

MEASUREMENT / TECHNICAL REPORT

Fujitsu Siemens Computers

Model: Audio board TT SOLO 1-NL

FCC ID: NJ5-TT-158250

Oct. 18, 1999

This report concerns: Original grant Class II change
Equipment type: Audio board

Request issue of grant: Immediately upon completion of review
 Defer grant per 47 CFR 0.457(d)(1)(ii) until _____ date _____. Company Name agrees to notify the Commission by _____ date _____ of the intended date of announcement of the product so that the grant can be issued on that date.

Measurement procedure used:
ANSI C63.4-1992
 FCC/OET MP-4(1987)
 other _____

Limits on compliance with: CISPR 22 resp. FCC class B

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Audio board TT SOLO 1-NL

FCC Identifier:
NJ5-TT-158250

Date: Oct. 18, 1999

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1 GENERAL INFORMATION

1.1 Product Description

The Plug in board TT SOLO 1-NL is a PCI audio board. It integrates a mount of peripheral audio connectors and an audio controller ES 1938S to perform the following features:

Features Overview:

- *PCI plug and play*
- *SoundBlaster/pro compatible*
- *Software Wavetable*
- *1 MB & 3 MB Wavetable sample sets*
- *VSpace eD Effect*
- *Enhanced Full Duplex*
- *Drivers for MS-DOS 7.0, Windows 95/98 and Windows NT 4.0*

The audio board is assembled by TerraTec Electronic GmbH, Herrenpfad 38, 41334 Nettetal.

1.2 Related Submittal Grant

N/A

1.3 Tested System Details

The FCC IDs for all equipment, plus description of all cables used in the tested system are:

Pos	Model Number (Serial Number)	FCC ID	Description	Cable Description (length in [cm])
1	Fujitsu Siemens Computers Scenic Pro M7 YBJF000509	HSSSCENICM701	Personal Computer PII 350 MHz	unshielded power cord [292]
2	Fujitsu Siemens Computers MCM 1705 NTD XC559734	A3LCGH760	Monitor	unshielded power cord [175] shielded video cable [168]
3	Microsoft Intelli mouse 1.1 A 0015096-00000	DOC: m/n:IM1	USB-Mouse	shielded mouse cable [197]
4	Microsoft MS 2.1A 6221424-40000	C3KKMP3	Mouse	shielded mouse cable [183]

Pos	Model Number (Serial Number)	FCC ID	Description	Cable Description (length in [cm])
5	Fujitsu Siemens Computers S26381-K240-V120 31303980153	HSS01TASTK240	Keyboard	shielded keyboard cable [143]
6	Hewlett Packard HP 2225C+ (2910S40941)	DSI6XU2225	Printer, parallel I/F	unshielded AC ca- ble [180], shielded centronics cable [190]
7	Hewlett Packard HP 2225D+ (2952S61298)	DSI6XU2225	Printer, serial I/F	unshielded power cord [185], shiel- ded serial cable [190]
8	Labtec AM-32	N/A	Microphone 2x	shielded cable [142]
9	Chairman Power Beat P-10	N/A	Loud- speakers	shielded cable [166 + 124]
10	Microsoft Side Winder 3D Pro 00877178	C3KMJ1	Joy stick	shielded cable
	Pos 1 contains:			
a	Terra Tec Electronic GmbH TT SOLO 1-NL	NJ5-TT-158250	Audio board EUT	

Remark:

1.4 Test Methodology

Both, conducted and radiated tests were performed according to the procedures in ANSI C63.4-1992. Radiated testing below 1 GHz was performed at an antenna to EUT distance of 10 meters above 1 GHz at an antenna to EUT distance of 3 meters. All radiated emission measurements were done in an anechoic chamber. Limits for radiated and conducted emission are in compliance with CISPR 22 resp FCC class B.

1.5 Test Facility

The anechoic chamber and conducted measurement facility used to collect the emission data is located at Siemens PC Systeme GmbH & Co. KG, Bürgermeister Ulrich Str. 100, 86199 Augsburg, Germany. This site has been fully described in a report dated January 24, 1997 submitted to your office, and accepted in a letter dated March 03, 1997 (31040/SIT).

