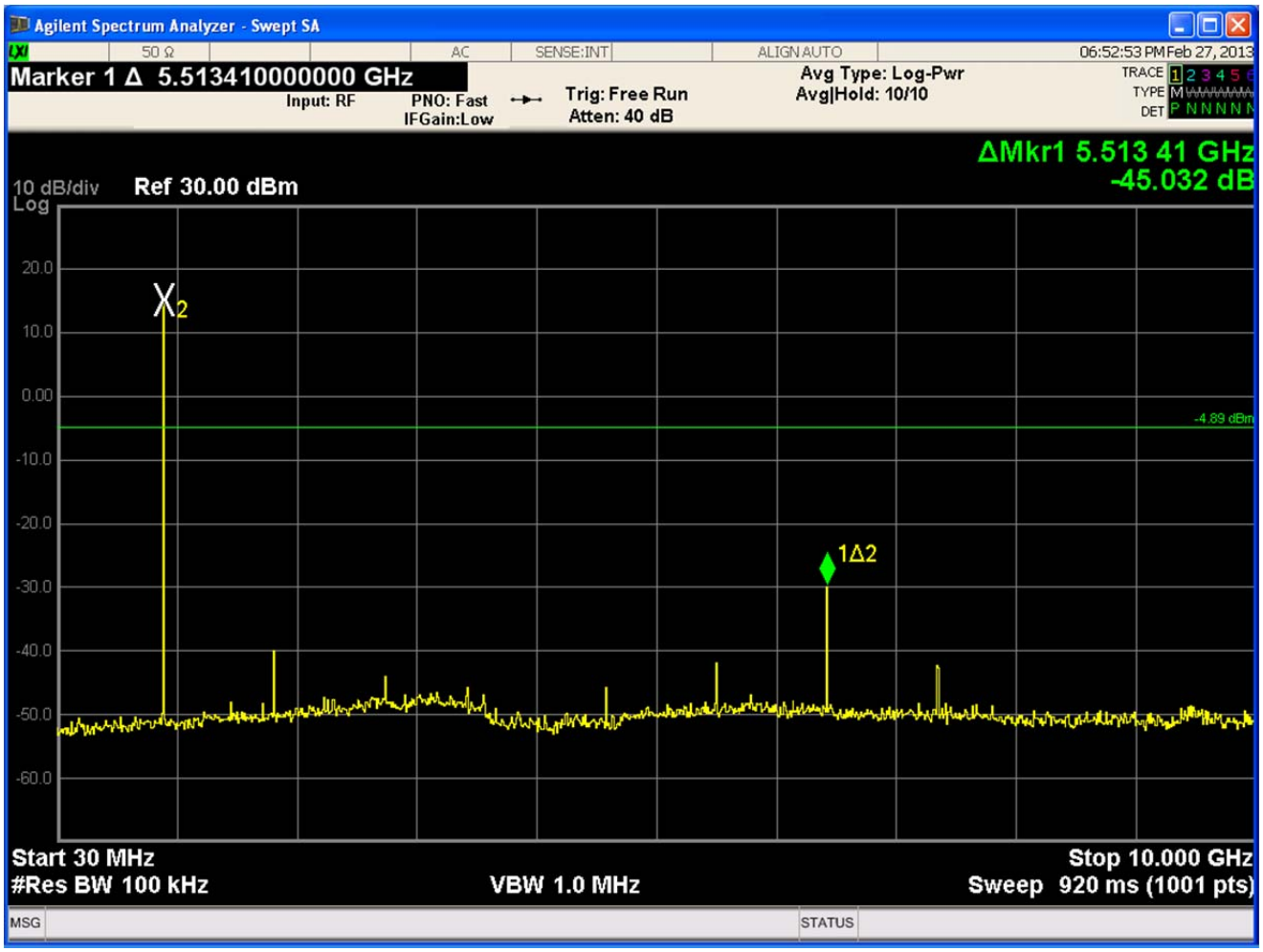
Operating frequency :	**910.92 MHz**
RBW :	**100 kHz**
VBW :	**1 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Spurious emission :	**44.7 dBc**

