

CHANGE NOTICE

Date Prepared: 3/4/02

1. The Boeing Company Post Office Box 58747 Houston, TX 77258		2. <input type="checkbox"/> Proposed <input checked="" type="checkbox"/> Approved		3. Code Ident. 2B945		4. Doc. No. SSP 30237F	
				5. Code Ident. 2B945		6. CDCN No. 020	
7. System Designation ISS		8. Related ECP No./Title SSCN 005263			9. Contract No. NAS15-10000		10. Contractual Activity SSCN 005263
11. Document Title Space Station Electromagnetic Emission and Susceptibility Req				12. Effectivity All Units			
THIS NOTICE INFORMS RECIPIENTS THAT THE DOCUMENT IDENTIFIED BY THE NUMBER (AND REVISION LETTER) SHOWN IN BLOCK 4 HAS BEEN CHANGED. THE PAGES CHANGED BY THIS CDCN BEING THOSE FURNISHED HEREWITH AND CARRYING THE SAME DATE AS THIS CDCN. THE PAGES OF THE PAGE NUMBERS AND DATES LISTED BELOW IN THE SUMMARY OF CHANGED PAGES COMBINED WITH NON-LISTED PAGES OF THE ORIGINAL ISSUE OF THE REVISION SHOWN IN BLOCK 4 CONSTITUTE THE CURRENT VERSION OF THIS DOCUMENT.							
13. CDCN No.	14. Pages Changed (Indicate Deletions)				S*	A*	15. Date
020	Revision and History page Pages 3-2, 3-3, 3-4, 3-5, 3-6, 3-8, and 3-10 Pages C-39, C-86, C-95, C-96, C-105, C-116, C-118, C-119, and C-121				X X X		3/4/02
020	Pages C-39a, C-86a, C-95a, C-95b, C-96a, C-105a, C-105b, C-105c Pages C-116a, C-116b, C-118a, C-119a, C-119b, C-119c, C-119d Pages C-119e, C-122, C-123, and C-124.					X X X	
	Order of Incorporation: DCN 017, 019, 020						
16. Technical Concurrence (Contracting Agency)						Date	

* "S" indicates supersedes earlier page. "A" indicates added page.

REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
-	SDR Version	03-07-94
B	Revision B (Reference SSCBD 000008 R1, Eff. 6-03-94) Revised to Transition from Freedom to ISS. Changes include extensive simplification of requirements and scope.	09-30-94
C	Revision C (SSCD 000263, EFF. 09-04-97) Administrative Update	01-29-97
	DCN 001 incorporates ECP 263 (Supplemental Release)	06-06-97
	DCN 002 incorporates SSCN 000777	07-20-98
	DCN 003 incorporates SSCN 001035	07-20-98
D	Revision D incorporates SSCN 001102	07-21-98
	DCN 004 incorporates SSCN 001462	02-17-99
	DCN 005 incorporates SSCN 001594	02-22-99
	DCN 006 incorporates SSCN 001662	06-15-99
	DCN 007 incorporates SSCN 001920	08-25-99
	DCN 008 incorporates SSCN 002045	08-25-99
	DCN 009 incorporates SSCN 002107	08-30-99
E	Revision E incorporates SSCN 002345	10-25-99
	DCN 010 incorporates SSCN 002485	04-06-00
	DCN 011 incorporates SSCD 003213 Eff. 06-28-00	04-13-01
	DCN 013 incorporates SSCN 003690 Eff. 11-08-00	04-13-01
	DCN 014 incorporates SSCN 003746 Eff. 11-15-00	04-13-01
	The following DCNs have been cancelled. The content of these DCNs have been incorporated into Revision F.	
	DCN 015 incorporates SSCN 004676 Administrative Cancel	
	DCN 018 incorporates SSCN 000256 Administrative Cancel	
F	Revision F incorporates SSCNs 000256, 004676, and 004140.	07-24-01
	DCN 017 incorporates SSCD 005008	08-31-01
	DCN 019 incorporates SSCN 005529	10-23-01
	DCN 020 incorporates SSCN 005263	03-27-02

3.2.1.1.2 CE01 LIMITS

Electromagnetic emissions shall not appear on dc leads in excess of the following values as shown below. The emission limit shown below is for equipment drawing one amp or less. For equipment drawing more than one amp, the limit, in decibels (dB) as shown in Table 3.2.1.1.2-1 shall be raised by $20 \times \log I$, where I equals the total dc current used by the equipment under test.

TABLE 3.2.1.1.2-1 CE01 EMISSION LIMIT

Frequency	Emissions
30 Hz to 200 Hz	110 dB above 1 microampere
200 Hz to 15 kHz	Decreasing log linearly with increasing frequency from 110 to 74 dB above 1 microampere

DCN 020

The limits shall be measured with an effective bandwidth not exceeding 100 Hz. See appendix C for exception (Electromagnetic Effects Control Board (EMECCB) Tailoring/Interpretation Agreement (TIA)-0025, EMECCB TIA-0134, EMECCB TIA-0138, EMECCB TIA-0155, EMECCB TIA-0159, and EMEP TIA-0315) to this paragraph.

DCN 020

3.2.1.2 CE03, CONDUCTED EMISSIONS

Direct current power leads, 15 kHz to 50 megahertz (MHz).

3.2.1.2.1 APPLICABILITY

CE03 is applicable only for narrowband emissions between 15 kHz and 50 MHz on dc leads which obtain power from other sources or provide power to other equipment, distribution panels or subsystems.

3.2.1.2.2 CE03 LIMITS

Electromagnetic emissions shall not appear on dc power leads in excess of the following values as shown below for narrowband emissions: The limit shown below is for equipment drawing one amp or less. For equipment drawing more than one amp, the limit as shown in Table 3.2.1.2.2-1 shall be raised by $20 \times \log I$, where I equals the total dc current used by the equipment under test. See appendix C for exception (EMECB TIA-0024, EMECB TIA-0025, EMECB TIA-0028, EMECB TIA-0039, EMECB TIA-0043, EMECB TIA-0053, EMECB TIA-0057, EMECB TIA-0064, EMECB TIA-0082, EMECB TIA-0095, EMECB TIA-0098, EMECB TIA-0101, EMECB TIA-0112, EMECB TIA-0114, EMECB TIA-0115, EMECB TIA-0118, EMECB TIA-0123, EMECB TIA-0131, EMECB TIA-0132, EMECB TIA-0134, EMECB TIA-0141, EMECB TIA-0147, EMECB TIA-0153, EMECB TIA-0167, EMECB TIA-0174, EMECB TIA-0176, EMECB TIA-0199, EMEP TIA-0203, EMEP TIA-0206, EMEP TIA-0226, EMEP TIA-0228, EMEP TIA-0244, EMEP TIA-0257, EMEP TIA-0258, EMEP TIA-0276, EMEP TIA-0283, EMEP TIA-0297, EMEP TIA-0340, and EMEP TIA-0353) to this paragraph.

DCN 020

TABLE 3.2.1.2.2-1 CE03 EMISSION LIMITS

Frequency	Emissions
15 kHz to 500 Hz	Decreasing log linearly with increasing frequency from 74 to 45 dB above 1 microampere
500 kHz to 50 MHz	45 dB above 1 microampere

DCN 020

3.2.1.3 CE07, CONDUCTED EMISSIONS

Direct current power leads, spikes, time domain.

3.2.1.3.1 APPLICABILITY

CE07 is applicable for dc input power leads.

3.2.1.3.2 CE07 LIMITS

CE07 on and off and mode switching transients shall not exceed the envelope defined by the following values listed in Table 3.2.1.3.2-1. Repetitive on and off and mode switching transients shall not occur more frequently than every 100 milliseconds. See appendix C for exception (EMECB TIA-0014, EMECB TIA-0027, EMECB TIA-0049, EMECB TIA-0050, EMECB TIA-0055, EMECB TIA-0057, EMECB TIA-0072, EMECB TIA-0077, EMECB TIA-0079, EMECB TIA-0095, EMECB TIA-0104, EMECB TIA-0110, EMECB TIA-0111, EMECB TIA-0114, EMECB TIA-0116, EMECB TIA-0124, EMECB TIA-0143, EMECB TIA-0144, EMECB TIA-0155, EMECB TIA-0189, EMECB TIA-0198, EMEP TIA-0200, EMEP TIA-0202, EMEP TIA-0203, EMEP TIA-0228, EMEP TIA-0242, EMEP TIA-0282, EMEP TIA-0283, EMEP TIA-0303, EMEP TIA-0350, and EMEP TIA-0353) to this paragraph.

DCN 017, 020

TABLE 3.2.1.3.2-1 CE07 MODE SWITCHING TRANSIENTS ENVELOPE

Time (Microseconds)	Percentage of Nominal Line Voltage
0.1 to 10	+ 50 percent
10 to 50	Decreasing log linearly with increasing time from + 50 percent to + 20 percent
50 to 1000	Decreasing log linearly with increasing time from + 20 percent to + 5 percent or + 6 volts, whichever is greater
1000 to 10,000	+ 6 percent or + 0.5 volts, whichever is greater
10,000 to 100,000	+ 5 percent or + 0.5 volts, whichever is greater

3.2.2 CONDUCTED SUSCEPTIBILITY

3.2.2.1 CS01, CONDUCTED SUSCEPTIBILITY

Direct current power leads, 30 Hz to 50 kHz. See appendix C for the exception (EMEP TIA-0327, EMEP TIA-0328, EMEP TIA-0348, and EMEP TIA-0369) to this paragraph.

DCN 019, 020

3.2.2.1.1 APPLICABILITY

CS01 is applicable to equipment and subsystems using dc power.

3.2.2.1.2 CS01 LIMITS

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications beyond the tolerances indicated in the individual equipment or subsystem specification when subjected to electromagnetic energy injected onto its power leads less than or equal to the values as shown in Table 3.2.2.1.2-1. See appendix C for exception (EMECB TIA-0090, EMECB TIA-0145, EMECB TIA-0161, EMECB TIA-0177, EMECB TIA-0178, EMECB TIA-0187, EMECB TIA-0188, EMEP TIA-0225, EMEP TIA-0231, EMEP TIA-0297, and EMEP TIA-0354) to this paragraph.

