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TEST REPORT For FCC

Test Report No. : 2008060028
Date of Issue : June 17, 2008
FCC ID : NLMURM-SK010
Model/Type No. : URM-SK010
Kind of Product : RFID READER MODULE
Applicant : SAMSUNG TECHWIN CO., LTD
Applicant Address : 145-3 Sangdaewon 1 dong, Chungwon-ku, Sunghnam City,
Kyungki-do, Korea
Manufacturer : SAMSUNG TECHWIN CO., LTD
Manufacturer Address : 145-3 Sangdaewon 1 dong, Chungwon-ku, Sunghnam City,
Kyungki-do, Korea
Contact Person : Moon Soo - Choi / Engineer
Telephone : +82-31-280-8073
Received Date : May 13, 2008
Test period : Start : June 05, 2008 End : June 17, 2008
Test Results : In Compliance Not in Compliance

The test results presented in this report relate only to the object tested.

Tested by

Kyu-Chul, Shin
Test Engineer
Date: June 17, 2008

Reviewed by

Young-Joon, Park
Technical Manager
Date: June 17, 2008



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REPORT REVISION HISTORY

Date	Revision	Page No
June 17, 2008	Issued (2008060028)	All

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1.0 General Product Description

Equipment model name : URM-SK010
Serial number : Prototype
EUT condition : Pre-production, not damaged
Antenna type : Patch antenna Gain 4.52dBi
Frequency Range : 902.75MHz ~ 927.25 MHz
RF power : 26.72dBm - Conducted
Number of channels : 50CH
Channel Spacing : 0.5MHz
Channel Access Protocol : Frequency Hopping
Type of Modulation : GFSK
Power Source : DC 4.2V

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz)	902.75	914.25	927.25



1.2 Model Differences

Not applicable

1.3 Device Modifications

The following modifications were necessary for compliance:

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC
Notebook PC	DELL	LATITUDE D505	32775808960	DoC

1.5 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.6 Test Facility

The measurement facility is located at 386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea.



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1.7 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	 93250
JAPAN	VCCI	10 meter Open Area Test Site and one conducted site.	 R-948, C-986
KOREA	MIC	EMI (10 meter Open Area Test Site and two conducted sites) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	 No. 51, KR0025
International	KOLAS	EMC	
Europe	GLAS	EMC EN 55011, EN 55022, EN 61000-6-3, EN 61000-6-4, EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 50130-4, EN 55024, EN 61204-3, EN 60601-1-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11	 No.13000796-02



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2.0 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	> 25 kHz	Conducted	C
15.247(a)	Number of Hopping Frequencies	> 50 hops		C
15.247(a)	Occupoed Bandwidth	< 500 KHz		C
15.247	Time of Occupancy	< 0.4 seconds		C
15.247(b)	Transmitter Output Power	< 1Watt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.249 /15.209	Field Strength of Harmonics	< 54 dBuV (at 3m)	Radiated	C
15.207 /15.107	AC Conducted Emissions	EN 55022	Line Conducted	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:
- FCC Part 15.247, ANSI C63.4-2003

2.1 Transmitter Requirements

2.1.1 Carrier Frequency Separation

Test Location

RF Test Room

Test Procedures

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled. After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 5 MHz

RBW = 100 kHz (\geq 1% of the span) Sweep = auto

VBW = 100 kHz (\geq RBW) Detector function = peak

Trace = max hold

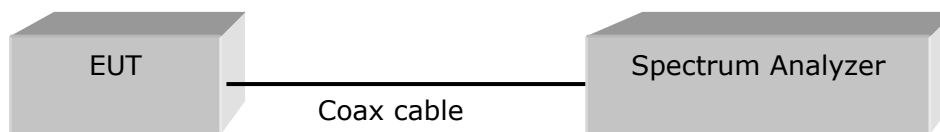


Figure 1 : Measurement setup for the carrier frequency separation

Limit

The EUT shall have hopping channel carrier frequencies separated minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Results

Carrier Frequency Separation (MHz)	Result
0.5	Complies

See next pages for actual measured spectrum plots.



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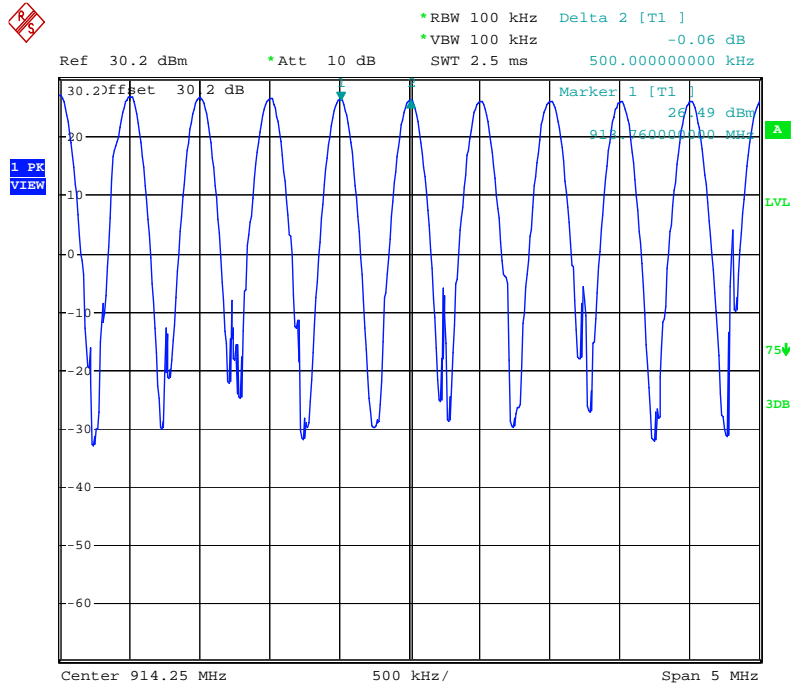
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Carrier Frequency Separation



2.1.2 Number of Hopping Frequencies

Test Location

RF Test Room

Test Procedures

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Frequency range Start = 902 MHz, Stop = 928 MHz

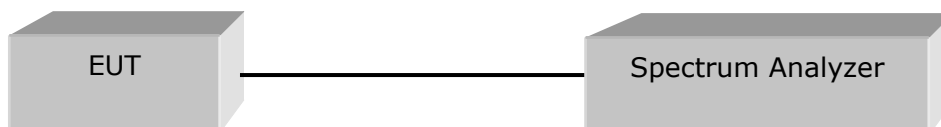
RBW = 300 kHz (\geq 1% of the span)

Sweep = auto

VBW = 300 kHz (\geq RBW)

Detector function = peak

Trace = max hold



Limit

The EUT in the 902MHz ~ 928MHz band shall use at least 50 channels.