1.6 Referenced Rules Sections

N/A

2 PRODUCT LABELING

2.1 FCC ID Label: see attached files

2.2 Location of Label on EUT: see attached files

3 SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a maximum fashion (as a customer can use it). Each type of external ports was connected with a peripheral unit (e.g. serial port connected to a serial printer, external keyboard port connected to a keyboard and so on).

3.2 Video mode Justification

The system was tested in video graphic modes 1024 x 768, 100 Hz, because this is the most commonly used resolution and reflects the worst case.

3.3 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to typical use.

The used sequence is:

- scrolling "H" with applicable video mode (see 3.2)
- internal Floppy drive writes to the HD and reads back
- internal CD-ROM drive writes to the HD
- "H's" are sent to the printer ports
- data is sent to USB ports
- data is sent to audio board (sound)

3.4 Special Accessories

As shown in Figure 3.1, all interface cables used for compliance testing are shielded like normally supplied by the manufacturer. All cable connectors feature integral metal hoods for shielding.

3.5 Equipment Modifications

To achieve compliance to Class B levels, the following modifications were made during compliance testing:

no modifications

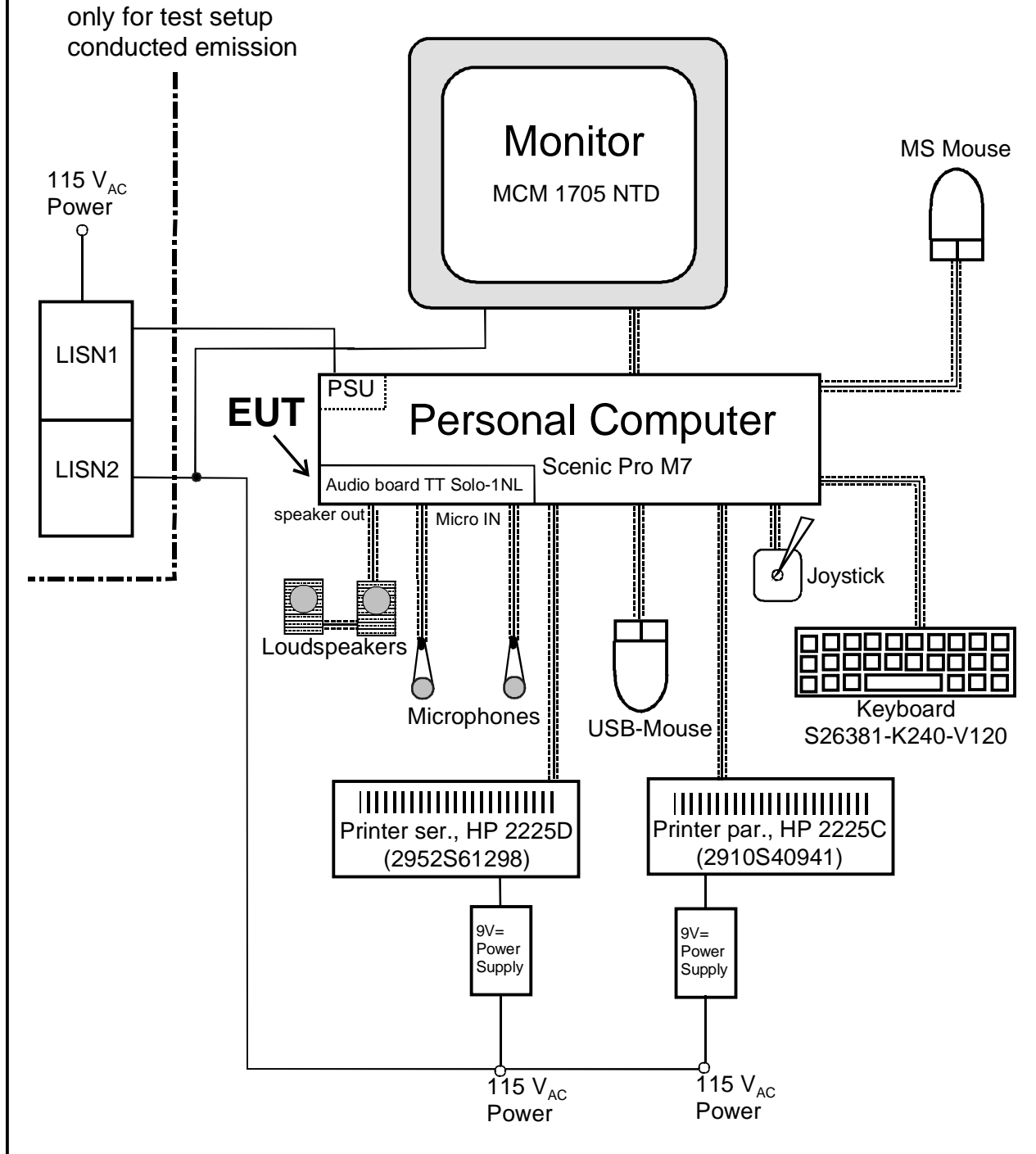
Applicant Signature _____ Date _____

Typed/Printed Name _____ Position _____

3.6 Configuration of Tested System

All necessary tests were carried out like figure 3.1. The system was used according to paragraph 1.1. During test for conducted emission the EUT was connected to a LISN. All peripherals were supplied by a second LISN. The equipment was configured according to ANSI C63.4-1992 Fig 11.

Figure 3.1 Configuration of Tested System



4 BLOCK DIAGRAM OF EUT

see fig 4.1 page 15

4.1 Block Diagram Description (see fig. 4.1)

The major parts of the system are (fig 4.1).

