TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Partial Test of: Sendo International Ltd
S361

To: FCC Part 22 & 24

Test Report Serial No:
RFI/MPTE1/RP70871JD01A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: **pp**	
Tested By: Steven Wong 	**Checked By: Nigel Davison**
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1. Client Information

Company Name:	Sendo International Ltd
Address:	Sendo Base Station Hatchford Brook Hatchford Way Sheldon Birmingham B26 3QA United Kingdom
Contact Name:	Mr M Bailey

2. Equipment Under Test (EUT)

The following information (with the exception of the Date of Receipt) has been supplied by the client:

2.1. Identification of Equipment Under Test (EUT)

Brand Name:	Sendo	
Model Name or Number:	S361	
Unique Type Identification:	SND361	
Serial Number:	0101C3865100002	
FCC ID Number:	P6PSND601	
Country of Manufacture:	Battery Cell	United Kingdom
	Mobile Station	Netherlands
Date of Receipt:	12 November 2004	

2.2. Accessories

The following accessories were supplied with the EUT:

Description:	Personal Hands free (PHF)
Brand Name:	None Stated
Model Name or Number:	None Stated
Serial Number:	None Stated
Country of Manufacture:	China

Description:	Leather Case
Brand Name:	None Stated
Model Name or Number:	None Stated
Serial Number:	None Stated
Country of Manufacture:	China

Accessories (Continued)

Description:	Hip Pouch
Brand Name:	Sendo
Model Name or Number:	None Stated
Serial Number:	None Stated
Country of Manufacture:	China

Description:	AC Charger
Brand Name:	Sendo
Model Name or Number:	DVR-530
Serial Number:	None Stated
Country of Manufacture:	China

2.3. Description of EUT

The equipment under test is a dual band 850 MHz and 1900 MHz mobile station, with PHF and case accessories.

2.4. Modifications Incorporated in EUT

During the course of testing the EUT was not modified.

2.5. Additional Information Related to Testing

Power Supply Requirement:	4.2 V DC Re-chargeable Li-ion Battery		
Declared Battery End Point Voltage	3.5 V DC		
Power Supply Requirement: (AC Battery Charger)	Nominal 110 V 60 Hz AC Mains Supply		
Intended Operating Environment:	Within GSM Network Coverage		
Equipment Category:	Portable		
Type of Unit:	Transceiver		
Interface Ports:	AC Charger / Handsfree Interface Port		
Highest Fundamental Frequency:	GSM 850	848.8 MHz	
	PCS 1900	1909.8 MHz	
Highest Unintentionally Generated Frequency:	GSM 850	893.8 MHz	
	PCS 1900	1989.8 MHz	
GSM 850 Transmit Frequency Range:	824 MHz to 849 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	128	824.2
	Middle	190	836.6
	Top	251	848.8
GSM 850 Transmit Frequency Range:	869 MHz to 894 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	128	869.2
	Middle	190	881.6
	Top	251	893.8
Maximum Power Output (ERP)	26.3 dBm		

Additional Information Related to Testing (Continued)

GSM 1900 Transmit Frequency Range:	1850 MHz to 1910 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1850.2
	Middle	660	1879.8
	Top	810	1909.8
GSM 1900 Receive Frequency Range:	1930 MHz to 1990 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	512	1930.2
	Middle	660	1960.0
	Top	810	1989.8
Maximum Power Output (EIRP)	28.0 dBm		

2.6. Support Equipment

No support equipment was supplied by the applicant and used to exercise the EUT during testing.

3. Test Results

Reference:	FCC Part 22 Subpart H: 2003 (Cellular Radiotelephone Service)
Title:	Code of Federal Regulations, Part 22 (47CFR22) Personal Communication Services.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

Reference:	FCC Part 24 Subpart E: 2003 (Broadband PCS)
Title:	Code of Federal Regulations, Part 24 (47CFR24) Personal Communication Services.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2002
Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (1987)
Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2003)
Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)
Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)
Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)
Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

DA00-705 (2000)
Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

3.2. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

4. Deviations from the Test Specification

None.

5. Operation of the EUT During Testing

5.1. Operating Conditions

During testing, the EUT was powered by a nominal 4.2 V DC Re-chargeable Li-ion Battery and connected to a 110 V 60 Hz AC Mains charger.

5.2. Operating Modes

The EUT was tested in the following operating modes, unless otherwise stated.
Preliminary radiated scans were performed on the EUT with the accessories stated in section 2.2 of this report connected and then disconnected. The combination that exhibited the worst case mode of operation was then used to perform final measurements.

Transmitter Modes:

All Transmitter radiated spurious pre-scan tests were performed at full power on the top channel of the assigned frequency block. Final measurements were then performed on the top, middle and bottom channels, if an emission was identified.

Receiver/Idle Modes:

Testing was performed with the call terminated from the GSM Test Simulator and the phone left in its idle modes.

5.3. Configuration and Peripherals

The EUT was tested in the following configuration:

Configured with AC charger.

All tests were performed with the EUT connected via an air link to a GSM test set.

6. Summary of Test Results – Part 22

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Receiver/Idle Radiated Emissions	C.F.R. 47 FCC Part 15: 2003 Section 15.109	Enclosure	Complied
Transmitter Effective Radiated Power (ERP)	C.F.R. 47 FCC Part 22: 2003 Section 22.913(a)	Antenna	Complied
Transmitter Occupied Bandwidth	C.F.R. 47 FCC Part 22: 2003 Section 2.1049	Antenna Terminals	Complied
Transmitter Out of Band Radiated Emissions	C.F.R. 47 FCC Part 22: 2003 Section 2.1053/22.917	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 22: 2003 Section 2.1053/22.917	Antenna	Complied

Summary of Test Results – Part 24

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Idle Mode Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2003 Section 15.109	Enclosure	Complied
Transmitter Effective Isotropic Radiated Power (EIRP)	C.F.R. 47 FCC Part 24: 2003 Section 24.232	Antenna	Complied
Transmitter Occupied Bandwidth	C.F.R. 47 FCC Part 24: 2003 Section 24.238	Antenna Terminals	Complied
Transmitter Out of Band Radiated Emissions	C.F.R. 47 FCC Part 24: 2003 Section 2.1053/24.238	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 2: 2003 Section 2.1053/24.238	Antenna	Complied

6.1. Location of Tests

All the measurements described in this report were performed at the premises of
RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

7. Measurements, Examinations and Derived Results

7.1. General Comments

7.1.1. This section contains test results only.

7.1.2. Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 8 for details of measurement uncertainties.

Test Results – Part 22

7.2. Receiver/Idle Mode Radiated Spurious Emissions: Section 15.109

7.2.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

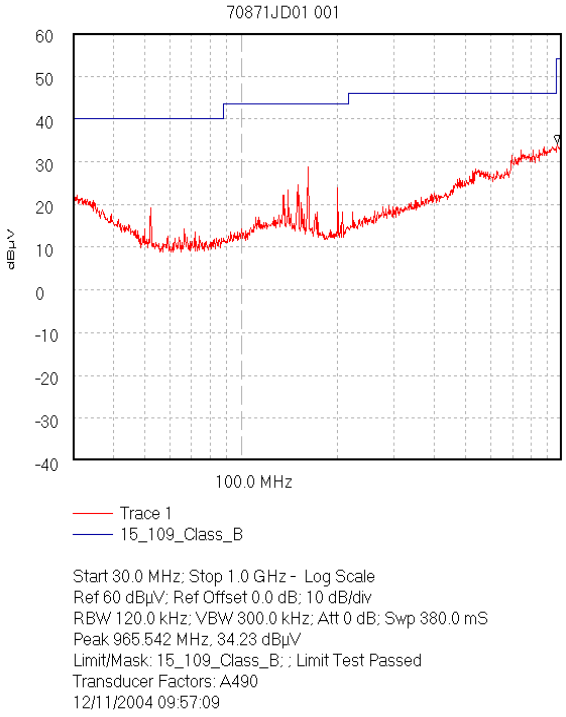
7.2.1.1. The EUT was configured as for radiated emissions testing as described in Section 9 of this report.

7.2.1.2. Tests were performed to identify the maximum receiver or standby radiated emissions levels.

Results:

Frequency (MHz)	Antenna Polarity	Quasi-Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
151.077	Vert.	22.0	43.5	21.5	Complied
160.905	Vert.	18.5	43.5	25.0	Complied

Idle Radiated Spurious Emissions: Section 15.109 (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Receiver/Idle Mode Radiated Emissions: Section 15.109 (Continued)

7.2.2. Electric Field Strength Measurements (Frequency Range: 1 to 5 GHz)

Results:

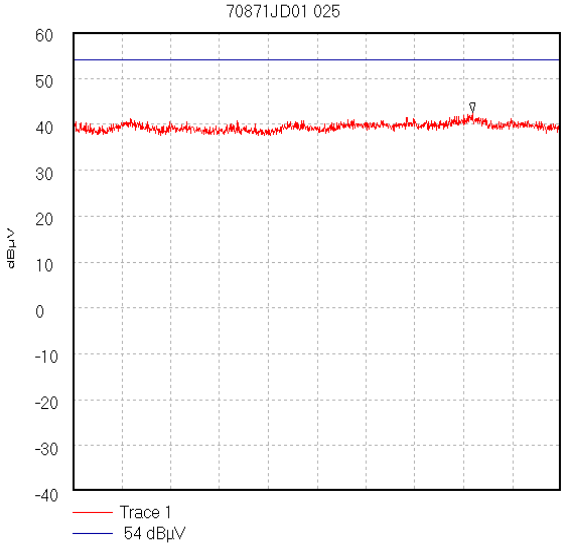
Frequency (GHz)	Antenna Polarity	Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Peak Level (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
1.818889	Vert.	20.4	21.6	0.7	42.7	54.0	11.3	Complied

Note(s):

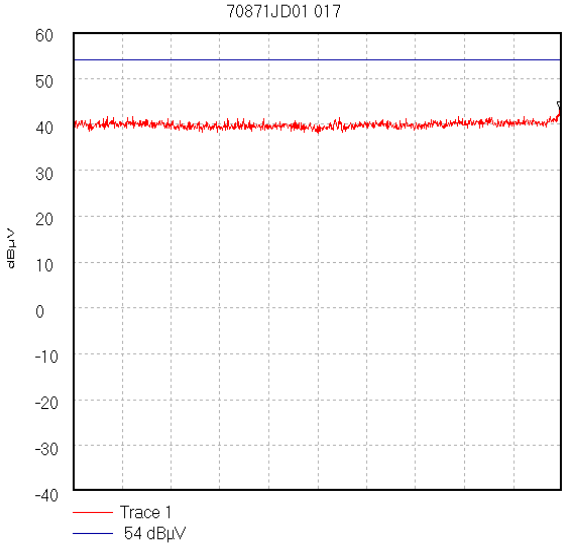
1. No spurious emissions were detected above the noise floor of the measuring receiver; therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above.

2. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.

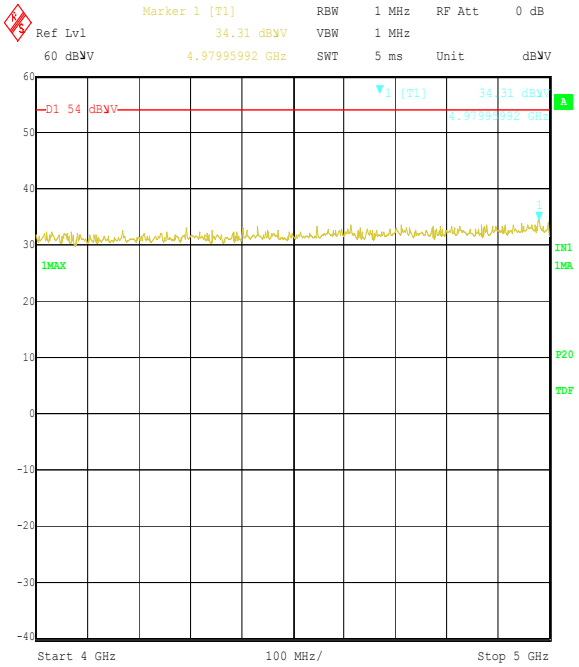
Receiver/Idle Mode Radiated Emissions: Section 15.109 (Continued)



Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.818889 GHz, 42.66 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
Transducer Factors: 1 to 2
12/11/2004 12:01:38



Start 2.0 GHz; Stop 4.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.991111 GHz, 42.97 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
Transducer Factors: 1 to 2
12/11/2004 11:23:06



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Receive Mode 850 GSM
Date: 17.NOV.2004 14:49:12

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

7.3. Transmitter Effective Radiated Power (ERP): Section 22.913(a)

7.3.1. The EUT was configured as for Effective Radiated Power as described in Section 9 of this report.

7.3.2. Tests were performed to identify the maximum Effective Radiated Power (ERP).

Results:

Channel	Measured Frequency (MHz)	Antenna Polarity	Maximum Transmitter ERP (dBm)	ERP Limit (dBm)	Margin (dB)	Result
Bottom	824.2	Vert.	26.3	38.4	8.1	Complied
Middle	836.6	Vert.	24.9	38.4	13.5	Complied
Top	848.8	Vert.	24.1	38.4	14.3	Complied

7.4. Transmitter Occupied Bandwidth: Section 2.1049

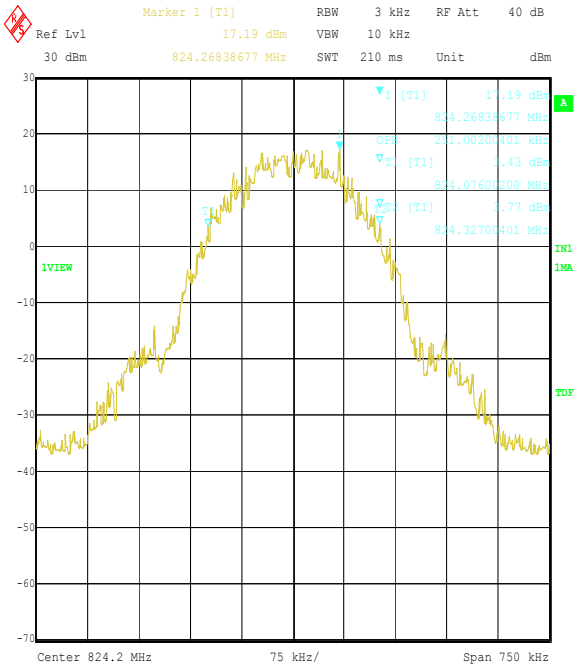
7.4.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 9 of this report.

7.4.2. Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

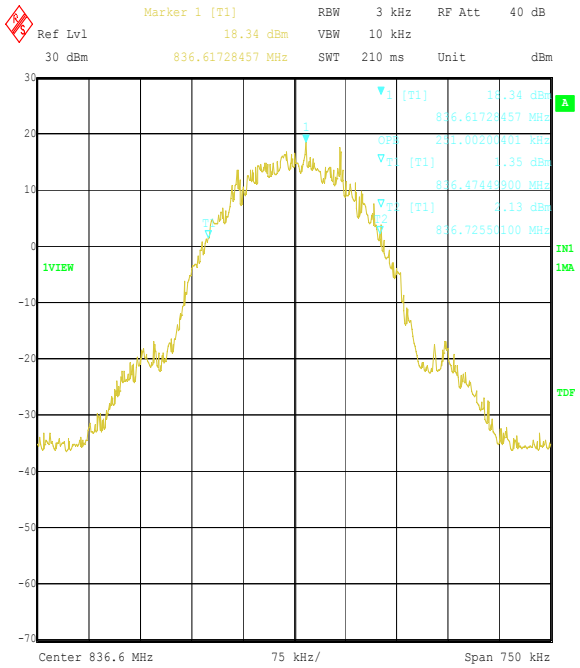
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	824.2	3.0	10.0	251.002
Middle	836.6	3.0	10.0	251.002
Top	848.8	3.0	10.0	251.002

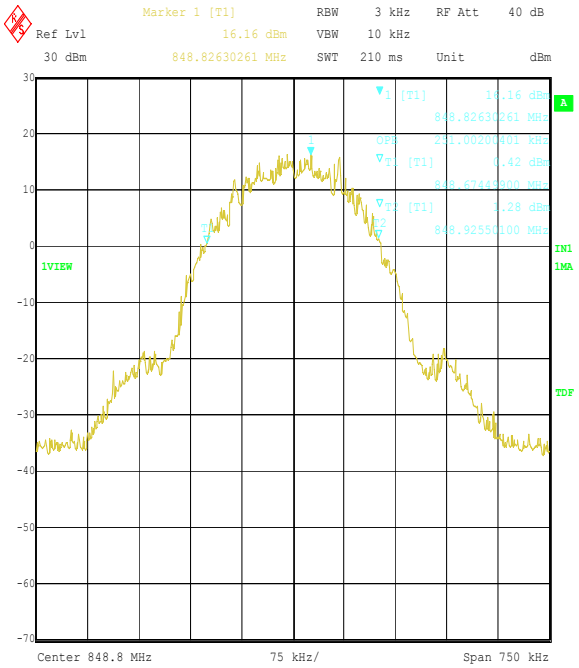
Transmitter Occupied Bandwidth: Section 2.1049 (Continued)



Title: SENDO Eut:S361 FCC P22/24. Occupied Bandwidth
Comment A: 70871JD01 Bottom Channel
Date: 17.NOV.2004 14:04:01



Title: SENDO Eut:S361 FCC P22/24. Occupied Bandwidth
Comment A: 70871JD01 Middle Channel
Date: 17.NOV.2004 14:05:22



Title: SENDO Eut:S361 FCC P22/24. Occupied Bandwidth
Comment A: 70871JD01 Top Channel
Date: 17.NOV.2004 14:06:41

Note: The occupied bandwidth is measured using the internal OBW function of the measurement analyser. The analyser automatically configures the measurement bandwidths to make an accurate measurement.
The results can be observed in the right hand corner of the graphs.

7.5. Transmitter Out of Band Radiated Emissions: Section 2.1053 & 22.917

7.5.1. The EUT was configured as for transmitter radiated emissions testing as described in Section 9 of this report.

7.5.2. Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1648.400	-40.3	-13.0	27.3	Complied

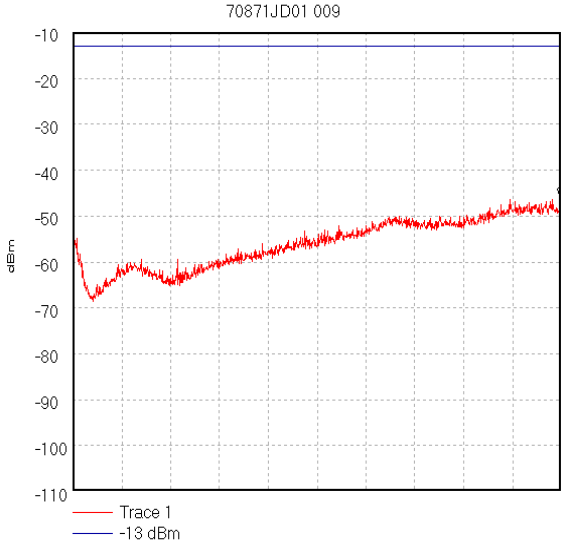
Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1672.886	-41.8	-13.0	28.8	Complied

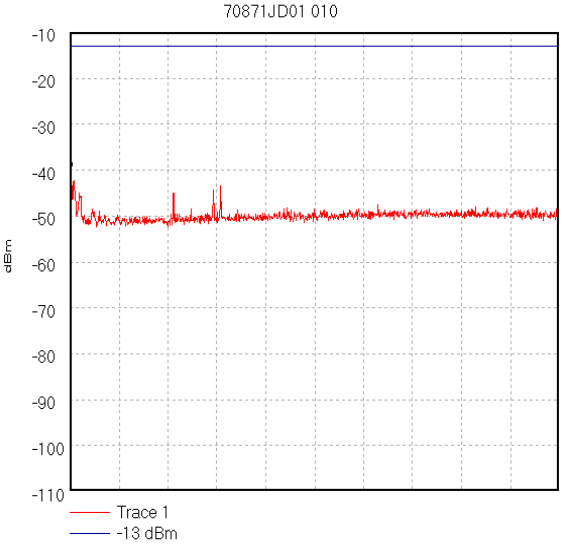
Top Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1697.363	-38.4	-13.0	25.4	Complied

