

**Estech Co., Ltd.**

97-1, Hooeok-ri, Majang-myun, Ichion-city, Gyonggi-do, South Korea

TEL : +82 31 6318037 FAX : +82 31 6318039 www.estech.co.kr

## Test Report for FCC

FCC ID : ZGB-IPBT-300

Report Number		ESTF151410-007			
Applicant	Company name	PNF CO, LTD			
	Address	(Sangdaewon-dong, Dayou-A-tech), 509, Dunchon-daero, Jungwon-gu, Seongnam-si, Gyeonggi-do, 462-807 South Korea			
	Telephone	+82-31-8022-9820			
	Contact Person	Jin-gu KIM			
Product	Product name	Equil SmartMarker			
	Model No.	IPBT-300	Manufacturer	PNF CO, LTD	
	Serial No.	NONE	Country of origin	KOREA	
Test date	17-Sep-14		Date of issued	30-Oct-14	
Test location	ESTECH Co., Ltd. 97-1, Hooeok-ri, Majang-myun, Ichion-city, Gyonggi-do, South Korea				
Standard	FCC PART 15 (2010) , ANSI C 63.4 2009				
Test item	<input checked="" type="checkbox"/> Conducted Emission	<input type="checkbox"/> Class A	<input checked="" type="checkbox"/> Class B	Test result	OK
	<input checked="" type="checkbox"/> Radiated Emission	<input type="checkbox"/> Class A	<input checked="" type="checkbox"/> Class B	Test result	OK
Measurement facility registration number		659627			
Tested by	Engineer S.B. Lee		(Signature)		
Reviewed by	Engineering Manager J.M. Yang		(Signature)		
Abbreviation	OK, Pass = Complied, Fail = Failed, N/A = not applicable				
<p>* Note</p> <p>- This test report is not permitted to copy partly without our permission</p> <p>- This test result is dependent on only equipment to be used</p> <p>- This test result based on a single evaluation of one sample of the above mentioned</p>					



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Appendix 1. Special diagram



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## 1. Laboratory Information

### 1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report. ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.

ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

### 1.2 Test Lab.

Corporation Name : ESTECH Co. Ltd

Head Office : Rm 1015, World Venture Center II, 426-5, Gasan-dong, Geumcheon-gu, Seoul, Korea

EMC Test Lab : 97-1, Hooeok-ri, Majang-myun, Ichion-city, Gyonggi-do, South Korea

### 1.3 Official Qualification(s)

KCC : Granted Accreditation from Ministry of Information & Communication for EMC, Safety and Telecommunication

KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC requirements

FCC : Conformity Assessment Body(CAB) with registration number 659627 under APEC TEL MRA between the RRA and the FCC.

VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE



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## 2. Description of EUT

### 2.1 Summary of Equipment Under Test

Product : Equil SmartMarker

Model Number : IPBT-300

Serial Number : NONE

Manufacturer : PNF Co, LTD

Country of origin : KOREA

Rating : <receiver>  
- INPUT : AC (100 ~ 240) V, (50 ~ 60) Hz, 0.15 A  
- OUTPUT : DC 5 V, 1.0 A  
- BATTERY : BATTERY DC 3.7 V  
<smartmarker>  
- BATTERY DC 3.7 V  
<eraser>  
- BATTERY DC 1.5 V, AA Size 1 ea

X-tal list(s) or : The highest operating frequency is 2 480 MHz(Bluetooth)  
Frequencies generated : XTAL : 12 MHz : 2 ea , 32.768 MHz : 1ea, Bluetooth : 2.4 GHz

### 2.2 General descriptions of EUT

The Bluetooth frequency hopping transceiver is designed to operate between 2 400 and 2 483.5MHz.

For the detailed features, please refer to the manufacturer's specifications or User's Manual.

The system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information) stream. It is also comply with FHSS requirements in Section 15.247(a)(1).: Its hopping sequence is pseudo random, all channels used equally on average. The receiver input bandwidth approximately equal the transmit band bandwidth, and its hop in sequence with the transmit signal.– the system does not coordinate its channel selection/hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.



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### 3. Test Standards

#### Test Standard : FCC PART 15 (2010)

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

#### Test Method : ANSI C 63.4 (2009)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain devices that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment. These methods apply to the measurement of individual units or systems comprised of multiple units.