- audio controller
- peripheral connection area

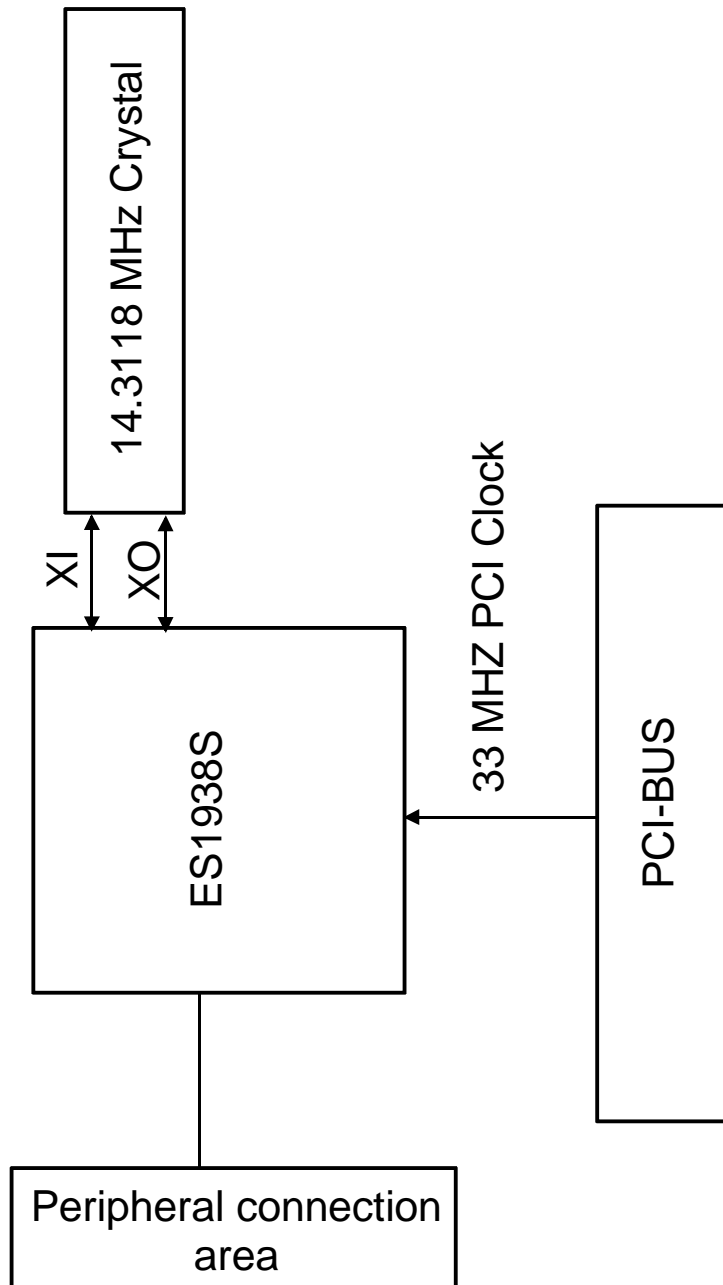
4.2 Clockfrequencies of EUT

Quarz frequency	14,318 MHz
PCI clock	33,0 MHz

4.3 Theory of Operation

The controller ES 19385 communicates with the PCI bus and converts the peripheral audio signals. The controller produces its own clock supported by the 14.31818 MHz Crystal.

4.1 Block Diagram of the EUT



5 CONDUCTED EMISSION DATA

5.1 Test Procedure

The initial step in collecting conducted emission data is a Rohde & Schwarz Test Receiver (ESHS10). During first scan all data in peak mode is measured, then all significant peaks are explored either in quasi-peak mode or in average mode. In case of low noise (no peak value reaches the quasi peak limit), only average checks are done.

5.2 Measured Data

The conducted emission was measured the following way:

1. Peak noise on L
2. Peak noise on N

During the emission measurement the printers and the monitor are supplied with power via a second LISN.

Judgement: Passed by

	Frequency [MHz]	Measured [dB(μV)]	Kind of value	Limit [dB(μV)]
neutral	0,876	43,7	QP	56,0
neutral	1,002	42,1	QP	56,0
neutral	1,500	43,8	QP	56,0
neutral	1,626	43,6	QP	56,0
phase	19,464	46,5	QP	60,0

Judgement: Passed by

	Frequency [MHz]	Measured [dB(μV)]	Kind of value	Limit [dB(μV)]
neutral	0,876	43,3	AV	46,0
neutral	1,002	41,5	AV	46,0
neutral	1,374	39,7	AV	46,0
neutral	1,500	43,3	AV	46,0
neutral	1,626	42,8	AV	46,0

AV: average

QP: quasi peak

Test Personnel:

Tester Signature: _____ Date: _____

Printed Name: A. Siebenhütter

Measurement Protocols: see attached file

EUT with Personal Computer Scenic Pro M7 PII 350 MHz
video resolution 1024 x 768/100Hz

5.3 Referenced Rules Sections

N/A

5.4 Test Instrumentation Used, Conducted Measurement