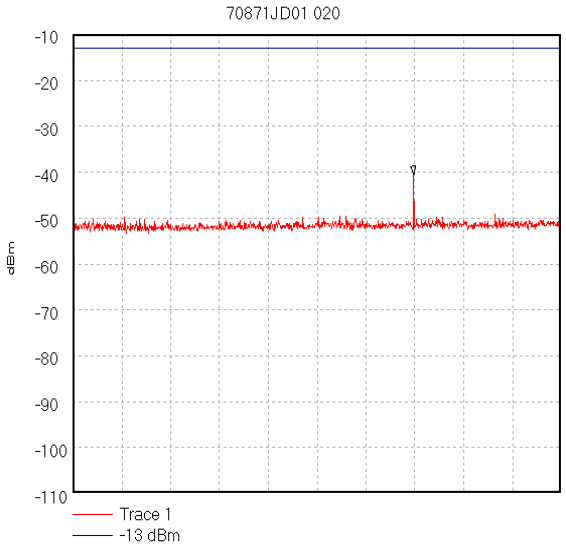
Transmitter Out of Band Radiated Emissions: Section 2.1053 & 22.917 (Continued)



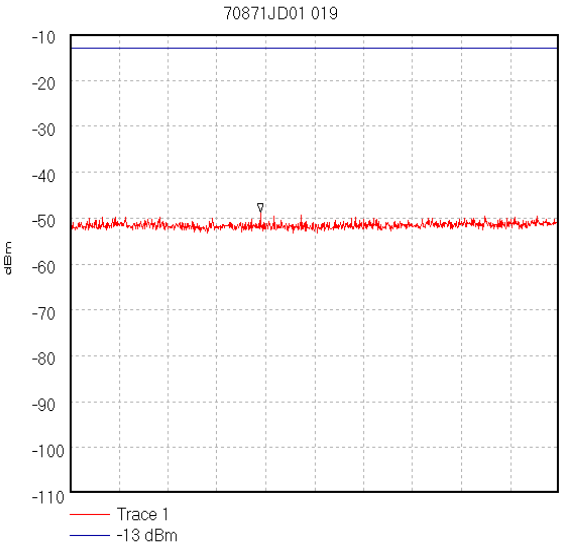
Start 30.0 MHz; Stop 824.0 MHz
Ref -10 dBm; Ref Offset 9.6 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 10 dB; Swp 520.0 mS
Peak 822.236 MHz, -45.95 dBm
Display Line: -13 dBm; ; Limit Test Passed
Transducer Factors: A490
12/11/2004 10:54:51



Start 850.0 MHz; Stop 1.0 GHz
Ref -10 dBm; Ref Offset 9.6 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 0 dB; Swp 60.0 mS
Peak 850.0 MHz, -40.42 dBm
Display Line: -13 dBm;
Transducer Factors: A490
12/11/2004 11:02:15



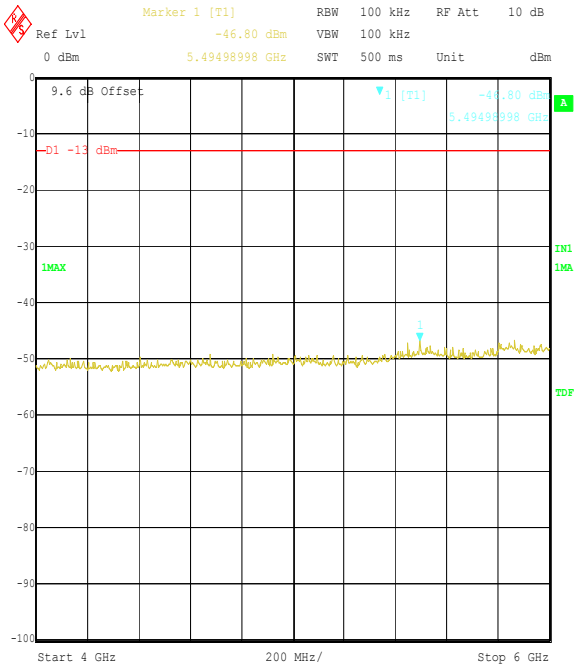
Start 1.0 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 9.6 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 0 dB; Swp 300.0 mS
Peak 1.697778 GHz, -40.57 dBm
Display Line: -13 dBm;
Transducer Factors: 1 to 2
12/11/2004 11:45:02



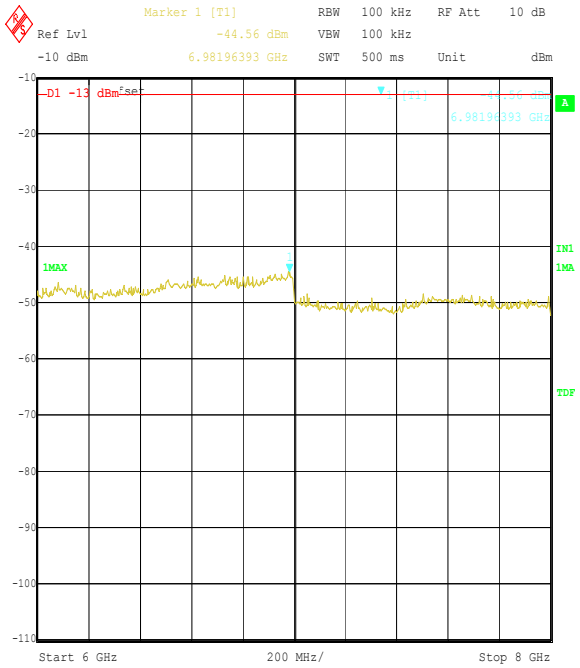
Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 9.6 dB; 10 dB/div
RBW 100.0 kHz; VBW 300.0 kHz; Att 0 dB; Swp 600.0 mS
Peak 2.78 GHz, -48.75 dBm
Display Line: -13 dBm;
Transducer Factors: 1 to 2
12/11/2004 11:28:14

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

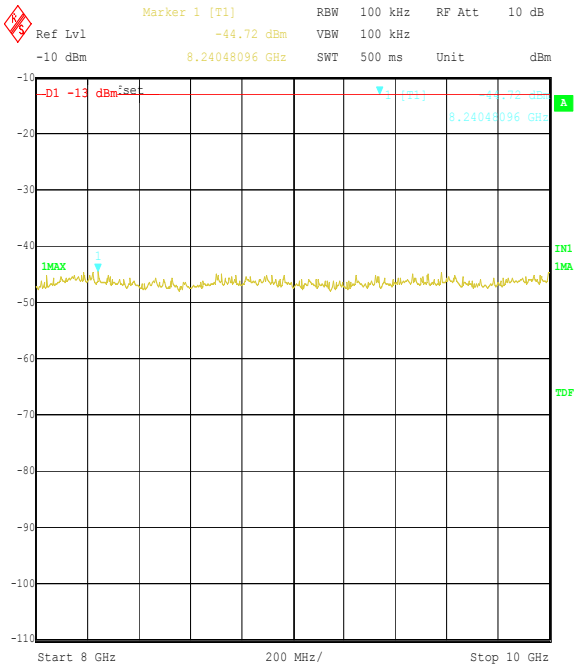
Transmitter Out of Band Radiated Emissions: Section 2.1053 & 22.917 (Continued)



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 850 GSM
Date: 17.NOV.2004 14:44:38



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 850 GSM
Date: 17.NOV.2004 15:13:56



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 850 GSM
Date: 17.NOV.2004 15:23:47

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

7.6. Transmitter Radiated Emissions at Band Edges: Section 2.1053/22.917

7.6.1. The EUT was configured as for transmitter radiated emissions testing described in Section 9 of this report.

7.6.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency block that the EUT will operate over.

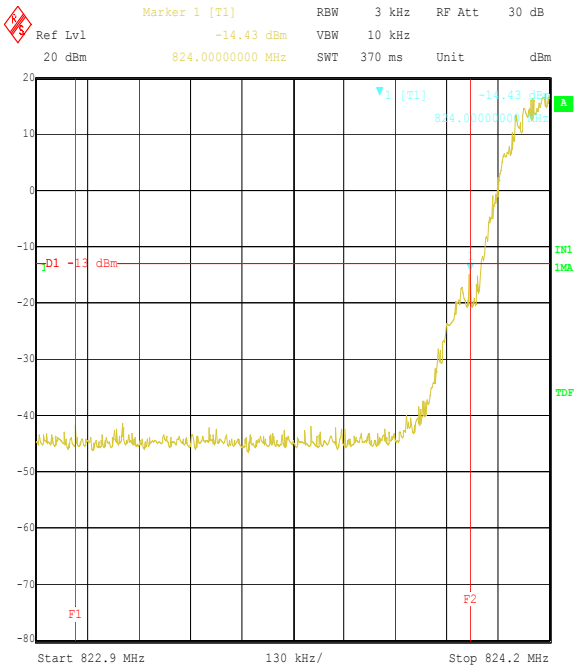
Results:

Bottom Band Edge

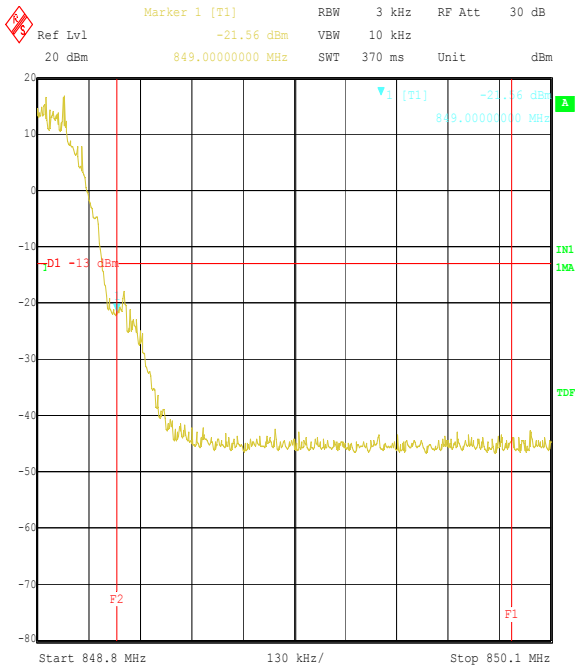
Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
824	-14.4	-13.0	1.4	Complied

