

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

### INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

**Product Name:** SmartNode

**Marketing Name:** SmartNode Receiver

**Brand Name:** Cadi Scientific Pte Ltd.

**Model No.:** SMN-890S

**Model Difference:** N/A

**FCC ID:** VPE-SMN890S

**Report No.:** ER/2011/C0002

**Issue Date:** Feb. 01, 2012

**FCC Rule Part:** §15.249

**Prepared for:** CADI SCIENTIFIC PTE LTD  
31, UBI ROAD, AZTECH BUILDING, #03-00,  
408694, Singapore

**Prepared by:** SGS Taiwan Ltd.  
Electronics & Communication Laboratory  
No. 134, Wu Kung Rd., Wuku Industrial Zone,  
Taipei County, Taiwan.



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**VERIFICATION OF COMPLIANCE**

**Applicant:** CADI SCIENTIFIC PTE LTD  
 31, UBI ROAD, AZTECH BUILDING, #03-00, 408694, Singapore

**Product Description:** SmartNode

**Marketing Name:** SmartNode Receiver

**Brand Name:** Cadi Scientific Pte Ltd.

**Model No.:** SMN-890S

**FCC ID:** VPE-SMN890S

**Model Difference:** N/A

**File Number:** ER/2011/C0002

**Date of test:** Dec. 02, 2011 ~ Jan. 31, 2012

**Date of EUT Received:** Dec. 02, 2011

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd., Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.249.

The test results of this report relate only to the tested sample identified in this report.

*Test By:* Jazz Huang *Date:* Feb. 01, 2012

*Jazz Huang / Engineer*

*Prepared By:* Judy Hsu *Date:* Feb. 01, 2012

*Judy Hsu / Clerk*

*Approved By:* Jim Chang *Date:* Feb. 01, 2012

*Jim Chang / Supervisor*

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## Version

Version No.	Date	Description
00	Feb. 01, 2012	Initial creation of document

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## 1. GENERAL INFORMATION

### 1.1 Product Description

Product Name:	SmartNode	
Marketing Name:	SmartNode Receiver	
Brand Name:	Cadi Scientific Pte Ltd.	
Model No.:	SMN-890S	
Model Difference:	N/A	
Transmit Power	114 dBuV/m	
Operation Frequency:	919.8MHz and 925.0MHz	
Channel number:	2 channels	
Modulation Type:	GFSK	
Hardware Version	version 6.0	
Software Version	version 5.2	
Power Supply	12Vdc by AC/DC power adapter	
	Adapter:	Model No.: NU20-5120125-I3, Supplier: LEADER ELECTRONIC INC
Antenna Designation:	Dipole Antenna	

This report complies with FCC 15.249

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## 1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: VPE-SMN890S filing to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

## 1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2003). Radiated testing was performed at an antenna to EUT distance 3 meters.

## 1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. FCC Registration Number is: 990257 and 236194, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

## 1.5 Special Accessories

Not available for this EUT intended for grant.

## 1.6 Equipment Modifications

Not available for this EUT intended for grant.

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## 2. System Test Configuration

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

The Transmitter was operated in the engineering operating mode. the Tx frequency was fixed which was for the purpose of the measurements.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7 and 13 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

#### 2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.4-2003.

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## 2.4 Limitation

### (1) Conducted Emission

According to section 15.207(a) Conducted Emission Limits is as following.

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 – 0.5	66 - 56	56 - 46
0.5 – 5	56	46
5 - 30	60	50

### (2) Radiated Emission 15.249(a)

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following.

Frequency (MHz)	Field strength of Fundamental	Field strength of Harmonics	Distance (m)
902 - 928	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
2400 – 2483.5	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
5725 – 5875	50 mV/m (94dBuV/m)	500 uV/m (54dBuV/m)	3
24.0 – 24.25 GHz	250 mV/m (107.95dBuV/m)	2500 uV/m (67.95dBuV/m)	3

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**(3) Radiated Emission 15.249 (d)**

Emission Radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209 as below, whichever is the lesser attenuation.

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V/m}$
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

**(4) Radiated Emission 15.249(e)**

For frequencies above 1000MHz, the above field strength limits are based on average limits. The peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20dB under any condition of modulation.

- Remark:
1. Emission level in  $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$
  2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
  3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of  $\xi$  15.205
  4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of  $\xi$  15.205, then the general radiated emission limits in  $\xi$  15.209 apply.