Type	Manufacturer/ Model No.	Serial No.	Last Cal.	Cal. Interval
Receiver	ESHS10 Rohde&Schwarz	842884/011	May 99	12 months
Receiver	ESH3 Rohde&Schwarz	879599/019	May 99	12 months
LISN	ESH2-Z5 Rohde&Schwarz	871884/004	May 99	12 months
LISN	ESH3-Z5 Rohde&Schwarz	883650/027	May 99	12 months
Pulse limiter	ESH3-Z2 Rohde&Schwarz	---	May 99	12 months

6 RADIATED EMISSION DATA

6.1 Test Procedure

The radiated emission was measured in two parts:

1. in the frequency range from 30 MHz to 1000 MHz. The bandwidth of the EMI-receiver was set to 120 kHz and the detector was set to peak. During prescan all data in peak mode are accumulated automatically. At final measurement the detector was set to CISPR quasi peak and values above the acceptance line were verified automatically.
2. in the frequency range from 1000 MHz to 5000 MHz. The bandwidth of the EMI-receiver was set to 1 MHz and the detector was set to peak. During prescan all data in peak mode are accumulated automatically. At final measurement the detector was set to average and values above the acceptance line were verified automatically.

Both tests were performed in a semi anechoic chamber, measurements below 1000 MHz in a distance of 10 meters between antenna and EUT, above 1 GHz with a distance of 3 meters between antenna and EUT. During tests the EUT was turned 360° and the actual used receiving antenna was moved from 1 to 4 meters and the antenna polarisation was changed from horizontal to vertical for finding the maximum levels of emission.

For each range one antenna for the whole span was used

1. 30 MHz to 1000 MHz: log.-per antenna
2. 1000 MHz to 5000 MHz: rigid tensor antenna

After automatic tests during manual verification the cables and the equipment were placed and moved within the range of position in order to find the maximum of emission.