Top Band Edge

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
849	-21.6	-13.0	8.6	Complied



Title: SENDO Eut:S361 FCC P22/24. Radiated Band Edge
Comment A: 70871JD01 Bottom Channel
Date: 17.NOV.2004 14:00:29



Title: SENDO Eut:S361 FCC P22/24. Radiated Band Edge
Comment A: 70871JD01 Top Channel
Date: 17.NOV.2004 13:59:00

Test Results – Part 24

7.7. Receiver Radiated Spurious Emissions: Section 15.109

7.7.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

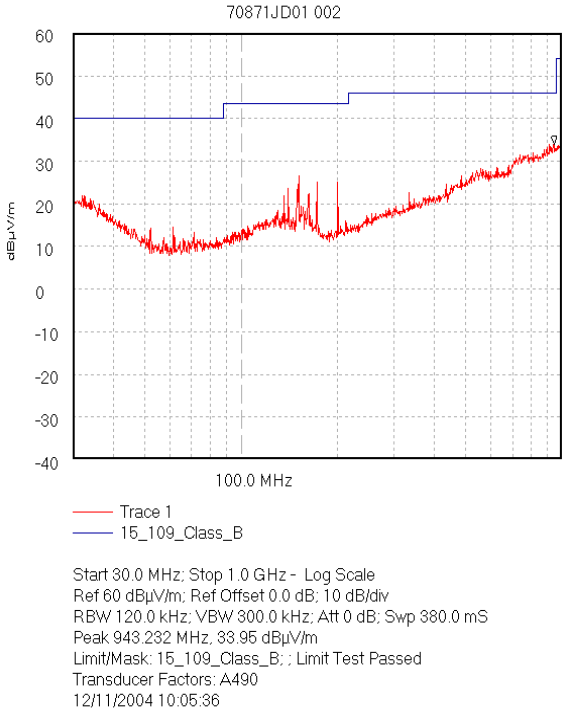
7.7.1.1. The EUT was configured as for receiver radiated emissions testing as described in Section 9 of this report.

7.7.1.2. Tests were performed to identify the maximum receiver or standby radiated emissions levels.

Results:

Frequency (MHz)	Antenna Polarity	Quasi-Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
151.077	Vert.	22.0	43.5	21.5	Complied
171.872	Vert.	18.9	43.5	24.6	Complied

Receiver Radiated Spurious Emissions: Section 15.109 (Continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Receiver Radiated Emissions: Section 15.109 (Continued)

7.7.2. Electric Field Strength Measurements (Frequency Range: 1 to 10 GHz)

Results:

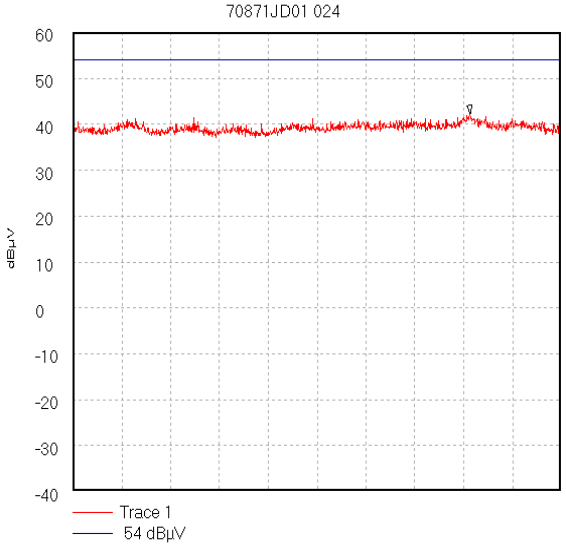
Frequency (GHz)	Antenna Polarity	Peak Detector Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Actual Peak Level (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
7.559118	Vert.	18.0	26.9	1.7	46.5	54.0	7.5	Complied

Note(s):

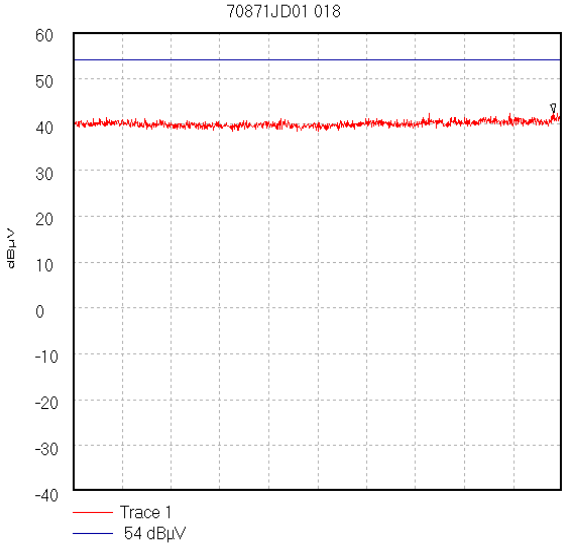
1. No spurious emissions were detected above the noise floor of the measuring receiver; therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above.

2. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.

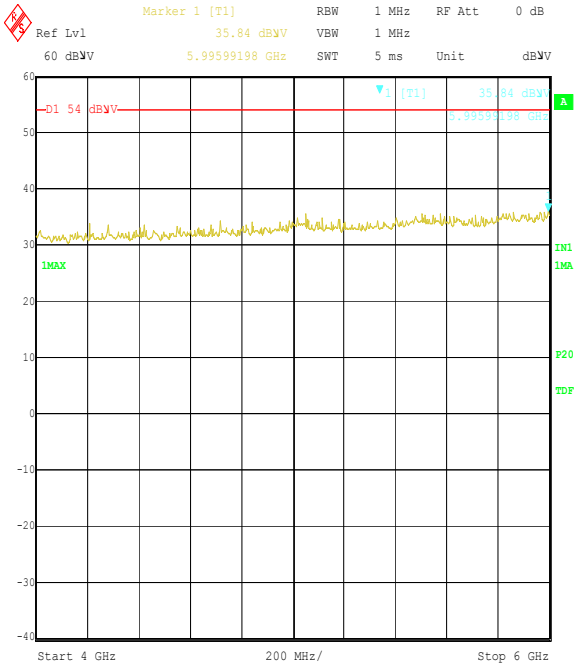
Receiver Radiated Spurious Emissions: Section 15.109 (Continued)



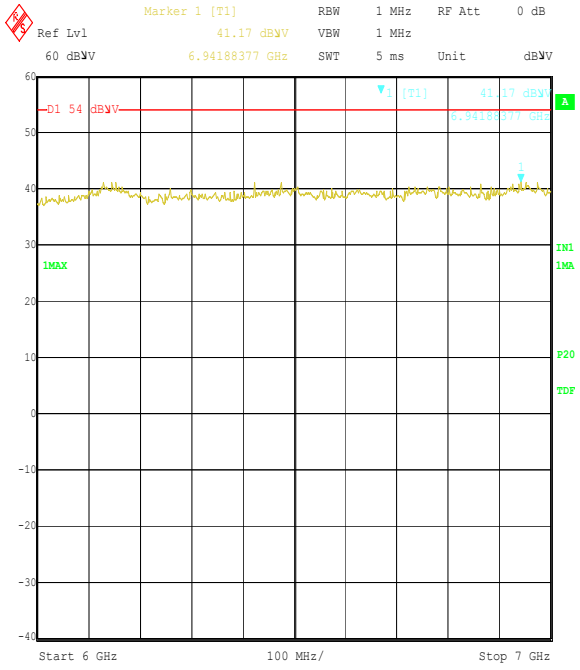
Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.813333 GHz, 42.25 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
Transducer Factors: 1 to 2
12/11/2004 12:00:20



Start 2.0 GHz; Stop 4.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.964444 GHz, 42.48 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
Transducer Factors: 1 to 2
12/11/2004 11:24:06



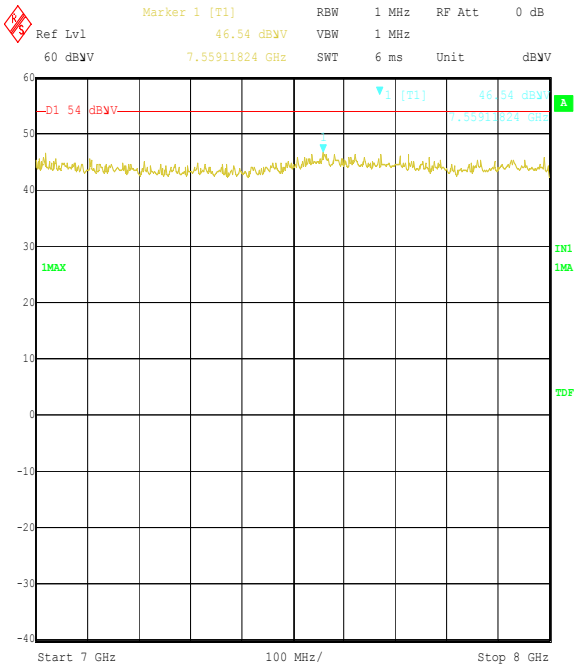
Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Receive Mode 1900 PCS
Date: 17.NOV.2004 14:50:56



