ISS Electromagnetic Effects Panel
Tailoring/Interpretation Agreement

SUBMITTAL DATE	AGREEMENT NO.	REV.	FLIGHT #(s)	
18 March 2011	TIA # 1195	a	STS-134 / ULF6	Page 1 of 19

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
AMS-02	Duong Nguyen (281) 486-6311	EA / Jacobs

END ITEM/CONFIG. ID NO.	PART NUMBER(s)	DESCRIPTION	ASSEMBLY(s)	GFE	Payload
AMS-02	SEG39135720-304	AMS-02 RE02	N/A	N	Y

SPECIFICATION NUMBER	SPEC. PARAGRAPH NO.	MANUFACTURER	CRITICALITY	SEVERITY
SSP 30237	3.2.3.1.2	NASA/CERN	3	2

ISSUE DESCRIPTION: (use continuation pages if required)

AMS-02 Payload failed the SSP 30237, Paragraph 3.2.3.1.2 RE02 requirement.

AMS-02 Payload EMI testing was conducted on 2/22 – 2/26/2010 at European Space Research and Technology Centre (ESTEC) Maxwell EMI Test Facility in Noordwijk, The Netherlands.

(Continued on page 2)

TAILORING /INTERPRETATION AGREEMENT: (use continuation pages if required)

The AMS-02, Part Number SEG39135720-304, is allowed to exceed the radiated emissions limits of SSP 30237 section 3.2.3.1.2 as listed in Table TIA-1195-1. **This TIA is for all the ISS except the Russian Segment.**

(Continued on page 16)

RATIONALE: (use continuation pages if required)

(Continued on page 17)

AGREEMENT DISPOSITION

PRIME EME	NASA EME	DATE	APPROVE	WITHDRAW	REJECT
Bob Armstrong	Matt McCollum	4/6/11	X		

COMMENTS:

4/5/11 Deferred. Approved pending updates to Spec Number, Severity, Agreement, and Rationale sections.
4/6/11 Frequency Management summary: “In summary no RF interference issues are expected for the non-compliances given in TIA 1195.”
4/6/11 Updated Spec Number, Severity, Agreement, and Rationale sections. **TIA approved.**

ISSUE DESCRIPTION Continued:

Configuration of the Equipment Under Test (EUT), AMS-02 Payload, shown in Figures 1 and 2 below. Once testing objectives were completed at a particular antenna location; antenna was moved to the next designated antenna location and testing repeated.

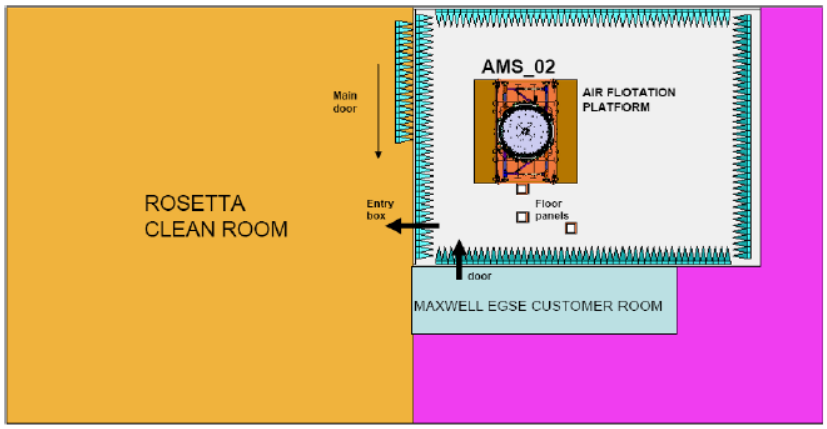


Figure 1. AMS-02 Location in the Maxwell EMI Chamber

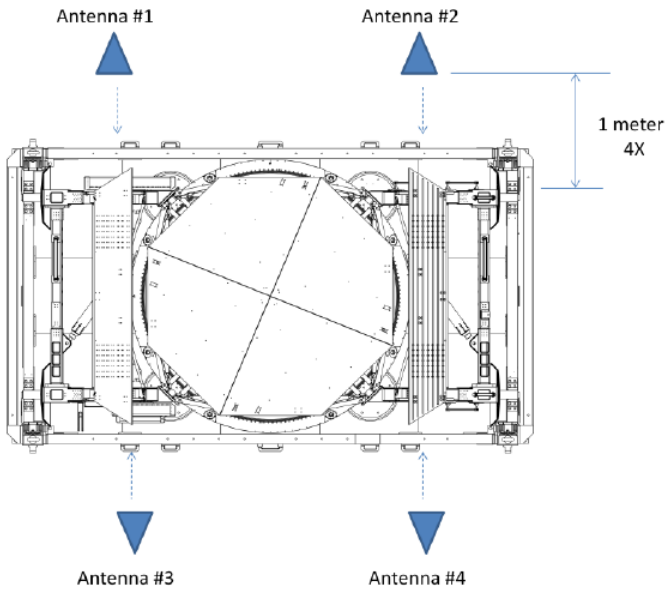
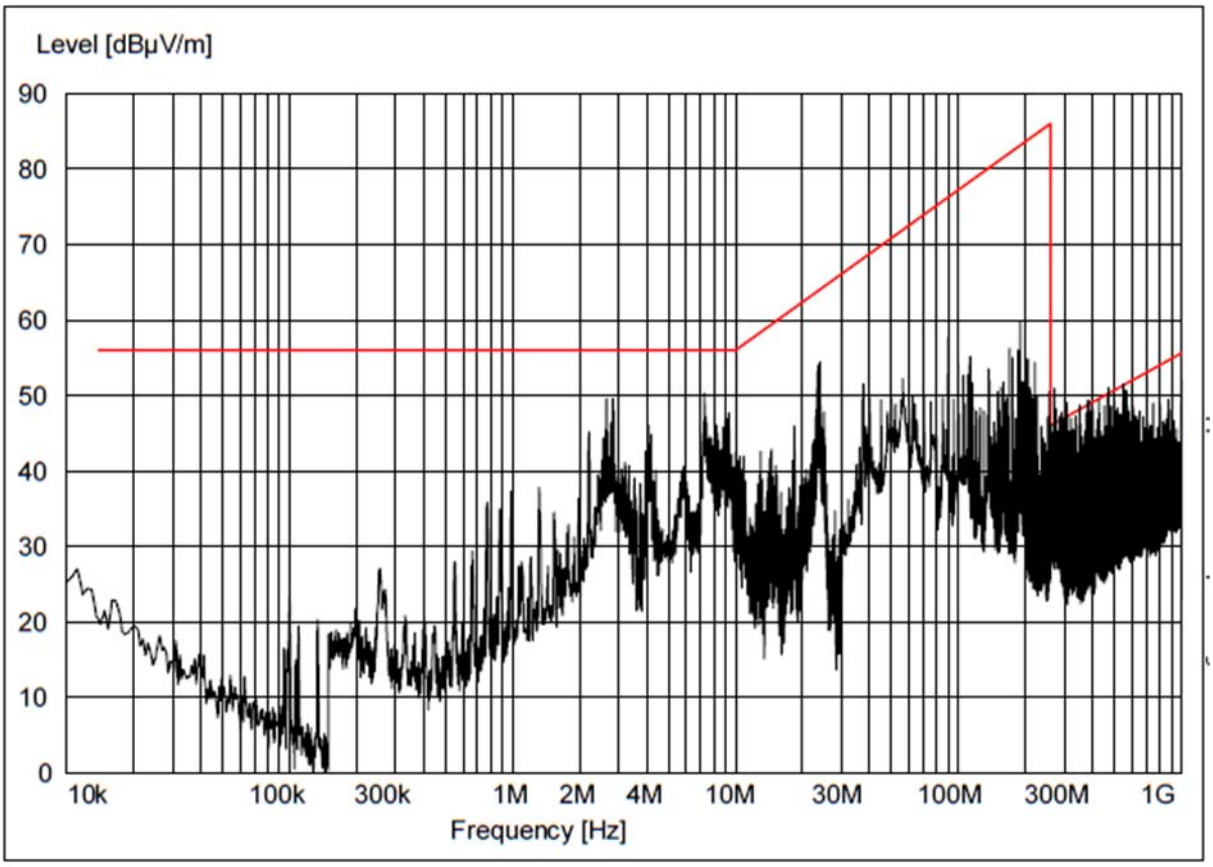