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## 2.5 Configuration of Tested System

Fig. 2-1 Configuration(Radiated)

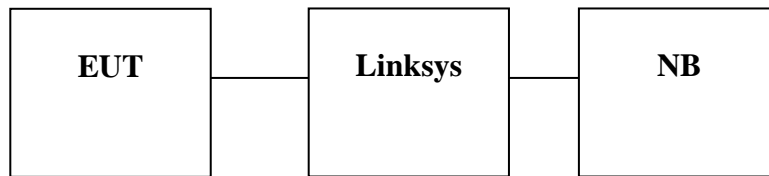


Fig. 2-1 Configuration(Conducted)

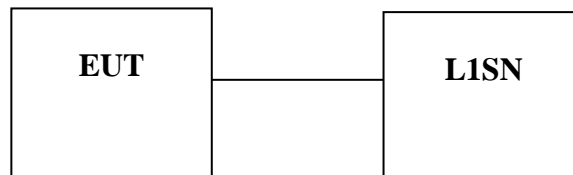


Table 2-2 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.
1.	Notebook	DELL	D505	20995915456
2.	8-Port 10/100 +2-Port Gigabit Switch	Linksys	SRW20PP	RMW00F8000022
3.	Software	Terminal	V1.96	N/A
4.	LISN	Rolf-Heine	NNB-2/16Z	99012

**Note:** All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

**Grounding:** Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

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### 3. Summary of Test Results

FCC Rules	Description Of Test	Result
§ 15.207	Conducted Emission	N/A
§ 15.249(a)(e)	Radiated Emission	Compliant
§ 15.249(d)	20dB band width Measurement	Compliant

### 4. Description of test modes

The EUT has been tested under operating condition.  
 The EUT is staying in continuous transmitting mode.

919.8MHz and 925MHz with highest data rate are chosen for full testing.

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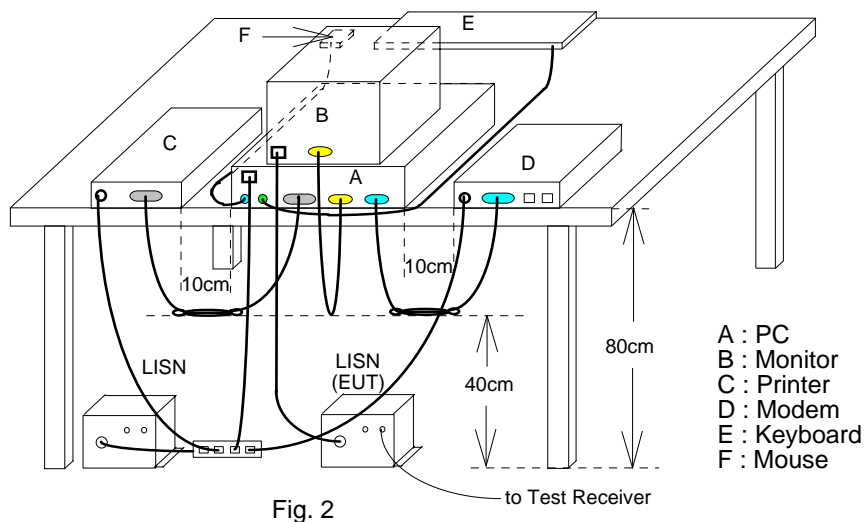
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## 5. Conducted Emissions Test

### 5.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

### 5.2 Test SET-UP (Block Diagram of Configuration)



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### 5.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCS30	828985/004	09/23/2010	09/22/2012
LISN	Rolf-Heine	NNB-2/16Z	99012	03/31/2011	03/30/2012
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/31/2011	03/30/2012
Coaxial Cables	N/A	WK CE Cable	N/A	11/28/2011	11/27/2012