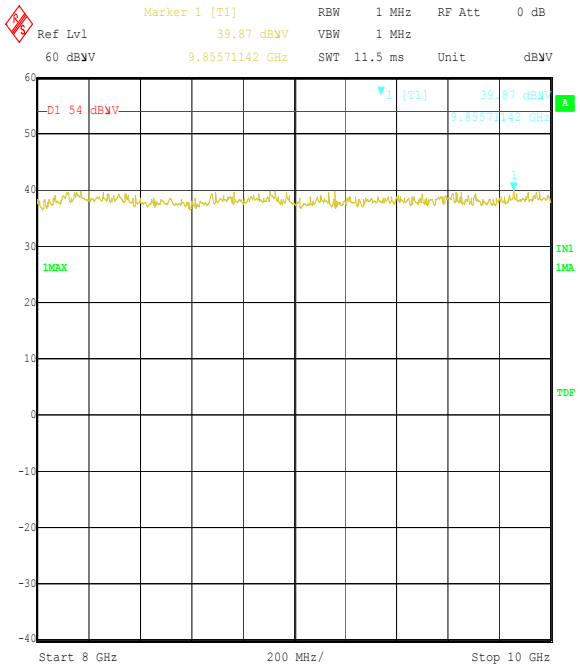
Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Idle Mode 1900 PCS
Date: 17.NOV.2004 15:16:20

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Receiver Radiated Spurious Emissions: Section 15.109 (Continued)



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Idle Mode 1900 PCS
Date: 17.NOV.2004 15:18:15



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Idle Mode 1900 PCS
Date: 17.NOV.2004 15:20:52

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

7.8. Transmitter Effective Isotropic Radiated Power (EIRP): Section 24.232

7.8.1. The EUT was configured as for Effective Isotropic Radiated Power as described in Section 9 of this report.

7.8.2. Tests were performed to identify the maximum Effective Isotropic Radiated Power (EIRP).

Results:

Channel	Measured Frequency (MHz)	Antenna Polarity	Maximum Transmitter EIRP (dBm)	Limit EIRP (dBm)	Margin (dB)	Result
Bottom	1850.2	Vert.	26.9	33.0	6.1	Complied
Middle	1879.8	Vert.	27.2	33.0	5.8	Complied
Top	1909.8	Vert.	28.0	33.0	5.0	Complied

7.9. Transmitter Occupied Bandwidth: Section 24.238

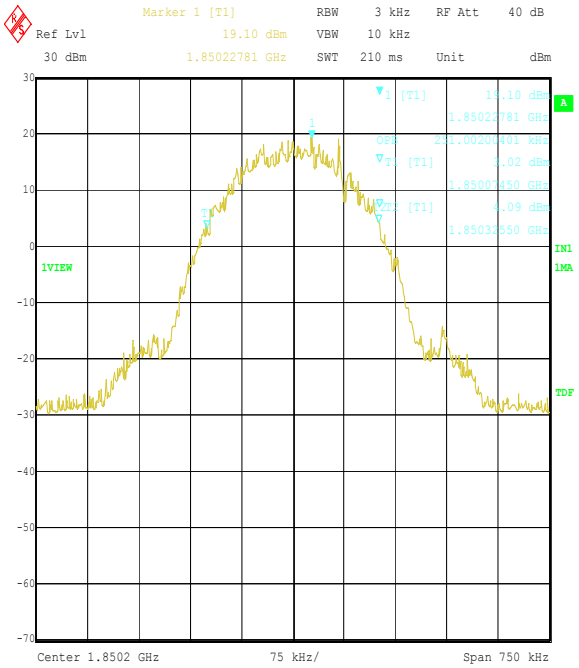
7.9.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 9 of this report.

7.9.2. Tests were performed to identify the maximum bandwidth occupied by the fundamental frequency of the EUT.

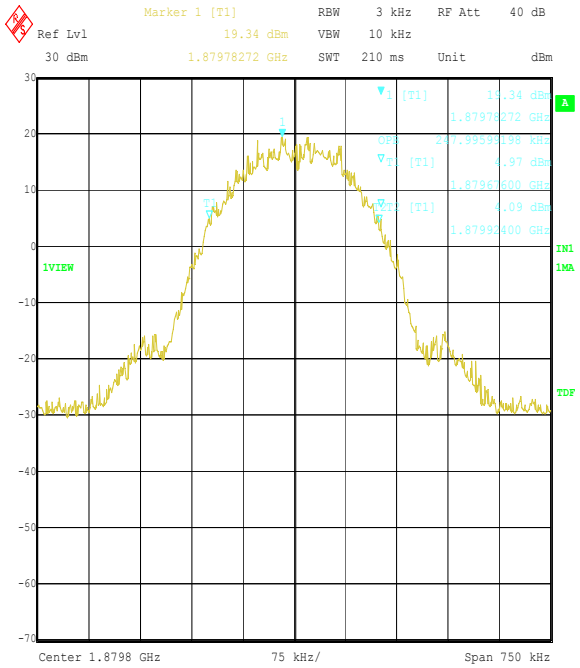
Results:

Channel	Frequency (MHz)	Resolution Bandwidth (kHz)	Video Bandwidth (kHz)	Occupied Bandwidth (kHz)
Bottom	1850.2	3.0	10.0	251.002
Middle	1879.8	3.0	10.0	247.996
Top	1909.8	3.0	10.0	251.002

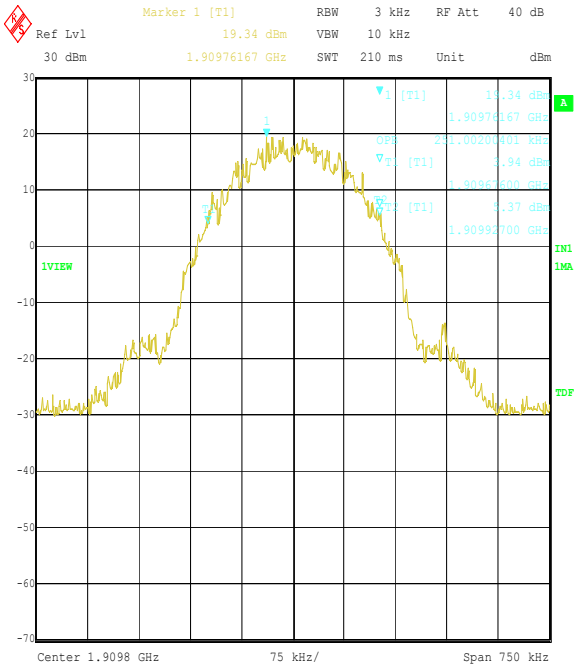
Transmitter Occupied Bandwidth: Section 24.238 (Continued)



Title: SENDO Eut:S361 FCC P22/24. Occupied Bandwidth
Comment A: 70871JD01 Bottom Channel
Date: 17.NOV.2004 11:33:39



Title: SENDO Eut:S361 FCC P22/24. Occupied Bandwidth
Comment A: 70871JD01 Middle Channel
Date: 17.NOV.2004 11:35:58



Title: SENDO Eut:S361 FCC P22/24. Occupied Bandwidth
Comment A: 70871JD01 Top Channel
Date: 17.NOV.2004 11:37:34

Note: The occupied bandwidth is measured using the internal OBW function of the measurement analyser. The analyser automatically configures the measurement bandwidths to make an accurate measurement.
The results can be observed in the right hand corner of the graphs.

7.10. Transmitter Out of Band Radiated Emissions: Section 2.1053 & 24.238

7.10.1. The EUT was configured as for transmitter radiated emissions testing as described in Section 9 of this report.

7.10.2. Tests were performed to identify the maximum transmitter radiated emission levels.

Results:

Bottom Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3700.520	-35.2	-13.0	22.2	Complied

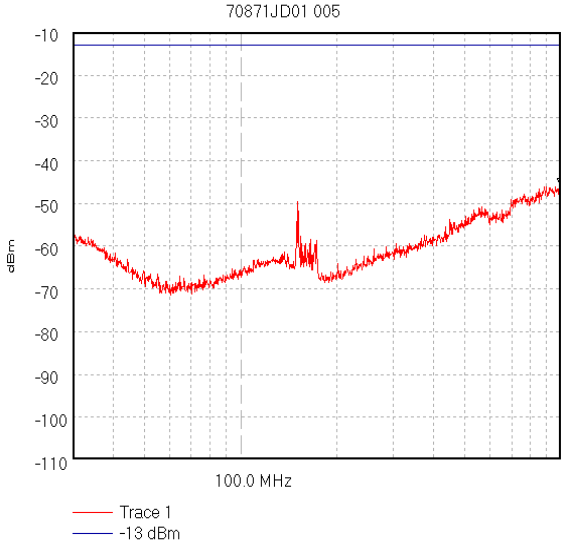
Middle Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3759.773	-33.4	-13.0	20.4	Complied

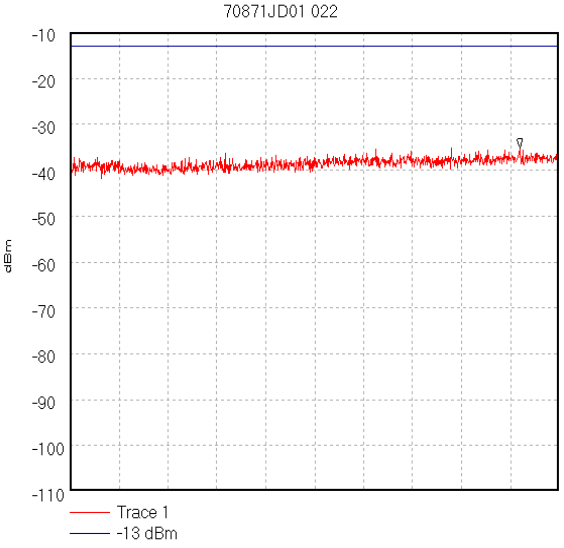
Top Channel

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
3819.590	-30.5	-13.0	17.5	Complied