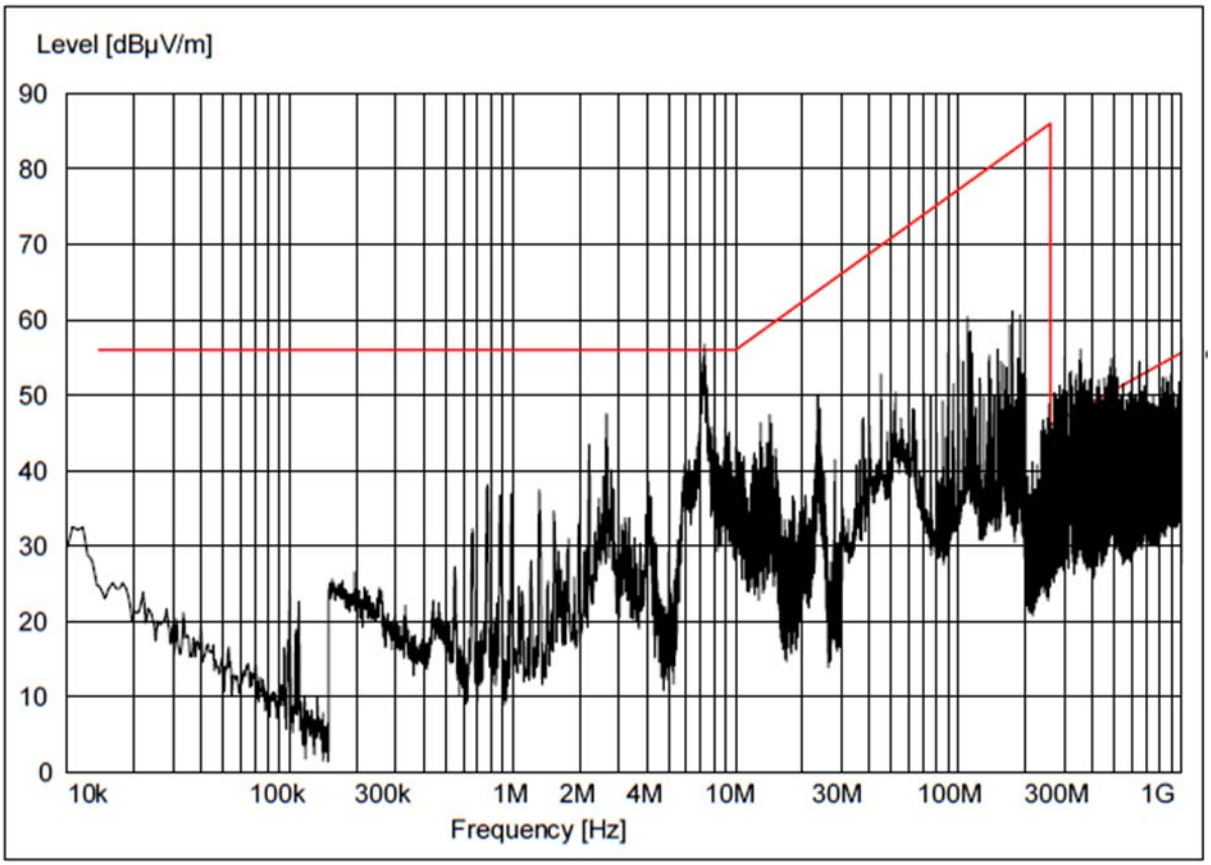
Figure 2. Antenna placement during testing

ISSUE DESCRIPTION Continued:



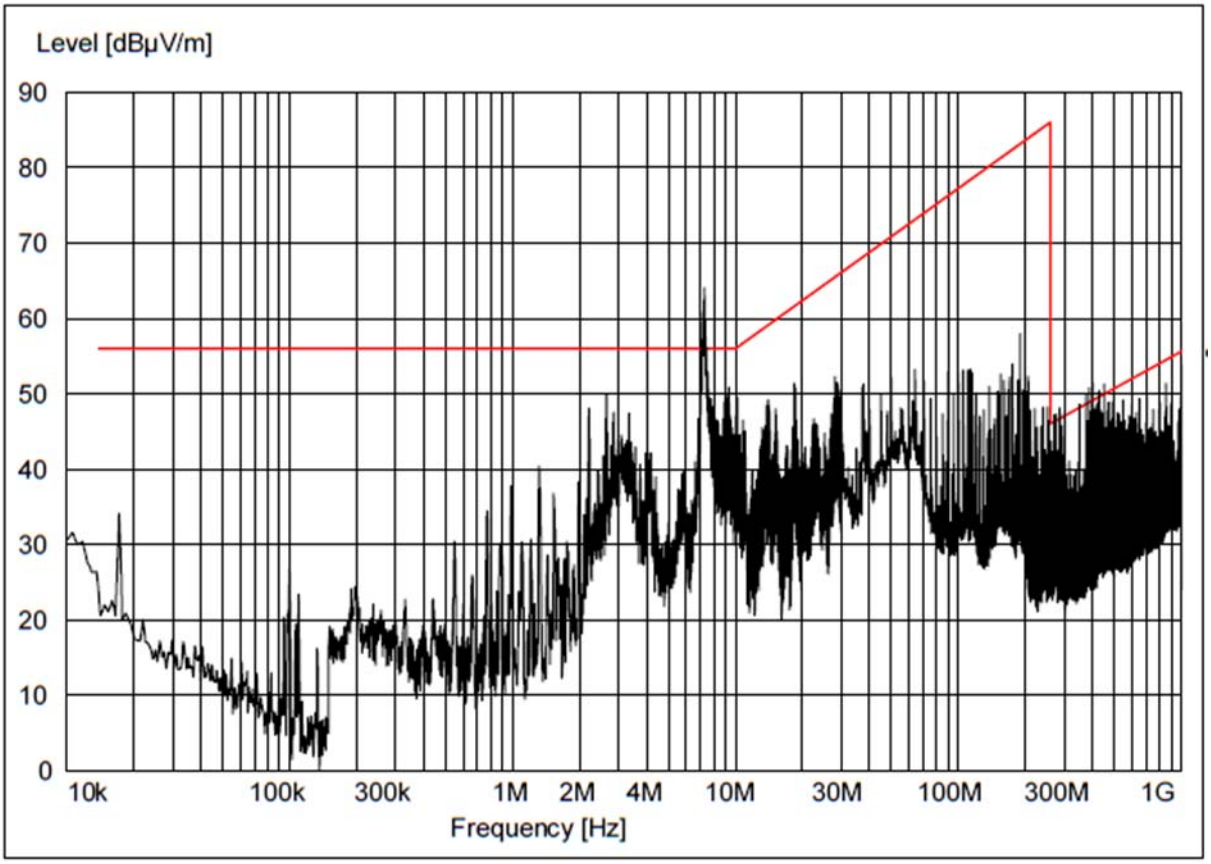
Plot 51. AMS-02 Payload RE 10 kHZ to 1 GHz, Antenna #1, Vertical Polarization