Test Results

Total number of Hopping Channels	Result
50	Complies

See next pages for actual measured spectrum plots.



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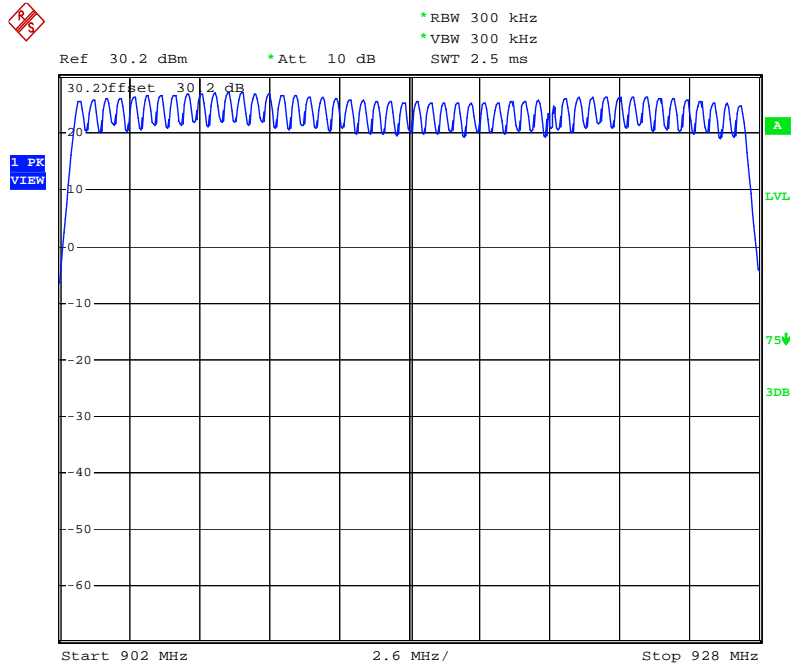
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Number of Hopping Frequencies



2.1.3 Occupied Bandwidth

Test Location

RF Test Room

Test Procedures

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

Span = 500kHz

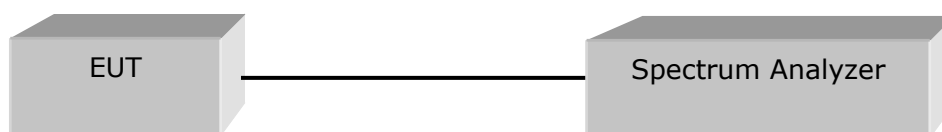
RBW = 3 kHz ($\geq 1\%$ of the span)

Sweep = auto

VBW = 10 kHz (\geq RBW)

Detector function = peak

Trace = max hold



Limit

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

Test Results

Frequency (MHz)	20dB bandwidth (KHz)	99% bandwidth (KHz)	Result
902.75	55.00	77.00	Complies
914.25	52.00	66.00	Complies
927.25	57.00	66.00	Complies

See next pages for actual measured spectrum plots.



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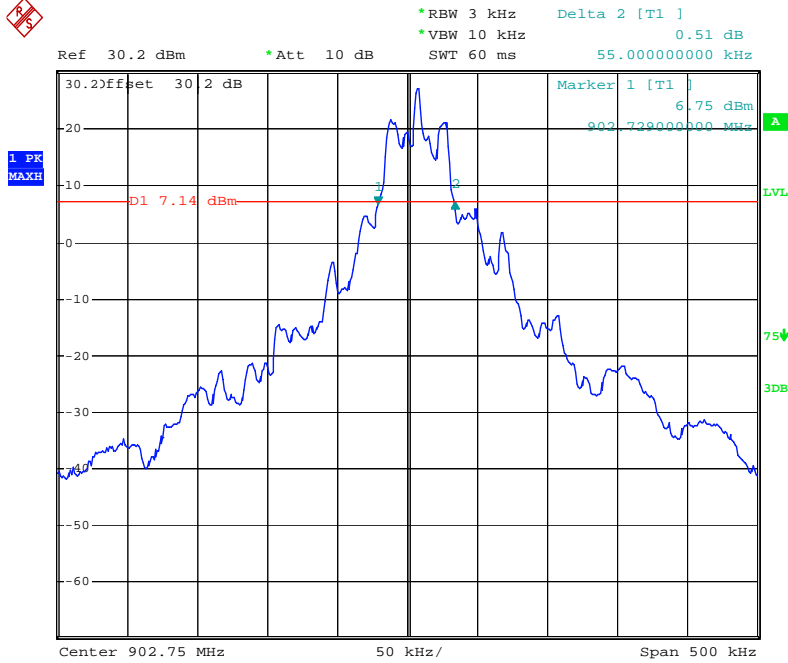
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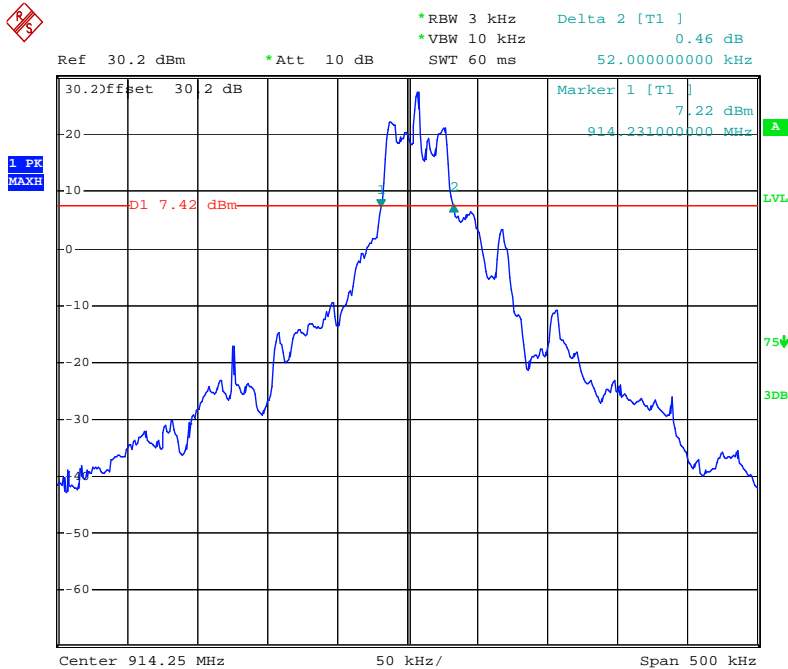
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20 dB Bandwidth Low Channel