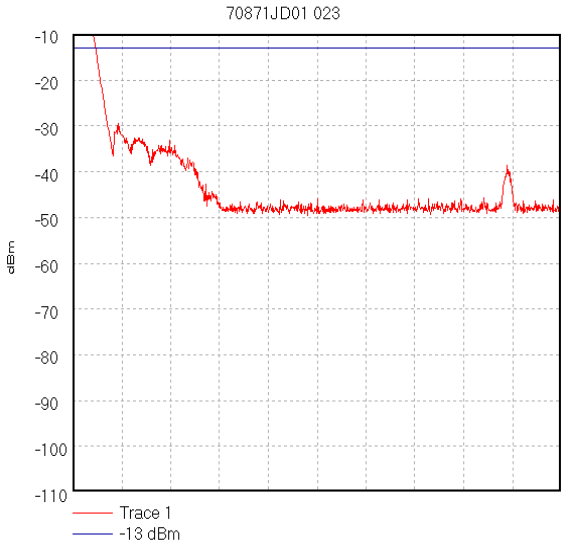
Transmitter Out of Band Radiated Emissions: Section 2.1053 & 24.238 (Continued)



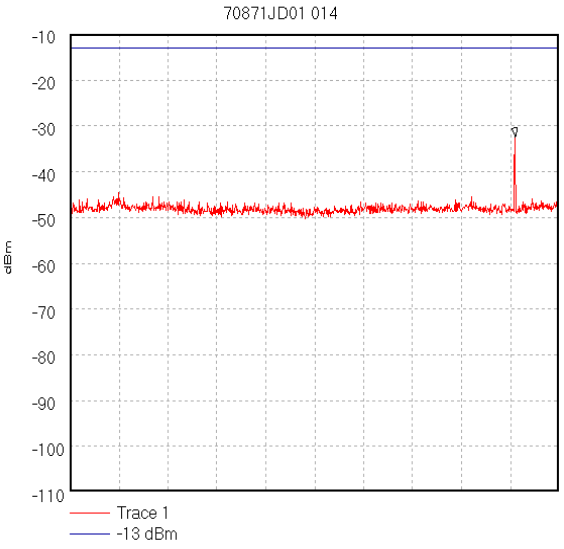
Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref -10 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 1000.0 kHz; VBW 3.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 996.111 MHz, -45.83 dBm
Display Line: -13 dBm; ; Limit Test Passed
Transducer Factors: A490
12/11/2004 10:33:50



Start 1.0 GHz; Stop 1.85 GHz
Ref -10 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS
Peak 1.782 GHz, -35.16 dBm
Display Line: -13 dBm;
Transducer Factors: 1 to 2
12/11/2004 11:51:16



Start 1.91 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.9116 GHz, -6.02 dBm
Display Line: -13 dBm;
Transducer Factors: 1 to 2
12/11/2004 11:53:26

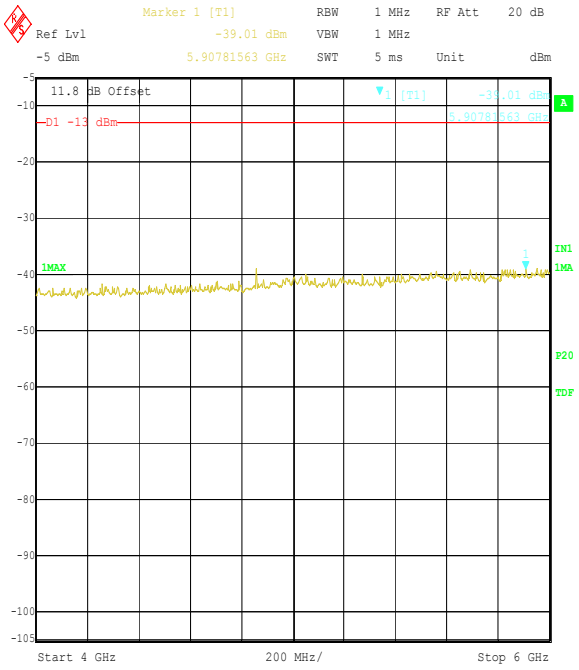


Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.82 GHz, -32.42 dBm
Display Line: -13 dBm;
Transducer Factors: 1 to 2
12/11/2004 11:18:54

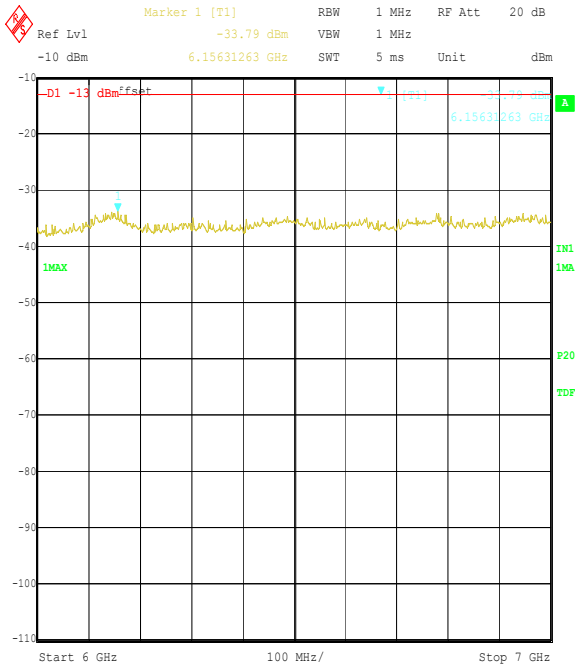
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: Sendo International Ltd S361
To: FCC Part 22 & 24

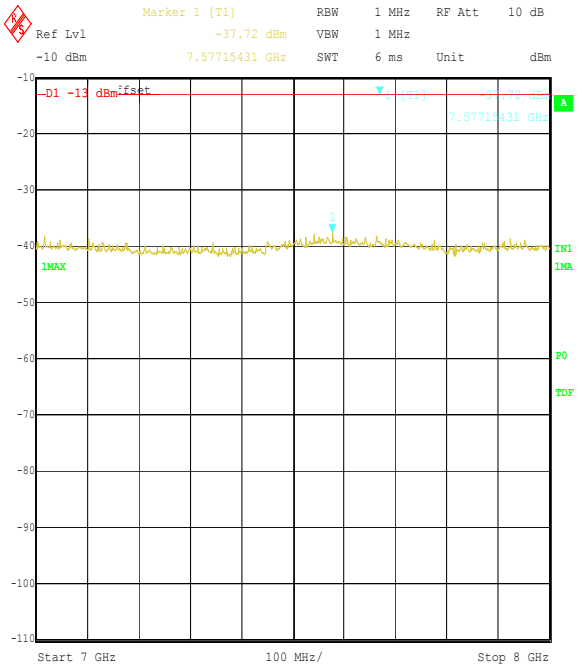
Transmitter Out of Band Radiated Emissions: Section 2.1053 & 24.238 (Continued)



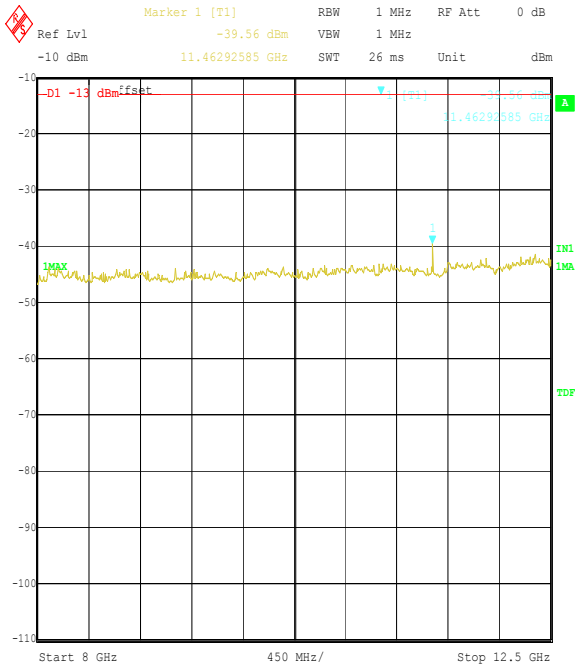
Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 1900 PCS
Date: 17.NOV.2004 15:10:29



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 1900 PCS
Date: 17.NOV.2004 15:07:17



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 1900 PCS
Date: 17.NOV.2004 15:08:47

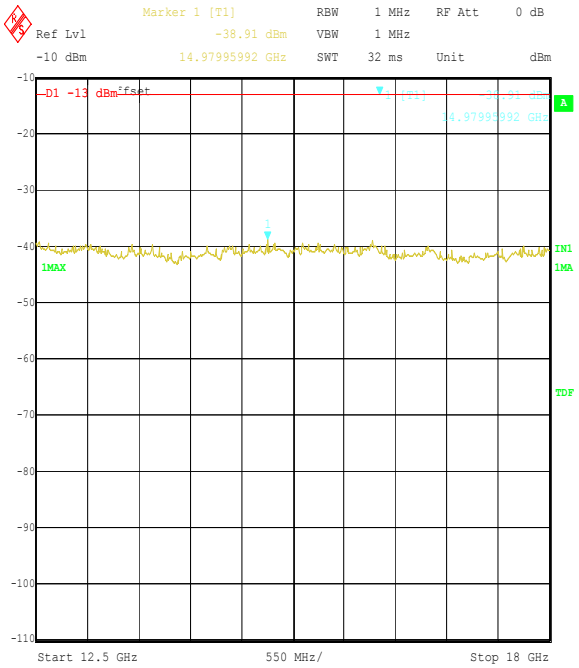


Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 1900 PCS
Date: 17.NOV.2004 15:26:07

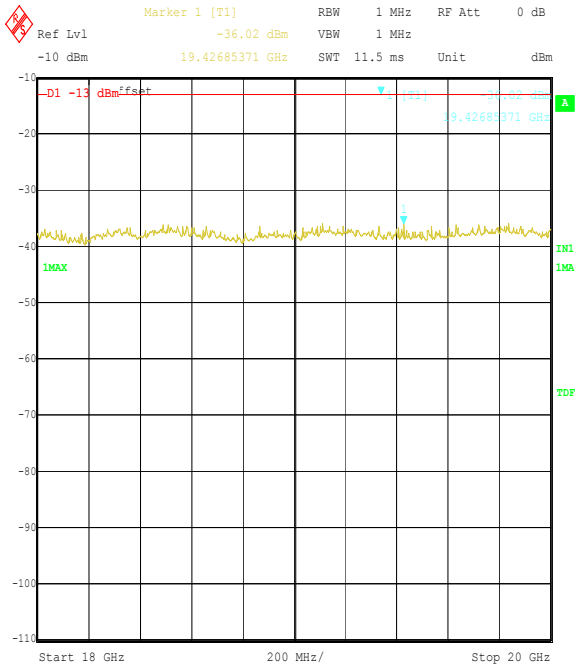
Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test of: **Sendo International Ltd S361**
To: **FCC Part 22 & 24**