ISSUE DESCRIPTION Continued:



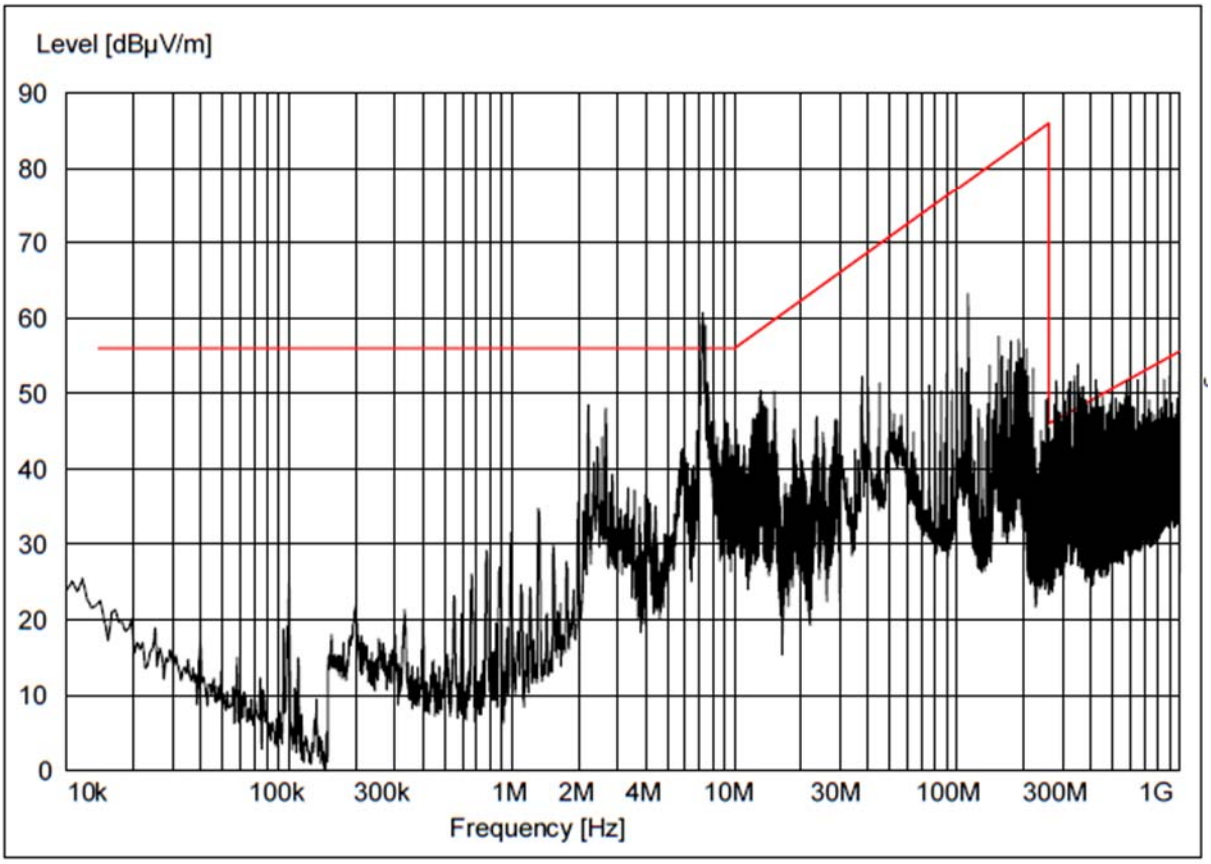
Plot 41. AMS-02 Payload RE 10 kHZ to 1 GHz, Antenna #2, Vertical Polaization

ISSUE DESCRIPTION Continued:



Plot 39. AMS-02 Payload RE 10 kHZ to 1 GHz, Antenna #3, Vertical Polarization

ISSUE DESCRIPTION Continued:



Plot 28. AMS-02 Payload RE 10 kHZ to 1 GHz, Antenna #4, Vertical Polarization

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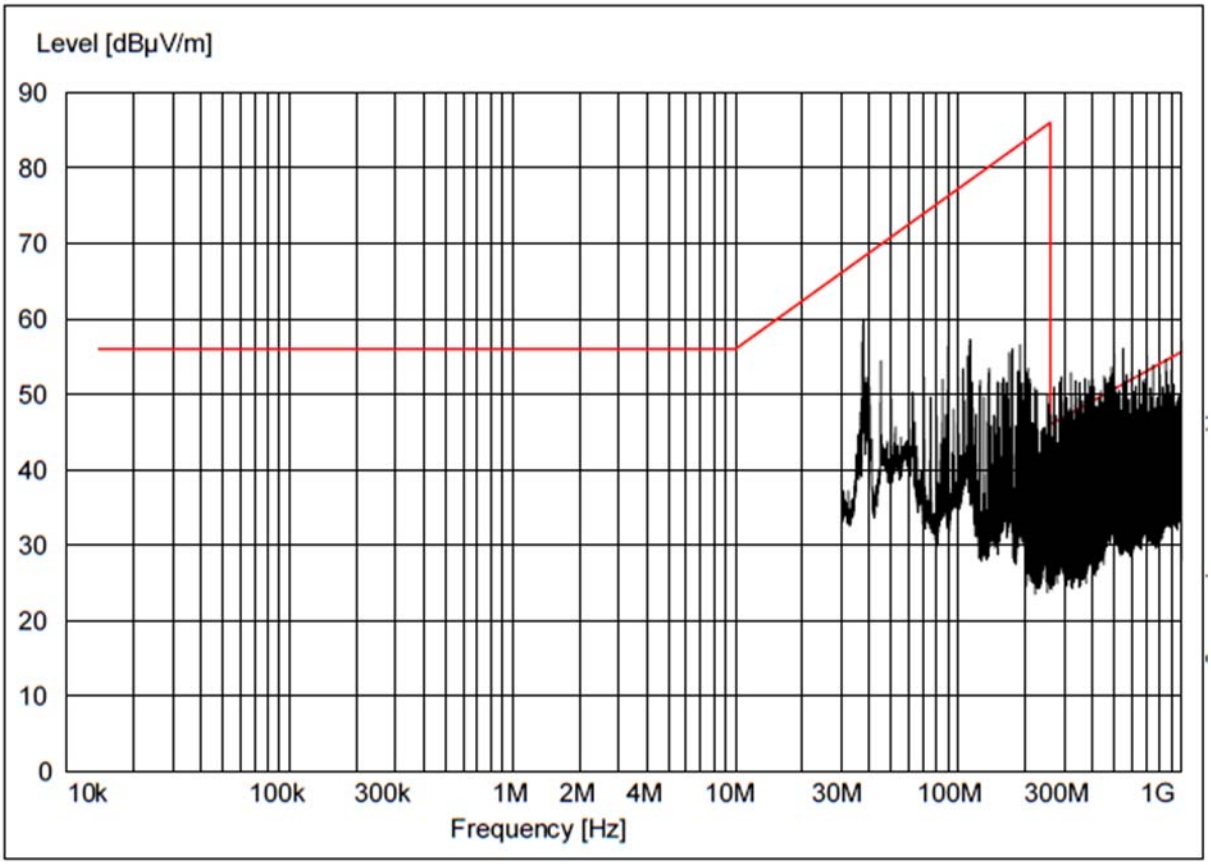
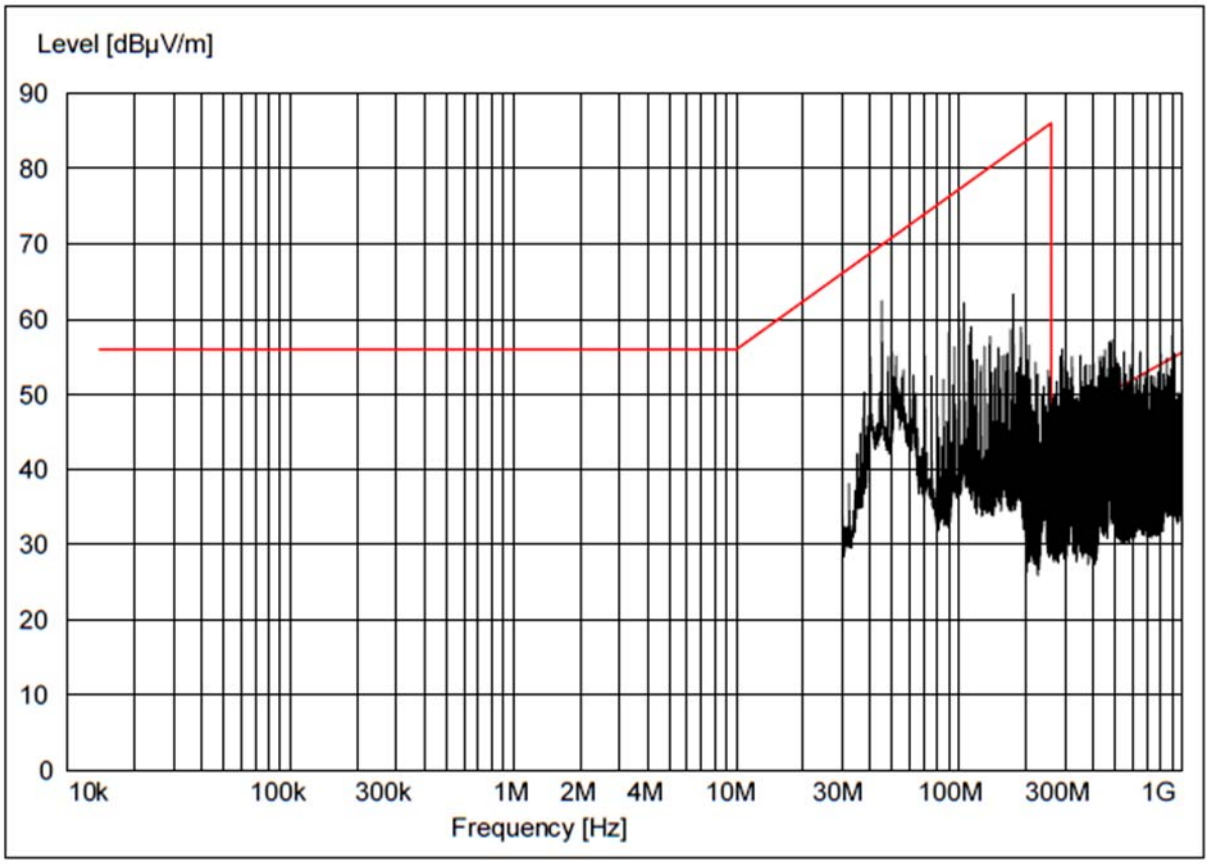
SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
AMS-02	Duong Nguyen (281) 486-6311	EA / Jacobs

ISSUE DESCRIPTION Continued:



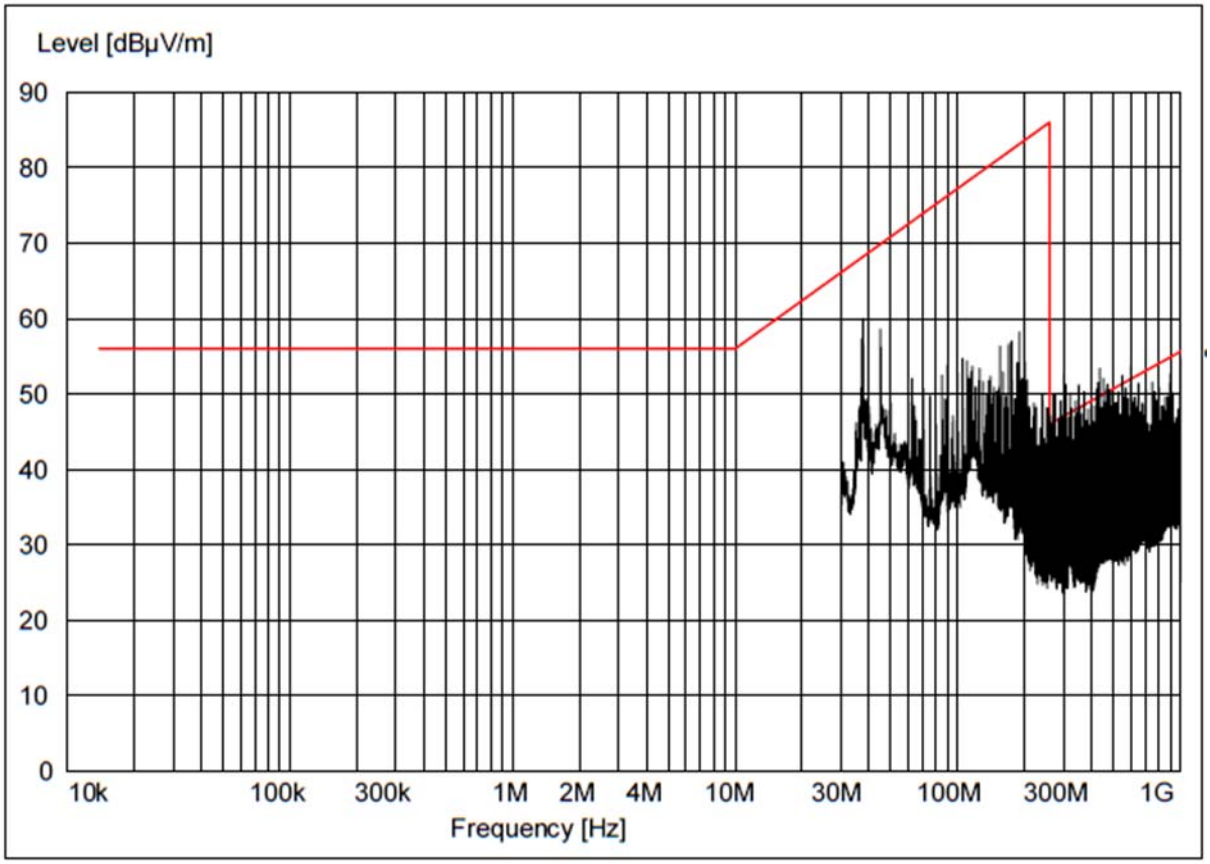
Plot 52. AMS-02 Payload RE 30 MHZ to 1 GHz, Antenna #1, Horizontal Polarization