### 5.4 Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Note: Refer to next page for measurement data and plots.

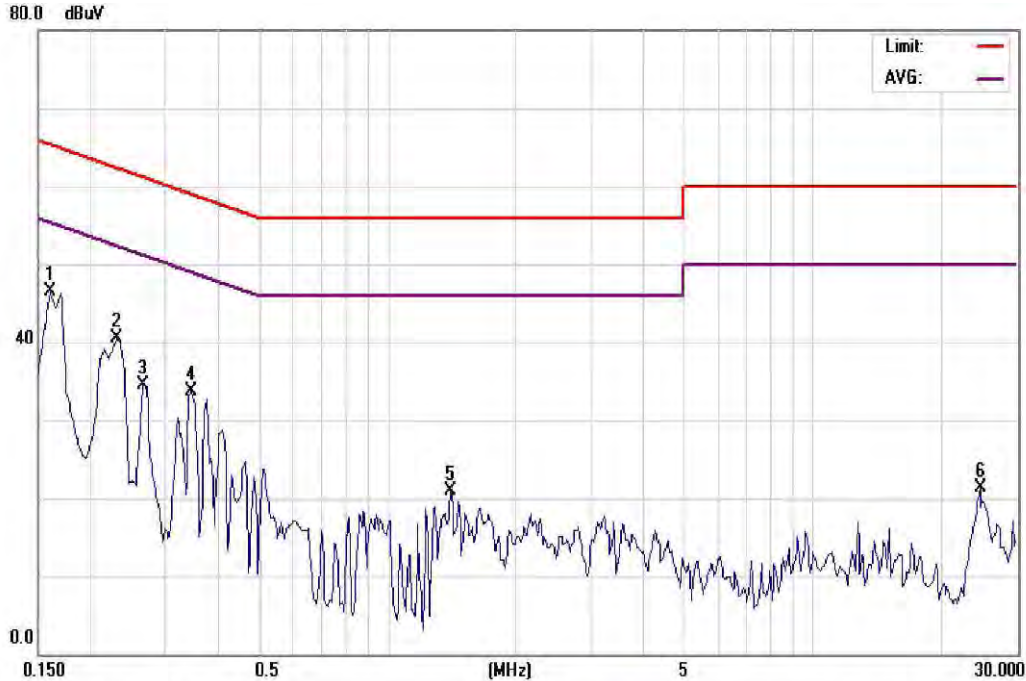
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### AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode		Test Date:	Jan. 22, 2012
Temperature:	22 °C	Humidity:	58 %	Test By: Jazz



Site: SGS CONDUCTED #1	Phase: L1	Temperature: 25 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 59%
EUT: SmartNode	Distance:	Air Pressure: hpa
M/N: SMN-890S		
Note: OPERATION		

No.	Mk.	Freq. MHz	Reading Level dBuV	Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1600	46.42	0.11	46.53	65.46	-18.93	peak	
2		0.2300	40.40	0.09	40.49	62.45	-21.96	peak	
3		0.2650	34.50	0.09	34.59	61.27	-26.68	peak	
4		0.3450	33.58	0.08	33.66	59.08	-25.42	peak	
5		1.4100	20.74	0.09	20.83	56.00	-35.17	peak	
6		24.8000	20.96	0.29	21.25	60.00	-38.75	peak	

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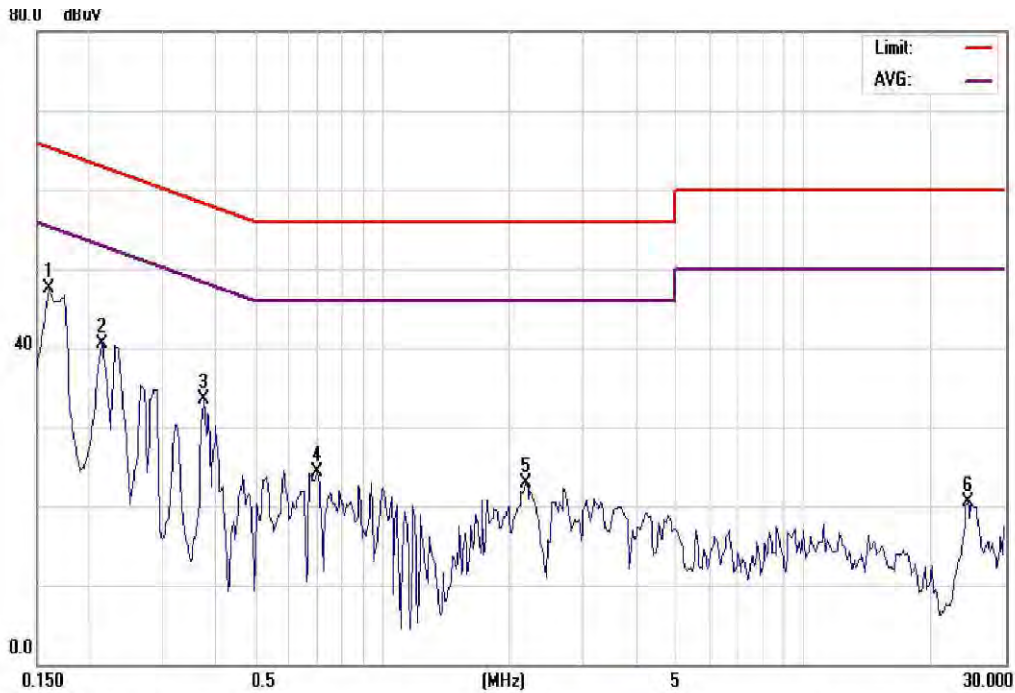
SGS Taiwan Ltd. No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan / 台北縣五股工業區五工路134號

