Korea Technology Institute Co., Ltd.

Test Report

Test Report No.:	**KTI07EF12003**		
Registration No.:	**99058**		
Applicant:	**NITGEN CO., LTD.**		
Applicant Address:	**Sam-Oh Bldg, 3rd Floor, 905-4 HoGye-dong, DongAn-gu, AnYang-city, Gyunggi-do, Korea**		
Product:	**ACCESS CONTROLLER**		
FCC ID:	**PEBNAC-2500LR**	**Model No.**	**NAC-2500LR**
Receipt No.:	**07-1126**	**Date of receipt:**	**November 29, 2007**
Date of Issue:	**December 05, 2007**		
Testing location	**Korea Technology Institute Co., Ltd. 51-19, Sanglim3-Ri, Docheok-Myeun, Gwangju-Shi, Gyeungki-Do, Korea**		
Test Standards:	**FCC/ANSI. C63.4: 2003**		
Rule Parts: FCC	**Part 15, Class B**		
Equipment Class:	**Digital device**		
Test Result:	**The above-mentioned product has been tested with compliance.**		

Tested by: T.W. Lee
/ Engineer

Signature **Date**

Approved by: G. C. Min
/President

Signature **Date**

Other Aspects:	
Abbreviations:	**∗ OK, Pass=passed ∗ Fail=failed ∗ N/A=not applicable**

☞ **- This test report is not permitted to copy partly without our permission.**

- This test result is dependent on only equipment to be used.

- This test result is based on a single evaluation of one sample of the above mentioned.

- This test report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S Government.

- We certify this test report has been based on the measurement standards that is traceable to the national or international standards.

≫≫ Contents ≪≪

≫ List of Tables

≫ List of Figures

≫ List of Photographs

≫≫ Contents ≪≪

1. General

This equipment has been shown to be capable of compliance with the applicable technical standards and was tested in accordance with the measurement procedures as indicated in this report.

We attest to the accuracy of data. Korea Technology Institute Co., Ltd. performed all measurements reported herein. And were made under Chief Engineer's supervisor.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. Test Site

Korea Technology Institute Co., Ltd.

Location

51-19, Sanglim3-Ri, Docheok-Myeun, Gwangju-Shi, Gyeungki-Do, Korea

The Test Site is in compliance with ANSI C63.4/2003 for measurement of radio Interference.

List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

- Conducted Emissions

Kind of Equipment	Type	S/N	Calibrated until
Field Strength Meter	ESIB40	100093	07.2008
LISN	KNW407	8-1157-2	01.2008
LISN	EM-7823	115019	05.2008
Conducted Cable	N/A	N/A	11.2008

- Radiated Emissions

Kind of Equipment	Type	S/N	Calibrated until
Field Strength Meter	ESIB40	100093	07.2008
Loop Antenna	6502	3434	06.2008
Biconic Logarithmic Periodic Antenna	VULB9163	9163-281	09.2008
Horn Antenna	3115	6443	08.2008
Open Site Cable	N/A	N/A	11.2008
Antenna Mast	DETT-03	N/A	N / A
Antenna & Turntable controller	DETT-04	91X519	N / A

Test Date

Date of Application: November 29, 2007

Date of Test: December 03, 2007

Test Environment

Indoor: 24℃/39%/1000mbar

Outdoor: 9.6℃/20%/1000mbar

3. Description of the tested samples

The EUT is ACCESS CONTROLLER

Rating and Physical Characteristics

Function		Spec.
Display	Type	128 * 32 Dots LCD
	Language	Default: Korean, English Additional Type A: Japanese, Chinese, Spanish, French, Thai, Indonesian Additional Type B: Polish, Farsi, Malay, Hebrew, Vietnamese(voice only), Portuguese
Sensor	Model	OPP03 LFD
	Type	Optical
	Resolution	500 DPI
	Additional	Auto on / Latent Image Check Live Finger Detection
Authentication	Speed	1:1 mode: less than 1 sec / 1:N mode: Application Note
	Algorithm	FRR: less than 0.1% / FAR: less than 0.001%
#of registered users	Terminal	2000(1 finger prints per user) 1000(2 finger prints per user)
Communication	TCP/IP	10 base-T Ethernet (optional)
	RS-485	Max. 115200bps (custom requirement)
Additional function	Guidelines recorded in voice	
	Downloadable logo / firmware	
	IP length (4~15 digits)	
	Authentication results to be displayed in LED	
Optional	Network Board	
	Door Control Board	
	RF Module [125KHz HID(3M 500 ㎶/m, 13.56MHz Mifare(10M 93.5 dB㎶/m)]	

Submitted Documents

- **User's Guide**
- **Block Diagram**

4. Measurement Conditions

Testing Input Voltage: AC 220V

Modes of Operation

The EUT was in the following operation mode during all testing;

1) EUT operates a finger print job with connection to Note Pc

Additional Equipment

DEVICE TYPE	Manufacturer	M/N	S/N	FCC ID
Note PC	Samsung	SV20	E77191AW100064	DOC
Mouse	EUNXING ELECTRONICS	M2000	N / A	DOC
Adapter	DongKwan Samsung	AD-9019	CNBA4400130ASE3 82CD2742	DOC