Mid Channel





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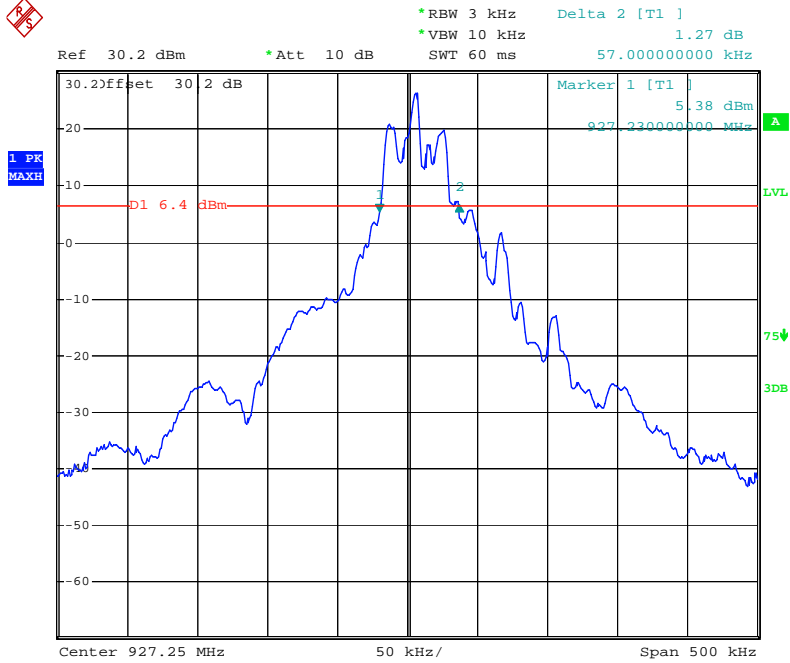
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20 dB Bandwidth High Channel





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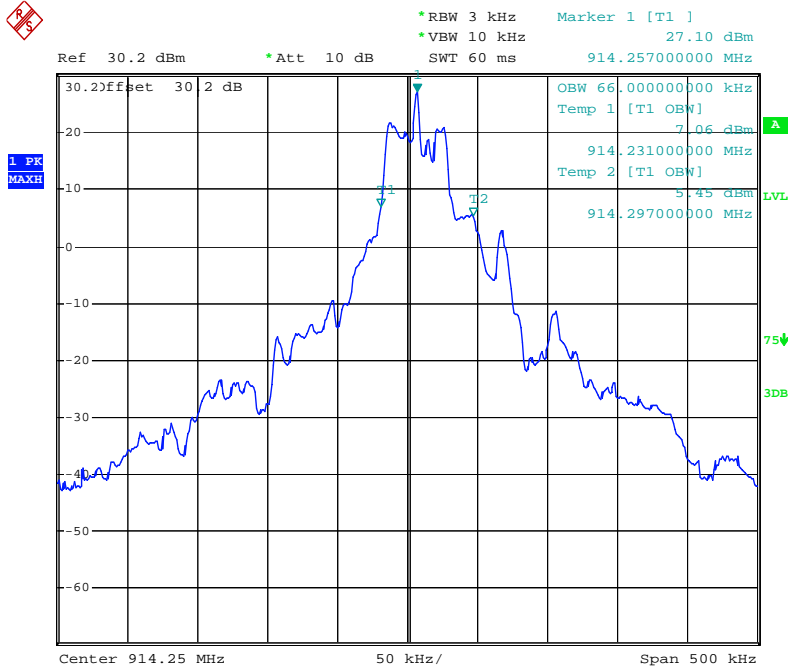
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99% Bandwidth Low Channel



Mid Channel





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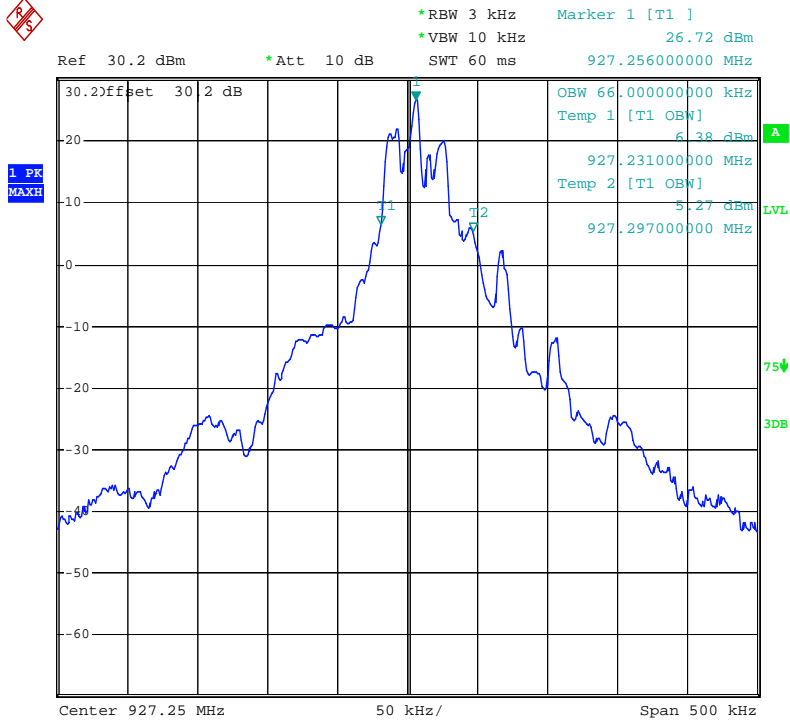
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99% Bandwidth High Channel



2.1.4 Time of Occupancy (Dwell Time)

Test Location

RF Test Room

Test Procedures

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = zero

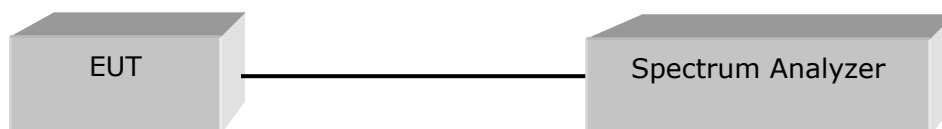
RBW = 3 kHz

Trace = max hold

VBW = 10 KHz (\geq RBW)

Detector function = peak

Sweep = as necessary to capture the entire dwell time per hopping channel



Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period .