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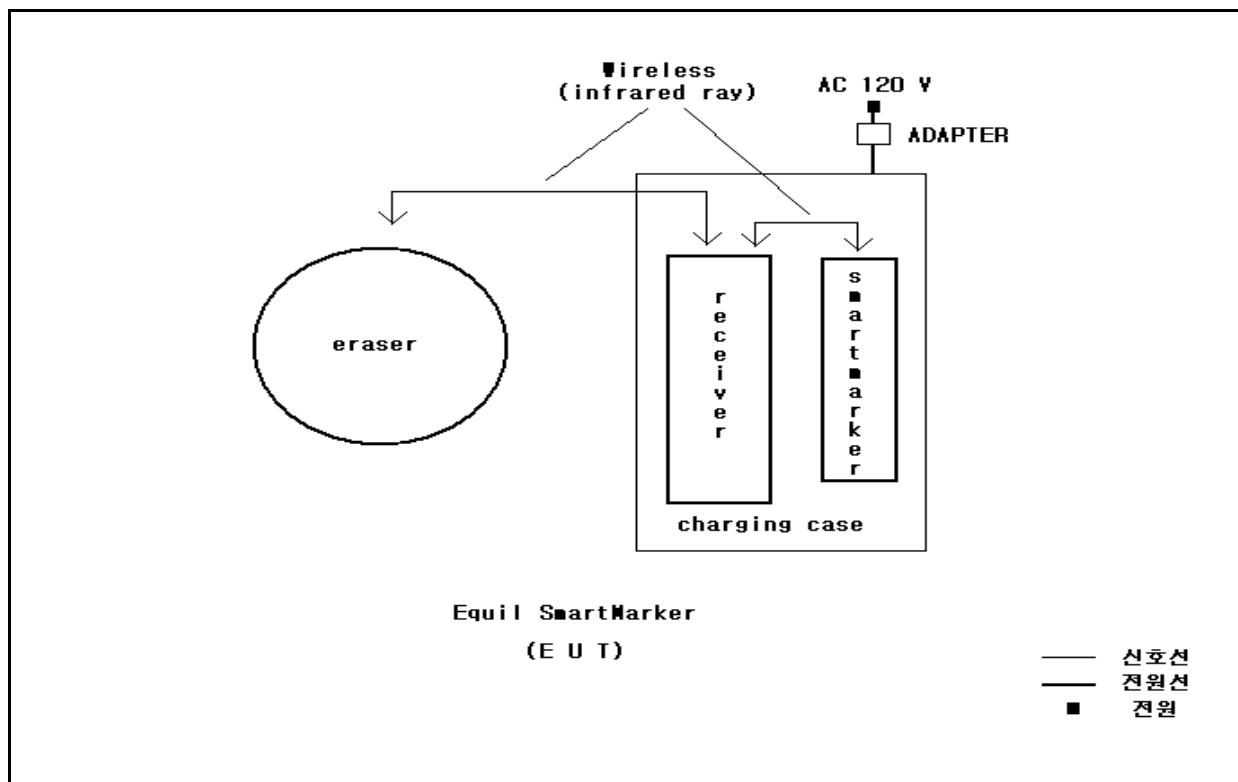
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## 4. Measurement Condition (ADAPTER MODE)

### 4.1 EUT Operation.

- \* The EUT was in the following operation mode during all testing
- \* The operational conditions of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected highest level of emission
- \* Monitoring the charging status of the receiver and smart Marker Pen
- \* receiver Connect to Wireless (infrared ray) eraser and smartmarker

### 4.2 Configuration and Peripherals





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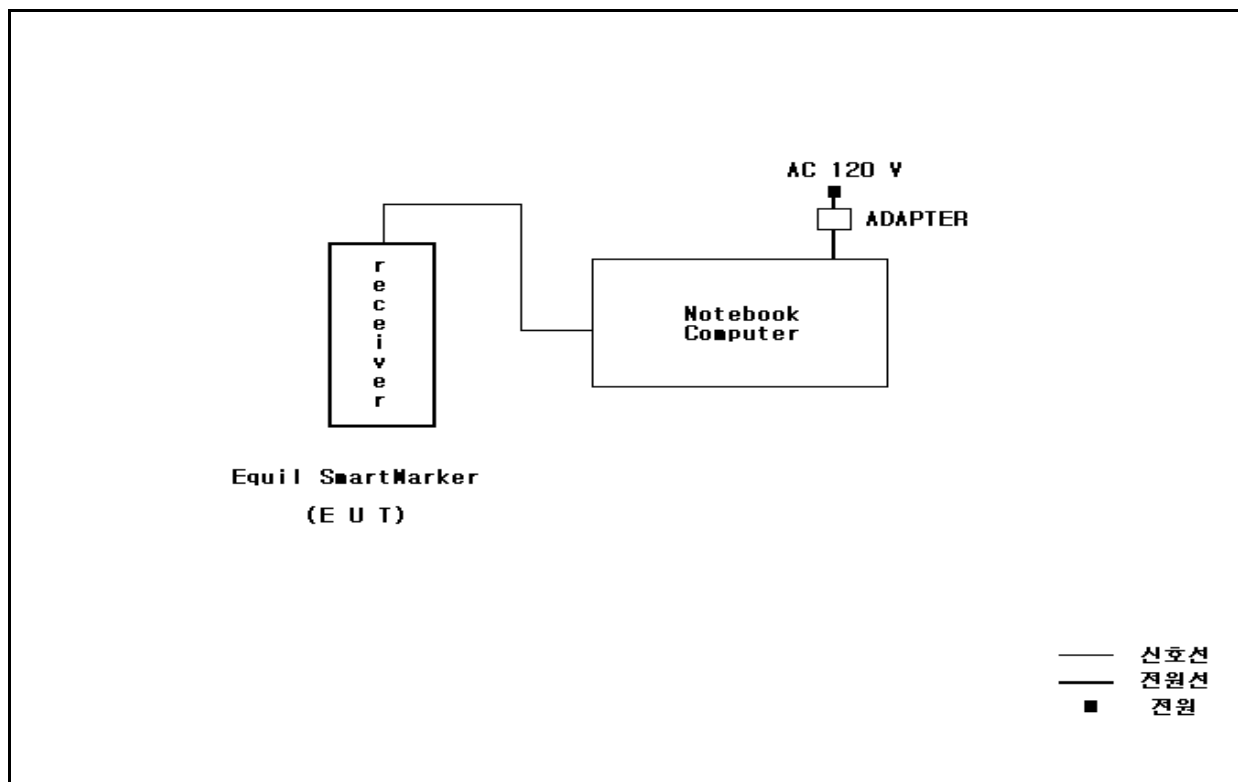
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## 4. Measurement Condition (PC LINK MODE)