Transmitter Out of Band Radiated Emissions: Section 2.1053 & 24.238 (Continued)



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 1900 PCS
Date: 17.NOV.2004 15:29:08



Title: SENDO Eut:S361 FCC P22/24. Radiated Spurious Emissions
Comment A: 70871JD01 Top Channel 1900 PCS
Date: 17.NOV.2004 15:32:38

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Out of Band Radiated Emissions: Section 2.1051 & 24.238 (Continued)

Integrated Power Over 1 MHz Strip Band: 1911 to 1912 MHz

1st 1 MHz block immediately outside adjacent frequency block

100 kHz Strip Number	Peak Power (nW/100 kHz)	100 kHz Strip Number	Peak Power (nW/100 kHz)
1	246.037	6	121.619
2	202.302	7	191.867
3	181.552	8	143.549
4	223.872	9	125.026
5	178.649	10	125.603
Total Peak Power:	1740.076 nW/MHz		

Integrated Power Over 1 MHz Strip Band: 1912 to 1913 MHz

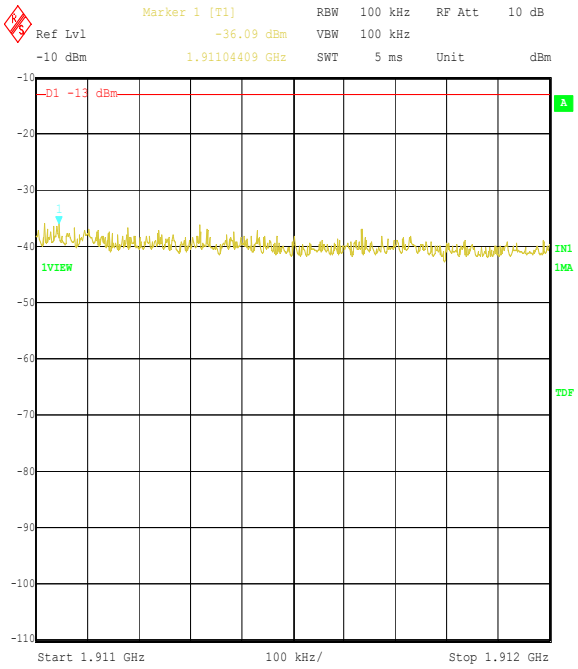
2nd 1 MHz block immediately outside adjacent frequency block

100 kHz Strip Number	Peak Power (nW/100 kHz)	100 kHz Strip Number	Peak Power (nW/100 kHz)
1	148.549	6	128.825
2	176.198	7	132.739
3	138.357	8	122.180
4	154.882	9	127.350
5	102.802	10	129.420
Total Peak Power:	1356.302 nW/MHz		

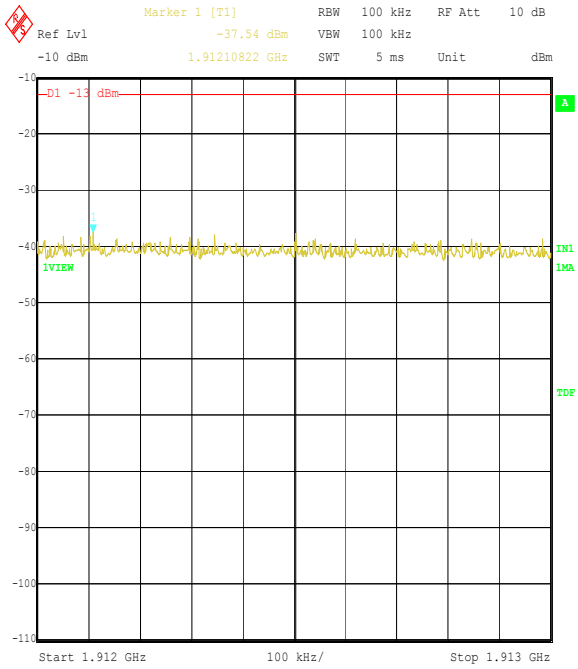
Results:

Band (MHz)	Peak Power (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)	Status
1911 to 1912	-27.6	-13.0	14.6	Complied
1912 to 1913	-28.7	-13.0	15.7	Complied

Transmitter Out of Band Radiated Emissions: Section 2.1051 & 24.238 (Continued)



Title: SENDO Eut:S361 FCC P22/24. Radiated Band Strip
Comment A: 70871JD01 Top Channel
Date: 17.NOV.2004 11:15:48



Title: SENDO Eut:S361 FCC P22/24. Radiated Band Strip
Comment A: 70871JD01 Top Channel
Date: 17.NOV.2004 11:11:59

7.11. Transmitter Radiated Emissions at Band Edges: Section 2.1053 & 24.238

7.11.1. The EUT was configured as for transmitter radiated emissions testing described in Section 9 of this report.

7.11.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency block that the EUT will operate over.

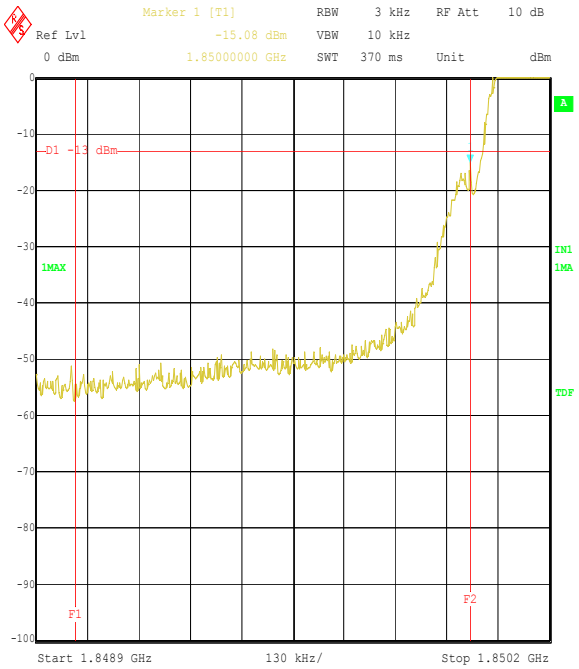
Results:

Bottom Band Edge

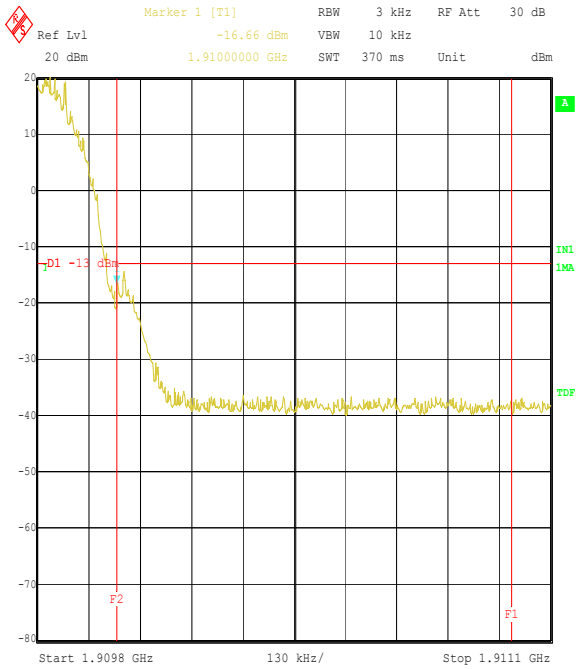
Frequency (MHz)	Spurious Emission (dBm)	Limit (dBm)	Margin (dB)	Result
1850	-15.1	-13.0	2.1	Complied

Top Band Edge

Frequency (MHz)	Peak Emission Level (dBm)	Limit (dBm)	Margin (dB)	Result
1910	-16.7	-13.0	3.7	Complied



Title: SENDO Eut:S361 FCC P22/24. Radiated Band Edge
Comment A: 70871JD01 Bottom Channel
Date: 17.NOV.2004 11:25:32



Title: SENDO Eut:S361 FCC P22/24. Radiated Band Edge.
Comment A: 70871JD01 Top Channel
Date: 17.NOV.2004 10:55:13

8. Measurement Uncertainty

8.1. No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

8.2. The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

8.3. The uncertainty of the result may need to be taken into account when interpreting the measurement results.

8.4. The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	+/- 3.25 dB
Carrier Output Power	Not applicable	95%	+/- 0.46 dB
Conducted Emissions	9 kHz to 26 GHz	95%	+/- 1.2 dB
Conducted Emissions Antenna Port	30 MHz to 40 GHz	95%	+/- 1.2 dB
Effective Radiated Power (ERP)	Not applicable	95%	+/- 1.78 dB
Frequency Stability	Not applicable	95%	+/- 20 Hz
Minimum Bandwidth	Not applicable	95%	+/- 0.12 %
Occupied Bandwidth	824 to 849 MHz	95%	+/- 0.12 %
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1 GHz to 26 GHz	95%	+/- 1.78 dB

8.5. The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

9. Measurement Methods

9.1. Effective Radiated Power (ERP)

ERP measurements were performed in accordance with the standard, against appropriate limits.

The ERP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4. The transmitter was fitted with an integral antenna; as such all radiated tests were performed with the unit operating into the integral antenna.

The level of the ERP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the Vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For ERP measurements a dipole antenna was used. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The ERP was calculated as:-

ERP = Signal Generator Level - Cable Loss + Antenna Gain

Effective Radiated Power (ERP) (Continued)

Circumstances where the signal generator could not produce the desired power substitution was performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The ERP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated ERP to obtain the substituted EUT ERP.

Delta (dB) = EUT – SG

Where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual ERP is calculated as:

ERP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT ERP is calculated as:

ERP EUT = ERP SG + Delta.