6.2 Measured Data

The EUT was measured with the Personal Computer Scenic Pro M7 (PII 350 MHz) in video mode 1024 x 768, 100 Hz. The test results below reflect the worst case with:

Part 1: frequency range 30 MHz - 1000 MHz:

Judgement: Passed by

Frequency [MHz]	Level* [dB(µV/m)]	10 Meter Limit [dB(µV/m)]	Exceeding [dB]	Ant Pol	Height in [m]	Angle in deg
83.73000	18.90	30.000	-11.1	ver	4.00	29.000
130.74000	22.20	30.000	-7.8	ver	1.00	210.000
166.74000	20.70	30.000	-9.3	ver	1.00	150.000
200.07000	24.00	30.000	-6.0	ver	1.00	210.000
333.51000	29.50	37.000	-7.5	ver	1.00	270.000
612.18000	28.40	37.000	-8.6	ver	3.40	180.000
753.45000	31.80	37.000	-5.2	ver	1.60	0.000

all levels are quasi-peak levels

*The correction factor is considered automatically by the test receiver. A table of correction factors is listed in paragraph 7.4.

Part 2: frequency range 1 GHz - 5 GHz:

Judgement: Passed by

Frequency [MHz]	Level* [dB(µV/m)]	Limit [dB(µV/m)]	Margin [dB]	Exceed Mark	Height [cm]	Azimuth [deg]	Ant Pol
1267.00000	33.00	53.9	20.9		100.00	29.00	ver
1700.80000	31.50	53.9	22.4		140.00	29.00	ver
1786.00000	37.20	53.9	16.7		140.00	29.00	ver

Frequency [MHz]	Level* [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Exceed Mark	Height [cm]	Azimuth [deg]	Ant Pol
1886.80000	29.00	53.9	24.9		100.00	210.00	ver
2131.00000	29.90	53.9	24.0		100.00	29.00	hor
4084.60000	31.00	53.9	22.9		100.00	330.00	ver
4965.40000	33.00	53.9	20.9		180.00	239.00	hor

all levels are average levels

*The correction factor is considered automatically by the test receiver.
A table of correction factors is listed in paragraph 7.4.

Test Personnel:

Tester Signature: _____ Date: _____

Printed Name: A. Siebenhütter

Measurement Protocols: see attached files

Frequency range 30 MHz - 1 GHz:

EUT with Personal Computer Scenic Pro M7 PII 350 MHz
video resolution 1024 x 768/10Hz

Frequency range 1 GHz - 5 GHz:

EUT with Personal Computer Scenic Pro M7 PII 350 MHz
video resolution 1024 x 768/10Hz

6.3 Referenced Rules Sections

N/A

6.4 Test Instrumentation Used, Radiated Measurement

Type	Manufacturer/ Model No.	Serial No.	Last Cal.	Cal. Interval
Receiver	ESMI Rohde&Schwarz	840607/006	May 99	15 months
Antenna	CBL 6111 Chase	1345	May 99	12 months
Antenna	CBL 6112 Chase	2041	May 98	15 months
Active Ridged antenna	Tensor 4105 Rohde&Schwarz	2063	May 98	15 months

6.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor automatically to the measured value. The display of the Receiver shows the corrected value. The complete table of correction factors is given on next page. The basic equation with a sample calculation is as follows:

$$\mathbf{FS = RA + AF + CF}$$

where FS = Field Strength

AF = Antenna Factor (incl. Preamplifier factor)

CF = Cable Attenuation Factor

Assume a receiver reading of 28,5 dB μ V is obtained. The Antenna Factor of 10,5 and a Cable Factor of 1,3 is added, giving a field strength of 40,3 dB μ V/m.

$$FS = 28,5 + 10,5 + 1,3 = 40,3 \text{ dB}\mu\text{V/m}$$

The 40,3 dB μ V/m value can be mathematically converted to its corresponding level in μ V/m.