Uncertainty

1) Radiated disturbance

Uc (Combined standard Uncertainty) = ± 1.8dB

Expanded uncertainty U=KUc

K = 2

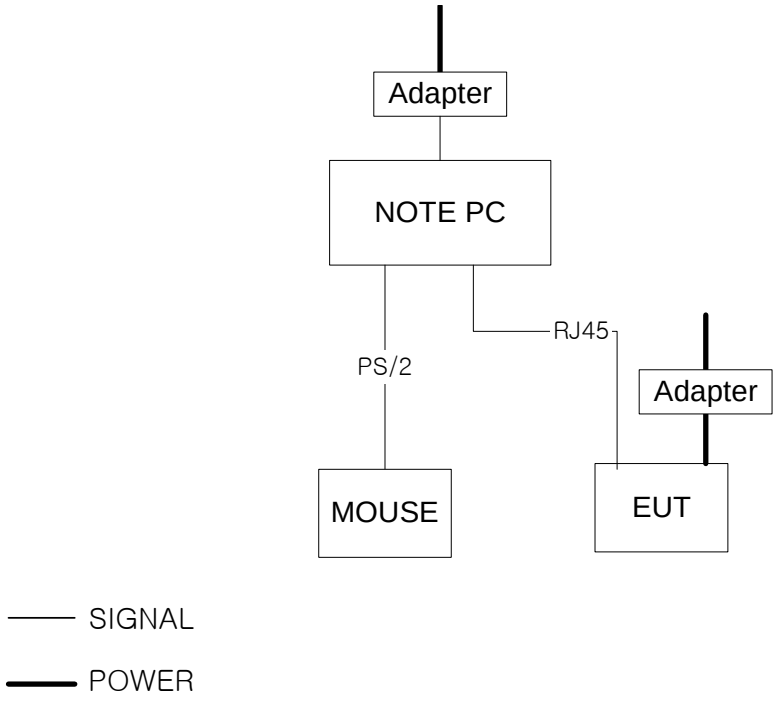
∴ U = ± 3.6dB

2) Conducted disturbance

Uc = ± 0.88dB

U = KUc=2 x Uc = ± 1.8dB

4.4 Test Setup



5. EMISSION Test

5.1.Conducted Emissions

Result: Pass

The line-conducted facility is located inside a 2.3M x 3.5M x 5.5M shielded closure.

The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 605-05. A 1m x 1.5m wooden table 80cm high is placed 80cm away from the conducting ground plane and 40cm away from the sidewall of the shielded room. Electro-Metroics Model EM-7823 (9kHz-30MHz)50ohm/50 uH Line-Impedance Stabilization Networks (LISN) are bonded to the shielded room.

The EUT is powered from the Electro-Metroics LISN and the support equipment is powered from the Kyoritsu LISN. Power to the LISN are filtered by a high-current high-insertion loss shield enclosures power line filters (100dB 14kHz-1GHz).

The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure.

All electrical cables are shielded by copper pipe with inner diameter of 1".

If the EUT is a DC-Powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the Rohde & Schwarz LISN.

All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length.

Sufficient time for the EUT, Support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was reexamined using EMI field Intensity meter (ESIB40). The detector function was set to CISPR quasi-peak mode.

The bandwidth of the receiver was set to 10kHZ. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; if applicable; whichever determined the worst-case emission.

Photographs of the worst-case emission can be seen in photograph of conducted test.

Each EME reported was calibrated using self-calibrating mode.