Test Results

Dwell time= 0.0102sec

Time between occupancy = 0.54sec

Time of Occupancy = period / time between occupancy * dwell time

Therefore -> $(20/0.54) * 0.0102 = 0.3777\text{second} < 0.4\text{second}$

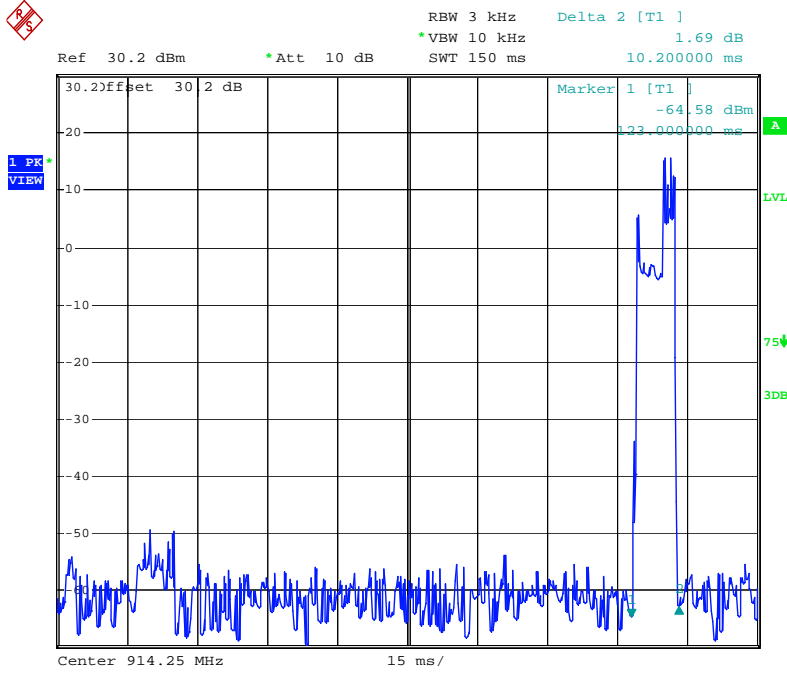


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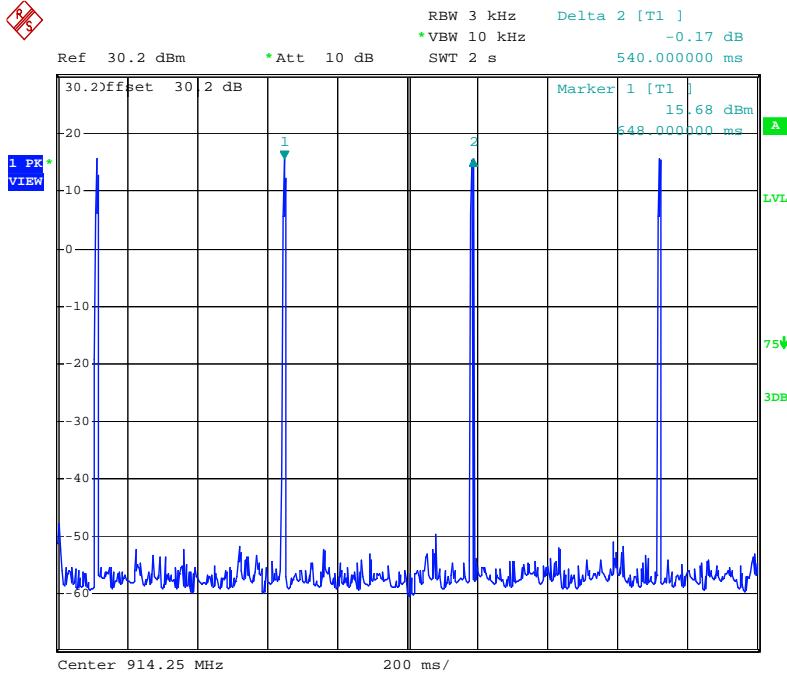
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Dwell time



Time between occupancy



2.1.5 Maximum peak Conducted Output Power

Test Location

RF Test Room

Test Procedures

The maximum peak conducted output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = 20 MHz (approximately 5 times of the 20 dB bandwidth)

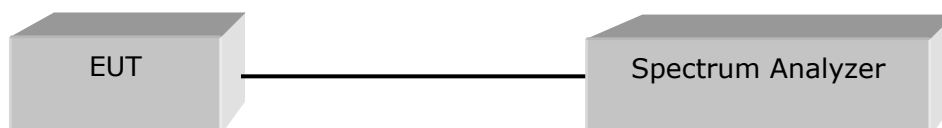
RBW = 3 MHz (greater than the 20 dB bandwidth of the EUT)

VBW = 3 MHz (\geq RBW)

Detector function = peak

Trace = max hold

Sweep = auto



Limit

< 1 W

Test Results

Frequency (MHz)	Peak output power(dBm)	Peak output power(mW)	Result
902.75	26.72	469.89	Complies
914.25	26.45	441.57	Complies
927.25	26.06	403.64	Complies

See next pages for actual measured spectrum plots.



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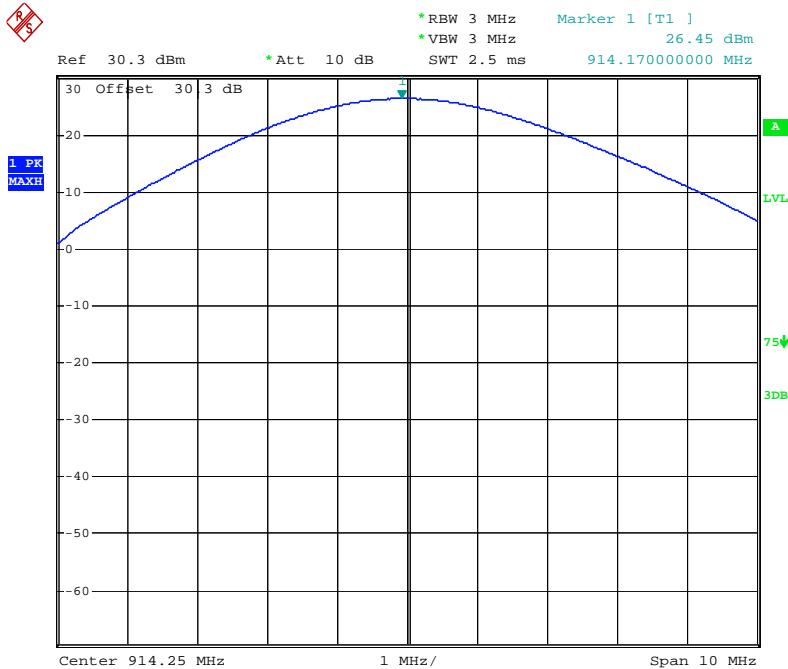
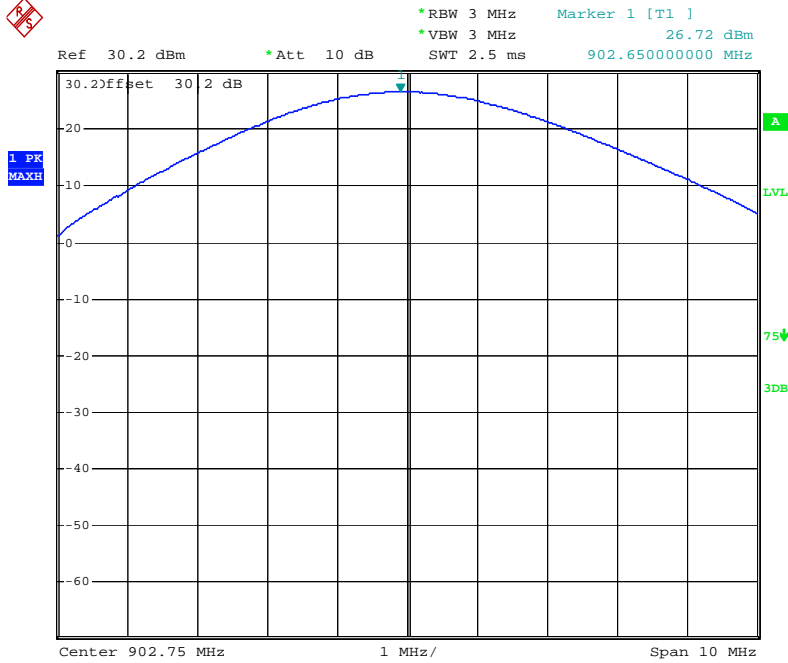
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Maximum peak Conducted Output Power