DCN 020

TABLE 3.2.2.1.2-1 CS01 ELECTROMAGNETIC ENERGY INJECTION

Frequency	Voltage
30 Hz to 2 kHz	5 Volts root mean square (Vrms) or 10 percent of the supply voltage (E1), whichever is less
2 kHz to 50 kHz	Decreasing log linearly with increasing frequency from 5 Vrms, or E1 whichever is less, to either 1 Vrms or 1 percent of the supply voltage, whichever is less

3.2.2.1.3 ALTERNATE CS01 LIMITS

The requirement is also met when the audio power source specified in SSP 30238 adjusted to dissipate 50 Watts in a 0.5 ohm load, cannot develop the required voltage at the EUT power input terminals, and the EUT is not susceptible to the output of the signal source.

3.2.2.2 CS02, CONDUCTED SUSCEPTIBILITY

Direct current power leads, 50 kHz to 50 MHz. See appendix C for the exception (EMEP TIA-0327, EMEP TIA-0328, EMEP TIA-0348, and EMEP TIA-0369) to this paragraph.

DCN 019, 020

3.2.2.2.1 APPLICABILITY

CS02 is applicable between 50 kHz and 50 MHz for equipment and subsystem dc power leads, including power returns which are not grounded internally to the equipment or subsystem.

3.2.2.2.2 CS02 LIMITS

The equipment subsystem shall not exhibit any malfunction, degradation of performance or deviation from specified indications beyond the tolerances indicated in the individual equipment or subsystem specification when subjected to 1 Vrms from a 50 ohm source. The test signal shall be applied to the equipment power line near the equipment input terminals. The requirement is also met under the following condition: A 1 Watt source of 50 ohms impedance cannot develop the required voltage at the EUT power input terminals, and the EUT is not susceptible to the output of the signal source. See appendix C for exception (EMECB TIA-0023, EMECB TIA-0051, EMECB TIA-0085, EMECB TIA-0110, EMECB TIA-0162, EMECB TIA-00199, EMEP TIA-0214, EMEP TIA-0215, EMEP TIA-0232, EMEP TIA-0253, and EMEP TIA-0293) to this paragraph.

3.2.2.3 CS06, CONDUCTED SUSCEPTIBILITY

Spikes, power leads. See appendix C for the exception (EMEP TIA-0327, EMEP TIA-0328, EMEP TIA-0348, and EMEP TIA-0369) to this paragraph.

DCN 019, 020

3.2.2.3.1 APPLICABILITY

CS06 is applicable to equipment and subsystem dc power leads, including grounds and returns which are not grounded internally to the equipment or subsystem.

3.2.2.3.2 CS06 LIMITS

The EUT shall not exhibit any malfunction, degradation of performance or deviation from specified indications beyond the tolerances indicated in the individual equipment or subsystem specification when the test spikes, each having the waveform shown on Figure 3.2.2.3.2-1, are applied sequentially to the dc power input leads. The values of E and t are given below. Each spike shall be superimposed on the powerline voltage waveform. See appendix C for exception (EMECB TIA-0088, EMECB TIA-0119, EMECB TIA-0124, EMECB TIA-0193, EMEP TIA-0204, and EMEP TIA-0242) to this paragraph.

3.2.3 RADIATED EMISSIONS

3.2.3.1 RE02, RADIATED EMISSIONS

Electric field, 14 kHz to 10 GHz (narrowband), 13.5 to 15.5 GHz.

3.2.3.1.1 APPLICABILITY

RE02 is applicable for radiated emissions from equipment and subsystems, cables (including control, pulse, intermediate frequency, power and antenna transmission lines) and interconnecting wiring of the test sample; for narrowband emissions, it applies at the fundamental frequencies and all spurious emissions including harmonics, but does not apply for radiation from antennas. This requirement is applicable for narrowband emissions from 14 kHz to 10 GHz and 13.5 to 15.5 GHz.

3.2.3.1.2 RE02 LIMITS

E-field emissions shall not be radiated in excess of those specified in the following paragraphs. Above 30 MHz, the limits shall be met for both horizontally and vertically polarized waves. Measurement shall be made in the peak detector mode. See appendix C for exception (EMECB TIA-0001, EMECB TIA-0044, EMECB TIA-0048, EMECB TIA-0052, EMECB TIA-0055, EMECB TIA-0057, EMECB TIA-0065, EMECB TIA-0073, EMECB TIA-0074, EMECB TIA-0075, EMECB TIA-0080, EMECB TIA-0095, EMECB TIA-0097, EMECB TIA-0102, EMECB TIA-0103, EMECB TIA-0105, EMECB TIA-0111, EMECB TIA-0133, EMECB TIA-0135, EMECB TIA-0137, EMECB TIA-0138, EMECB TIA-0142, EMECB TIA-0164, EMECB TIA-0165, EMECB TIA-0167, EMECB TIA-0170, EMECB TIA-0171, EMECB TIA-0183, EMECB TIA-0154, EMEP TIA-0160, EMECB TIA-0192, EMEP TIA-0203, EMEP TIA-0207, EMEP TIA-0208, EMEP TIA-0209, EMEP TIA-0212, EMEP TIA-0219, EMEP TIA-0220, EMEP TIA-0227, EMEP TIA-0237, EMEP TIA-0213, EMEP TIA-0229, EMEP TIA-0241, EMEP TIA-0252, EMEP TIA-0254, EMEP TIA-0256, EMEP TIA-0257, EMEP TIA-0258, EMEP TIA-0261, EMEP TIA-0264, EMEP TIA-0269, EMEP TIA-0270, EMEP TIA-0276, EMEP TIA-0277, EMEP TIA-0283, EMEP TIA-0287, EMEP TIA-0288, EMEP TIA-0299, EMEP TIA-0305, EMEP TIA-0307, EMEP TIA-0311, EMEP TIA-0314, EMEP TIA-0320, EMEP TIA-0330, EMEP TIA-0331, EMEP TIA-0332, EMEP TIA-0335, EMEP TIA-0340, EMEP TIA-0349, EMEP TIA-0353, EMEP TIA-0355, EMEP TIA-0357, and EMEP TIA-0360) to this paragraph.

DCN 017, 020

TABLE 3.2.3.1.2.1-1 FIELD EMISSION LIMITS

Frequency	Emissions
14 kHz to 10 MHz	56 dB μ V/m
10 MHz to 259 MHz	Increasing log linearly with increasing frequency from 56 to 86 dB μ V/m (16 dB per decade)
259 MHz to 10 GHz	Increasing log linearly with increasing frequency from 46 to 72 dB μ V/m (16 dB per decade)
13.5 to 15.5 GHz	72 dB μ V/m

3.2.4 RADIATED SUSCEPTIBILITY

3.2.4.1 RS02, RADIATED SUSCEPTIBILITY

Magnetic induction field. See appendix C for the exception (EMEP TIA-0327, EMEP TIA-0328, EMEP TIA-0348, and EMEP TIA-0369) to this paragraph.

DCN 019, 020

3.2.4.1.1 APPLICABILITY

RS02 is applicable for all equipment and subsystems. These susceptibility signals are electromagnetically coupled into the equipment or subsystem wiring. See appendix C for exception (EMEP TIA-0211, EMEP TIA-0218, and EMEP TIA-0239) to this paragraph.

3.2.4.1.2 RS02 LIMITS

The EUT shall not exhibit any malfunction, degradation of performance, or deviation from specified indications beyond the tolerances indicated in the individual equipment or subsystem specification when subjected sequentially to the test spikes, shown in Figure 3.2.2.3.2-1 each having the waveform with the values of E and t are given below:

- Spike #1 E = \pm Twice the nominal line voltage, t = 10 microseconds \pm 20 percent
- Spike #2 E = \pm Twice the nominal line voltage, t = 0.15 microseconds \pm 20 percent.

See appendix C for exception (EMECB TIA-0095, EMECB TIA-0100, EMECB TIA-0116, and EMECB TIA-0155) to this paragraph.

3.2.4.2 RS03, RADIATED SUSCEPTIBILITY

Electric field, 14 kHz to 20 GHz. See appendix C for the exception (EMEP TIA-0327, EMEP TIA-0328, EMEP TIA-0348, and EMEP TIA-0369) to this paragraph.

DCN 019, 020

3.2.4.2.1 APPLICABILITY

RS03 is applicable for all equipment and subsystems between 14 kHz and 20 GHz. Above 10 GHz, this requirement applies only at specific frequencies and amplitudes known to be present at the Space Station. Below 10 GHz, this requirement shall be increased only at specific frequencies and amplitudes known to be present at the International Space Station (ISS). Module shielding effectiveness can be used to limit the levels applied.

3.2.4.2.2 RS03 LIMITS

The EUT shall not exhibit any malfunction, degradation of performance, or deviation, from specified indications beyond the tolerances indicated in the individual equipment or subsystem specification when subjected to the radiated electric fields less than or equal to those specified herein. Above 30 MHz, the requirement shall be met for both horizontally and vertically polarized waves. As a minimum, the levels shown in Table 3.2.4.2.2-1 apply at either the specific frequencies stated or across the ranges stated. See appendix C for exception (EMECB TIA-0005, EMECB TIA-0055, EMECB TIA-0059, EMECB TIA-0062, EMECB TIA-0063, EMECB TIA-0080, EMECB TIA-0083, EMECB TIA-0084, EMECB TIA-0089, EMECB TIA-0095, EMECB TIA-0104, EMECB TIA-0105, EMECB TIA-0108, EMECB TIA-0117, EMECB TIA-0118, EMECB TIA-0119, EMECB TIA-0128, EMECB TIA-0138, EMECB TIA-0149, EMECB TIA-0151, EMECB TIA-0153, EMECB TIA-0155, EMEP TIA-0158, EMECB TIA-0161, EMECB TIA-0163, EMECB TIA-0168, EMECB TIA-0172, EMECB TIA-0175, EMECB TIA-0183, EMECB TIA-0184, EMECB TIA-0190, EMECB TIA-0199, EMEP TIA-0219, EMEP TIA-0243, EMEP TIA-0250, EMEP TIA-0255, EMEP TIA-0257, EMEP TIA-0262, EMEP TIA-0287, EMEP TIA-0288, and EMEP TIA-0360) to this paragraph.