Figure 1: Spectral Diagram, LINE-PE

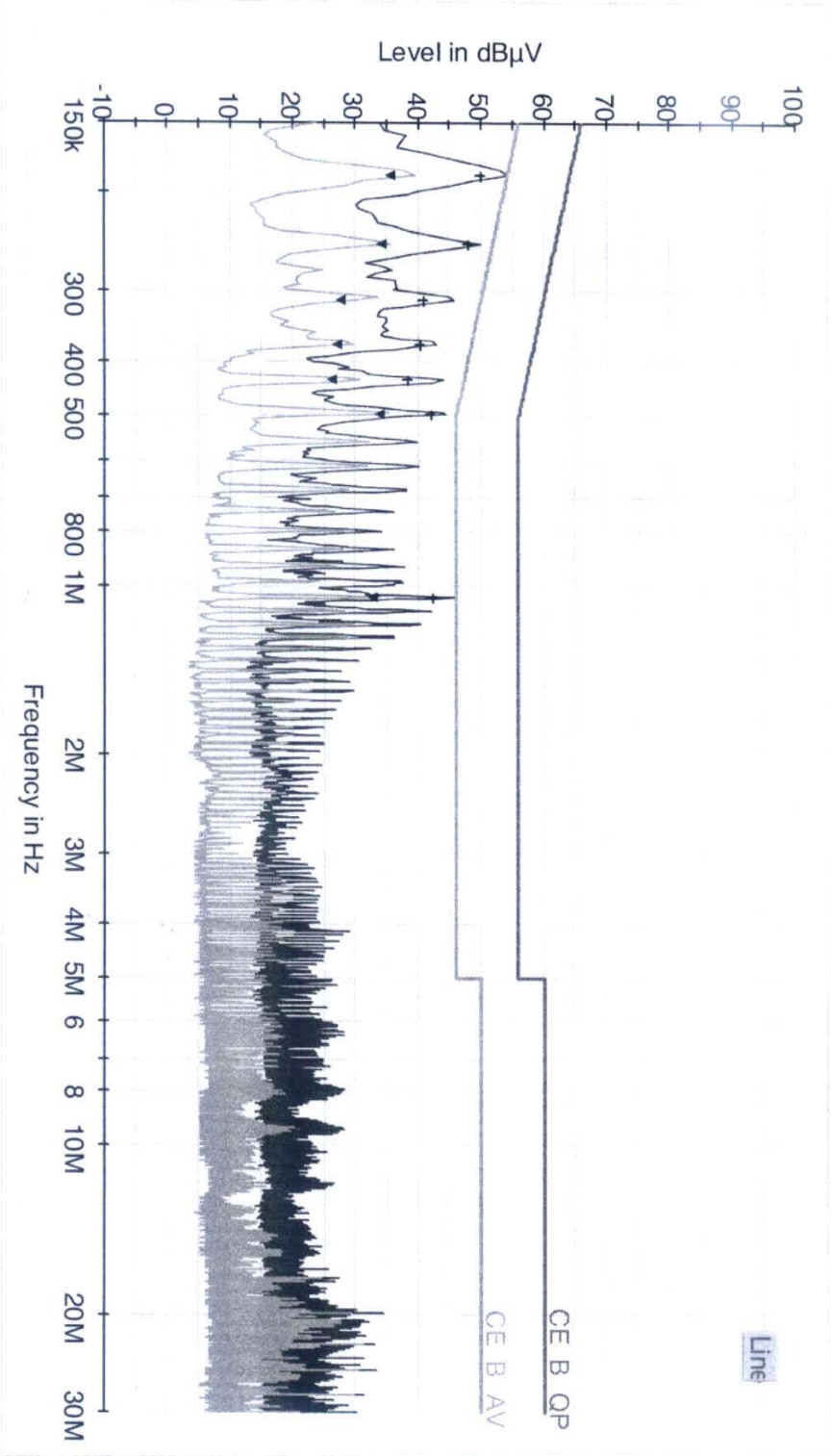


Figure 2: Spectral Diagram, NEUTRAL-PE

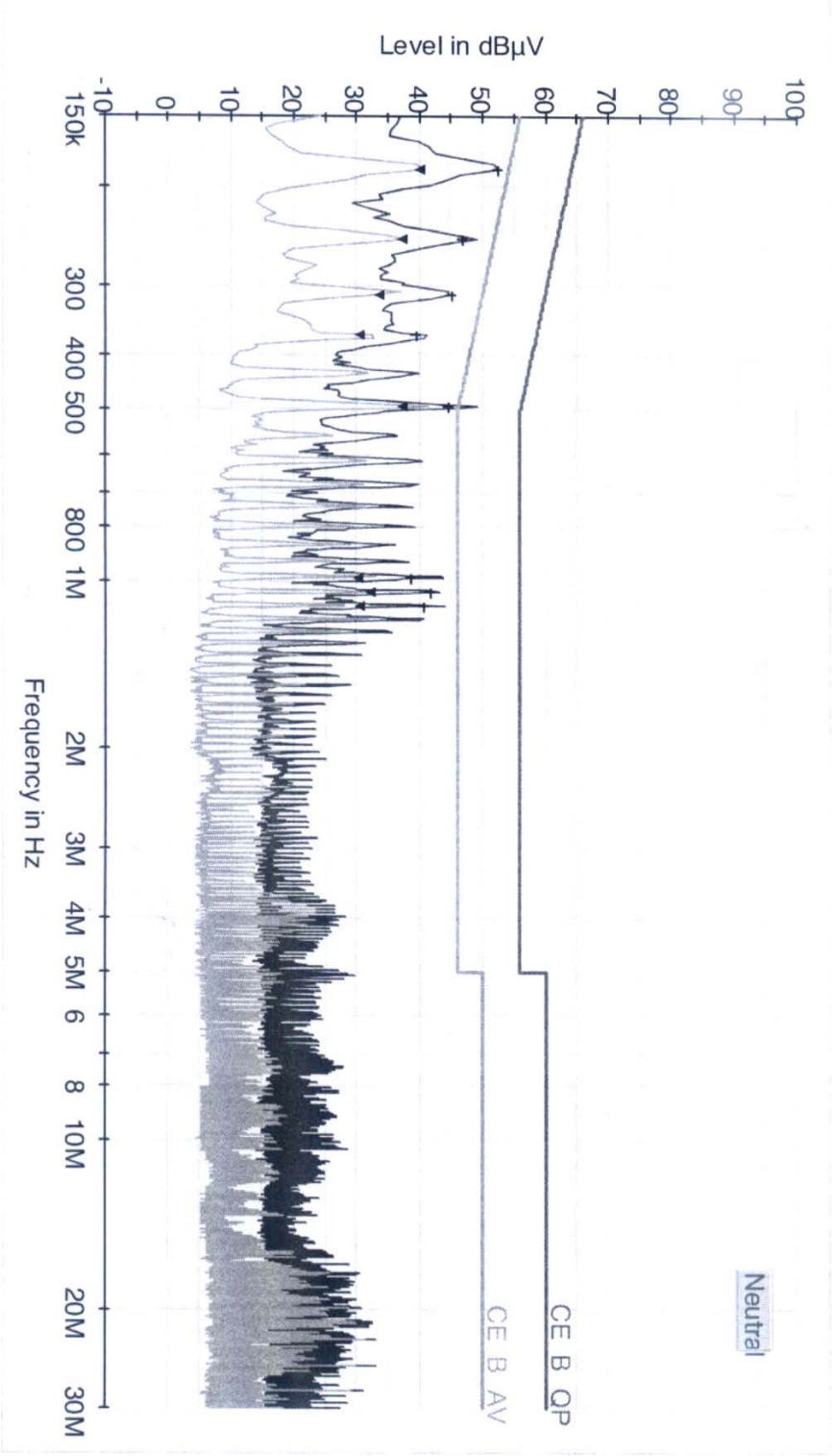


Table 2: Test Data, Conducted Emissions

Frequency (MHz)	(1) Reading (dBμV)	Line	(2)C/F (dB)	(3)Actual (dBμV)	(4) Limit (dBμV)	(5) Margin (dB)
0.19	52.30	L2	0.18	52.48	64.04	11.56
0.25	47.87	L1	0.19	48.06	61.76	13.70
0.31	44.99	L2	0.14	45.13	59.97	14.84
0.49	44.57	L2	0.21	44.78	56.17	11.39
1.05	42.23	L1	0.23	42.46	56.00	13.54
1.11	40.52	L2	0.20	40.72	56.00	15.28