### 4.1 EUT Operation.

- \* The EUT was in the following operation mode during all testing
- \* The operational conditions of the EUT was determined by the manufacturer according to the typical use of the EUT with respect to the expected highest level of emission
- \* Using a test program to connect the USB cable between the EUT and Note PC data read / write execution

### 4.2 Configuration and Peripherals





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#### 4.3 EUT and Support equipment (ADAPTER MODE)

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Equil SmartMarker	IPBT-300	NONE	PNF CO, LTD	EUT
ADAPTER	HDP-QB05010U	NONE	HDP	

#### 4.4 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Equil SmartMarker (receiver)	Docking Terminal	Equil SmartMarker (charging case)	Docking Terminal	-	-	
Equil SmartMarker (smartmarker)	Docking Terminal	Equil SmartMarker (charging case)	Docking Terminal	-	-	
Equil SmartMarker (charging case)	Micro USB	ADAPTER	Micro USB	3.0	Shielded	with ferrite core
Equil SmartMarker (receiver)	Wireless (infrared ray)	Equil SmartMarker (eraser)	Wireless (infrared ray)	-	-	
Equil SmartMarker (receiver)	Wireless (infrared ray)	Equil SmartMarker (smartmarker)	Wireless (infrared ray)	-	-	





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#### 4.3 EUT and Support equipment (PC LINK MODE)

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Equil SmartMarker	IPBT-300	NONE	PNF CO, LTD	EUT
Notebook Computer	ProBook 4530s	NONE	HEWLETT-PACKARD COMPANY	
ADAPTER	PPP009D	WBGSV0AAR1MTWI	DELTA ELECTRONICS (JIANG SU), LTD.	

#### 4.4 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Equil SmartMarker (receiver)	Micro USB	Notebook Computer	USB	3.0	Shielded	with ferrite core
Notebook Computer	POWER	ADAPTER	-	2.0	Shielded	



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## 5. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15 (2010) . The test setup was made according to ANSI C 63.4 (2009) on an 10 m semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of Plastic table. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

### 5.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESCI7	ROHDE & SCHWARZ	100916	13-Jan-15
Logbicon Antenna	VULB 9168	SCHWARZBECK	237	13-Jan-15
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00595	13-Jan-15
Horn Antenna	BBHA9120D	SCHWARZBECK	469	11-Nov-14
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	13-Jan-15
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Antenna Master & Turn table controller	CO2000-P	Innco System GmbH	CO2000/642 /28051111/L	-

### 5.2 Environmental Condition

Below 1 GHz -Test Place : 10 m Semi-anechoic chamber

#### (ADAPTER MODE)

Temperature (°C) : 20.4 °C

Humidity (% R.H.) : 55.9 % R.H.

#### (PC LINK MODE)

Temperature (°C) : 21.4 °C

Humidity (% R.H.) : 55.1 % R.H.

Above 1 GHz-Test Place : 3 m Semi-anechoic chamber

#### (ADAPTER MODE)

Temperature (°C) : 22.4 °C

Humidity (% R.H.) : 54.9 % R.H.

#### (PC LINK MODE)

Temperature (°C) : 22.0 °C

Humidity (% R.H.) : 55.4 % R.H.



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### 5.3 Test data (Below 1 GHz) (ADAPTER MODE)

Test Date : 17-Sep-14

Measurement Distance :

3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Result Value(Quasi-peak)		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
90.90	15.84	V	1.0	7.70	1.45	43.50	24.99	18.51
102.20	19.42	V	1.0	8.51	1.55	43.50	29.47	14.03
144.00	6.04	H	2.2	12.34	1.83	43.50	20.21	23.29
195.00	10.91	V	1.0	9.99	2.13	43.50	23.03	20.47
225.00	11.04	V	1.0	10.62	2.29	46.00	23.95	22.05
270.00	11.83	V	1.0	12.48	2.52	46.00	26.82	19.18
435.00	11.44	H	1.5	16.61	3.22	46.00	31.26	14.74
540.00	9.29	H	1.3	18.87	3.61	46.00	31.76	14.24
720.00	10.88	H	1.2	21.38	4.18	46.00	36.44	9.56
854.80	4.64	H	1.0	23.17	4.58	46.00	32.40	13.60
Remark	H : Horizontal, V : Vertical *Result Value = Reading + Ant Factor + Cable loss *Margin= Limit - Result *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection							



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### 5.3 Test data (Below 1 GHz) (PC LINK MODE)

Test Date : 17-Sep-14

Measurement Distance :

3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Result Value(Quasi-peak)		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
72.00	16.07	V	1.0	10.85	1.30	40.00	28.22	11.78
78.00	16.76	V	1.0	9.74	1.34	40.00	27.84	12.16
84.00	21.81	V	1.0	8.68	1.39	40.00	31.88	8.12
120.10	15.41	V	1.0	10.19	1.67	43.50	27.27	16.23
132.00	14.07	V	1.0	11.40	1.75	43.50	27.23	16.27
144.00	17.51	H	1.8	12.34	1.83	43.50	31.68	11.82
207.00	19.52	H	1.6	9.80	2.20	43.50	31.52	11.98
462.00	18.96	H	1.5	17.22	3.32	46.00	39.51	6.49
474.00	18.74	H	1.4	17.50	3.37	46.00	39.61	6.39
498.00	18.51	H	1.2	18.04	3.46	46.00	40.02	5.98
954.60	7.32	H	1.0	24.17	4.85	46.00	36.34	9.66
Remark	H : Horizontal, V : Vertical *Result Value = Reading + Ant Factor + Cable loss *Margin= Limit - Result *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection							