ISSUE DESCRIPTION Continued:



Plot 42. AMS-02 Payload RE 30 MHZ to 1 GHz. Antenna #2. Horizontal Polarization

ISSUE DESCRIPTION Continued:



Plot 40. AMS-02 Payload RE 30 MHZ to 1 GHz, Antenna #3, Horizontal Polarization

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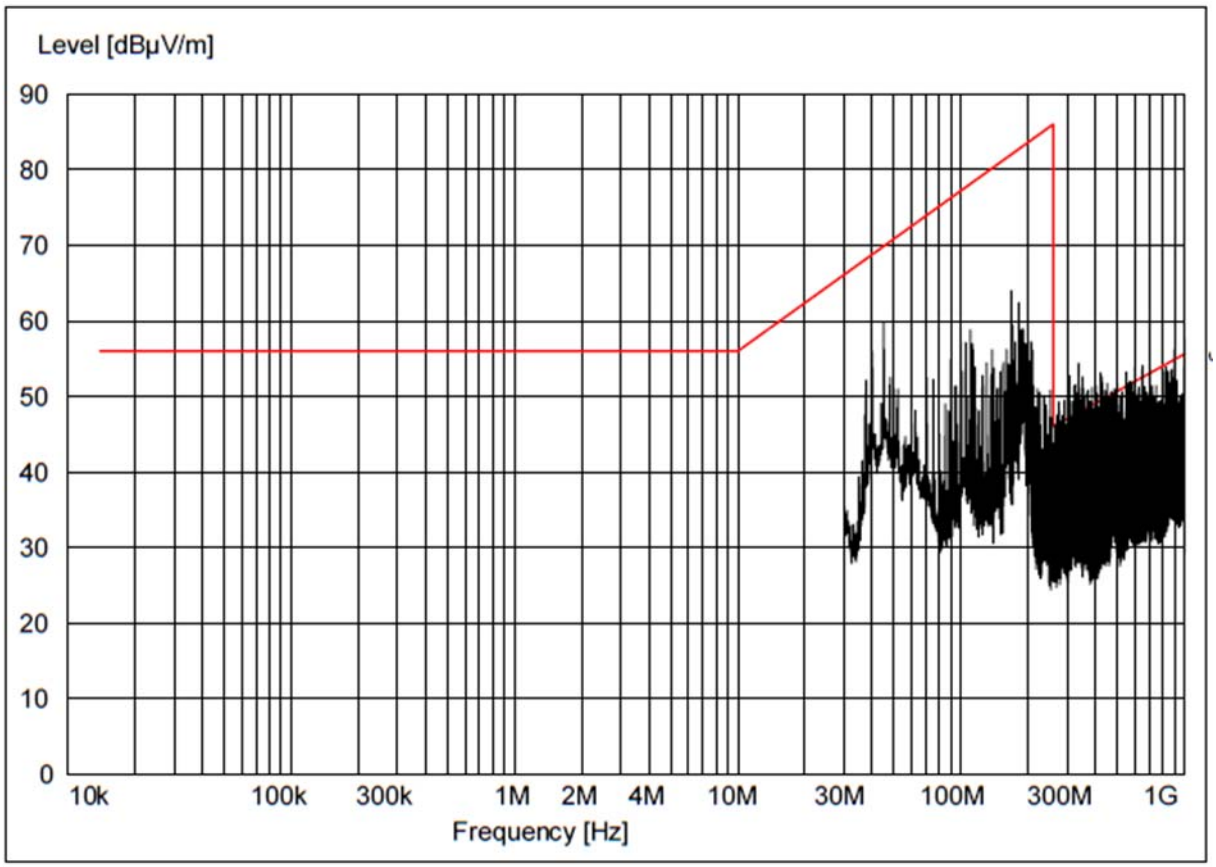
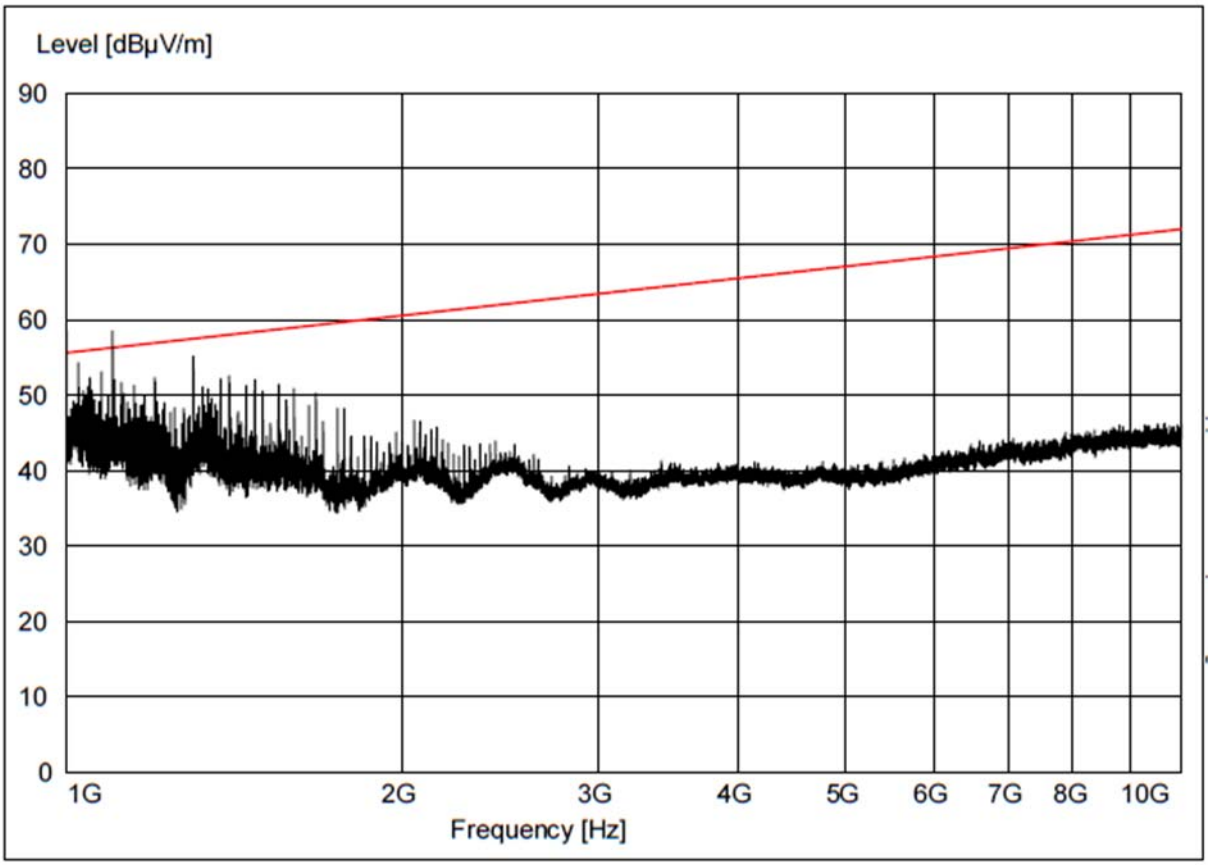
SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
AMS-02	Duong Nguyen (281) 486-6311	EA / Jacobs