The test equipment settings for ERP measurements were as follows:

Receiver Function	**Setting**
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	≥ Emission Bandwidth
Amplitude Range:	100 dB
Sweep Time:	Coupled

9.2. Effective Isotropic Radiated Power (EIRP)

EIRP measurements were performed in accordance with the standard, against appropriate limits.

The EIRP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4. The transmitter was fitted with an integral antenna; therefore all radiated tests were performed with the unit operating into the integral antenna.

The level of the EIRP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the Vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

All measurements were performed using broadband Horn antennas.

Effective Isotropic Radiated Power (EIRP) (Continued)

Circumstances where the signal generator could not produce the desired power substitution was performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

Delta (dB) = EUT – SG

where :

EUT = spectrum analyser indicated EUT raw level

SG = spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

EIRP SG= Signal Generator Level - Cable Loss + Antenna Gain

The EUT EIRP is calculated as:

EIRP EUT = EIRP SG + Delta.

The test equipment settings for EIRP measurements were as follows:

Receiver Function	**Setting**
Detector Type:	Peak
Mode:	Not applicable
Bandwidth:	1 MHz
Amplitude Range:	100 dB
Sweep Time:	Coupled

9.3. Transmitter Radiated Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 10 times the highest fundamental frequency. The scans were performed within a screened chamber in order to identify frequencies on which the EUT was generating spurious. This procedure identified the frequencies from the EUT, which required further examination. Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit by characterising the screen room using a known signal source set at exactly the same location as the EUT. The signal source was derived from either a horn antenna or a dipole dependant on the frequency band under investigation. Any levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Peak detector was used for final measurements at each frequency recorded in the screen room.

The levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the vertical polarisation. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT. The procedure was repeated for the horizontal polarisation.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

The limit in the standard states that emissions shall be attenuated by at least 43+10 log (P) dB below the transmitter power (P), where (P) is the maximum measured fundamental power for the channel under test. This limit always reduces to –13 dBm therefore, the limit line presented on the accompanying plots is set to –13 dBm.

Any spurious measured were then compared to the –13 dBm limit. The requirement is for the emission to be less than –13 dBm. The margin between emission and limit is recorded and should always be positive to indicate compliance.

All measurements were performed using broadband Horn antennas.

Transmitter Radiated Emissions (Continued)

It should be noted that FCC Part 24.238 states that the 1st MHz band immediately adjacent to the applicants declared frequency block may be measured using a resolution bandwidth of at least 1% of the emission bandwidth. This bandwidth was found by calculating 1% of the bandwidth measured in the transmitter occupied bandwidth section of this report. The next largest available bandwidth above this calculated figure was, therefore, used i.e. 3 kHz.

The measurements in the 2nd and 3rd 1 MHz blocks away from the adjacent 1 MHz block from 1911 MHz to 1912 MHz and 1912 MHz to 1913 MHz were carried out using an analyser span of 1 MHz and a 100 kHz receiver resolution bandwidth (RBW). 10 linear readings were taken for each 100 kHz strip across the 1 MHz band. These readings were integrated to give the emission level in an equivalent 1 MHz bandwidth.

9.4. Receiver Radiated Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to the upper frequency detailed in Section 15.33(b) were performed within a screened chamber in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT, which required further examination. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit. Levels within 20dB of this limit were measured where possible, on occasion, the receiver noise floor came within the 20dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Quasi-Peak detector was used for measurements below 1000 MHz, for measurements above 1000 MHz average and peak detectors were used.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the horizontal polarisation. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT. The procedure was repeated for the vertical polarisation.

The final field strength was determined as the indicated level in dBμV plus cable loss and antenna factor.

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	**Initial Scan**	**Final Measurements Below 1GHz**	**Final Measurements Above 1 GHz**
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 1GHz) (1MHz > 1GHz)	120 kHz	1 MHz (If Applicable)
Amplitude Range:	60 dB	20 dB	20 dB (typical)
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A027	Horn Antenna	Eaton	9188-2	301
A059	3146 Log Periodic Antenna	EMCO	3146	8902-2378
A091	EMCO 3110 Biconical Antenna	EMCO	3110	9008-1182
A1063	N-M Offset Short	Maury Microwave	8807C	294
A259	Bilog Antenna	Chase	CBL6111	1513
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
A427	WG 14 horn	Flann	14240-20	150
A428	WG 12 horn	Flann	12240-20	134
A429	WG 16 horn	Flann	16240-20	561
A430	WG 18 horn	Flann	18240-20	425
A436	WG 20 horn	Flann	20240-20	330
A512	Wave Guide Antenna	EMCO	3115	3993
A513	Bi-Con	Rohde & Schwarz	HK116	829822/002
C1065	Rosenberger	Rosenberger	UFA210-1-7872	0985
C1078	Rosenberger 3m Cable	Rosenberger	FA210A1030M 5050	28464-2
C373	Cable	Rosenberger	RG400	None
C572	C572-N-N-2	Rosenberger	UFA210A-1-788-50x50	97E0935
C573	C573-N-N-2	Rosenberger	UFA210A-1-788-50x50	97E0936

Test Equipment Used (Continued)

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M028	FSB Spectrum Analyser	Rohde & Schwarz	FSB	860 001/009 (RF), 860 161/007 (Display)
M044	ESVP Receiver	Rohde & Schwarz	ESVP	891 845/026
M093	HP Oscilloscope	Hewlett Packard	54520A	US34360744
M1093	Will tek	Will tek	4202S	0513018
M1124	Rohde & Schwarz	Rohde & Schwarz	ESIB26	100046K
S201	Site 1	RFI	1	
S202	Site 2	RFI	2	S202-15011990

NB In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

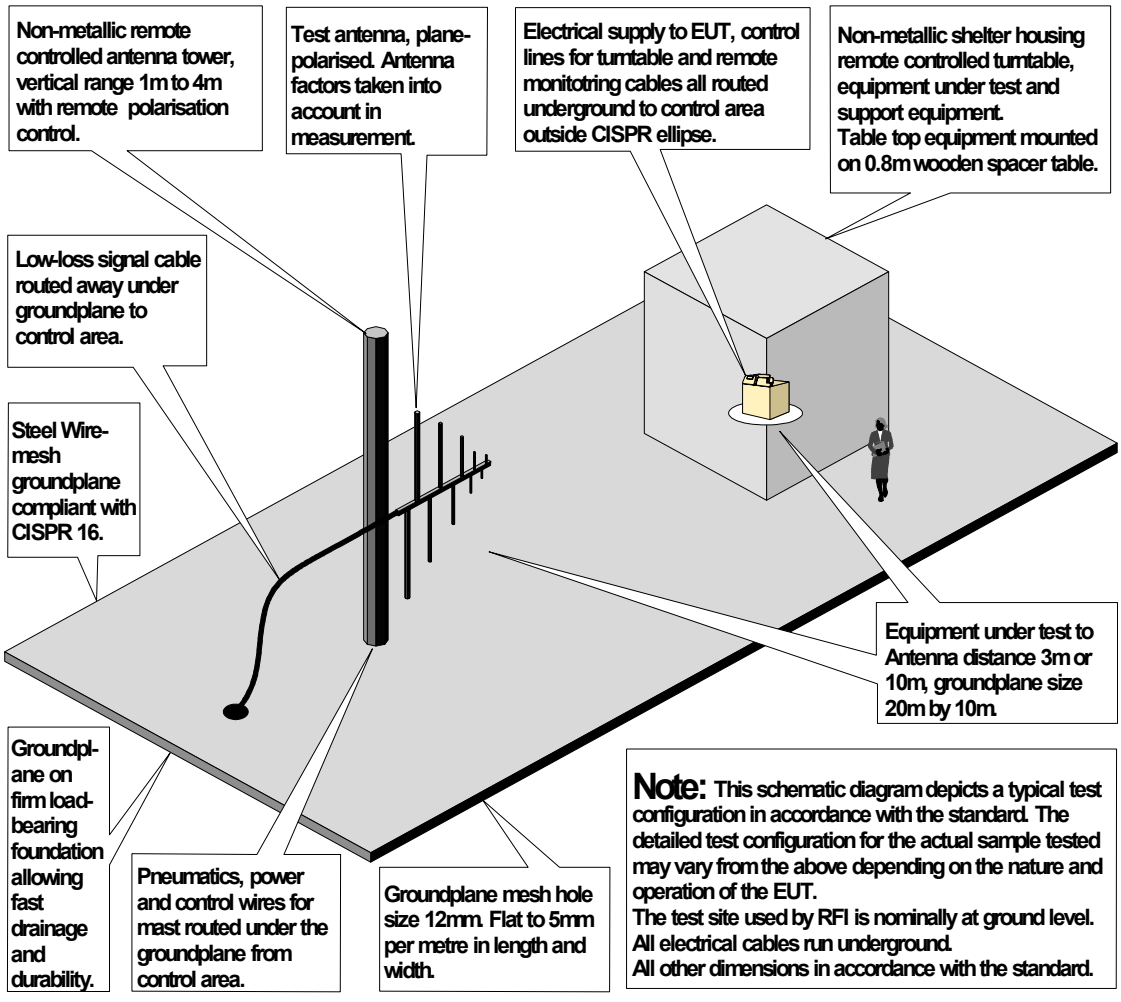
Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\70871JD01\EMIRAD	Test configuration for measurement of radiated emissions.

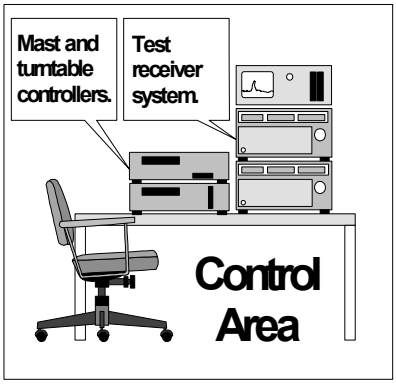
Test of: Sendo International Ltd
S361
To: FCC Part 22 & 24

DRG\70871JD01\EMIRAD



Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m
(CISPR ellipse)
Groundplane Earthed
Control room outside CISPR ellipse



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