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## 5.4 Test data (Above 1 GHz) (ADAPTER MODE)

Test Date : 17-Sep-14

Measurement Distance :

3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
Peak(RBW:1 MHz VBW:1 MHz)								
1946.00	49.28	H	1.0	26.52	-29.29	74.00	46.52	27.48
1946.00	47.84	V	1.0	26.52	-29.29	74.00	45.08	28.92
3950.00	43.31	H	1.0	29.81	-24.98	74.00	48.14	25.86
3950.00	31.58	V	1.0	29.81	-24.98	74.00	36.41	37.59
Average(RBW:1 MHz VBW:10 Hz)								
1946.00	37.13	H	1.0	26.52	-29.29	54.00	34.37	19.63
1946.00	37.33	V	1.0	26.52	-29.29	54.00	34.57	19.43
3950.00	42.91	H	1.0	29.81	-24.98	54.00	47.74	6.26
3950.00	31.87	V	1.0	29.81	-24.98	54.00	36.70	17.30
Remark	H : Horizontal, V : Vertical							
	* Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain							
	* Margin= Limit - Result							
	* The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 10 Hz for average detection at frequency above 1 GHz.							
	* Above 3950 MHz did not detect the radiated emission.							
	*Application method of the highest frequency is in the following							
	*Highest frequency of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz.							
	*Highest frequency of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.							
	*Highest frequency of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz.							
	*Highest frequency of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 40 GHz,							

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## 5.4 Test data (Above 1 GHz) (PC LINK MODE)

Test Date : 17-Sep-14

Measurement Distance :

3 m

Frequency (MHz)	Reading (dB $\mu$ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB $\mu$ V/m)	Result (dB $\mu$ V/m)	Margin (dB)
Peak(RBW:1 MHz VBW:1 MHz)								
1600.00	51.01	H	1.0	26.33	-30.53	74.00	46.81	27.19
1600.00	52.08	V	1.0	26.33	-30.53	74.00	47.88	26.12
1920.00	49.17	H	1.0	26.51	-29.32	74.00	46.35	27.65
1920.00	48.71	V	1.0	26.51	-29.32	74.00	45.89	28.11
1994.00	52.25	H	1.0	26.55	-29.22	74.00	49.58	24.42
1994.00	58.54	V	1.0	26.55	-29.22	74.00	55.87	18.13
Average(RBW:1 MHz VBW:10 Hz)								
1600.00	43.50	H	1.0	26.33	-30.53	54.00	39.30	14.70
1600.00	46.02	V	1.0	26.33	-30.53	54.00	41.82	12.18
1920.00	40.19	H	1.0	26.51	-29.32	54.00	37.37	16.63
1920.00	40.95	V	1.0	26.51	-29.32	54.00	38.13	15.87
1994.00	39.20	H	1.0	26.55	-29.22	54.00	36.53	17.47
1994.00	43.05	V	1.0	26.55	-29.22	54.00	40.38	13.62
Remark	H : Horizontal, V : Vertical							
	* Result Value = Reading + Ant Factor + Cable loss - Amplifier Gain							
	* Margin= Limit - Result							
	* The resolution bandwidth and video bandwidth of spectrum analyzer is 1 MHz and 10 Hz for average detection at frequency above 1 GHz.							
	* Above 3950 MHz did not detect the radiated emission.							
	*Application method of the highest frequency is in the following							
	*Highest frequency of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz.							
	*Highest frequency of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.							
	*Highest frequency of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz.							
	*Highest frequency of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 40 GHz,							



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## 6. Measurement of conducted disturbance

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15 (2010) . The test setup was made according to ANSI C 63.4 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

### 6.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
Test Receiver	ESPI	Rohde & Schwarz	100005	13-Jan-15
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	13-Jan-15
Pulse Limiter	ESH3-Z2	Rohde & Schwarz	NONE	13-Jan-15

### 6.2 Environmental Condition

Test Place : Shielded Room

(ADAPTER MODE)

Temperature (°C) : 21.4 °C

Humidity (% R.H.) : 53.7 % R.H.

(PC LINK MODE)

Temperature (°C) : 21.9 °C

Humidity (% R.H.) : 53.1 % R.H.



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### 6.3 Test data (ADAPTER MODE)

Test Date : 17-Sep-14

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Cispr Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB $\mu$ V)	Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB)
0.15	0.15	0.19	N	66.00	48.66	49.00	56.00		
0.17	0.14	0.19	H	64.96	45.52	45.85	54.96		
0.18	0.14	0.19	H	64.49	46.07	46.40	54.49		
0.22	0.15	0.19	N	62.82	44.61	44.95	52.82		
0.25	0.15	0.19	N	61.76	43.12	43.47	51.76		
0.28	0.14	0.20	H	60.82	43.64	43.98	50.82		
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								





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## 6.3 Test data (PC LINK MODE)

Test Date : 17-Sep-14

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Cispr Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB $\mu$ V)	Limit (dB $\mu$ V)	Reading (dB $\mu$ V)	Result (dB)
0.16	0.15	0.19	N	65.46	45.94	46.28	55.46		
0.18	0.15	0.19	N	64.49	42.52	42.86	54.49		
0.19	0.14	0.19	H	64.04	50.04	50.37	54.04		
0.25	0.14	0.19	H	61.76	42.32	42.66	51.76		
0.31	0.14	0.20	H	59.97	37.17	37.51	49.97		
14.22	0.75	0.46	N	60.00	36.04	37.25	50.00		
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								