台灣檢驗科技股份有限公司 t (886-2) 2299-3279

f (886-2) 2298-0488

[www.tw.sgs.com](http://www.tw.sgs.com)

Member of SGS Group



Site: SGS CONDUCTED#1  
 Limit: FCC Class B Conduction(QP)  
 EUT: SmartNodeI  
 M/N: SMN-890S  
 Note: OPERATION

Phase: **N**  
 Power: AC 120V/60Hz  
 Distance:

Temperature: 26 °C  
 Humidity: 59%  
 Air Pressure: hpa

No.	Mk.	Freq. MHz	Reading Level dBuV	Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1600	47.34	0.16	47.50	65.46	-17.96	peak	
2		0.2150	40.38	0.13	40.51	63.01	-22.50	peak	
3		0.3750	33.44	0.12	33.56	58.39	-24.83	peak	
4		0.7000	24.12	0.12	24.24	56.00	-31.76	peak	
5		2.2000	22.76	0.13	22.89	56.00	-33.11	peak	
6		24.7200	20.16	0.35	20.51	60.00	-39.49	peak	

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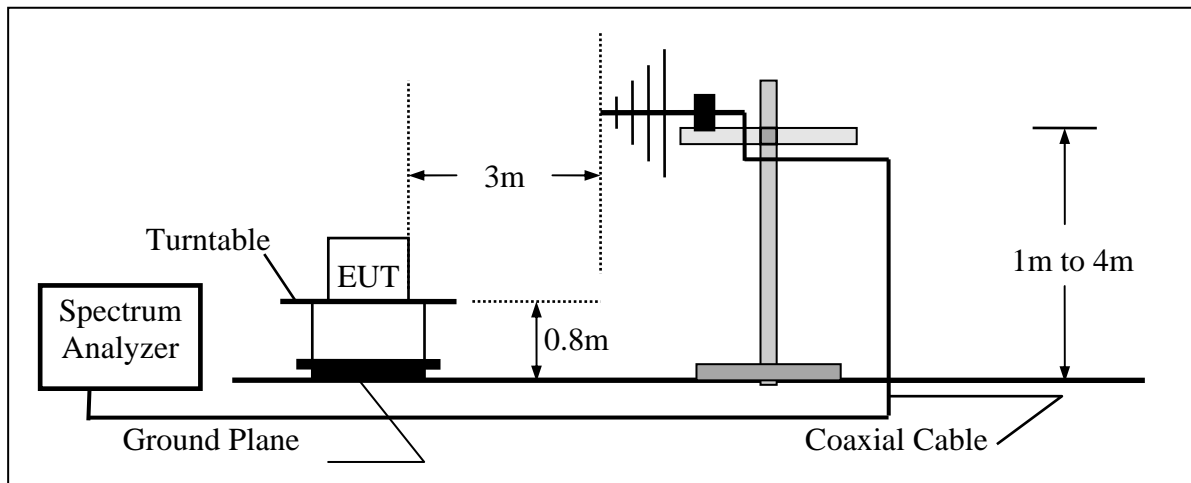
## 6. Radiated Emission Test