DCN 020

TABLE 3.2.4.2.2-1 RS03 LIMIT LEVELS

Frequency Range	Radiated Electric Field Level
14 kHz to 10 MHz	5 V/m
200 MHz to 8 GHz	60 V/m
8 GHz to 10 GHz	20 V/m
2.2 GHz	161 V/m
8.5 GHz	79 V/m
13.7 GHz to 15.2 GHz	250 V/m

EMEP TIA-0128

DCN 020

C.3.2.4.2.2 RS03 LIMITS

DCN 020

Exception: For the USA Simplified Aid For EVA Rescue (SAFER) (PN SED33105900-303) the RS03 limit specified in 3.2.4.2.2 will be reduced as shown in Table TIA-0128-1. **DCN 020**

TABLE TIA-0128-1 SPECIFIED RS03 LIMITS

Frequency	Radiated Electric Field Level
55.00 to 57.39 MHz	4.17 V/m
200.00 to 209.99 MHz	23.59 V/m
259.7 MHz	54.7 V/m
275.00 to 303.99 MHz	19.32 V/m
329.63 to 349.99 MHz	50.58 V/m

DCN 020

Note: An effect was observed on the SAFER electronic displays during test at additional frequencies as having a display error in the issue description of this TIA. According to the TIA originator no change to the numeric values of the display occurred. These effects are considered minor and do not affect the functionality or checkout operation of the SAFER. The SAFER continued to operate to the required levels at these frequencies with no other effect. This note provides an interpretation that the SAFER performance at these frequencies is acceptable.

DCN 020

Rationale: EME analysis of SAFER RS03 test results considered avionics lockup errors for the operational phase without shielding. Ground based, ISS based and STS based transmitters were included.

DCN 020

Ground based transmitters do not constitute a threat to SAFER. Ground based transmitters at the avionics lockup frequencies are sufficiently low level that there is at least 10 dB margin against operational interference.

DCN 020

One STS EVA/ATC (air to ground) transmitter at 296.8 MHz can cause avionics lockup within 1 meter of SAFER. This is not a credible threat as discussed in memo 2-6930-1998-RCC-27. Because of this, it is recommended to accept the SAFER RS03 performance.

DCN 020

EMECB TIA-0131

C.3.2.1.2.2 CE03 LIMITS

Exception: The CE03 conducted emissions requirement specified in 3.2.1.2, shall be relaxed by 2 dB (from 65 to 67 dBμA) for the DCSU (PN R072610) primary power leads only. This tailored requirement shall apply to DCSU emissions between the frequency of 500 kHz and 1.0 MHz.

(The CE03 emissions limit for the DCSU primary power leads is 20 dB above the CE03 limit for a 1 ampere device as defined in 3.2.1.2. This is because the DCSU primary power switching system is characterized as a 10 ampere power system device or “user”.)

Rationale: The CE03 emissions limit for the DCSU is 15 dB less than the DDCU emission requirement and 20 dB less than the BCDU emissions requirement. The DDCU and BCDU emission limits above 500 kHz are 80 dB μ A and 85 dB μ A, respectively. The DCSU emissions will not threaten the susceptibility of any other device on the primary power system because these devices (ORUs) are designed to be immune to emissions from the DDCU, BCDS and SSU. All other ORUs connected to the primary power distribution system have CE03 emission limits that are at least 15 dB greater than the DCSU. Since these ORUs are compatible with each other, it is a mute point whether they will be compatible with DCSU emissions. It is unreasonable and costly to design the DCSU to CE03 emission limits that are unnecessarily stringent when compared to the other primary power system users on the same power cable. Also, it could be debated whether the relaxation of the CE03 limit in 3.2.1.2.2, is intended for all devices that 'use or draw' greater than 1 ampere, even if the current is power system throughput.

As a measure of compatibility between the Space Station primary power hardware, all EPS hardware meets the conducted susceptibility requirements of 3.2.2.2.2. Conducted emissions to susceptibility margins are documented in the on going assessment document D684-10232-01. Implementation of this TIA does not degrade the margin required by SSP 30243, paragraph 3.2.3.

EMECB TIA-0132

C.3.2.1.2.2 CE03 LIMITS

Exception: The CE03 conducted emissions requirement specified in 3.2.1.2, shall be relaxed by 8 dB for the DCSU (CI 370PG2, PN R072610) 120 volt Controller Power Output leads only. This tailored requirement shall apply to DCSU emissions between the frequency of 90 and 100 kHz.

Rationale: The DCSU 120 V Controller Power Output is a dedicated power supply output for the MDM. No other load is connected to this terminal.

This TIA is approved for use on the USL only. It will not be used in other segments.

Rationale:

Issue 1: An isolation amplifier in the H-Reflex Hardware creates the narrowband emissions that are out of RE02 specification. The amplifier being used was chosen because it is a very specialized, high grade, medical quality amplifier. In addition, since this amplifier has flown before (STS-78), the design of the circuitry is proven to provide the data quality required by the hardware. To change now would imply a new circuit board, new certification testing, and would cause many months of delays. The total anticipated usage time for this hardware on the ISS is approximately 6 hours per increment.

Issue 2: The hardware in question has been determined to be criticality 3 (criticality assessment in signature cycle). Therefore, any failures resulting from radiated susceptibility will affect the science gathered by this particular experiment only. The hardware has a history of performing in noisy EMI environments (on the ground and in flight) without any difficulty. It is believed that the cost of performing the radiated testing outweighs the potential benefit gained by this test. The hardware provider will accept the risk associated with not performing this testing. A 77 dB margin exists between RS03 and RE02 at these frequencies. There are no intentional receivers at these RE02 exceedances.

EMEP TIA-0225

DCN 020

C.3.2.2.1.2 CS01 LIMITS

DCN 020

Exception: The basic EXPRESS Rack 8/2 (PN 683-46052-002, CEI 683P78A, PEI 683P79A) is allowed to pass the CS01 test at a level of 4 Vrms instead of 5 Vrms in the frequency range of 300 to 500 Hz.

DCN 020

Rationale: The AAA passed its EMI testing as a stand alone unit.

DCN 020

The alternate CS01 limit in 3.2.2.1.3 is 50 watts into 0.5 ohm load. For this test, 4.8 volts was equivalent to 50 watts.

DCN 020

The basic EXPRESS Rack is criticality 3. It provides power, data connections, and some control for payloads in suitable packages.

DCN 020

SSP 30482, Volume 1, specifies the Interface C ripple at 6 dB below the CS01 requirement. The worst case measured bus noise during the USL EPS testing was less than 1 volt peak to peak. Although this did not include experimental payloads, the noise on payload power busses is likewise expected to be less than 1 volt peak to peak. Should the AAA shut down, it can be restarted.

DCN 020

Based on an analysis of the CE01 test data and the power quality input impedance on the AAA, the problem is caused by the injected signal noise giving a false overcurrent indication to the AAA controller. The input impedance to the AAA fan is only approximately 1 ohm in the 300 to 500 Hz range. The SSPCM passes through the 120 Vdc power to the AAA after its input EMI filters, but with no further filtering or buffering and only an overcurrent protection circuit. The AAA fan uses a 3-phase converter to drive the fan motor. Its normal operating frequency at normal fan speeds is in the 300 to 500 Hz range. The controller monitors the motor current in this frequency range. With the low input filter impedance in this range, the injected noise current adds to the normal motor current. The total current is interpreted as excessive current by the controller which then shuts down the motor.

DCN 020

EMEP TIA-0226**C.3.2.1.2 CE03 LIMITS**

Exemption: When evaluating the Plasma Contactor Unit (PCU) (CI 270PG2, PN R078480) power input leads for conducted emissions, the CE03 limit specified in 3.2.1.2 shall be relaxed from the limit of 45 dB microamperes by 3.5 dB for conducted emissions between 1 to 2 MHz.

Rationale: The PCU conducted emission outages identified by this TIA exceed the SSP 30237, CE03 limit by less than 3.5 dB. The PCU receives secondary power from two dedicated RPCM-V output channels. The PCU emissions are greater than 6 dB below the RPCM-V approved CE limit line and are a fraction of the total noise budget for the secondary power system. As a result adequate safety margins exist.

EMEP TIA-0227**C.3.2.3.1.2 RE02 LIMITS**

Exemption: The EXPRESS Rack 8/2 ((PN 683-46052-002, CEI 683P78A, PEI 683P79A) is allowed to exceed the RE02 limits by the amounts indicated at the listed frequency ranges; the excess ambient levels are attributed to the EXPRESS Rack 8/2: 80 to 100 kHz by 10 dB above the 56 dB microvolt/meter requirement, 250 to 275 kHz by 7 dB above the 56 dB microvolt/meter requirement, 375 to 400 kHz by 4 dB above the 56 dB microvolt/meter requirement, 1.5 to 5.0 MHz by 20 dB above the 56 dB microvolt/meter requirement, 6.7 to 10 MHz by 25 dB above the 56 dB microvolt/meter requirement, and 10 to 25 MHz by 25 dB above the requirement, which rises from 56 dB microvolt/meter at 10 MHz to 64.5 dB microvolt/meter at 25 MHz. This is approved for use on US segments only, and is not to be used on JEM or Columbus until approved by NASDA and ESA.

Based on this precedent, the MBSUs, as installed within S0 and operating on-orbit, will comply with the full 60 V/m RS03 requirement.

Additionally, the PVCA software samples the temperature sensors once every second and reports the measurement to the higher tier every tenth sample. The PVCA software does not perform any closed loop control or FDIR functionality based on these temperature measurements. The PVCA software does perform a Caution & Warning Associated Indicator (CWA) check on these data resulting in a CWA flag only if the temperature measurement exceeds -45 or $+170$ degrees Celsius for three consecutive samples.