NOTES:

1. All modes of operation were investigated
   And the worst-case emissions are reported.
2. All other emissions are non-significant.
3. All readings are calibrated by self-mode in receiver.
4. Measurements using CISPR Quasi-peak mode.
5. L1 = LINE-PE, L2 = NEUTRAL-PE
6. C/F = Correction Factor(LISN factor + Cable loss)
7. The limit for Class B digital device is 66dBuV to 56dBuV from 150KHz to 500KHz, 56dBuV from 500KHz to 5MHz, 60dBuV Above 5MHz.

♠ Margin Calculation

(5) Margin = (4) Limit – (3) Actual

[(3) Actual = (1) Reading + (2) C/F]

5.2 Radiated Emissions

Result: Pass

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband Amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and Investigated. The system configurations, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1GHz using Biconic Logarithmic Periodic Antenna. Above 1GHz, Double ridged horn Antenna was used.

Final measurements were made outdoors at 3-meter test range using Schwarzbeck antennas. The test equipment was placed on a wooden table situated on a 4x4 meter area adjacent to the measurement area. Turntable was to protect from weather in the dome that made with Polyethylene film. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter (ESIB40). The detector function was set to CISPR quasi-peak or peak mode as appropriate and the bandwidth of the receiver was set to 120kHz or 1 MHz depending on the frequency or type or signal.

The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8meter high non-metallic 1 x 1.5 meter table.

The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed, and/or support equipment, if applicable; and changing the polarity of the antenna and rotating the EUT in turns with three orthogonal axes for portable devices, whichever determined the worst-case emission.

Photographs of the worst-case emission can be seen in photograph of radiated emission test.

Each EME reported was calibrated using self-calibrating mode.

Table 3: Test Data, Radiated Emissions

Frequency (MHz)	Pol.	Height [m]	Angle [°]	(1) Reading (dBμV)	(2) AFCL (dB/m)	(3) Actual (dBμV/m)	(4) Limit (dBμV/m)	(5) Margin (dB)
48.56	V	1.06	32	21.50	13.40	34.90	40.00	5.10
125.00	V	1.10	192	22.50	11.53	34.03	43.50	9.47
298.60	V	1.18	45	21.40	17.34	38.74	46.00	7.26
335.48	H	2.56	50	21.20	18.84	40.04	46.00	5.96
575.08	V	1.19	38	15.60	25.71	41.31	46.00	4.69
623.00	V	1.12	40	16.20	25.71	41.91	46.00	4.09

Table. Radiated Measurements at 3-meters

Notes: 1.All modes of operation were investigated.
And the worst-case emission are reported.

2.All other emission is non-significant.

3.All readings are calibrated by self-mode in receiver.

4.Measurements using CISPR quasi-peak mode.

5.AFCL = Antenna factor and cable loss

6.H = Horizontal, V = Vertical Polarization

7. The limit for Class B digital device is 100uV(40dBuV) from 30MHz to 88MHz, 150 uV (43.5dBuV) from 88MHz to 216MHz, 200uV(46dBuV) from 216MHz to 960MHz and 500 uV (54dBuV) from above 960MHz.

♠ Margin Calculation

(5) Margin = (4) Limit – (3) Actual

[(3) Actual = (1) Reading + (2) AFCL]

6. TEST AND MEASUREMENTS

Summary of Test Results

Table 4: Test Data, Radiated Emissions

Requirement	CFR Section	Report Section	Test Result
Antenna Requirement	15.203	6.1	PASS
Radiated Spurious Emissions	15.209	6.2	PASS
Conducted Emissions	15.207	*	*
Radiated Spurious Emissions	15.109	*	*
Conducted Emissions	15.107	*	*

***According to the Section 15.33(b)(1)&(c), Radiated Emissions & Conducted Emissions were reported in Report No.KTI07EF12004.**

6.1 ANTENNA REQUIREMENT

6.1.1 Regulation

FCC section 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack of electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

6.1.2 Results: PASS

The transmitter has an integral loop coil antenna and meets the requirements of this section.

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6.2 Test and Measurements

6.2.1 Regulation

-Emissions below 30MHz

According to 15.209, the field strength of emissions from intentional radiators operated under this frequency band shall not exceed the following:

Frequency(MHz)	Field strength	Calculation of Field strength(μN/m)	Calculation of Field strength(dBμN/m)
0.009 – 0.490	2400/F(kHz) (μN/m@300m)	266.7 - 4.9 (μN/m@300m)	48.5 – 13.8 (dBμN/m@300m)
0.490 – 1.705	24000/F(kHz) (μN/m@30m)	49.0 – 14.1 (μN/m@30m)	33.8 – 23.0 (dBμN/m@30m)
1.705 – 30.0	30(μN/m@30m)	30(μN/m@30m)	29.5(dBμN/m@30m)

-Emissions above 30MHz

According to the Section 15.33(b)(1) and 15.109, Radiated Emissions were reported in Report No.KTI07EF12004

6.2.2 Measurement Procedure

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8meter high nonconductive table that sits on a flush mounted metal turntable. Preview tests are performed to determine the “worst case” mode of operation. With the EUT operating in “worst case” mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable.

The initial step in collecting radiated data is a peak scan of the measurement range with an EMI test receiver under closer distances as given in the rule. The significant peaks are then measured with the appropriate detectors(QP, AV and PK).