### 6.1 Measurement Procedure

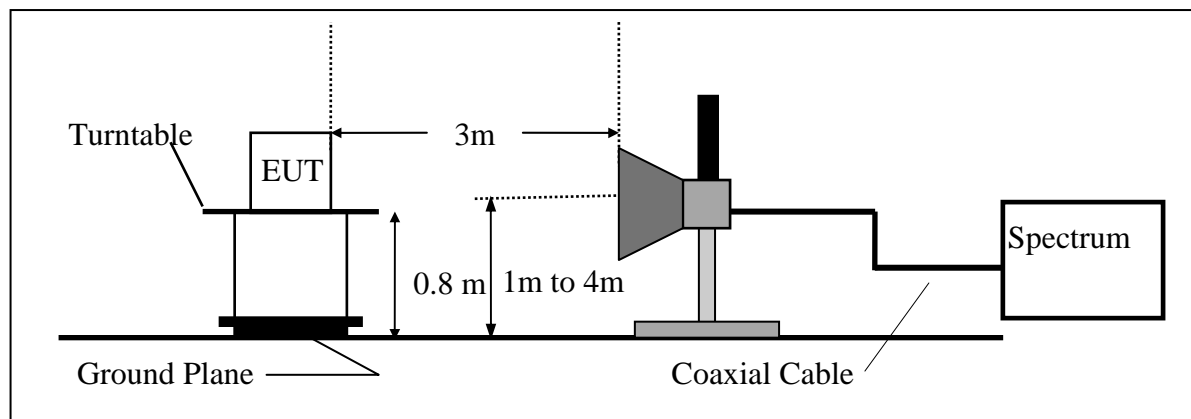
1. The EUT was placed on a turntable that is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

### 6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Over 1 GHz



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### 6.3 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	03/30/2011	03/29/2012
Bilog Antenna	SCHWAZBECK	VULB9160	3136	11/19/2011	11/18/2013
Horn antenna	ETS.LINDGREN	3117	123995	03/19/2011	03/18/2013
Pre-Amplifier	Agilent	8447D	1937A02834	11/28/2011	11/27/2013
Pre-Amplifier	Agilent	8449B	3008A01973	01/05/2012	01/04/2013
Radio Communication Analyzer	R & S	CMU200	102189	08/12/2010	08/11/2012
DC Block	Agilent	BLK-18	155452	01/05/2012	01/04/2013
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	01/05/2012	01/04/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	01/05/2012	01/04/2013
3m Site	SGS	966 chamber	N/A	07/15/2011	07/14/2012

### 6.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

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## 6.5 Measurement Result

### Radiated Spurious Emission Measurement Result

Operation Band	:919.8 MHz	Test Date	:2011-12-26
Fundamental Frequency	:919.8 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX	Engineer	:Marcus
EUT Pol.	:E2	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
40.67	S	Peak	48.61	-13.33	35.28	40.00	-4.72
115.36	S	Peak	55.03	-14.46	40.57	43.50	-2.93
161.92	S	Peak	47.65	-11.82	35.83	43.50	-7.67
199.75	S	Peak	41.29	-15.43	25.86	43.50	-17.64
459.71	S	Peak	42.37	-9.20	33.17	46.00	-12.83
689.60	S	Peak	36.82	-4.49	32.33	46.00	-13.67
919.79	F	Peak	84.31	-1.77	82.54	114.00	-31.46
1837.60	H	Peak	44.90	3.64	48.54	74.00	-25.46
2756.40	H	---					
3675.20	H	---					
4594.00	H	---					
5512.80	H	---					
6431.60	H	---					
7350.40	H	---					
8269.20	H	---					
9188.00	H	---					

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Operation Band	:919.8 MHz	Test Date	:2011-12-26
Fundamental Frequency	:919.8 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX	Engineer	:Marcus
EUT Pol.	:E2	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Safe Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
92.08	S	Peak	50.46	-16.86	33.60	43.50	-9.90
166.77	S	Peak	46.42	-12.18	34.24	43.50	-9.26
199.75	S	Peak	49.46	-15.43	34.03	43.50	-9.47
399.57	S	Peak	44.32	-10.40	33.92	46.00	-12.08
459.71	S	Peak	49.72	-9.20	40.52	46.00	-5.48
689.60	S	Peak	42.15	-4.49	37.66	46.00	-8.34
919.65	F	Peak	89.89	-1.77	88.12	114.00	-25.88
1837.60	H	Peak	43.96	3.96	47.92	74.00	-26.08
2756.40	H	---					
3675.20	H	---					
4594.00	H	---					
5512.80	H	---					
6431.60	H	---					
7350.40	H	---					
8269.20	H	---					
9188.00	H	---					