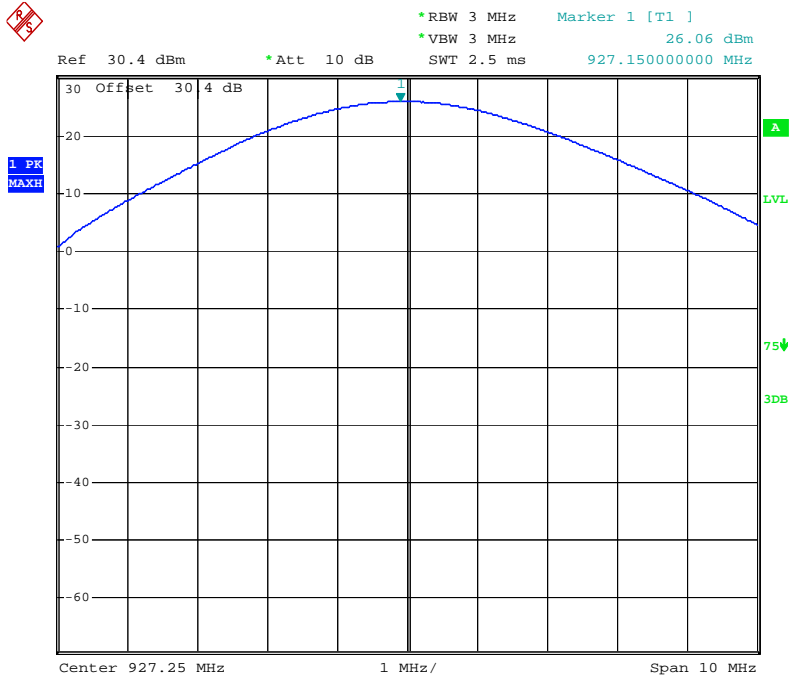
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2.1.6 Band-edge

Test Location

RF Test Room

Test Procedures

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

RBW = 100 kHz

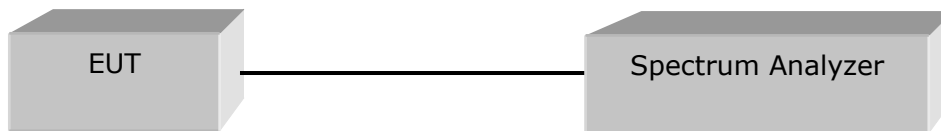
VBW = 100 kHz (\geq RBW)

Span = 100 MHz

Trace = max hold

Detector function = peak

Sweep = auto



Limit

> 20 dBc

Test Results

All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



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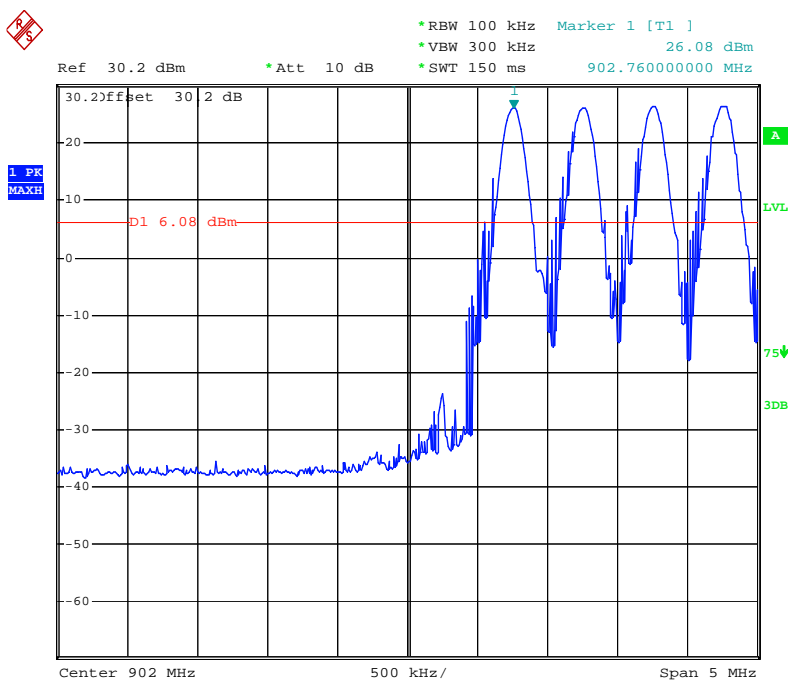
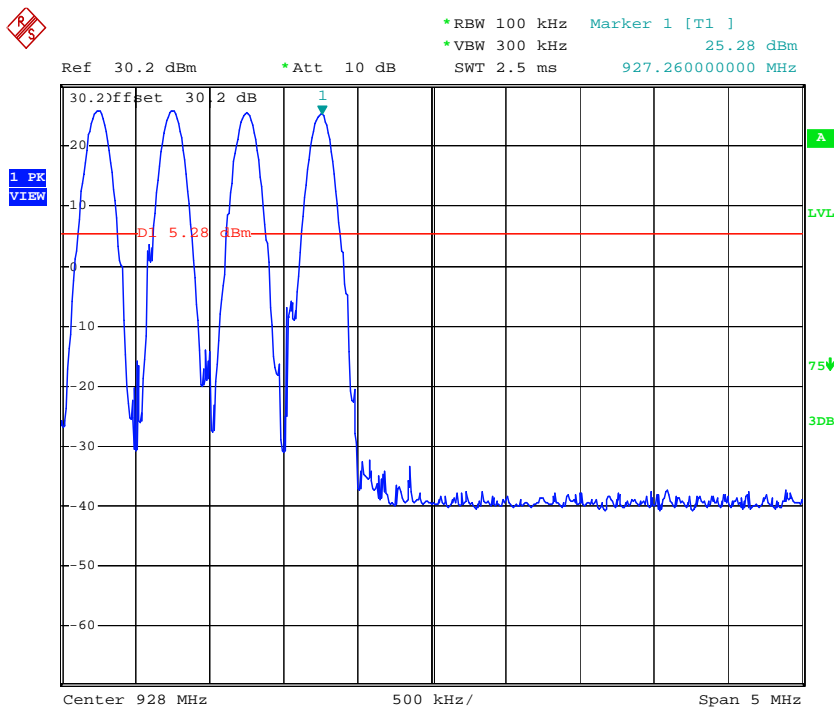
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Band – edge (with Hopping)