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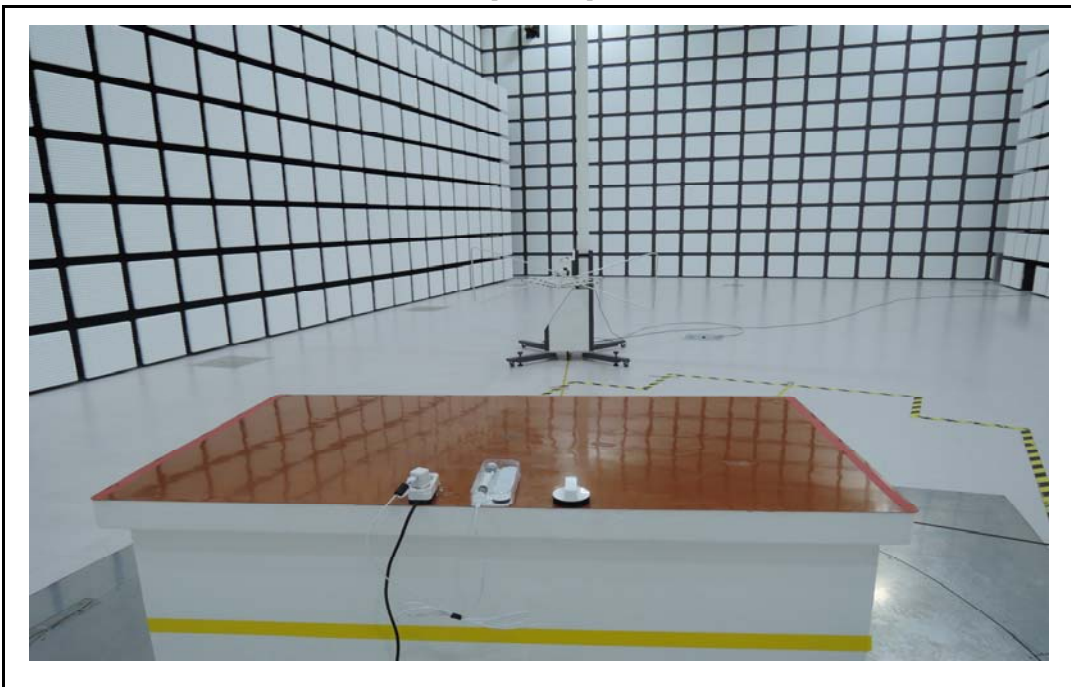
## 7. Photographs of test setup

### 7.1 Setup for Radiated Test : 30 ~ 1000 MHz (ADAPTER MODE)

[ Front ]



[ Rear ]





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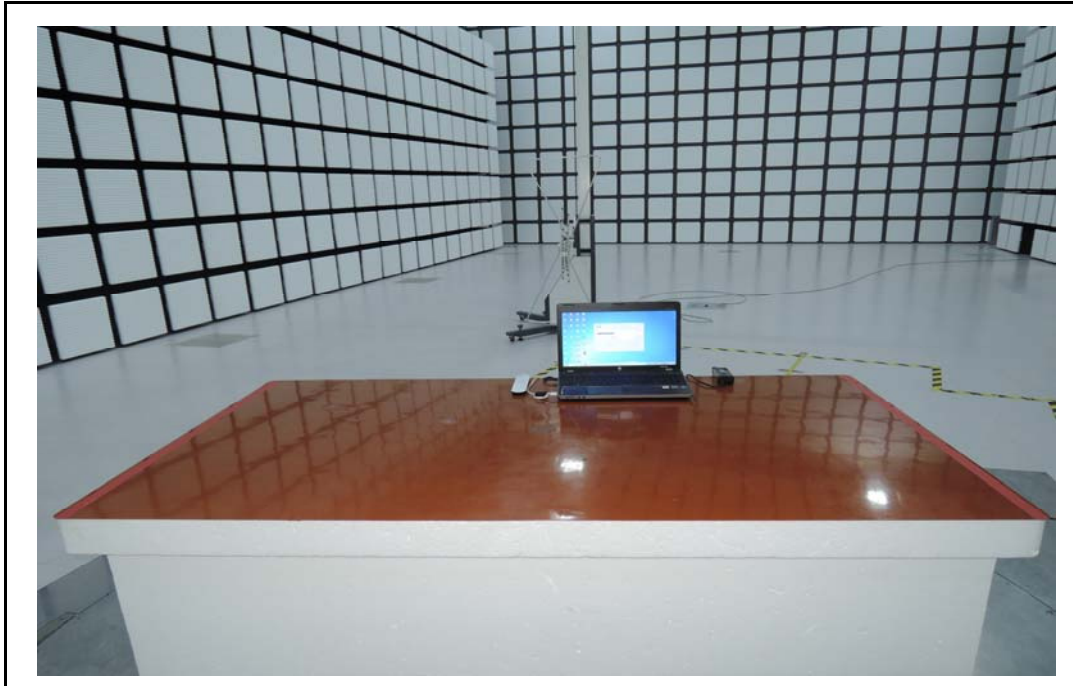
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TEL : +82 31 6318037 FAX : +82 31 6318039 [www.estech.co.kr](http://www.estech.co.kr)