6.2.3 Calculation of the field strength limits

-Emissions below 30MHz

No special calculation for obtaining the field strength in dBμN/m is necessary, because the EMI receiver and the active loop antenna operate as a system, where the reading gives directly the field strength result(dBμN/m). The gain antenna factors and cable losses are already taken into consideration.

For test distance other than what is specified, but fulfilling the requirements of section 15.31 (f)(2) the field strength is calculated by adding additionally an extrapolation factor of 40dB/decade(inverse lineardistance for field strength measurements).

All following emission measurements were performed using the test receiver's average detector and peak detector function.

The basic equation is as follow;

FS = RA + DF

Where

FS = Field strength in dBμN/m

RA = Receiver Amplitude in dBμN/m

DF = Distance Extrapolation Factor in dB

Where DF = 20log(Dtest/Dspec) where Dtest = Test distance and Dspec = Specified Distance

DF = 40log(3m/300m) = -80dB (Frequency : 0.009 ~ 0.490 MHz)

DF = 40log(3m/30m) = -40dB (Frequency : 0.490 ~ 30 MHz)

6.2.4 Test Results : PASS

The results of the field strength of the fundamental and spurious/harmonic emissions are shown in Table 5. The worst-case emission level is 13.94 dBμN/m @ 3m at 0.633 MHz, This is 17.63 dB below the specified limit.

Table 5 : Measured values of the Field Strength (below 30MHz)					
Frequencty (MHz)	Reading (dBμN)	AFCL (dB/m)	Actual (dBμV/m)	Limit (dBμN/m)	Margin (dB)
Emissions (Average Detector)					
0.126 (Fundamental)	61.38	18.13	- 0.49	25.59	26.08
0.252	32.31	12.92	- 34.77	19.58	54.35
0.333	32.73	12.92	- 34.35	17.56	51.91
0.379	30.45	12.92	- 36.63	16.03	52.66
Emissions (Peak Detector)					
0.127 (Fundamental)	62.90	18.13	1.03	25.59	24.56
0.236	44.04	12.92	- 23.04	20.15	43.19
0.633	41.82	12.12	13.94	31.57	17.63
9.019	38.56	9.77	8.33	29.54	21.21
28.47	38.17	6.51	4.68	29.54	24.86
Emissions DATA 15.205 Restricted Bands					
No Emissions Found					

Margin (dB) = Limit – Actual
[Actual = FS + AF + CL]