ISSUE DESCRIPTION Continued:



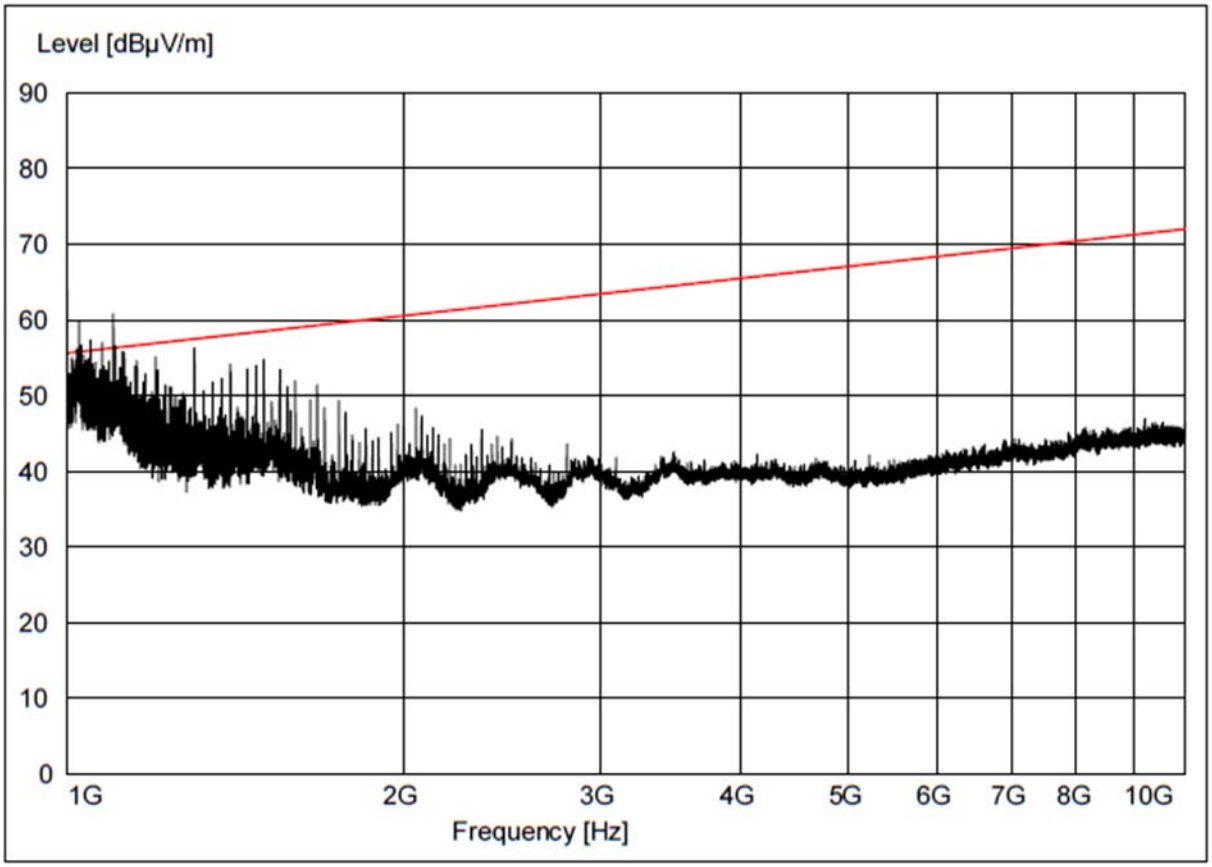
Plot 29. AMS-02 Payload RE 30 MHZ to 1 GHz, Antenna #4, Horizontal Polarization

ISSUE DESCRIPTION Continued:



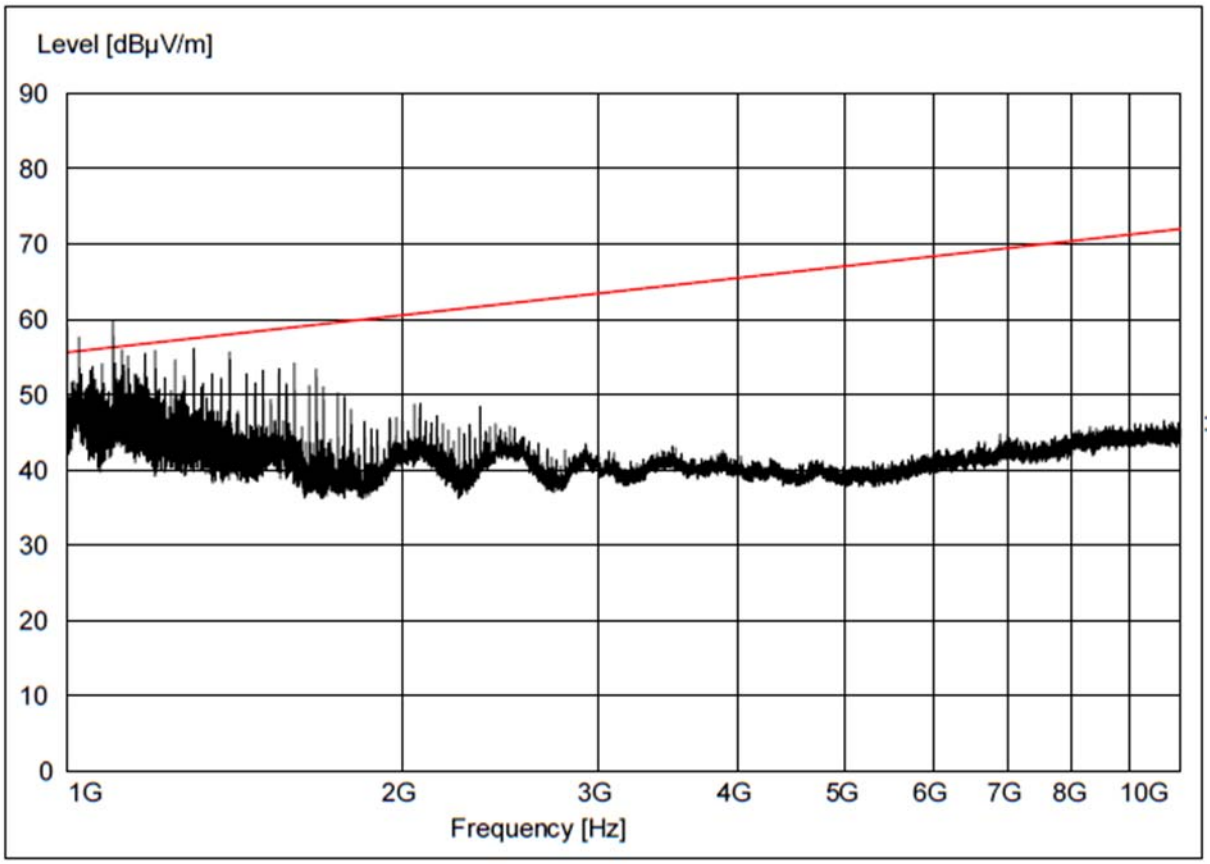
Plot 47. AMS-02 Payload RE 1 GHZ to 10 GHz, Antenna #1, Horizontal Polarization