EMEP TIA-0256

C.3.2.3.1.2 RE02 LIMITS

Exemption: The RE02 radiated emissions requirement specified in 3.2.3.1, shall be relaxed by 6 dB for emissions between the frequencies of 2.2 MHz and 10.0 MHz when applied to the DDCU-I (CI DDCU-IA, PN R076500), DDCU-E (CI DDCU-EA, PN R076522) and DDCU-HP (CI DDCU-HPA, PN R076672).

Rationale: The RE02 emission outages indicated in this TIA are caused by DDCU switching noise radiating from the DDCU external power leads. These worst case emissions exceed the RE02 limit by less than 6 dB. A margin of greater than 40 dB exists between the RE02 and RS03 limits. There are no intended visiting vehicles or ISS receivers systems within the frequency range of these outages.

These exceedances were measured during RE02 qualification retests that were ordered after modifications to the DDCU power switch snubber circuits and output rectifier diodes. There is 77 dB margin between the RE02 and RS03 at these frequencies.

EMEP TIA-0257

DCN 020

C.3.2.1.2.2 CE03 LIMITS,

C.3.2.3.1.2 RE02 LIMITS,

C.3.2.4.2.2 RS03 LIMITS

DCN 020

Exception: The Solid State Power Controller Module, EXPRESS (SSPCM-E) (No CI Number, PN 9070147-1) is allowed to pass the 3.2.1.2.2 CE03 requirements at the levels shown in Tables TIA-0257-1 and TIA-0257-2.

DCN 020

**TABLE TIA-0257-1 CE03 PASS LEVELS – POSITIVE LEAD
(PAGE 1 OF 2)**

Positive Lead Frequency (kHz)	Emission (dB μ a)	Outage (dB)	Limit (dB μ a)
158.5	69.2	2.7	66.5
230.5	65.2	1.7	63.5
239.5	71.2	8.2	63.0
392.5	62.5	3.6	58.9

**TABLE TIA-0257-1 CE03 PASS LEVELS – POSITIVE LEAD
(PAGE 2 OF 2)**

Positive Lead Frequency (kHz)	Emission (dB μ a)	Outage (dB)	Limit (dB μ a)
545.5	60.5	3.5	57.0
554.5	67.3	10.3	57.0
1045.0	61.1	4.1	57.0
1135.0	61.3	4.3	57.0
1225.0	61.6	4.6	57.0

DCN 020

TABLE TIA-0257-2 CE03 PASS LEVELS – NEGATIVE LEAD

Negative Lead Frequency (kHz)	Emission (dB μ a)	Outage (dB)	Limit (dB μ a)
158.5	68.5	2.0	66.5
230.5	66.1	2.6	63.5
239.5	70.6	7.6	63.0
545.5	60.7	3.7	57.0
554.5	68.5	11.5	57.0
1045.0	59.6	2.6	57.0
1135.0	60.8	3.8	57.0
1225.0	61.6	4.6	57.0

DCN 020

The SSPCM is allowed to pass the 3.2.3.1.2 RE02 requirements as shown in Table TIA-0257-3.

DCN 020

TABLE TIA-0257-3 RE02 PASS LEVELS

Frequency (kHz)	Emission (dB μ V/m)	Outage (dB)	Limit (dB μ V/m)
80.0 kHz	63	7	56
15.85 MHz	67	7	60
18.90 MHz	68	6	62

DCN 020

The SSPCM is allowed to pass the 3.2.4.2.2 RS03 requirements as shown in Table TIA-0257-4. **DCN 020**

TABLE TIA-0257-4 RS03 PASS LEVELS

Frequency (kHz)	Susceptibility (V/m)	Limit (V/m)
15.0 to 329.0	4.2	5
345.0 to 440.0	1.8	5

DCN 020

Rationale: The SSPCM is installed as a payload power supply in the EXPRESS Rack. It is a criticality 3 item. Conducted emissions to susceptibility margins are documented in the on going assessment document D684-10232-01. There are no receivers in the range of the RE02 emissions and no transmitters in the range of the RS03 susceptibilities. **DCN 020**

EMEP TIA-0258

**C.3.2.1.3.2 CE07 AND
C.3.2.3.1.2 RE02 LIMITS**

Exemption: The B Bolt Bus Controller (BBC) (CI 222064A, PN 1F45012-1) is allowed to exceed the 3.2.3.1.2 RE02 limits of 56 dBuV/m by 1 dB at 10 MHz. The BBC is also allowed to exceed the 3.2.1.3.2 CE07 limits by 3 volts at 80 µsecs and 5 volts at 160 µsecs.

Rationale: The coupled powerline interference is unlikely to affect any of the equipment that shares the power source at this time.

The radiated emission out of specification margin is small enough to be considered within the repeatability margin of the test setup.

The CE07 requirement is not relevant to actual application since an RPCM provides a power source controlled voltage ramp up.

EMEP TIA-0261

C.3.2.3.1.2 RE02 LIMITS

Exemption: The tailoring would apply to the Portable Fan Assembly (PFA) GFE (PN 96M68020-1). The PFA may exceed 3.2.3.1.2 RE02 requirements in the vertical polarization by 2.9 dB at 46.15 MHz, 0.4 dB at 68.25 MHz, and 1.6 dB at 300 MHz. The PFA may exceed RE02 requirements in the horizontal polarization by 0.8 dB at 68.25 MHz, 5.5 dB at 69.95 MHz, 1.3 dB at 276 MHz, and 5.5 dB at 300 MHz.

Rationale: The radiated emission outages occur in frequency bands where no receivers exist and therefore will not impact the ISS operations.

EMEP TIA-0262

DCN 020

C.3.2.4.2.2 RS03 LIMITS

DCN 020

Exception: For the Space to Space Station Radio (SSSR) (PN SED16102482-303), the 3.2.4.2.2 RS03 requirements may be relaxed by the margins shown in Tables TIA-0262-1 and TIA-0262-2.

DCN 020

TABLE TIA-0262-1 LOW FREQUENCY, LOW POWER

Susceptibility Band	Threshold of Susceptibility	Relaxation Margin
400 MHz to 405 MHz	4.4 V/m	55.6 V/m
405 MHz to 426 MHz	1.8 V/m	58.2 V/m
426 MHz to 431 MHz	46.11 V/m	13.89 V/m

DCN 020

TABLE TIA-0262-2 HIGH FREQUENCY, LOW POWER

Susceptibility Band	Threshold of Susceptibility	Relaxation Margin
207 MHz to 210 MHz	45.2 V/m	14.8 V/m
400 MHz to 402 MHz	44.4 V/m	15.6 V/m
402 MHz to 405 MHz	8.0 V/m	52.0 V/m
405 MHz to 425 MHz	1.4 V/m	58.6 V/m
425 MHz to 428 MHz	17.1 V/m	59.0 V/m

DCN 020

Notice: This TIA supplements TIA-0138.

DCN 020

Rationale: The SSSR susceptibility mode begins with audio distortion. As the interference level increases, the radio will eventually lose lock. When the interference is removed, the radio regains lock without requiring crew intervention. No Shuttle or ISS transmitters other than those associated with the SSSR system exist in SSSR susceptibility bands. Only one ground transmitter (Research Radar at Aerocibo, Puerto Rico) operates in SSSR susceptibility band. However, the margin between the SSSR threshold of susceptibility and transmitter maximum field level is 6 dB. Additionally, interference from the Aerocibo transmitter, although not likely, would last no more than 5 seconds, and the MTBF would be approximately 93 days. The SSSR transmits on 414.2 MHz and 417.1 MHz. The 3 dB bandpass is 12 MHz and the 60 dB bandpass is 48 MHz.

DCN 020

EMEP TIA-0264

C.3.2.3.1.2 RE02 LIMITS

Exception: The Portable Computer System (PCS) (series 760 computers) with Timex Adapter Assembly (PN SEG12100477-801), COSS Audio/Video Cable (PN SEG12100475-301), and Timex Watch Assembly (PN SEG12100476-801) are allowed to pass the 3.2.3.1.2 RE02 requirements, having a maximum peak of 18.8 dB μ V above the specified limit at the frequency levels listed in Table TIA-0264-1.

TABLE TIA-0264-1 RE02 LIMIT EXCEEDANCES (PCS, COSS AUDIO/VIDEO CABLE, AND TIMEX WATCH ASSEMBLY)

Peak Number	Frequency (MHz)	Emission (dB μ V)	Delta Exceedance (dB)
1	0.02435	72.5	16.5
2	0.05069	74.2	18.2
3	0.07367	58.6	2.6

Rationale: TPS 710020109 removed the COSS Hardware from the PCS Laptop and performed the test to compare the data. The results of the test were very similar to the first test. Many of the failures occurred at the same point. The PCS computer has already received waivers for these failures. Based on the test results, the deviation of the PCS should not affect other hardware.

Corrective measures, which could significantly improve the EMI emission, will have major cost impacts to the PCS program.

EMEP TIA-0269

C.3.2.3.1.2 RE02 LIMITS

Exception: The Empty Rack Configuration, consisting of the HRF Flight Rack 1 (PN SEG46117298-301) and the EXPRESS Laptop (PN SDZ39129262-301), may exceed the RE02 requirements of 3.2.3.1, by the frequency levels shown in Table TIA-0269-1.

The narrowband conducted emissions measurements that were obtained from test CE03 as specified in SSP 30238, paragraph 3.2.1.2.1, contained exceedances at two frequencies that will not affect the operation or performance of any equipment onboard the Space Station module.

The SMPA/BC does not critically exceed the required Time Domain Transient Test (CE07) envelope. The exceedances are attributed to the automatic internal power switch and the internal power routing to the Fluke 105B Scopemeter and Makita battery charging circuit.