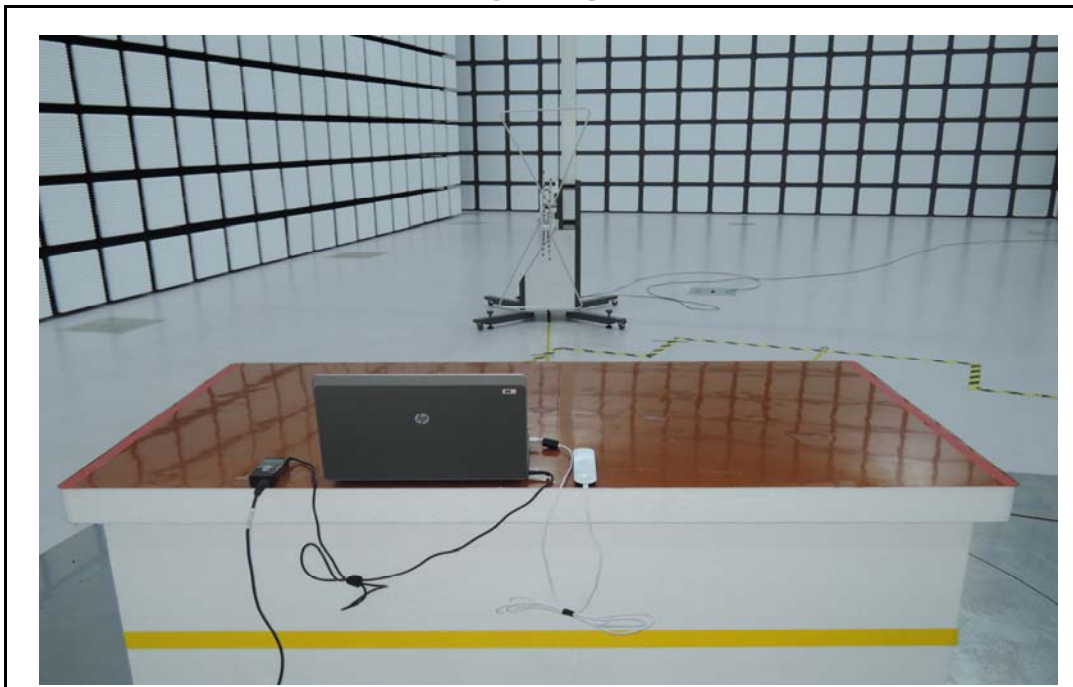
## 7. Photographs of test setup

### 7.1 Setup for Radiated Test : 30 ~ 1000 MHz (PC LINK MODE)

[ Front ]



[ Rear ]





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## 7.2 Setup for Radiated Test : above 1 GHz (ADAPTER MODE)

[ Front ]



[ Rear ]







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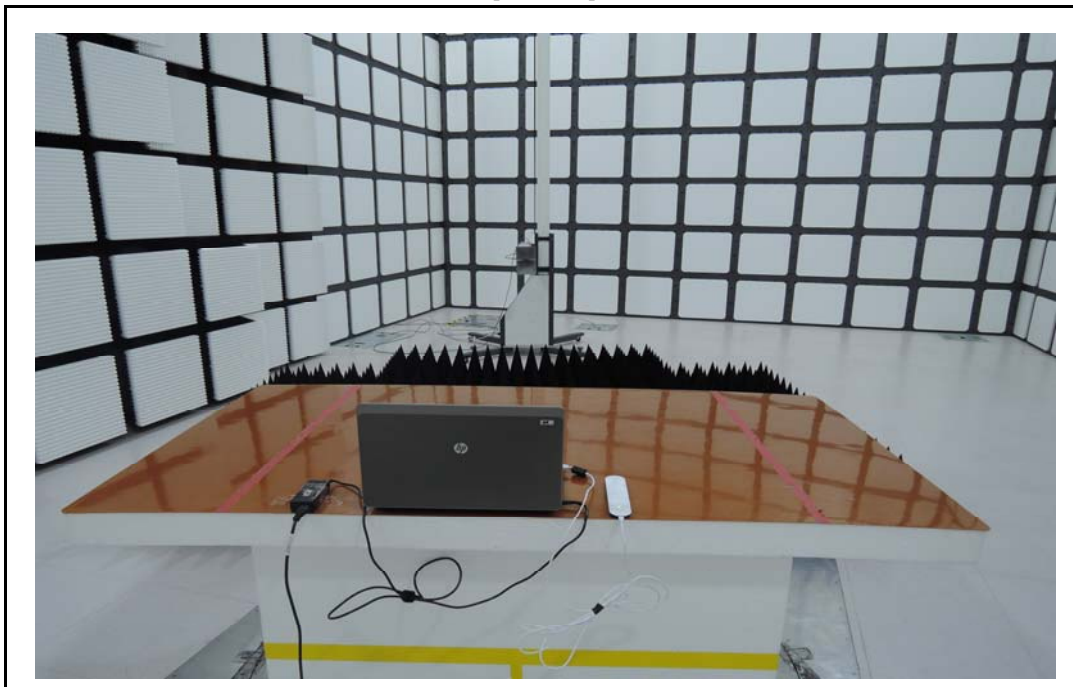
TEL : +82 31 6318037 FAX : +82 31 6318039 [www.estech.co.kr](http://www.estech.co.kr)

## 7.2 Setup for Radiated Test : above 1 GHz (PC LINK MODE)

[ Front ]



[ Rear ]





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### 7.3 Setup for Conducted Test : 0.15 ~ 30 MHz (ADAPTER MODE)

[ Front ]



[ Rear ]





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### 7.3 Setup for Conducted Test : 0.15 ~ 30 MHz (ADAPTER MODE)

[ Front ]



[ Rear ]





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## 8. Photographs of EUT

[ Front ]



[ Rear ]