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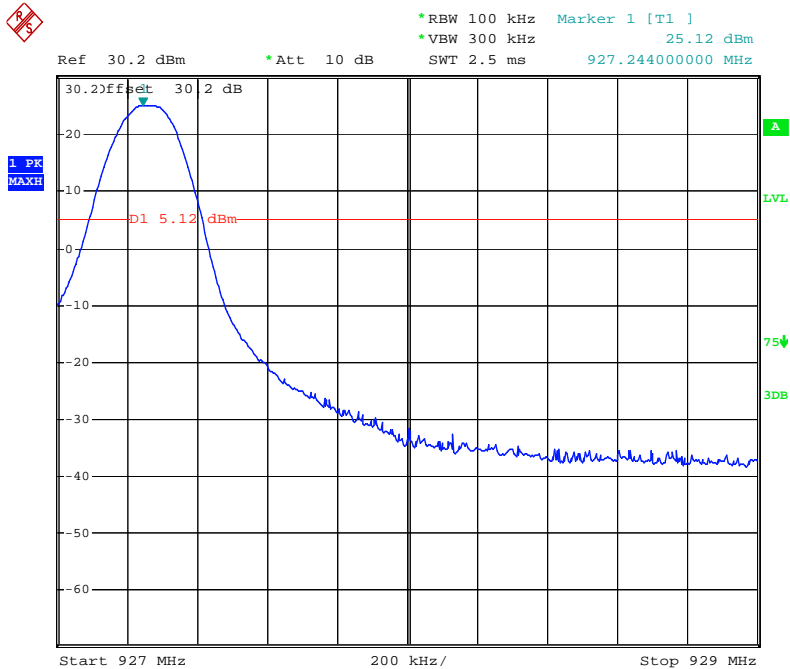
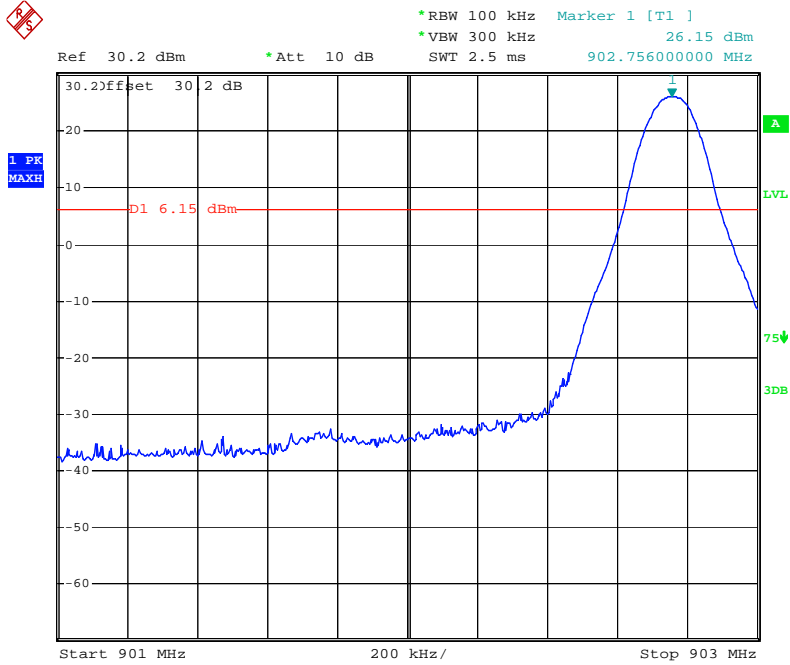
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Band – edge (without Hopping)



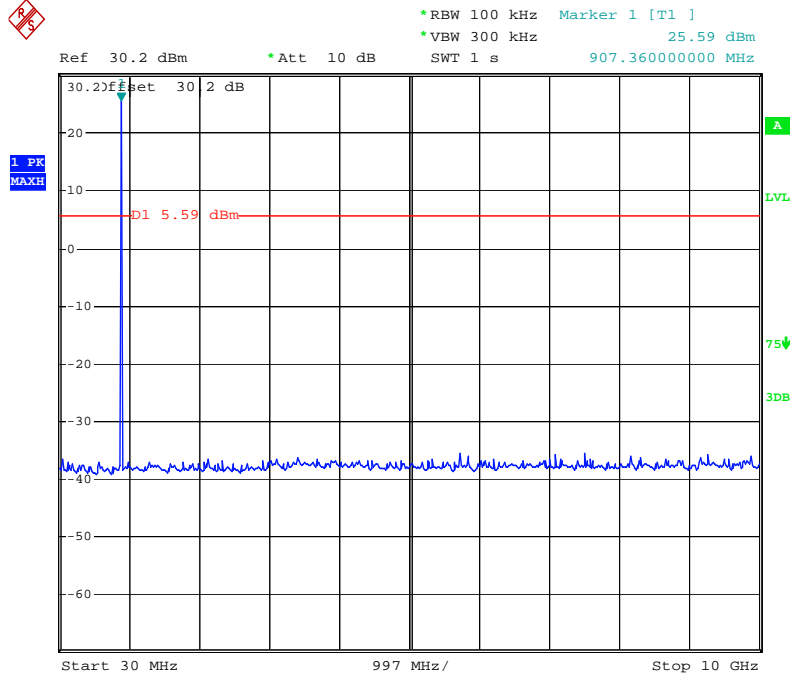


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Band – edge (at 20 dB blow) – Low channel Frequency Range = 30 MHz ~ 10th harmonic