Since this is a criticality 3 piece of equipment, NASA EC5 accepts the risk that the kit may have to be turned off (temporarily or permanently) if interference with other equipment is noted. The SMPA/Charger Kit is approved for use on US elements only.

EMEP TIA-0287

C.3.2.3.1.2 RE02 LIMITS

C.3.2.4.2.2 RS03 LIMITS

DCN 020

Exception: The CGBA (PN 1M103) payload may exceed the 3.2.3.1.2 (SSP 57000, paragraph 3.2.4.4) RE02 limits by 1.5 dB at 0.0225 MHz.

DCN 020

For the ADVASC (PN 1000-ADVASC-001) payload, RS03PL electric field levels specified in 3.2.4.2.2 (SSP 57000, paragraph 3.2.4.4) may be reduced to the following levels for the specified frequencies: 2.24 V/m from 0.65 to 1.25 MHz, 2.59 V/m at 187 MHz, 2.27 V/m from 1810 to 1940 MHz, and 9.39 V/m from 3750 to 3875 MHz.

DCN 020

For the CPCG (PN PCG-F1-0032-1) payload, RS03 electric field levels specified in 3.2.4.2.2 (SSP 57000, paragraph 3.2.4.4) may be reduced to the following levels for the specified frequencies: 11.39 V/m at 1930 MHz and 23.48 V/m at 3875 MHz.

DCN 020

Rationale: A minimum of 55 dB margin exists between the RE02 and RS03 limits. There are no receivers at these RE02 outages. RS03 testing of criticality 3 hardware is for on-orbit trouble shooting. Risk of nonoperation due to known susceptibilities has been accepted by the equipment provider. Nonoperation due to susceptibility will not impact ISS safety or critical hardware functionality.

DCN 020

EMEP TIA-0288

DCN 020

C.3.2.3.1.2 RE02 LIMITS

C.3.2.4.2.2 RS03 LIMITS

DCN 020

Exception: The EXPCS (PNs 60050AMA3000 and 60050UMA2000) payload may exceed the 3.2.3.1.2 RE02 limits by 8.23 dB from 32.5 to 33.75 MHz.

DCN 020

For the ARIS ICE Shaker (PN 1J00304-1) payload, RS03PL electric field levels specified in 3.2.4.2.2 (SSP 57000, paragraph 3.2.4.4) may be reduced to the following levels for the specified frequencies: 0.30 V/m from 5.25 to 8.25 MHz and 2.50 V/m at 16.8 MHz.

DCN 020

Rationale: The radiated exceedances for these payloads do not occur over the same frequency range and therefore should not provide any compatibility issues for the EXPRESS Rack 2. A minimum of 55 dB margin exists between the RE02 and the RS03 limits. There are no receivers at these RE02 outages. RS03 testing of criticality 3 hardware is for on-orbit trouble shooting. Risk of nonoperation due to known susceptibilities has been accepted by the equipment provider. Nonoperation due to susceptibility will not impact ISS safety or critical hardware functionality.

DCN 020

EMEP TIA-0293

C.3.2.2.2.2 CS02 LIMITS

Exception: The Video Tape Recorder (PN 683-51020, CI Number 683138A) is allowed to pass CS02 at 5.0 Vrms for 30 Hz to 339 Hz, 4.0 Vrms for 340 Hz to 500 Hz, 3.5 Vrms for 501 Hz to 700 Hz, 3.0 Vrms for 701 to 1300 Hz, 2.8 Vrms for 1301 Hz to 3800 Hz, 3.0 Vrms for 3801 Hz to 4500 Hz, 3.5 Vrms for 4501 Hz to 5300 Hz, and the standard CS02 curve above 5300 Hz.

Rationale: The VTR passed CS02 testing functionally at the standard levels. A subsequent component failure led to evaluation of electrical stress factors for components in the failed circuit. Although CS02 testing did not cause the component failure, R1 and R3 on schematic drawing 683-51059 (120 Vdc power input) were found to be overstressed with respect to their derated levels of 0.6 Watts per ISS design guidelines at some portions of the standard CS02 test curve. The CS02 limits for the VTR are being reduced to avoid component overstress instead of malfunction. The expected noise ripple on the power bus is less than 1 Vrms. The VTR is a criticality 3 item.

EMEP TIA-0297

DCN 020

C.3.2.1.2.2 CE03 LIMITS

C.3.2.2.1.2 CS01 LIMITS

DCN 020

Exception: For the Bolt Bus Controller (CI 222064A, PN 1F45012-1) the following exceptions apply:

DCN 020

- A. The Bolt Bus Controller (BBC) 3.2.1.2.2 CE03 emission limit is increased to 82 dB μ A, which is 30 dB above the specified limit in the frequency range of 190 kHz to 1 MHz.

DCN 020

- B. The motor speed change effect of CS01 interference is not considered a BBC functional problem should it occur during the bolting operation.

DCN 020

Rationale:

DCN 020

- A. Segment to Segment Attach System (SSAS) components include the BBC and the Motorized Bolt Assembly (MBA). The running time to drive a single bolt into its mating segment is approximately 8 minutes and a four bolt pattern will take less than 35 minutes to complete. The MBA is a one time use item and is not designed for on-orbit replacement. The BBC provides filtered secondary power to the MBA, and only will be utilized during the bolting operation. The BBC's CE03 exceedance is directly attributable to common mode voltage ripple. The BBC passes its power quality differential mode ripple requirement of 0.5 volts peak to peak. The actual measured voltage was 0.146 volts peak to peak. The common mode ripple voltage was measured as part of troubleshooting and was 0.92 volts peak to peak or 0.65 Vrms directly at the output terminals and was less at the output from the RPC. Each Space Station ORU is required to pass CS02 conducted susceptibility testing which imparts 1 Vrms (1.7 volts peak to peak) ripple voltage. Because the BBC common mode voltage ripple is lower than what each ORU is qualified, no risk is posed due to this exceedance. Further system level testing as part of S0 acceptance testing has been performed where the BBC operated a flight MBA with a qualification bolt. The bolting operation was performed per on-orbit procedures in the flight configuration and no functional problems or anomalies were encountered. All test objectives and requirements were met. The primary goal of conducted testing is to ensure functional self compatibility of the ORUs at the system level. This functional self compatibility has been demonstrated on the flight vehicle (including MDMs). The maximum common mode voltage ripple generated by the BBC is considerably less than the ORU conducted susceptibility requirement limit. Thus, the BBC CE03 exceedance does not pose a risk to system performance and should be accepted as is.

DCN 020

The coupled powerline interference is unlikely to affect any of the equipment that shares the power source at this time.

DCN 020

- B. CS01 threshold of upset appears from 6.5 to 7.0 volts peak to peak between 30 and 100 Hz. The failure mode is not likely to present a problem during bolting operation, should it occur.

DCN 020

EMEP TIA-0299**C.3.2.3.1.2 RE02 LIMITS**

Exception: The Portable Digital Notepad Assembly, TouchPad, Notebook Speakers, and RIO player all configured with the IBM ThinkPad 760D are allowed to pass the 3.2.3 requirements, having a maximum peak of 42.4 dB μ V above the specified limit at the frequency levels listed in Table TIA-0299-1 through TIA-0299-11.

**TABLE TIA-0299-1 RE02 RADIATED EMISSION EXCEEDANCES
(PAGE 1 OF 3)**

Digital Notepad and Laptop				Laptop Only			
RE02 14 kHz to 25 MHz Narrowband							
Peaks	Frequency (MHz)	Emission (dB μ V/m)	Exceedence (dB)	Peaks	Frequency (MHz)	Emission (dB μ V/m)	Exceedence (dB)
1	0.01805	47.2	2.8	1	0.01805	45.9	1.5
2	0.02453	76	32.2	2	0.02453	76.7	32.9

**TABLE TIA-0299-11 RE02 RADIATED EMISSION EXCEEDANCES
(PAGE 1 OF 1)**

All Devices (Including RIO)				Laptop Only			
RE02 14 kHz to 25 MHz Narrowband							
Peaks	Frequency (MHz)	Emission (dBµV/m)	Exceedence (dB)	Peaks	Frequency (MHz)	Emission (dBµV/m)	Exceedence (dB)
1	60.07	36.7	0.9	1	40.56	33.7	0.5
2	63.54	37.3	1.1	2	81.02	41.7	3.9
3	80.68	38.0	0.2	3	146.76	44.5	2.7
4	180.64	43.8	0.6	4	149.53	43.3	1.4
				5	158.15	44.7	2.4

Rationale: TPS 7L0020188 also conducts a test of only the IBM Thinkpad 760D laptop. The results of the test showed that the laptop was responsible for the majority of the exceedances and that most of the exceedances are below the specifications listed in 3.2.3.1.2.1 for USL only. The crew preference items are COTS hardware and corrective measures will have major cost impacts. The emission exceedances from the crew preference items will not interfere with any other ISS operations.

EMEP TIA-0303

DCN 020

C.3.2.1.3.2 CE07 LIMITS

DCN 020

Exception: The Intravehicular Charged Particle Directional Spectrometer (IVCPDS) (PN SEG16103191-301) is allowed to exceed the 3.2.1.3.2 CE07 limits as follows: at 425 microseconds the peak voltage excursion is -21.2 volts, an exceedance of 9.2 volts as powered off of 28 Vdc.

DCN 020

Rationale: These switch transients are of small energy. The transient is 8 percent of line voltage with a width of a few microseconds. It occurs only once per switch excitation. It would not even be out of the allowed envelope except that it occurred fairly late at 425 microseconds after actuation.

DCN 020

In addition, the operational scenario for IVCPDS calls for the switch to operated infrequently. It is a radiation monitoring instrument which is normally left on. A worst case scenario for IVCPDS is a weekly occurrence of switching it off for relocation throughout the ISS. It would not be switched off for a simple reorientation such as turning it to a new direction. Turning it off only needs to take place when the unit is being moved to a new location. Thus, as a matter of routine, the IVCPDS may not be powered down and back up for several weeks at a time.