ISSUE DESCRIPTION Continued:



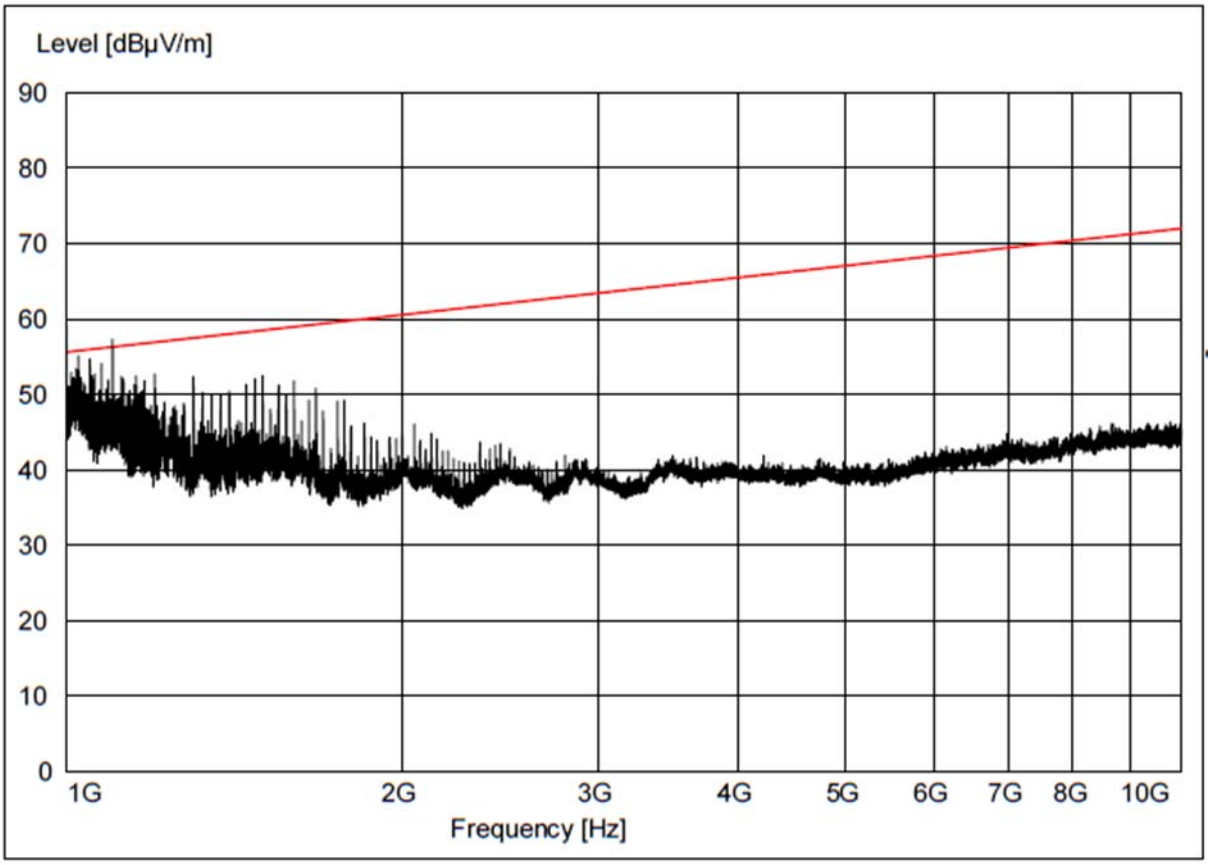
Plot 43. AMS-02 Payload RE 1 GHZ to 10 GHz, Antenna #2, Vertical Polarization

ISSUE DESCRIPTION Continued:



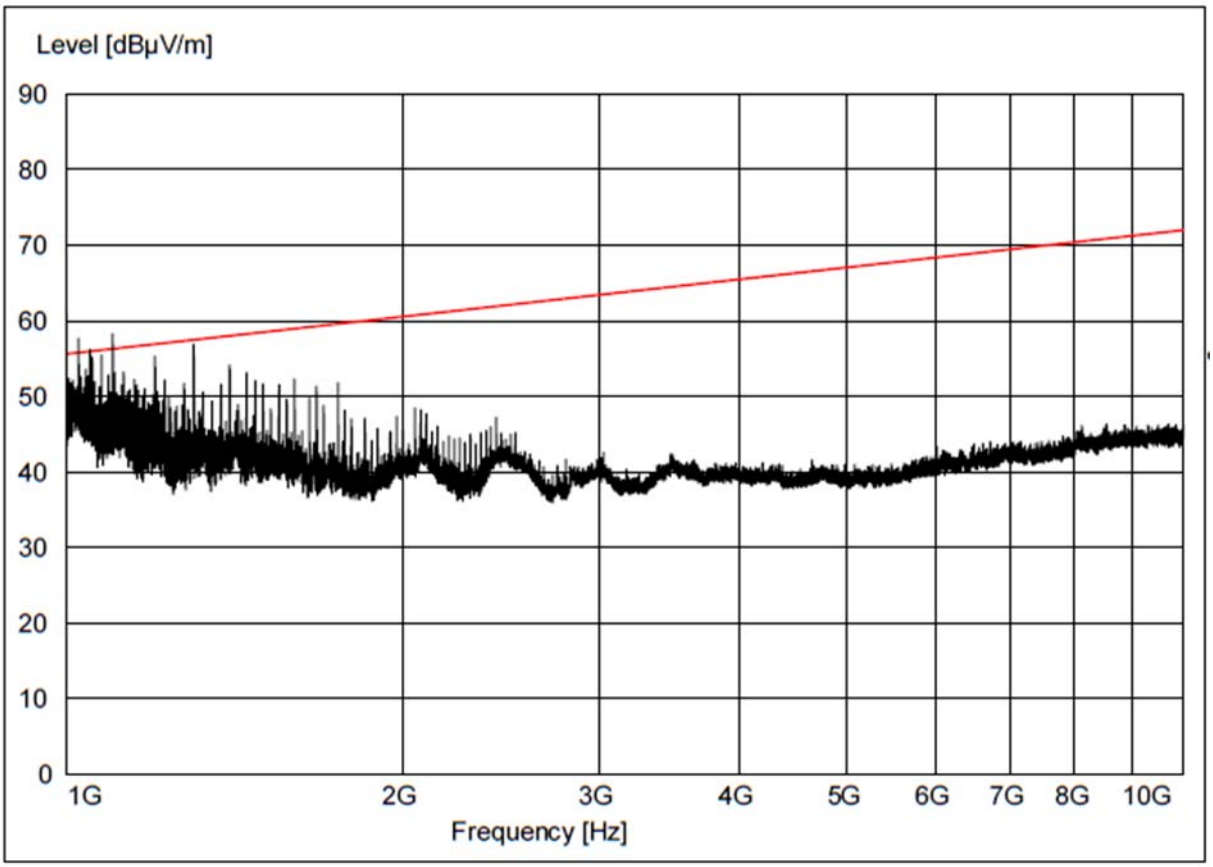
Plot 45. AMS-02 Payload RE 1 GHZ to 10 GHz. Antenna #2. Horizontal Polarization