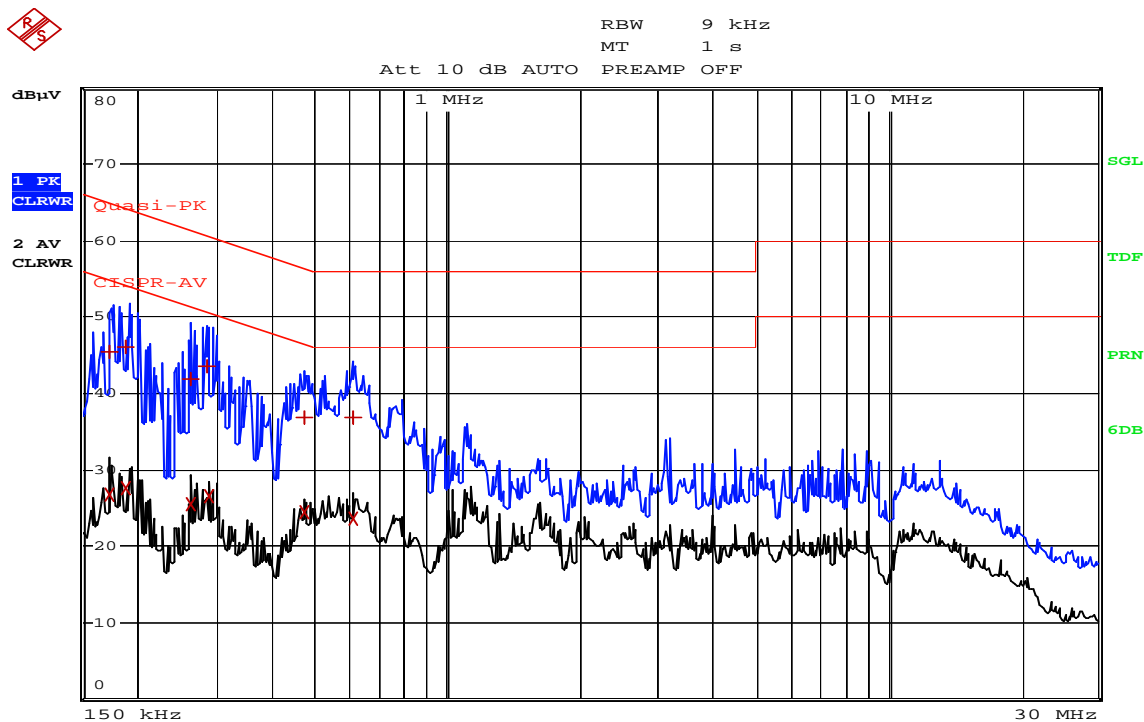




# Appendix 1. Special diagram

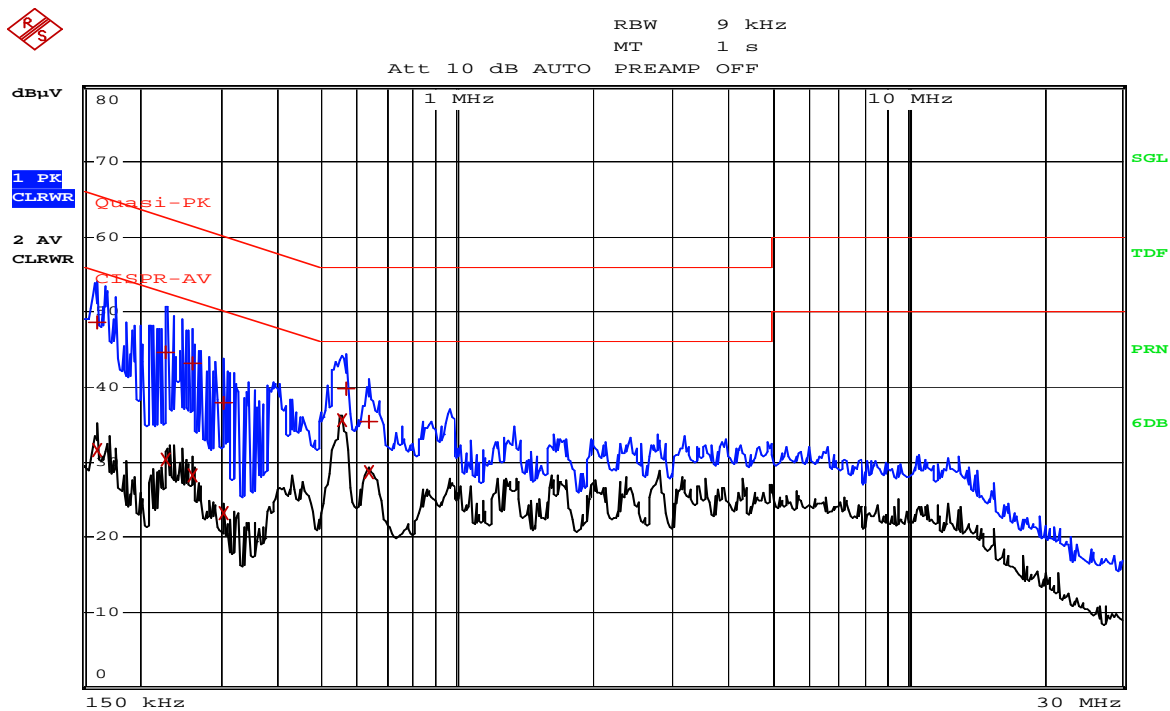
\*HOT

(ADAPTER MODE)