DCN 020

EMEP TIA-0305

DCN 020

C.3.2.3.1.2 RE02 LIMITS

DCN 020

Exception: The SAMS-II ICU and ISS Laptop (PNs 60005MA17100 and SDZ39129262-303) are allowed to exceed the 3.2.3.1.2 RE02 requirements by the amount listed in Tables TIA-0305-1 and TIA-0305-2.

DCN 020

ICU Door Open and ISS Laptop Extended with Screen Closed (Vertical Plane):

DCN 020

TABLE TIA-0305-1 RE02 EXCEEDANCE LEVELS WITH SCREEN CLOSED

Frequency (MHz)	Exceedance (dB)
280	7.6
299.44	3.2
309.64	1.1
489.4	6.2

DCN 020

ICU Door Open and ISS Laptop Extended with Screen Open (Vertical Plane):

DCN 020

TABLE TIA-0305-2 RE02 EXCEEDANCE LEVELS WITH SCREEN OPEN

Frequency (MHz)	Exceedance (dB)
0.02447	16.3
0.03911	1.3
0.05653	26.8
0.07308	8.5
0.1688	4.5
280.03	5.6
289.57	5.4
327.41	4.9
391.46	1.3
457.69	4.1
598.34	0.9
618.72	3.8

DCN 020

Rationale: Usage of the modified ISS Laptop with the SAMS-II ICU is primarily with the ISS Laptop screen closed and off and inside a modified ISIS Drawer, which is part of the SAMS-II ICU. There are no exceedances in this configuration. Usage of the modified ISS Laptop with the screen open and on is limited to during SAMS-II ICU initial setup and reconfiguration and for some malfunction procedures.

DCN 020

EMEP TIA-0307**C.3.2.3.1.2 RE02 LIMITS**

Exception: The Clio Personal Data Assistant (PDA) (PN SEG12100596-801) when utilized with the Clio Battery Pouch Assembly (PN SEG12100600-301), PCMCIA Adapter Assembly (PN SEZ33113155-801), and Calluna Card Assembly (PN SEG12100478-801) are allowed to pass the paragraph 3.2.3.1.2 requirements, having a maximum peak of 18.4 dB μ V above the specified limit at the frequency levels listed in Tables TIA-0307-1 through TIA-0307-3.

TABLE TIA-0307-1 RE02 LIMIT EXCEEDANCES

Clio PDA with Serial Cable to Laptop (Laptop Outside of Chamber)			
Peaks	Frequency (MHz)	Emission (dB μ V/m)	Delta
1	0.04668	69.7	13.7
2	0.1391	60.3	4.3
3	282.14	51.4	4.8
4	506.56	54.9	4.2

EMEP TIA-0314

C.3.2.3.1.2 RE02 LIMITS

Exception: The Jazz PC Speakers Assembly (PN SEG12100594-303), which consists of the Jazz PC Speakers Assembly (PN SEG12100594-301) receiving power from an IBM Thinkpad 760XD via the PS/2 Power Cable Assembly (PN SEG12100603-801), is allowed to pass the 3.2.3 requirements, having a maximum peak of 16.8 dBµV above the specified limit at the frequency levels listed in Table TIA-0314-1.

TABLE TIA-0314-1 RE02 RADIATED EMISSIONS EXCEEDANCES

Jazz PC Speakers Assembly (PN SEG 12100594-303) (Consists of the Jazz PC Speakers Assembly (PN SEG 12100594-301), PS/2 Power Cable Assembly (PN SEG 12100603-801), and IBM Thinkpad 760XD Laptop Computer)			
Peaks	Frequency (MHz)	Emission (dBµV/m)	Delta
1	0.02435	72.8	16.8
2	0.05107	67.9	11.9
3	0.07367	59.5	3.5

Rationale: The Jazz PC Speakers Assembly (PN SEG12100594-303) is an additional configuration of the Jazz PC Speakers Assembly (PN SEG12100594-301). It receives power from the IBM Thinkpad 760XD via the PS/2 Power Cable Assembly (PN SEG12100603-801) instead of the alkaline batteries used by the -301 configuration (two AA alkaline batteries). These items are modified COTS hardware and any modifications will have major cost impacts.

EMEP TIA-0315

DCN 020

C.3.2.1.1.2 CE01 LIMITS

DCN 020

Exception: The SAMS-II Remote Triaxial Sensor (RTS) Drawer (PN 60005MA31400) is allowed to exceed the 3.2.1.1.2 CE01 requirements by 2.7 dB at 0.006014 MHz and 0.3 dB at 0.006253 MHz.

DCN 020

Rationale: This requirement is also levied upon SAMS by its integrator EXPRESS Rack. SAMS has exceeded an EXPRESS Rack requirement. An EXPRESS Rack PIRN 52017-016 for these exceedances was submitted for approval to the EXPRESS Rack Project. Since this safety requirement is levied upon the EXPRESS Rack, it is SAMS's understanding that an approved PIRN from the EXPRESS Rack Project verifies that there is margin for the RTS Drawer exceedances and that safety is not compromised.

DCN 020

EMEP TIA-0320

C.3.2.3.1.2 RE02 LIMITS

Exception: The Clio PDA (PN SEG12100596-801) and Clio Battery Pouch Assembly (PN SEG12100600-301), when configured with the PC Card 7401 (PN SEZ39129739-303) or the Flashcard (PN SDZ39131200-301), are allowed to pass the 3.2.3 requirements, having a

maximum peak of 33.9 dBuV above the specified limit at the frequency levels listed in Table TIA-0320-1 through TIA-0320-3.

TABLE TIA-0320-1 RE02 RADIATED EMISSIONS EXCEEDANCES

Clio PDA WITH PC CARD 7401 (3 dB Attenuation Added) (IBM Thinkpad 760 XD also in chamber) 0.014 to 25 MHz			
Peaks	Frequency (MHz)	Emission (dB μ V/m)	Delta
1	0.04633	88.7	32.7
2	0.0929	63.8	7.8
3	0.1391	64.9	8.9

TABLE TIA-0320-2 RE02 RADIATED EMISSIONS EXCEEDANCES

Clio PDA WITH PC CARD 7401 (IBM Thinkpad 760XD also in chamber) 200 MHz to 1000 MHz			
Peaks	Frequency (MHz)	Emission (dBµV/m)	Delta
1	281.68	51.5	5.0
2	564.18	52.2	0.7

TABLE TIA-0320-3 RE02 RADIATED EMISSIONS EXCEEDANCES

Clio PDA WITH FLASHCARD 0.014 to 25 MHz			
Peaks	Frequency (MHz)	Emission (dBµV/m)	Delta
1	0.04739	89.9	33.9
2	0.09501	65.3	9.3
3	0.1423	66.4	10.4

Rationale: The Clio PDA, Clio Battery, PC Card 7401, and Flashcard are modified COTS hardware and any modifications will have major cost impacts. The Clio PDA has been approved for USOS use per EMEP TIA #307b when utilized with the Clio Battery Pouch Assembly, PCMCIA Adapter, and Calluna Card Assembly (Reference TPS 7L0020252 and EMEP TIA-0307b). Approval of this TIA would allow the Clio to use the PC Card 7401 to communicate with a 760XD Laptop Thinkpad as well as store data using the SAN disk Flashcard. The PC Card 7401 (RF LAN Card) has been previously certified for ISS use under GCAR 3135. The SAN disk Flashcard has been previously certified for ISS use under GCAR 3547. This is internally installed equipment. There are no receivers at these frequencies.

EMEP TIA-0327

DCN 020

C.3.2.2.1 CS01, CONDUCTED SUSCEPTIBILITY

C.3.2.2.2 CS02, CONDUCTED SUSCEPTIBILITY

C.3.2.2.3 CS06, CONDUCTED SUSCEPTIBILITY

C.3.2.4.1 RS02, RADIATED SUSCEPTIBILITY

C.3.2.4.2 RS03, RADIATED SUSCEPTIBILITY

DCN 020

Exception: The Biotechnology Specimen Temperature Controller (BSTC) equipment listed here: Ethernet Cable Assembly (PN SED46112592-701), Wire Harness Payload Power Cable (EXPRESS Provided) (PN 683-44024), and BSTC PCMCIA card (PN WLSI241976-603) do not need to meet the 3.2.2.1 CS01, 3.2.2.2 CS02, 3.2.2.3 CS06, 3.2.4.1 RS02, and 3.2.4.2 RS03 requirements. These requirements are contained in SSP 57000, paragraph 3.2.4.4. **DCN 020**

Rationale: BSTC is criticality 3 hardware. Therefore, any failure(s) resulting from conducted or radiated susceptibility will affect the science gathered by this particular experiment only. Any failure due to conducted or radiated susceptibility will not cause a safety hazard or interfere with other equipment. Major components of BSTC have flown on Shuttle missions with no indication of functional degradation due to radiated or conducted susceptibility. The hardware provider will accept the risk associated with not performing the test. DCN 020

EMEP TIA-0328 DCN 020

C.3.2.2.1 CS01, CONDUCTED SUSCEPTIBILITY

C.3.2.2.2 CS02, CONDUCTED SUSCEPTIBILITY

C.3.2.2.3 CS06, CONDUCTED SUSCEPTIBILITY

C.3.2.4.1 RS02, RADIATED SUSCEPTIBILITY

C.3.2.4.2 RS03, RADIATED SUSCEPTIBILITY DCN 020

Exception: The Biotechnology Refrigerator (BTR) equipment listed here: Cable Assembly, RS-422 Data (PN SED46112593-701) and Wire Harness Payload Power Cable (EXPRESS Provided) (PN 683-44024) do not need to meet the 3.2.2.1 CS01, 3.2.2.2 CS02, 3.2.2.3 CS06, 3.2.4.1 RS02, and 3.2.4.2 RS03 requirements. These requirements are contained in SSP 57000, paragraph 3.2.4.4. DCN 020

Rationale: BTR is criticality 3 hardware. Therefore, any failure(s) resulting from conducted or radiated susceptibility will affect the science gathered by this particular experiment only. Any failure due to conducted or radiated susceptibility will not cause a safety hazard or interfere with other equipment. Major components of BTR have flown on Shuttle missions with no indication of functional degradation due to radiated or conducted susceptibility. The hardware provider will accept the risk associated with not performing the test. DCN 020