ISSUE DESCRIPTION Continued:



Plot 33. AMS-02 Payload RE 1 GHZ to 10 GHz, Antenna #4, Vertical Polarization

ISSUE DESCRIPTION Continued:



Plot 30. AMS-02 Payload RE 1 GHZ to 10 GHz, Antenna #4, Horizontal Polarization

AGREEMENT Continued:

AMS-02 Radiated Emissions testing results showed non-compliances, as shown in Table TIA-1195-1 below.

Plot	RE02 Measurement	Antenna Position	Polarization	Non-Compliance Frequency	Max delta above limit
51	10 kHz to 1 GHz	1	Vertical	250 MHz to 500 MHz	4 dB
41		2		7 MHz to 8 MHz	1 dB
				250 MHz to 700 MHz	7 dB
39		3		7 MHz to 8 MHz	8 dB
				250 MHz to 450 MHz	2 dB
28		4		7 MHz to 8 MHz	5 dB
				250 MHz to 500 MHz	7 dB
52	30 MHz to 1 GHz	1	Horizontal	250 MHz to 500 MHz	5 dB
42		2		250 MHz to 1 GHz	8 dB
40		3		250 MHz to 600 MHz	7 dB
29		4		250 MHz to 900 MHz	7 dB
47	1 GHz to 10 GHz	1	Horizontal	1.1002 GHz	2 dB
43		2	Vertical	1.025 GHz to 1.1002 GHz	3 dB
45			Horizontal	1.025 GHz	1 dB
				1.1002 GHz	2 dB
33		4	Vertical	1.1002 GHz	1.3 dB
30			Horizontal	1.025 GHz	1.6 dB
				1.1002 GHz	1.5 dB

Table TIA-1195-1. AMS-02 RE02 Non-compliances

RATIONALE Continued:
The Frequency Analysis review included the statement that no RF interference issues are expected for the non-compliances given in TIA 1195. Table TIA-1195-2 lists the rationale for those non-compliances with potential impact to C&T.

Non-compliance frequency, MHz	Comments
7-8	Potential interference to the MARES RFID receiver at 13.56 MHz. However the MARES RFID is internal to the ISS. Therefore there is no issue.
260, 265, 270	No interference issues expected for the SSO UHF ATC receiver at 259.7 MHz: This is a narrowband emission well outside of the receiver RF bandwidth. The SSO UHF ATC receiver is activated only for testing purposes while on orbit.
280-305	No interference issues expected for the SSO UHF ATC receiver at 296.8 MHz: This is a narrowband emission well outside of the receiver RF bandwidth. The SSO UHF ATC receiver is activated only for testing purposes while on orbit.
390	No interference issues expected for the WVS UHF Command at 400.575 MHz since the front end filter provides about 10 dB of rejection at this frequency, while the IF filter provides another 20 dB of rejection.
395	No interference issues expected for the WVS UHF Command at 400.575 MHz is not expected since the front end filter provides about 3 dB of rejection at this frequency, while the IF filter provides another 20 dB of rejection. No interference expected for SM GTS at 400.1 MHz since the receiver is on the ground.
399.98. 400.04	Interference is expected for the WVS UHF Command receiver at 400.575 MHz. However, for operational scenarios using worst case RF parameter assumptions, there is sufficient link margin to mitigate the degradation. No interference issues expected for SM GTS at 400.1 MHz since the receiver is on the ground.
405	No interference issues expected for the WVS UHF Command at 400.575 MHz since the front end filter provides about 3 dB of rejection at this frequency, while the IF filter provides another 20 dB of rejection. No interference issues expected for SSCS radios at 414.2 MHz because of frequency separation. No interference issues expected for SM GTS at 400.1 MHz since the receiver is on the ground.

Table TIA-1195-2 Frequency Management evaluation of AMS-02 RE02 exceedances (continued on next page)

(Continued on page 18)

RATIONALE Continued:

Non-compliance frequency, MHz	Comments
414.98, 415	Interference is expected for the SSCS receivers at 414.2 MHz since these emissions fall into the IF bandwidth after mixing. However, for operational scenarios using worst case RF parameter assumptions, there is sufficient link margin to mitigate the degradation. No interference issues expected for SSCS radios at 417.1 MHz because of frequency separation and filtering at IF.
420, 425	No interference issues are expected for SSCS receivers at 414.2 MHz and 417.1 MHz because of frequency separation.
430, 435, 440	No interference issues expected for the SM ARISS at 436.5 MHz since this is a narrowband receiver.
450, 455, 470, 475	Potential for interference to Russian TV (SM, FGB, Progress, Soyuz) at 463 MHz. However, receiver parameters are unavailable.
900, 925	No interference issues expected for the EWIS receivers centered at 915 MHz, since the EWIS system uses QPSK spread spectrum at a spreading rate of 11 Mcps.

Table TIA-1195-2 Frequency Management evaluation of AMS-02 RE02 exceedances (continued from previous page)

Since the current NASA plan is to continue the operation of the ISS until at least 2020 and with the retirement of the Shuttle fleet; it would be difficult to return AMS to Earth after 3 years as originally planned. To accommodate this plan; the AMS-02 payload was upgraded to the use of a permanent magnet to be able to extend the operations of the AMS science mission in full through the lifetime of the ISS.

After ESTEC EMI Testing, the Cryo-Cooled Magnet was replaced with Permanent Magnet. Reference JSC Report # JSC-66168 for assessment of AMS shielding effectiveness associated with change from Cryo-Cooled Magnet to Permanent Magnet. No new electronics were added. Cryo-Cooled Magnet with associated electronics was removed and additional MLI shrouding was added. These modifications should contribute to reducing the radiated emissions of the AMS payload.

The AMS-02 is criticality 3 and severity 2 hardware. This TIA does not impose any operational constraints. This TIA is for all the ISS except the Russian Segment.

ISS Electromagnetic Effects Panel
Tailoring/Interpretation Agreement
Technical Concurrence

SUBMITTAL DATE	AGREEMENT NO.	REV.	FLIGHT #(s)	
18 March 2011	TIA # 1195	a	STS-134 / ULF6	Page 19 of 19

SYSTEM	ORIGINATOR and PHONE NO.	ORGANIZATION / CONTRACTOR
AMS-02	Duong Nguyen (281) 486-6311	EA / Jacobs

MEMBERS

NAME	DATE	ORGANIZATION
		Space Station Office, KSC
		Payloads Office, ISSP
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