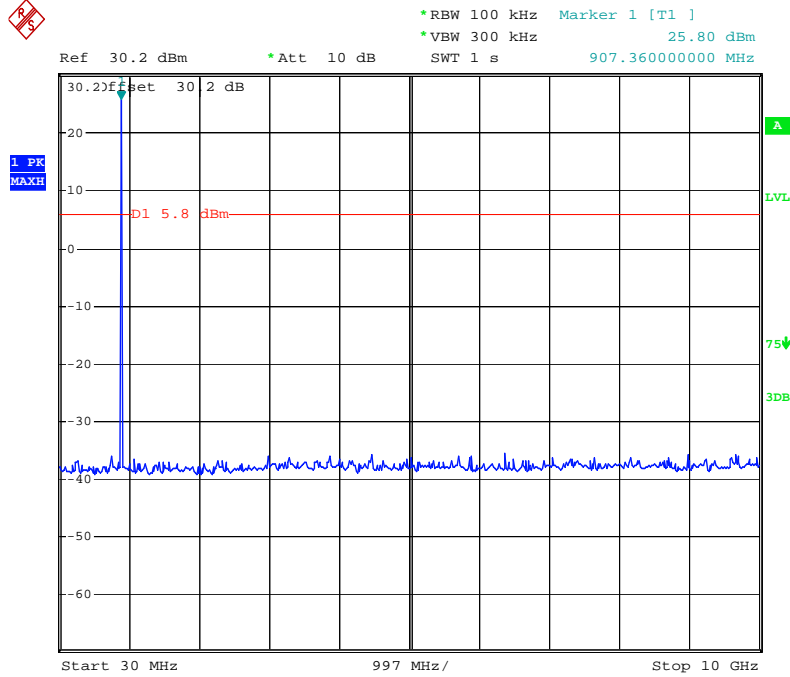


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Band – edge (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10th harmonic





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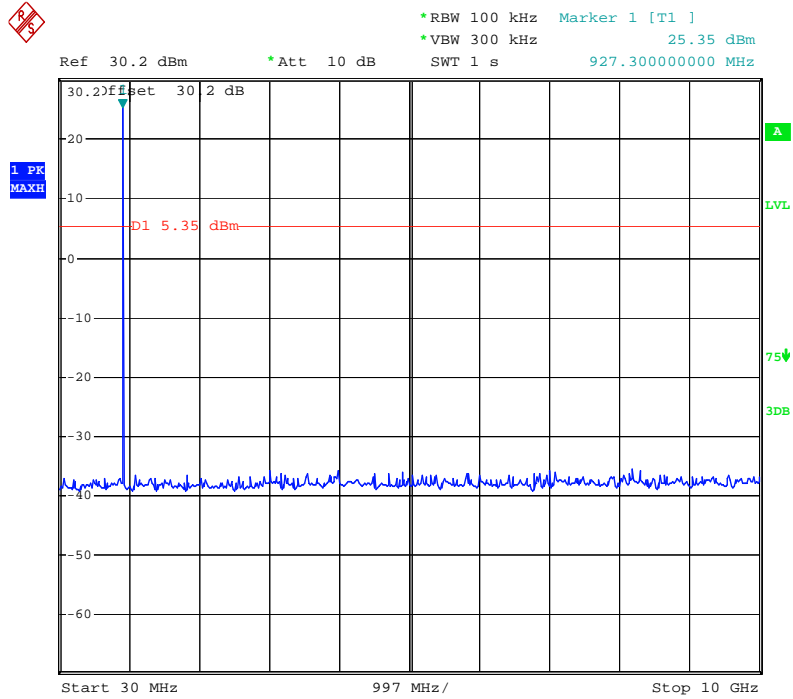
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Band – edge (at 20 dB blow) – High channel Frequency Range = 30 MHz ~ 10th harmonic



2.1.7 Field Strength of Emissions

Test Location

Testing was performed at a test distance of 3 meter Open Area Test Site

Test Procedures

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 30 MHz ~ 10th harmonic

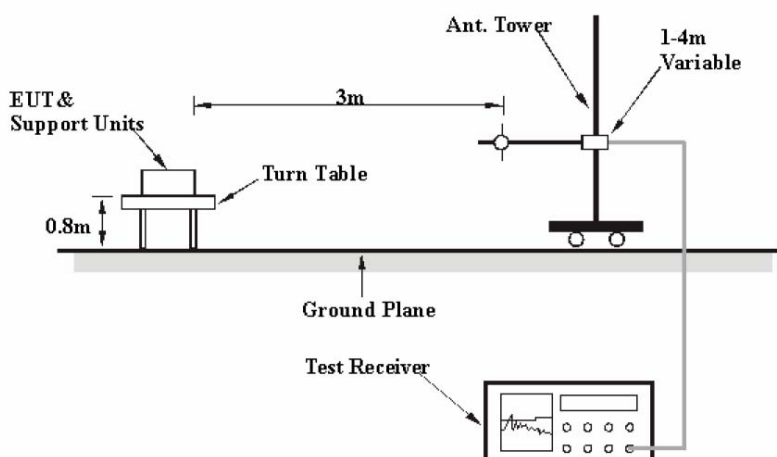
RBW = 120 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Detector function = Quasi-peak

Trace = max hold



Limit

- 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m
30-88	100**	40
88-216	150**	43.5
216-960	200**	46
Above 960	500	54

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.



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Test Results

EUT	RFID READER MODULE	Measurement Detail	
Model	URM-SK010	Frequency Range	Below 1000MHz
Channel	-	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
168.24	37.7	5.8	Quasi-Peak

Test Data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor		Limits [dBuV/m]	Result [dBuV/m]	Margin [dB]
				Antenna	Cable			
168.24	29.2	H	2.0	7.1	1.4	43.5	37.7	5.8
192.50	28.0	H	1.5	7.2	1.5	43.5	36.7	6.8
253.17	26.3	H	2.0	9.8	1.9	46.0	37.9	8.1
289.55	22.8	H	2.0	10.8	2.3	46.0	35.8	10.2
338.01	22.8	H	2.0	12.2	2.6	46.0	37.5	8.5
384.19	20.3	H	2.0	13.0	2.7	46.0	36.0	10.0

H : Horizontal, V : Vertical



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Test Results

EUT	RFID READER MODULE	Measurement Detail	
Model	URM-SK010	Frequency Range	1-25GHz
Frequency	902.75MHz	Detector function	Average/Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
1805.54	51.37/62.58	2.63/11.42	Average/Peak

Test Data

Frequency [MHz]	Reading A/P [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits/ Detector A/P [dBuV/m]	Result A/P [dBuV/m]
				Antenna	Amp. Gain	Cable		
1805.54	55.27/66.48	V	1	28.2	35.3	3.2	54.0 /74.0	51.37/62.58

*No emission Were detected at level greater than 20dB below limit.