EMEP TIA-0330 DCN 020

C.3.2.3.1.2 RE02 LIMITS DCN 020

Exception: The Remote Power Distribution Assembly (RPDA) (PN SPO-PD-020000) is allowed to exceed the level of the radiated emission specified in the 3.2.3.1.2 RE02 limits indicated in Table TIA-0330-1. DCN 020

TABLE TIA-0330-1 RE02 EXCEEDANCE LEVELS

Frequency (MHz)	Specified Value (dBμV/m)	Measured Value (dBμV/m)	Out of Specification (dB)
0.324	56	61	5
0.589	56	66	10
1.002 ÷ 1209	56	68	12
5.814 ÷ 7.842	56	67	11
11.484 ÷ 12.944	58	66	8
21.125 ÷ 24.629	62	65	3

DCN 020

Rationale: The Remote Power Distribution Assembly (RPDA) is one of the Standard Payload Outfitting Equipment (SPOE) items, which was developed and qualified by European Industry under ESA contract to support the European payload contribution to the ISS and the first generation of the Columbus payload. There are no ISS receivers at these frequencies. The RPDA is expected to be used in the USL and Columbus only. **DCN 020**

The RPDA is designed to serve as the rack interface to the ISS power distribution system (both main and auxiliary power busses are supported). It consists of an eight slot housing, which can accommodate five types of Exchangeable Standard Electronics Modules (ESEM). The internal interface cabling, between the ESEMs and the backplane connectors, are provided via the motherboard. **DCN 020**

RPDA manages up to 6 kW total input power and it is primarily meant for 120 Vdc power distribution. **DCN 020**

ESEM#1 (internal power supply) and ESEM#2 (MIL-1553B bus interface) are mandatory to operate the RPDA. ESEM#3 (120 Vdc power distribution), ESEM#4 (28 Vdc power conversion), and ESEM#5 (switching between the two power busses) are selectable by users, within the above constraints. **DCN 020**

The referenced measurement took place in the frame of the qualification activities of the RPDA, whereas its configuration included two active ESEM#4, consuming respectively 560 watts and 480 watts (which is also their individual maximum capability), in addition to the above mentioned modules. The 120 volt lines were loaded with passive loads consuming the maximum power rating. The measurements were performed in conformity with the test methods of SSP 30238. **DCN 020**

The equipment under test also successfully passed the Radiated Susceptibility test in conformity with the levels specified in SSP 30237 and with the test method specified in SSP 30238, which implies an inherent large measure of EMI margin. **DCN 020**

The equipment has in place EMI filtering, both differential and common mode. **DCN 020**

Analysis has been completed, showing that this RE effect is mainly due to the resonant topology of the converter in ESEM#4, whose MOSFET cannot be snubbed since this would impact on the converter's intrinsic performances. **DCN 020**

The frequency where out of specification has been detected is below the cut off frequency of the modules (cross section diameter assumed to be approximately 4.5 meters) so the propagation of the relevant electromagnetic radiation will be strongly attenuated at very short distances. **DCN 020**

Supporting rationale of this TIA are: **DCN 020**

- 1) The small exceedance of the specified limits,
- 2) the large EMI margin between RE and RS,
- 3) the worst case power consumption of the power supply modules during the qualification activity, and
- 4) the frequencies are below the cut off frequency of the modules. **DCN 020**

The SPOE items were developed and qualified by the European Industry under ESA contract to support the European payload contribution to the ISS and the first generation of Columbus payload. There are no ISS receivers at these frequencies. The RPDA is expected to be used in the USL and Columbus only.

DCN 020

EMEP TIA-0331

DCN 020

C.3.2.3.1.2 RE02 LIMITS

DCN 020

Exception: The EXPRESS Rack 8/2 (PN 683-46052-1 and PN 683-46052-2, CEI 683P20A and CEI 683P78A, PEI 683P21A and PEI 683P79A) are allowed to exceed the RE02 limits at the listed frequencies by the amounts indicated in Table TIA-0331-1.

DCN 020

TABLE TIA-0331-1 RE02 EXCEEDANCE LEVELS

Frequency	Out of Specification (dB)
75 to 77 kHz	2.0 dB
230.5 kHz	0.5 dB
671 to 690 kHz	3.0 dB
824 to 834 kHz	4.0 dB
1.0 to 1.6 MHz	2.5 dB
5.0 to 5.6 MHz	1.0 dB
13.3 to 13.5 MHz	4.5 dB
14.3 to 14.7 MHz	2.5 dB
18.5 to 18.7 MHz	2.5 dB

Note:

1. Ranges are provided for convenience and to provide margin. Measured exceedances were scattered sparse spot frequencies in the ranges listed. Levels have been rounded up to the next 0.5 dB increment to provide margin.

DCN 020

This TIA supersedes TIA-0227. The ARIS RE02 exceedances listed in TIAs-0192, -0213, and -0247 were not found and have been suppressed by installation in the rack as expected.

DCN 020

Rationale: The measured RE02 exceedances are relatively small and are actually from two to four narrow spot frequencies in each of the ranges listed. The nearest listed ISS related receivers are the SOYUZ Rassvet 17V14 at 14.962 MHz and 17V15 at 18.06 MHz and are not expected to experience interference as a result of the narrow bandwidths used and the ISS hull shielding. The ISS hull will provide significant (40 dB or greater) shielding between the rack locations and the SOYUZ antennas. Approved for use on USL only.

DCN 020

EMEP TIA-0332**C.3.2.3.1.2 RE02 LIMITS**

Exception: The Sony DSR-PD100A Camcorder (PN SEZ16103293-301) when used in battery operated mode is allowed to exceed the 3.2.3.1 requirements of 48.3 dB μ V/m by 0.1 dB μ V/m at 392.29 MHz, 48.8 dB μ V/m by 2.4 dB μ V/m at 419.69 MHz, and 49.4 dB μ V/m by 0.6 dB μ V/m at 459.24 MHz.

Rationale: These outages are insignificant and they should cause no EME concerns. There are no ISS receivers at these frequencies.

EMEP TIA-0335**DCN 020****C.3.2.3.1.2 RE02 LIMITS****DCN 020**

Exception: The Biotechnology Specimen Temperature Controller (BSTC) (PN SED46113420-303) payload may exceed the 3.2.3.1.2 RE02 limits by 5.0 dB at 75.0 MHz, 10.0 dB at 275.0 MHz, 1.5 dB at 280.0 MHz, and 1.0 dB at 330.0 MHz and the 3.2.4.2 RE04 limits by 5 dB at 0.040 MHz.

DCN 020

Rationale: A minimum of 55 dB margin exists between the RE02 and RS03 limits. There are no receivers at these radiated emission outages.

DCN 020**EMEP TIA-0340****DCN 020****C.3.2.1.2.2 CE03 LIMITS****C.3.2.3.1.2 RE02 LIMITS****DCN 020**

Exception: The Optical Time Domain Reflectometer (OTDR) (Model OFM1020) is allowed to exceed the 3.2.3.1.2 RE02 requirements with a series of 25 power supply switching harmonics that are below 500 kHz with a maximum of 31.3 dB above limit and recorded 23.2 kHz and 3.2.1.2.2 CE03 requirements with a single point 8.6 dB above limit at 234 kHz and 0.5 dB above limit at 116 kHz.

DCN 020

Rationale: This unit will be used as a stand alone test equipment unit with no electrical interconnections to other equipment. This is a criticality 3 portable test equipment unit. The OTDR is powered by 28 volts. This unit is GFE and COTS equipment. This unit has been denoted as applicable to RS03PL (payload) radiated susceptibility qualification limits. Compliance is adequate for a portable COTS test unit. This unit is used intermittently for trouble shooting only.

DCN 020

EMEP TIA-348**DCN 020****C.3.2.2.1 CS01, CONDUCTED SUSCEPTIBILITY****C.3.2.2.2 CS02, CONDUCTED SUSCEPTIBILITY****C.3.2.2.3 CS06, CONDUCTED SUSCEPTIBILITY****C.3.2.4.1 RS02, RADIATED SUSCEPTIBILITY****C.3.2.4.2 RS03, RADIATED SUSCEPTIBILITY****DCN 020**

Exception: The Pulmonary Function in Flight (PuFF) equipment listed:

Pressure Flow Module (44100)

PFM Data Cable (44150)

8MB Flash Storage Card (DP-ATA/B)

Fleisch #2 Flowmeter Assembly (44250)

ECG Electrodes Pack (PN SDG46117695-801)

Assembly, Single Housing PSC Unit (PN SEG46117965-801)

Cable Assembly W16 - PSC ECG Data (PN SED46112486-303)

Cable Assembly ECG Electrodes Leads (PN SED46113083-303) and

Battery Pack Assembly (PN SEG46117914-301)

does not need to meet 3.2.2.1 CS01, 3.2.2.2 CS02, 3.2.2.3 CS06, 3.2.4.1 RS02, and 3.2.4.2 RS03 requirements. These requirements are contained in SSP 57000, paragraph 3.2.4.4. **DCN 020**

Rationale: PuFF is criticality 3 hardware. Any failure due to susceptibility will not cause a safety hazard or interfere with other equipment. PuFF equipment is located downstream of the HRF Rack SSPCM which should provide significant protection from ISS ESP transients. HRF plans to conduct abbreviated functional tests of the integrated PuFF hardware using the HRF Rack prior to hardware delivery. This should provide some evidence of the ability to withstand conducted transients. The HRF Program and Principle Investigators accept the risk of science loss due to radiated or conducted susceptibility. There are no operational constraints. **DCN 020**

Rationale: The CE07 test is for use on a 120 volts system. The US segments are powered by 120 volts. The CE07 emissions are on tertiary power and will not affect the 120 Vdc secondary power bus. The video systems are criticality 3 items which do not cause loss of life, loss of the station, or loss of the mission.