2.AF/CL = Antenna Factor and Cable Loss

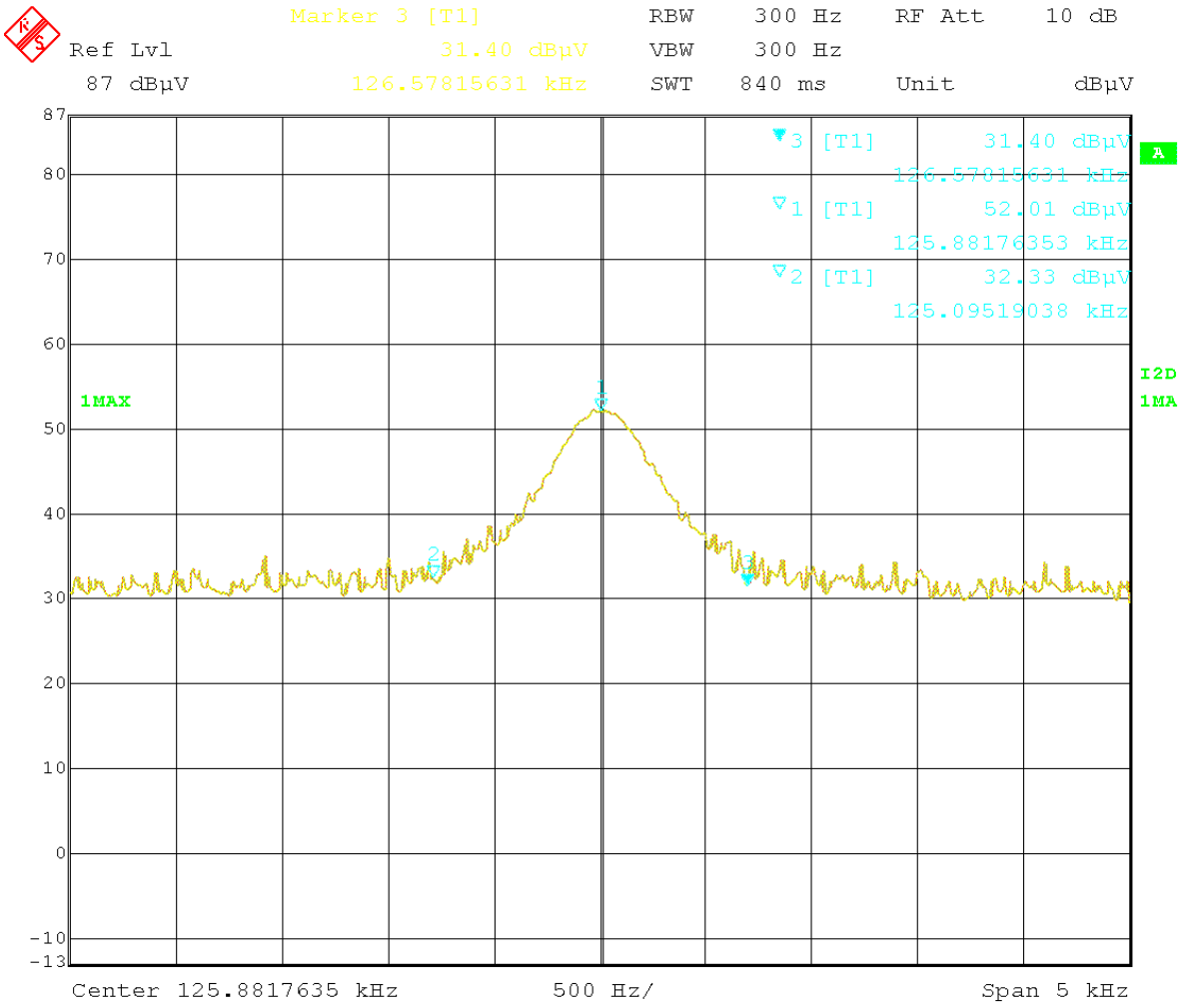
3.FS = RA + DF

Where FS = Field strength in dBuV/m

RA = Reciever Amplitude in dBuV/m

DF = Distance Extrapolation Factor in dB

Occupied Bandwidth