Restricted band edge test data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]
				Antenna	Amp. Gain	Cable		
No emissions were detected at a level greater than 20dB below limit.								



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Test Results

EUT	RFID READER MODULE	Measurement Detail	
Model	URM-SK010	Frequency Range	1-25GHz
Frequency	914.25MHz	Detector function	Average/Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
1828.42	51.82/61.51	2.18/12.49	Average/Peak

Test Data

Frequency [MHz]	Reading A/P [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits/ Detector A/P [dBuV/m]	Result A/P [dBuV/m]
				Antenna	Amp. Gain	Cable		
1828.42	55.72/65.41	V	1	28.2	35.3	3.2	54.0 /74.0	51.82/61.51

*No emission Were detected at level greater than 20dB below limit.

Restricted band edge test data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]
				Antenna	Amp. Gain	Cable		
No emissions were detected at a level greater than 20dB below limit.								



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Test Results

EUT	RFID READER MODULE	Measurement Detail	
Model	URM-SK010	Frequency Range	1-25GHz
Frequency	927.25MHz	Detector function	Average/Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
1854.57	50.29/60.76	1.65/14.47	Average/Peak

Test Data

Frequency [MHz]	Reading A/P [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits/ Detector A/P [dBuV/m]	Result A/P [dBuV/m]
				Antenna	Amp. Gain	Cable		
1854.57	54.19/63.43	V	1	28.2	35.3	3.2	54.0 /74.0	50.29/59.53

*No emission Were detected at level greater than 20dB below limit.

Restricted band edge test data

Frequency [MHz]	Reading [dBuV/m]	Pol.	Height [m]	Correction Factor			Limits [dBuV/m]	Result [dBuV/m]
				Antenna	Amp. Gain	Cable		
No emissions were detected at a level greater than 20dB below limit.								



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APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
1	Spectrum Analyzer	Agilent	8564E	3551A0041	2008-11-01
2	Spectrum Analyzer	HP	E4403B	US39440619	2008-09-03
3	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2008-11-19
4	EMI Test Receiver	Rohde & Schwarz	ESVS30	826638/008	2009-03-07
5	ULTRA Broadband Antenna	Rohde & Schwarz	HL562	361324/014	2010-06-12
6	LOOP ANTENNA	EMCO	6502	9107-2652	2008-10-17
7	LOOP ANTENNA	EMCO	6502	9607-3020	2010-03-06
8	System Power Supply	HP	6032A	3440A-10521	2008-07-16
9	EPM Series Power Meter	HP	E4418A	GB38272734	2008-11-03
10	Power Sensor	HP	8481A	331BA92056	2008-11-03
11	Power Sensor	HP	8482B	331BA05406	2008-11-03
12	Audio Analyzer	HP	8903B	2747A03432	2008-11-01
13	ESG-D Series Signal Generator	Agilent	E4432B	US40054094	2008-11-01
14	SYNTHESIZED SWEEPER	HP	8341B	2819A01563	2008-11-22
15	Modulation Analyzer	HP	8901B	3438A05228	2008-11-08
16	Attenuator	HP	8494A	3308A33351	2008-11-06
17	Attenuator	HP	8496A	3308A15142	2008-11-06
18	Temp&Humi Chamber	Kunpoong	KP-1000	2002KP050041	2009-01-21
19	Temp&Humi Chamber	Kunpoong	KP-RC2000	2002KP650042	2009-01-21
20	EMC Analyzer	Agilent	E7405A	MY45110859	2008-01-09
21	Horn Antenna	ETS-Lindgren	3115	00078894	2008-11-29
22	Horn Antenna	ETS-Lindgren	3115	00078895	2008-11-29
23	Horn Antenna	ETS-Lindgren	3116	00062504	2008-11-27
24	Horn Antenna	ETS-Lindgren	3116	00062916	2008-11-27
25	Dipole Antenna	SCHWARZBECK	VHA 9103	VHA91032557	2009-11-27
26	Dipole Antenna	SCHWARZBECK	UHA 9105	UHA91052417	2009-11-27
27	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2009-02-28
28	PREAMPLIFIER	Agilent	8449B	3008A02307	2008-11-05
29	Radio Communication Tester	Rohde & Schwarz	CMU200	106765	2009-02-09
30	Band Reject Filter	Wainwright Instruments	WRCG824	-	2009-04-16
31	Band Reject Filter	Wainwright Instruments	WRCG1750	-	2009-04-16
32	Field Strength Meter	Rohde & Schwarz	ESHS30	862024/001	2009-03-04
33	LISN	Rohde & Schwarz	ESH3-Z5	100207	2008-12-20
34	LISN	EMCO	3825/2	9206-1971	2008-12-20



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APPENDIX B – MPE CALCULATION



* * MPE Calculations * *

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the user. The MPE calculation for this exposure is shown below.

The peak radiated output power (EIRP) is calculated as follows:

$\text{EIRP} = P + G$ $\text{EIRP} = 31.24 \text{ dBm}$	Where, P = Power input to the antenna (mW) G = Power gain of the antenna (dBi)
---	--

The numeric gain(G) of the antenna with a gain specified in dB is determined by:

$$G = \text{Log}^{-1} (\text{dB antenna gain} / 10)$$

$$G = \text{Log}^{-1} (4.52 / 10)$$

$$G = 2.83$$

Power density at the specific separation:

$S = PG / (4R^2 \pi)$ $S = (469.89 * 2.83) / (4 * 20^2 * \pi)$ $S = 0.2648 \text{ mW/cm}^2$	Where, S = Maximum power density (mW/cm^2) P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)
---	--

The Maximum permissible exposure (MPE) for the general population is 1 mW/cm^2 .

The power density at 20cm does not exceed the 1 mW/cm^2 limit.

Estimated safe separation:

$R = \sqrt{PG / 4 \pi}$ $R = \sqrt{(469.89 * 2.83 / 4 \pi)}$ $R = 10.29 \text{ cm}$	Where, P = Power input to the antenna (mW) G = Numeric power gain of the antenna R = Distance to the center of the radiation of the antenna (20cm = limit for MPE)
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