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Operation Band	:925 MHz	Test Date	:2011-12-27
Fundamental Frequency	:925 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX	Engineer	:Marcus
EUT Pol.	:E2	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
70.74	S	Peak	51.42	-16.50	34.92	40.00	-5.08
167.74	S	Peak	49.79	-12.31	37.48	43.50	-6.02
199.75	S	Peak	52.89	-15.43	37.46	43.50	-6.04
459.71	S	Peak	49.16	-9.20	39.96	46.00	-6.04
600.36	S	Peak	35.22	-6.59	28.63	46.00	-17.37
689.60	S	Peak	38.23	-4.49	33.74	46.00	-12.26
924.92	F	Peak	83.96	-1.67	82.29	114.00	-31.71
1850.00	H	Peak	43.76	3.64	47.40	74.00	-26.60
2775.00	H	---					
3700.00	H	---					
4625.00	H	---					
5550.00	H	---					
6475.00	H	---					
7400.00	H	---					
8325.00	H	---					
9250.00	H	---					

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Operation Band	:925 MHz	Test Date	:2011-12-27
Fundamental Frequency	:925 MHz	Temp./Humi.	:27 deg_C / 66 RH
Operation Mode	:TX	Engineer	:Marcus
EUT Pol.	:E2	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Safe Margin dB
105.66	S	Peak	47.87	-15.60	32.27	43.50	-11.23
166.77	S	Peak	48.32	-12.18	36.14	43.50	-7.36
199.75	S	Peak	53.63	-15.43	38.20	43.50	-5.30
399.57	S	Peak	40.95	-10.40	30.55	46.00	-15.45
459.71	S	Peak	49.51	-9.20	40.31	46.00	-5.69
689.60	S	Peak	43.02	-4.49	38.53	46.00	-7.47
924.92	F	Peak	88.98	-1.67	87.31	114.00	-26.69
1850.00	H	Peak	44.73	3.87	48.60	74.00	-25.40
2775.00	H	---					
3700.00	H	---					
4625.00	H	---					
5550.00	H	---					
6475.00	H	---					
7400.00	H	---					
8325.00	H	---					
9250.00	H	---					

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## 7. 20 dB Band Width Measurement

### 7.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set ETU normal operating mode.
3. Set SPA Center Frequency = fundamental frequency, RBW = 100kHz, VBW = 300kHz, Span = 1MHz.
4. Set SPA Max hold. Mark peak, -20dB.

### 7.2 Test SET-UP (Block Diagram of Configuration)

Same as 4.2 Radiated Emission Measurement.

### 7.3 Measurement Equipment Used:

Same as 4.2 Radiated Emission Measurement.

### 7.4 Measurement Results:

919.8MHz = 264.418 kHz

925.0MHz = 264.494 kHz

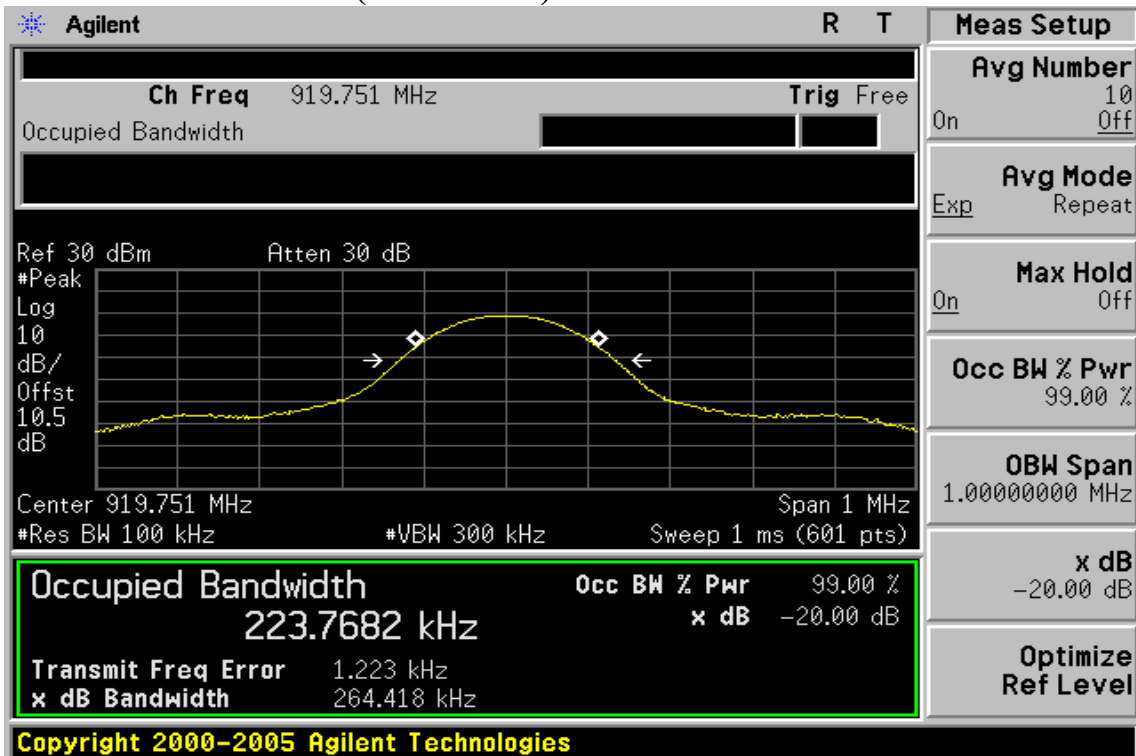
Refer to attached data chart.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