Level in μ V/m =
Common Antilogarithm [(40,3 dB μ V/m)/20] =

103,5 μ V/m

6.6 Table of Correction Factors

Frequency range: 30 MHz to 1000 MHz

Frequency [MHz]	Correction Bilog Antenna [dB]	Correction Cable [dB]	Correction Antenna + Cable [dB]
30,0	17,90	0,65	18,55
35,0	15,20	0,67	15,87
40,0	12,80	0,68	13,48
45,0	10,00	0,73	10,73
50,0	8,20	0,74	8,94
55,0	6,90	0,82	7,72
60,0	6,50	0,84	7,34
70,0	6,40	0,90	7,30
80,0	7,20	0,95	8,15
90,0	9,30	0,99	10,29
100,0	11,10	1,10	12,20
120,0	12,10	1,14	13,24
140,0	11,30	1,27	12,57
160,0	10,60	1,35	11,95
180,0	9,60	1,45	11,05
200,0	9,50	1,51	11,01
250,0	12,40	1,71	14,11
300,0	13,80	1,84	15,64
350,0	15,00	2,00	17,00
400,0	16,40	2,18	18,58
450,0	16,90	2,35	19,25
500,0	17,40	2,43	19,83

Frequency [MHz]	Correction Bilog Antenna [dB]	Correction Cable [dB]	Correction Antenna + Cable [dB]
550,0	19,00	2,62	21,62
600,0	18,70	2,73	21,43
650,0	19,70	2,88	22,58
700,0	19,00	2,91	21,91
750,0	20,00	3,01	23,01
800,0	19,90	3,21	23,11
850,0	22,90	3,32	26,22
900,0	20,70	3,40	24,10
950,0	21,00	3,49	24,49
1000,0	25,00	3,69	28,69

Frequency range: 1 GHz to 5 GHz

Frequency [GHz]	Correction Tensor Antenna with Pre-amplifier [dB]	Correction Cable [dB]	Correction Antenna + Cable [dB]
1,0	5,70	1,62	7,32
1,1	4,80	1,68	6,48
1,2	5,10	1,75	6,85
1,3	5,00	1,80	6,80
1,4	5,10	1,96	7,06
1,5	5,90	2,00	7,90
1,6	5,60	2,15	7,75
1,7	6,70	2,30	9,00
1,8	6,60	2,32	8,92
1,9	5,90	2,35	8,25
2,0	7,20	2,44	9,64
2,1	7,30	2,62	9,92
2,2	7,40	2,75	10,15
2,3	8,40	2,70	11,10
2,4	8,00	2,69	10,69
2,5	9,30	2,65	11,95
2,6	8,70	2,75	11,45
2,7	8,70	2,92	11,62
2,8	9,00	2,98	11,98
2,9	8,60	3,10	11,70
3,0	9,50	3,12	12,62
3,1	9,20	2,37	11,57
3,2	8,60	2,40	11,00

Frequency [GHz]	Correction Tensor Antenna with Pre-amplifier [dB]	Correction Cable [dB]	Correction Antenna + Cable [dB]
3,3	8,70	2,42	11,12
3,4	9,70	2,43	12,13
3,5	9,70	2,46	12,16
3,6	10,40	2,43	12,83
3,7	10,80	2,45	13,25
3,8	11,50	2,47	13,97
3,9	11,90	2,49	14,39
4,0	10,90	2,46	13,36
4,1	10,10	2,48	12,58
4,2	8,80	2,49	11,29
4,3	8,70	2,51	11,21
4,4	8,50	2,53	11,03
4,5	8,70	2,54	11,24
4,6	9,50	2,57	12,07
4,7	10,10	2,57	12,67
4,8	11,10	2,59	13,69
4,9	11,50	2,60	14,10
5,0	11,60	2,62	14,22

7 Conducted And Radiated Emission Measurement Photos: see attached files

7.1 Test setup, conducted emission, front side view

7.2 Test setup, conducted emission, rear side view

7.3 Test setup, radiated emission, front side view

7.4 Test setup, radiated emission, rear side view

8 Photos of Tested EUT: see attached files

8.1 Front side of EUT

8.2 Rear side of EUT

9 User Manual: see attached files

The FCC statement will be added to the user manual on page 2. Meanwhile a yellow sheet will be attached to the board set.

For the yellow sheet refer to the attached file.