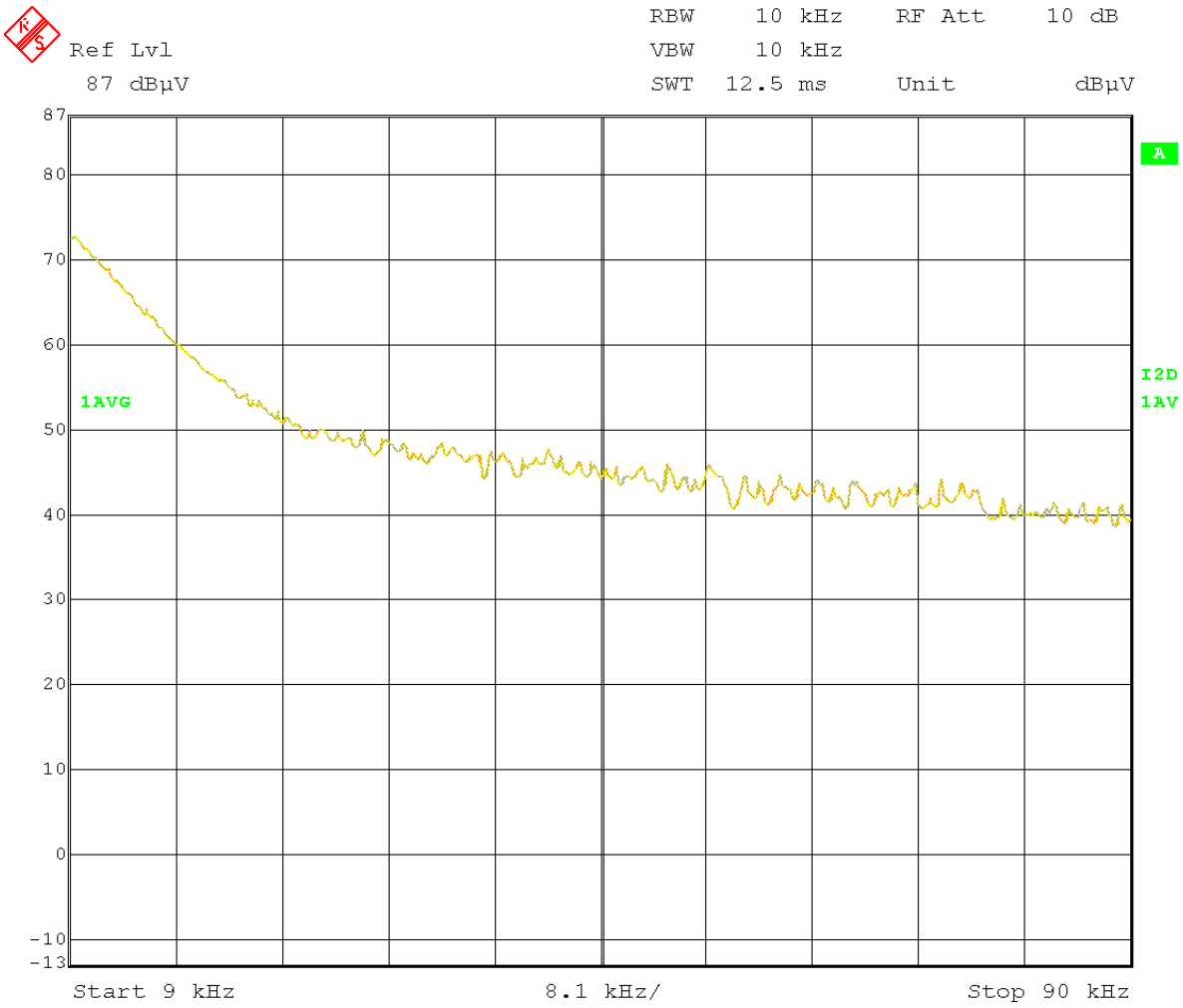


F_L = 125.095 kHz

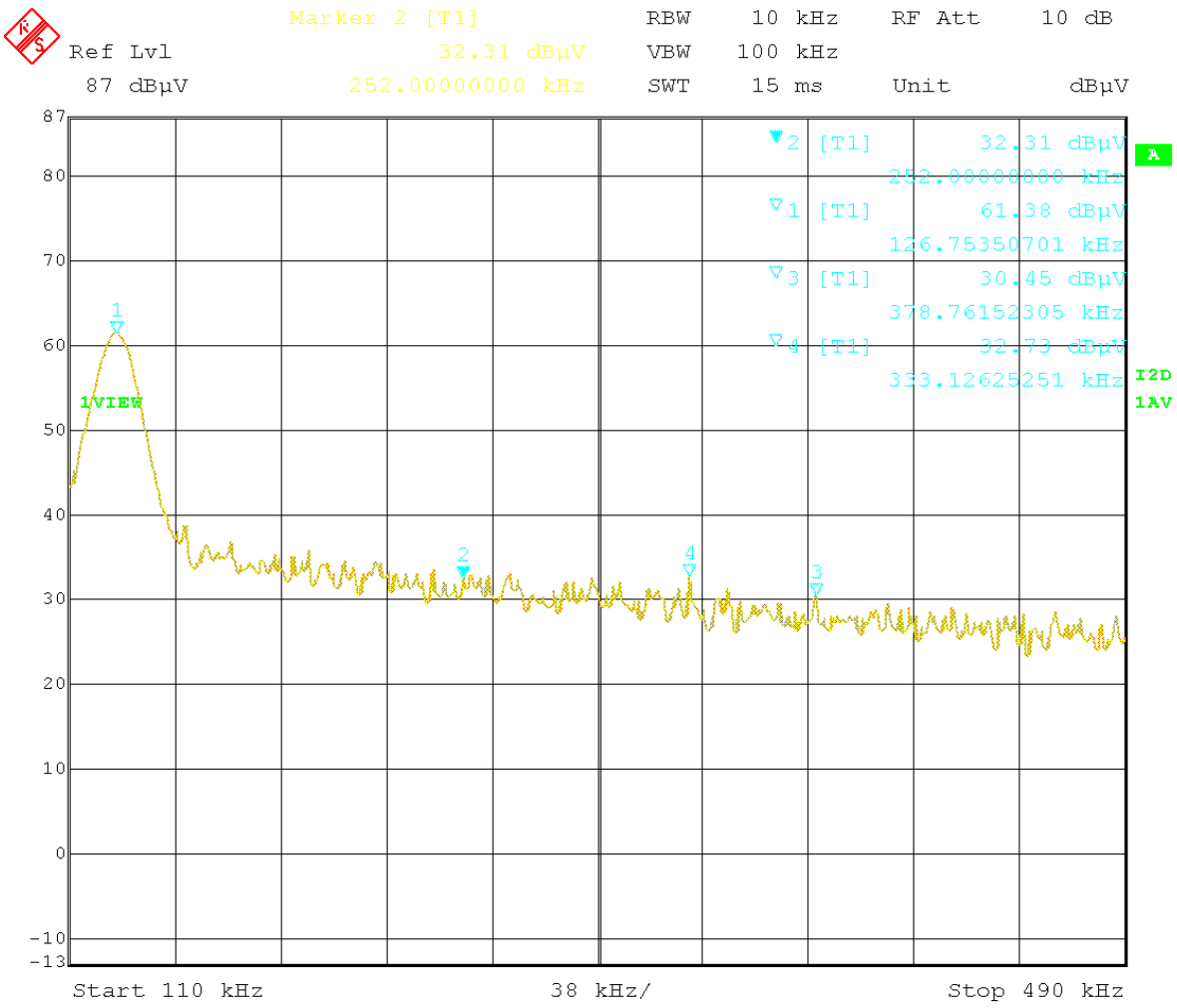
F_H= 126.570 kHz

Occupied Bandwidth = 1.475 kHz

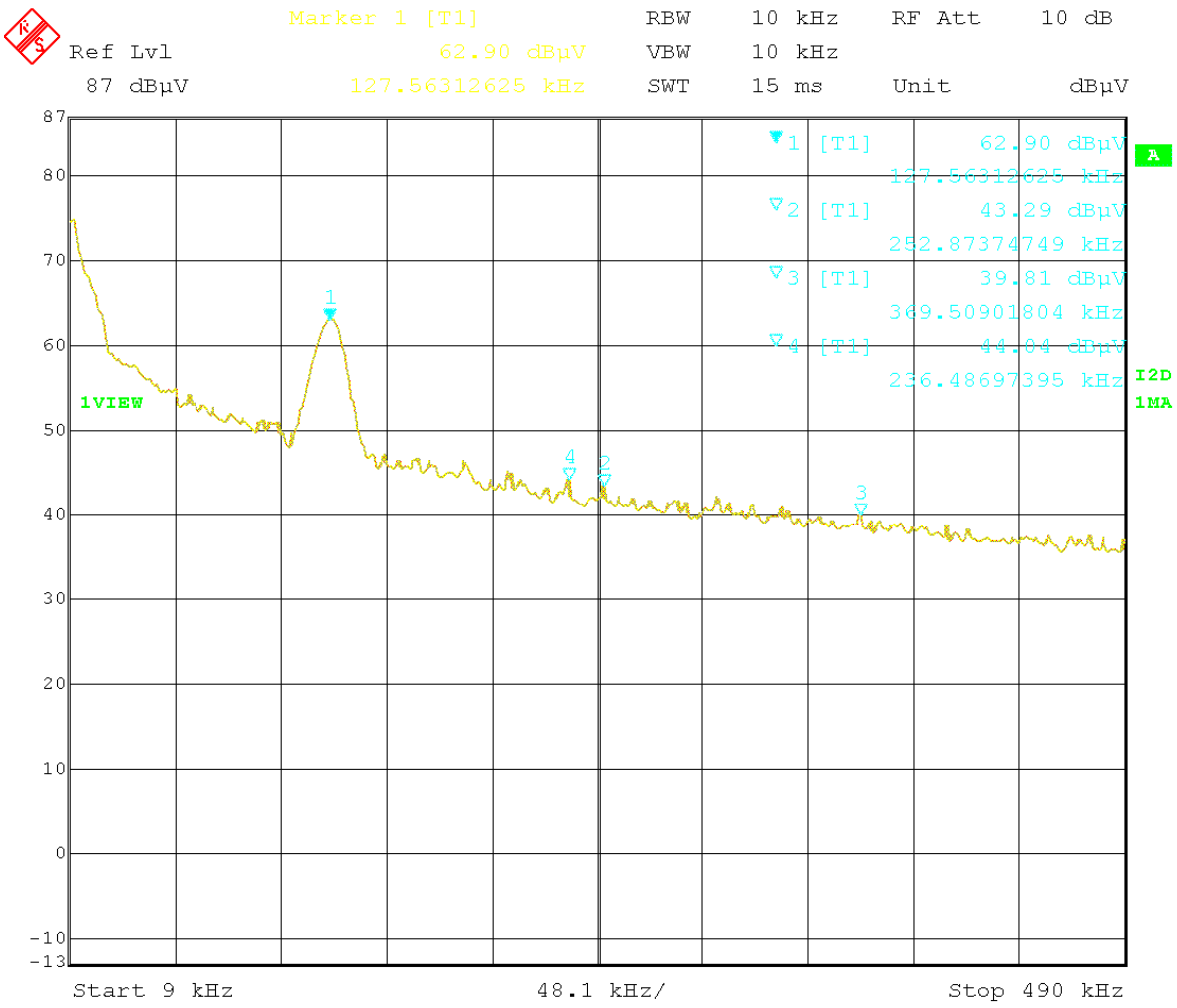
Emissions below 30MHz (9 - 90 kHz)