3.7.10.2 Channel 13



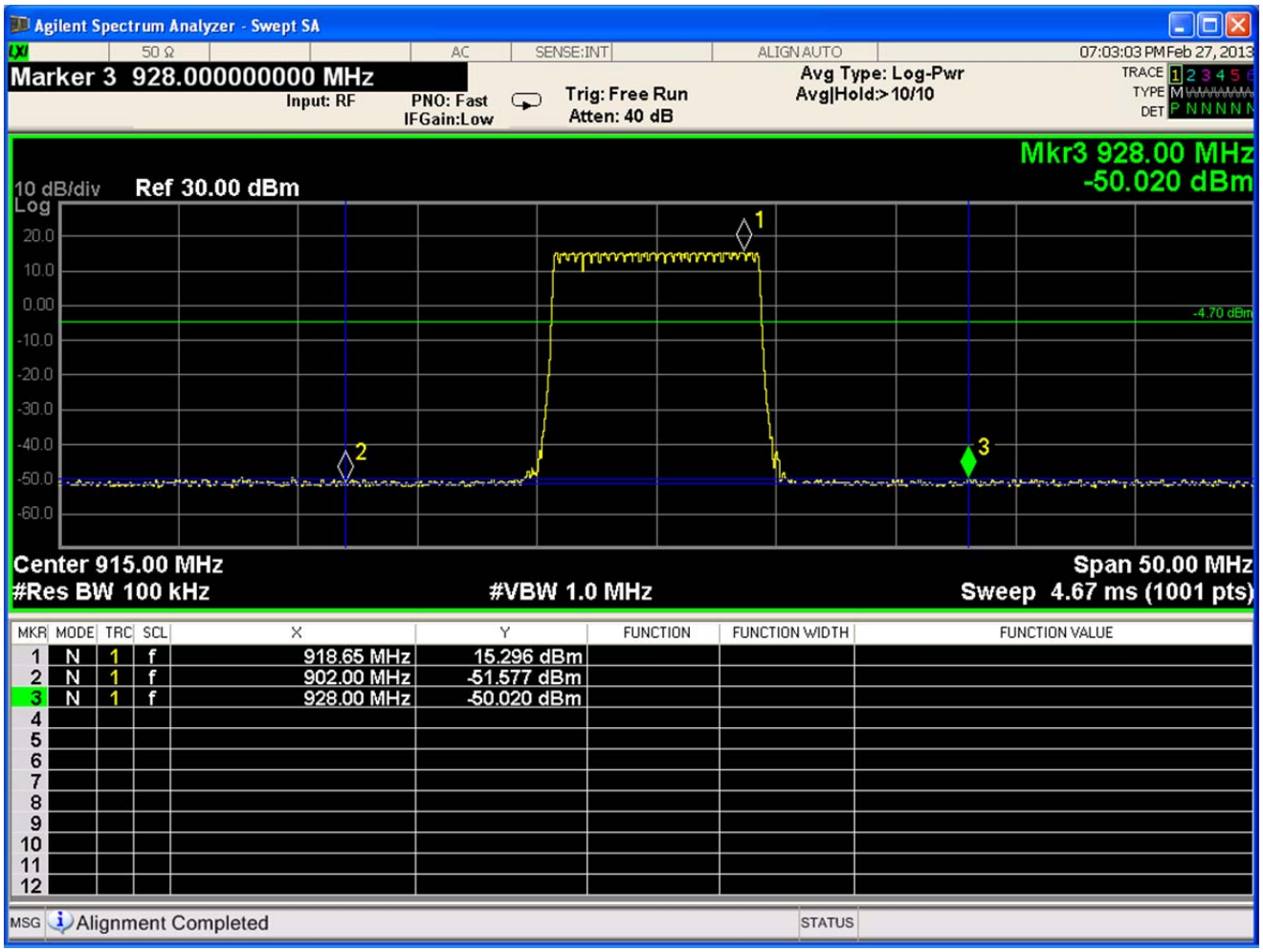
Operating frequency :	**915.00 MHz**
RBW :	**100 kHz**
VBW :	**1 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Spurious emission :	**44.8 dBc**

3.7.10.3 Channel 25



Operating frequency :	**919.08 MHz**
RBW :	**100 kHz**
VBW :	**1 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Spurious emission :	**45.0 dBc**

3.7.10.4 Band edge at full hopping mode



Operating frequency :	**Full hopping**
RBW :	**100 kHz**
VBW :	**1 MHz**
Detector mode :	**Peak**
Trace mode :	**Max hold**
Sweep time :	**Auto**
Lower band edge :	**66.8 dBc**
Upper band edge :	**65.3 dBc**

4. RF Exposure Compliance Requirement

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

Where :

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (20 cm)

The Max Conducted Peak Output Power is below;

Channel Number	Frequency	Field strength at 3 meter		Output power	Power density
	[MHz]	[dBμV/m]	[V/m]	[mW]	[mW/cm^2]
1	910.92	114.8	0.550	91.2	0.018 153
13	915.00	114.7	0.543	89.1	0.017 740
25	919.08	114.8	0.550	91.2	0.018 153

Result:

Complied with FCC/IC limit: 1 mW/cm^2, 10 mW/cm^2

5. Test equipment list

The listing below denotes the test equipment for the test(s).

No.	Equipment	Model	Manufacturer	Serial Number	Calibration Due date
1	Spectrum analyzer	N9020A	Agilent	MY48010456	02/04/14
2	Test receiver	ESCI 7	Rohde & Schwarz	1166.5950.07	01/30/14
3	Power supply	E3633A	Agilent	SG40002272	01/28/14
4	Loop antenna	6502	EMCO	9609-9087	02/26/14
5	Biconical antenna	VHA9103	Schwarzbeck	2217	11/29/13
6	Log-Periodic antenna	VULP9118A	Schwarzbeck	382	11/29/13
7	Horn antenna	BBHA 9120 D	Schwarzbeck	395	08/07/13
8	Pre-amplifier	SCU-01	R&S	10020	09/26/13
9	Pre-amplifier	JS4-00102600	MITEQ	383521	01/31/14
10	Turn table	N/A	Daeil EMC	N/A	N/A
11	Antenna mast	EAM4.5	Daeil EMC	N/A	N/A
12	Controller	DE200	Daeil EMC	AAA69813111	N/A