DCN 017

EMEP TIA-0353

DCN 020

C.3.2.1.2.2 CE03 LIMITS**C.3.2.1.3.2 CE07 LIMITS****C.3.2.3.1.2 RE02 LIMITS**

DCN 020

Exception: The Bolt Motor Actuator (BMA) (CI 222068A, PN 1F49216-1) was included in the Bolt Bus Controller (BBC) qualification test setup. Its interface cables were set up in compliance with the requirements of SSP 30238. The BMA unit was positioned outside the shield room. As a load to the BBC, the BMA conducted emission and conducted susceptibility EMC qualification is complete with the BBC qualification. Compliance with the RE02 and RS03 requirements has been demonstrated by the BBC qualification because the BMA cables were positioned correctly with the remaining BBC cabling. Due to the above, the BMA is not required to pass the 3.2.1.2.2 CE03, 3.2.1.3.2 CE07, nor 3.2.3.1.2 RE02 requirements.

DCN 020

Rationale: To perform a BMA EMC qualification test would be a repeat of the BBC qualification test except that the BMA motor unit would be positioned on the bench beside the BBC. Because the cables were positioned and tested with the BBC cables, test data and susceptibility response will be identical to that of the BBC EMC qualification.

DCN 020

EMEP TIA-0354

DCN 020

C.3.2.2.1.2 CS01 LIMITS

DCN 020

Exception: The EXPRESS Rack 8/2 with ARIS (EXPRESS 2, PN 683-46052-001, CEI 683P20A, PEI 683P21A) is allowed to pass the CS01 test at a level of 4 Vrms instead of 5 Vrms in the frequency range of 300 to 500 Hz.

DCN 020

Rationale: No separate CS01 test was performed on the EXPRESS 2 (with ARIS) configuration since the ARIS components have separately passed CS01 and the remainder of the configuration was the same as the EXPRESS 1 configuration. This TIA reiterates the approved TIA-0225D for the EXPRESS 2 configuration.

DCN 020

The failure mode was a shutdown of the Avionics Air Assembly (AAA).

DCN 020

The AAA passed EMI testing as a stand alone unit.

DCN 020

The alternate CS01 limit in 3.2.2.1.3 is 50 watts into a 0.5 ohm load. For this test, 4.8 volts was equivalent to 50 watts.

DCN 020

The EXPRESS Rack is criticality 3. It provides power, data connections, and some control for payloads in suitable packages.

DCN 020

SSP 30482, Volume 1 specifies the Interface C ripple at 6 dB below the CS01 requirement. The worst case measured bus noise during the USL EPS testing was less than 1 volt peak to peak. Although this did not include experimental payloads, the noise on payload power busses is likewise expected to be less than 1 volt peak to peak. Should the AAA shut down, it can be restarted. **DCN 020**

Based on an analysis of the CE01 test data and the power quality input impedance on the AAA, the problem is caused by the injected signal noise giving a false overcurrent indication to the AAA controller. The input impedance to the AAA fan is approximately 1 ohm in the 300 to 500 Hz range. The SSPCM passes through the 120 Vdc power to the AAA after its input EMI filters, but with no further filtering or buffering and only an overcurrent protection circuit. The AAA fan uses a 3-phase converter to drive the fan motor. Its normal operating frequency at normal fan speeds is in the 300 to 500 Hz range. The controller monitors the motor current in this frequency range. With the low input filter impedance in this range, the injected noise current adds to the normal motor current. The total current is interpreted as excessive current by the controller which then shuts down the motor. **DCN 020**

EMEP TIA-0355 **DCN 020**

C.3.2.3.1.2 RE02 LIMITS **DCN 020**

Exception: The Advanced Protein Crystallization Facility (APCF) (PN 2220-300 000.00C) payload may exceed the 3.2.3.1.2 RE02 limits by 2.0 dB at 9.3 MHz, 9.0 dB at 12.0 MHz, and 4.0 dB at 19.0 MHz. **DCN 020**

Rationale: There are no receivers at these RE02 outages. **DCN 020**

EMEP TIA-0357 **DCN 020**

C.3.2.3.1.2 RE02 LIMITS **DCN 020**

Exception: For the Phantom Torso (PNs SEG46117170-301, SEG46117170-303, and SEG46117170-305) and Cable (PN SEG46117179-301), the 3.2.3.1.2 RE02 requirements shall be relaxed over the frequency of 0.01675 MHz and 0.4536 MHz as listed in Table TIA-0357-1. **DCN 020**

TABLE TIA-0357-1 RE02 EXCEEDANCE LEVELS

RE03 Frequency (MHz)	Measured Intensity (dBμV/m)	Standard Intensity (dBμV/m)	Exceedance Delta (dB)	Standard Peak (dB)
0.01675	56.7	56.0	0.7	
0.1112	65.5	56.0	9.5	
0.1154	67.5	56.0	11.5	
0.1225	56.9	56.0	0.9	
0.2179	56.1	56.0	0.1	
0.344	56.7	56.0	0.7	
0.4536	57.9	56.0	1.9	

DCN 020

Rationale: These exceedances are minor and are only present during data downloads that occur for a duration of 100 minutes every six days. **DCN 020**

The radiated emissions to susceptibility margins are documented in the ongoing EPS assessment document D684–10232–01. Implementation of this TIA does not degrade the EMI Safety Margin required by SSP 30243, paragraph 3.2.3. **DCN 020**

These exceptions to requirements in SSP 57000, paragraph 3.2.4.4, and SSP 57200 do not impose any operational constraints. **DCN 020**

EMEP TIA–0360 **DCN 020**

C.3.2.3.1.2 RE02 LIMITS

C.3.2.4.2.2 RS03 LIMITS **DCN 020**

Exception: For the Dynamically Controlled Protein Crystal Growth (DCPCG) –C (Command Control Locker) and –V (Vapor Locker Experiment Location) (PNs PCG–F10031–1 and PCG–F10030–1) payload, the 3.2.4.2.2 RS03 electric field levels may be reduced for the specified frequencies listed in Table TIA–0360–1. **DCN 020**

TABLE TIA–0360–1 RS03 EXCEEDANCE LEVELS

Frequency (MHz)	Radiated Electric Field Level Exceedances (V/m)
50.0	1.0
100	1.0
128	1.0
172	1.0

DCN 020

The DCPCG payload may exceed the 3.2.3.1.2 RE02 limits by 0.5 dB at 316 MHz. **DCN 020**

Rationale: There are no receivers at these RE02 outages. RS03 testing of criticality 3 hardware is for on-orbit trouble shooting. No ISS transmitters exist at these frequencies. Risk of nonoperation due to known susceptibilities has been accepted by the equipment provider. Nonoperation due to susceptibility will not impact ISS safety or critical hardware functionality.

DCN 020

EMEP TIA–0369 **DCN 019**

**C.3.2.2.1 CS01, CONDUCTED SUSCEPTIBILITY,
 C.3.2.2.2 CS02, CONDUCTED SUSCEPTIBILITY,
 C.3.2.2.3 CS06, CONDUCTED SUSCEPTIBILITY,
 C.3.2.4.1 RS02, RADIATED SUSCEPTIBILITY, AND
 C.3.2.4.2 RS03, RADIATED SUSCEPTIBILITY**

DCN 019

Exception: The Pulmonary Function In Flight (PuFF) equipment listed (DSR PCMCIA Card (PN SED46115614–303 or PN SED46115614–305), and ECG electrodes (PN 7663)) do not need to meet the 3.2.2.1 (CS01), 3.2.2.2 (CS02), 3.2.2.3 (CS06), 3.2.4.1 (RS02), and 3.2.4.2 (RS03) requirements. These requirements are contained in SSP 57000, paragraph 3.2.4.4. The PuFF equipment listed (Pressure Flow Module (PN 44100), PFM Data Cable (PN 44150), 8MB

Flash Storage Card (PN DP-ATA/B), Fleisch #2 Flowmeter Assembly (PN 44250), ECG Electrodes Pack (PN SDG46117695-801), Assembly, Single Housing PSC Unit (PN SEG46117965-801), Cable Assembly W16 - PSC ECG Data (PN SED46112486-303), Cable Assembly ECG Electrodes Leads (PN SED46113083-303), Battery Pack Assembly (PN SEG46117914-301), DSR PCMCIA Card (PN SED46115614-303 or PN SED46115614-305), and ECG electrodes (PN 7663)) do not need to meet SSP 30243, paragraph 3.2.9 requirements. These requirements are contained in SSP 57000, paragraph 3.2.4.5. **DCN 019**

Rationale: Susceptibility - PuFF is criticality 3 hardware. Any failure due to susceptibility will not cause a safety hazard or interfere with other equipment. PuFF equipment is located downstream of the HRF Rack SSPCM which should provide significant protection from ISS ESP transients. HRF plans to conduct abbreviated functional tests of the integrated PuFF hardware using the HRF Rack prior to hardware delivery. This should provide some evidence of the ability to withstand conducted transients. The HRF Program and Principal Investigators accept the risk of science loss due to radiated or conducted susceptibility. There are no operational constraints. The ECG electrodes (PN 7633) are a subassembly of the ECG Electrodes Pack (PN SDG46117695-801) approved in TIA-0348A. **DCN 019**

ESD - PuFF hardware contains electronics which may be damaged by the application of 4000 volts to pins. PuFF hardware is criticality 3 hardware. Any failure due to electrostatic discharge will not cause a safety hazard or interfere with other equipment. PuFF hardware uses standard commercial or military specification connectors. The PuFF equipment has connector covers, female connectors, or recessed connectors which will protect the PuFF electronics from ESD until PuFF cabling is connected to other HRF hardware. Once the PuFF hardware is connected to other HRF hardware, it remains redundantly grounded (ground wire and shield) reducing the chance of damage due to ESD. HRF will assume responsibility for determining if the risk of damage due to ESD requires the inclusion of ESD handling techniques in HRF procedures. The HRF Program and Principal Investigators accept the risk of science loss due to ESD. There are no operational constraints. **DCN 019**