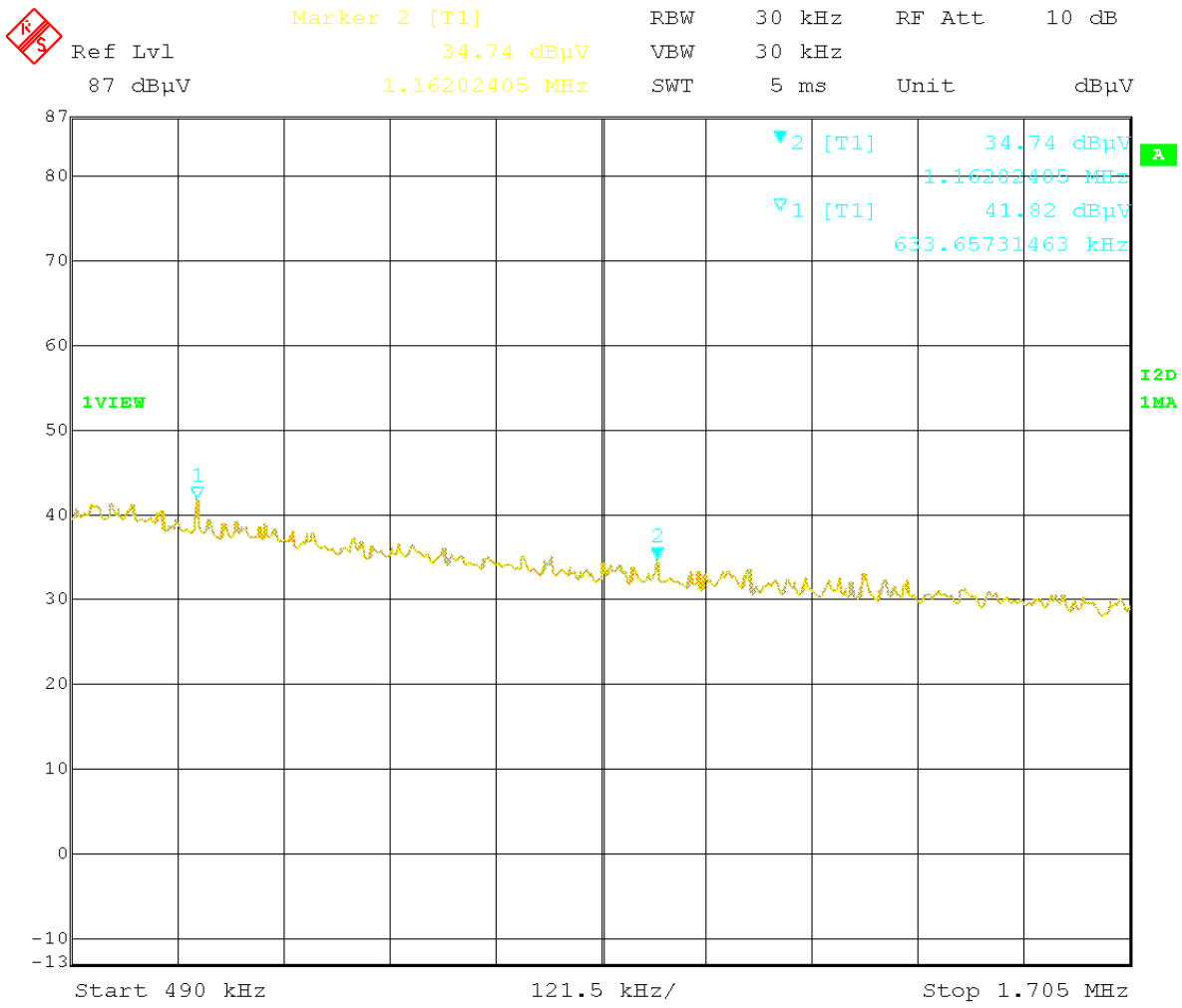
Emissions below 30MHz (110 – 490 kHz)



Emissions below 30MHz (9 – 490 kHz)



Emissions below 30MHz (490 kHz – 1.705MHz)



Emissions below 30MHz (1.705 – 30 MHz)