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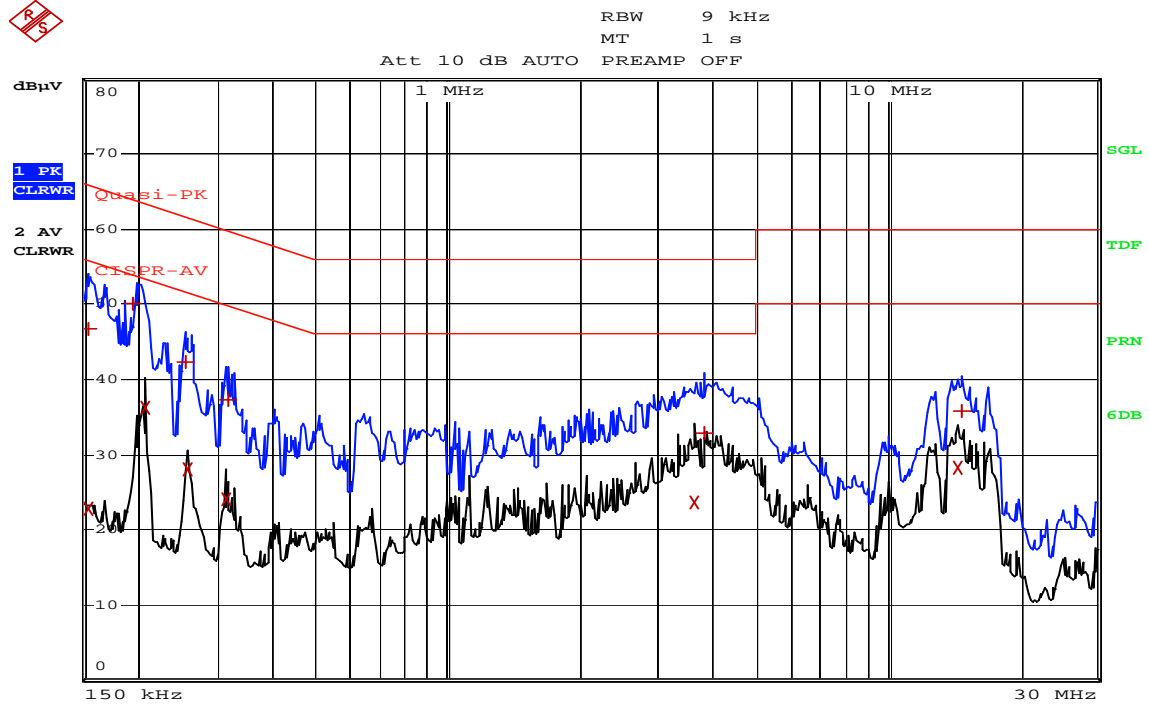
\*NEUTRAL



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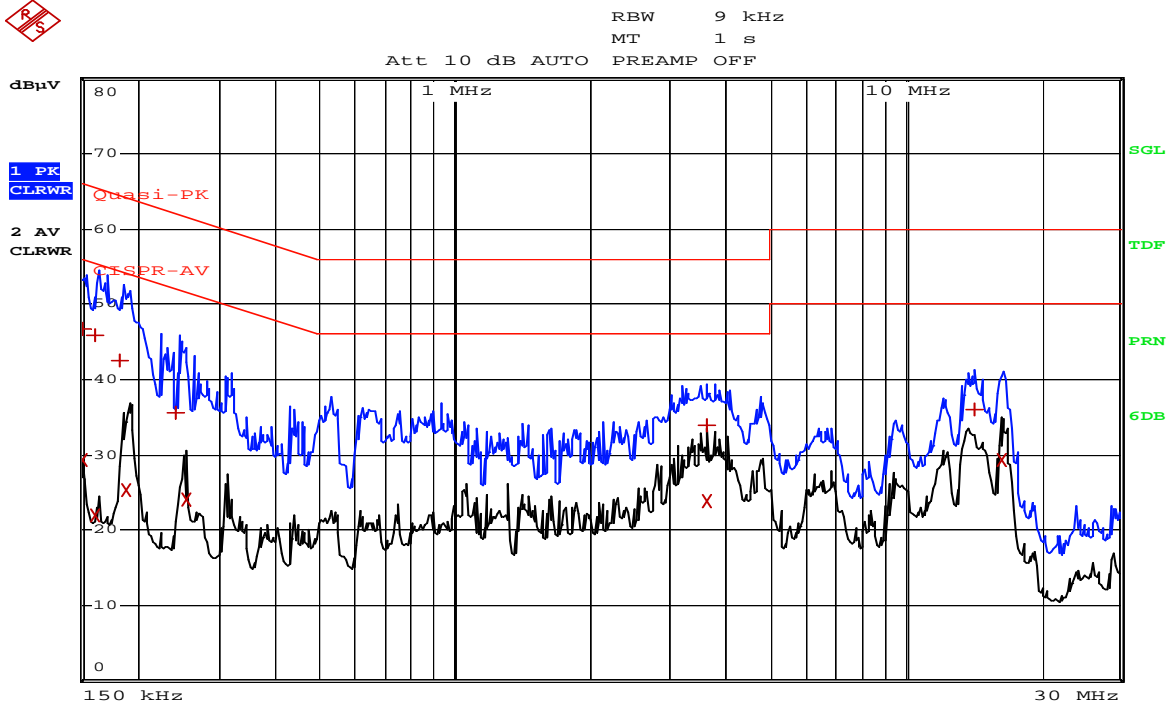
\*HOT

(PC LINK MODE)



Comment: 01467(PC LINK)\_HOT  
Date: 17.SEP.2014 15:13:17

\*NEUTRAL



Comment: 01467(PC LINK)\_NEUTRAL  
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