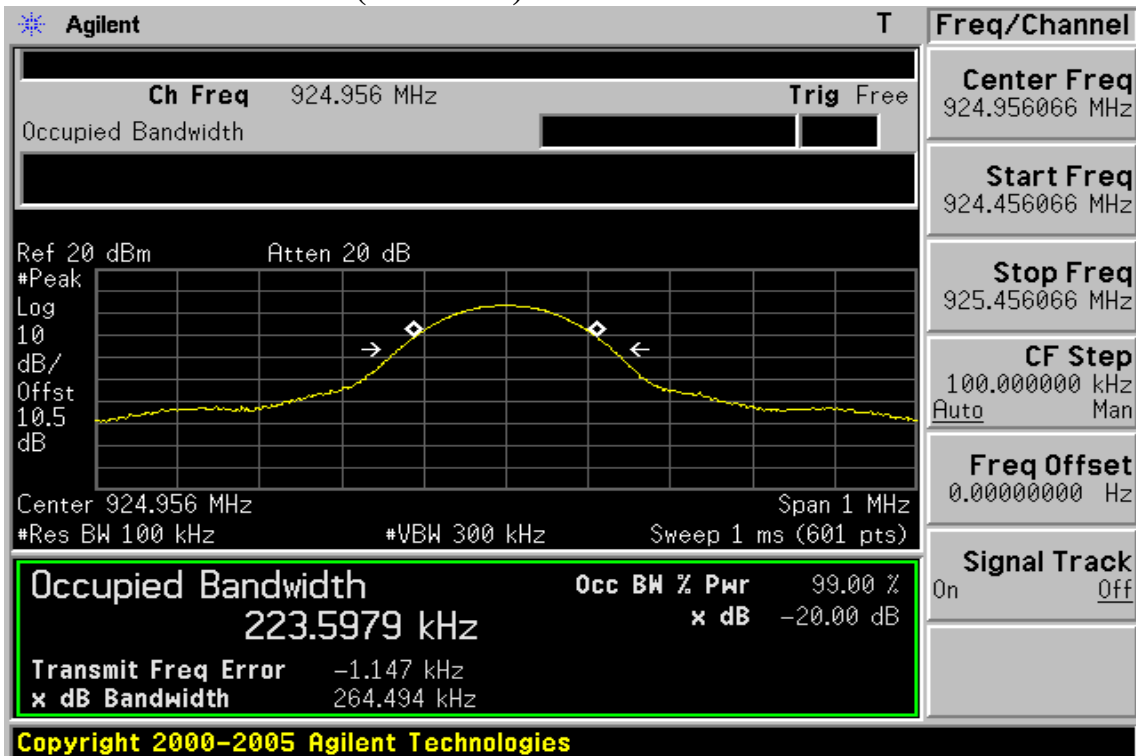
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### 20dB Band Width test Plot (919.8 MHz)



### 20dB Band Width test Plot (925 MHz)



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