

**ESTECH CO., Ltd.**

347-69, Jungbu-daero 147beon-gil, Majang-myeon,
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Test Report for FCC

FCC ID : ROYSA366PBWC

Report Number		ESTF151510-001		
Applicant	Company name	Trinus Systems Inc.		
	Address	8F, RM801, UNITECHVILLE ILSAN-RO 142, ILSANDONG-GU, GOYANG-SI, GYEONGGI-DO, SOUTH KOREA Zip Code : 410-722		
	Telephone	82-31-904-5588		
	Contact person	Ahnse Lee		
Product	Product name	Body Worn Camera System		
	Model No.	ARB-SA366	Manufacturer	Trinus Systems Inc.
	Serial No.	None	Country of origin	KOREA
Test date	2015-09-24 ~ 2015-09-30		Date of issue	6-Oct-15
Testing location	347-69, Jungbu-daero 147beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do 467-811, R. O. Korea			
Standard	FCC PART 15 Subpart C (15.247), ANSI C 63.10(2009), KDB 558074 D01(2015)			
Measurement facility registration number		659627		
Tested by	Senior Engineer K.H. Chung			(Signature)
Reviewed by	Engineering Manager J.M. Yang			(Signature)
Abbreviation	OK, Pass = Passed, Fail = Failed, N/A = not applicable			
* Note - 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 based on a single evaluation of one sample of the above mentioned				



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Appendix 1. Special diagram

Appendix 2. Antenna Requirement



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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 : Suite 1015 World Meridian II, 123 Gasan Digital 2-ro, Geumcheon-gu, Seoul 153-759, R. O. Korea

EMC/Telecom/Safety Test Lab : 347-69, Jungbu-daero 147beon-gil, Majang-myeon, Icheon-si,
Gyeonggi-do 467-811, R. O. Korea

1.3 Official Qualification(s)

MSIP : 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

Modulation Type	: 802.11n (OFDM)
Transfer Rate	: MCS(0 ~ 7)
Number of Channel	: 11 ch
PEAK Output Power	: 8.69 dBm
Rating	: DC 3.7 V
Receipt Date	: 24-Sep-15
X-tal list(s) or Frequencies generated	: The highest operating frequency is 2 462 MHz

2.2 General descriptions of EUT

Category	Item	Specification
Camera	Resolution	1280 X 720
	View Angle (Horizontal)	130
	Recording Speed	30fps
	Minimum Illuminance	Color : 1.2lx, BW : 0.9lx
	Night Mode	Yes
General	Optional Camera	Yes
	Robustness	MIL810G
	Dust / Waterproof	IP54
	Dimensions	Controller -> 64.2 X 83.9 X 21mm 2 nd Camera -> 22.5Ø X 37.5mm
	Weight	Controller -> 130g (With Battery) 2 nd Camera -> 17g
	Storage	32GB
	Operating Temperature	-20 to 50°C
	Storage Temperature	-30 to 60°C
Recording	Video Compression	H.264
	Audio Format	AAC
	Time / Date Stamp	Yes

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3. Test Standards

Test Standard : FCC PART 15 Subpart C (15.247)

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 63.10 (2009) & KDB558074 D01(2015)

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.

Summary of Test Results

Applied Standard : 47 CFR Part 15 Subpart C				remark
Standard	Test Type	Result	Remark	Limit
15.207	AC Power Conducted Emission	Pass	Meet the requirement	
15.205 & 15.209	Restricted band / Intentional Radiated Emission	Pass	Meet the requirement	
15.247(a)(2)	6 dB Bandwidth	Pass	See Note 1	Min. 500 kHz
	Occupied Bandwidth			
15.247(b)(3)	Maximum Peak/average output power	Pass	See Note 1	Max. 30 dBm
15.247(c)	Transmitter Radiated Emission	Pass	Meet the requirement	Table 15.209
15.247(e)	Power Spectral Density	Pass	See Note 1	Max. 8 dBm
15.247(d)	Band Edge Measurement	Pass	See Note 1	20 dB less

Note 1: Please refer to test report ESTF151508-001 for FCC ID. That way original FCC report

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4. Measurement Condition

4.1 EUT Operation

a. Channel

Ch.	Frequency	Ch.	Frequency
1	2 412 MHz	9	2 452 MHz
2	2 417 MHz	10	2 457 MHz
3	2 422 MHz	11	2 462 MHz
4	2 427 MHz		
5	2 432 MHz		
6	2 437 MHz		
7	2 442 MHz		
8	2 447 MHz		

b. Measurement Channel : 802.11n : Low(2 412 MHz), Middle(2 437 MHz),High(2 462 MHz)

c. Test Mode : Continuous Output, OFDM

d. Test rate : 65 Mbps



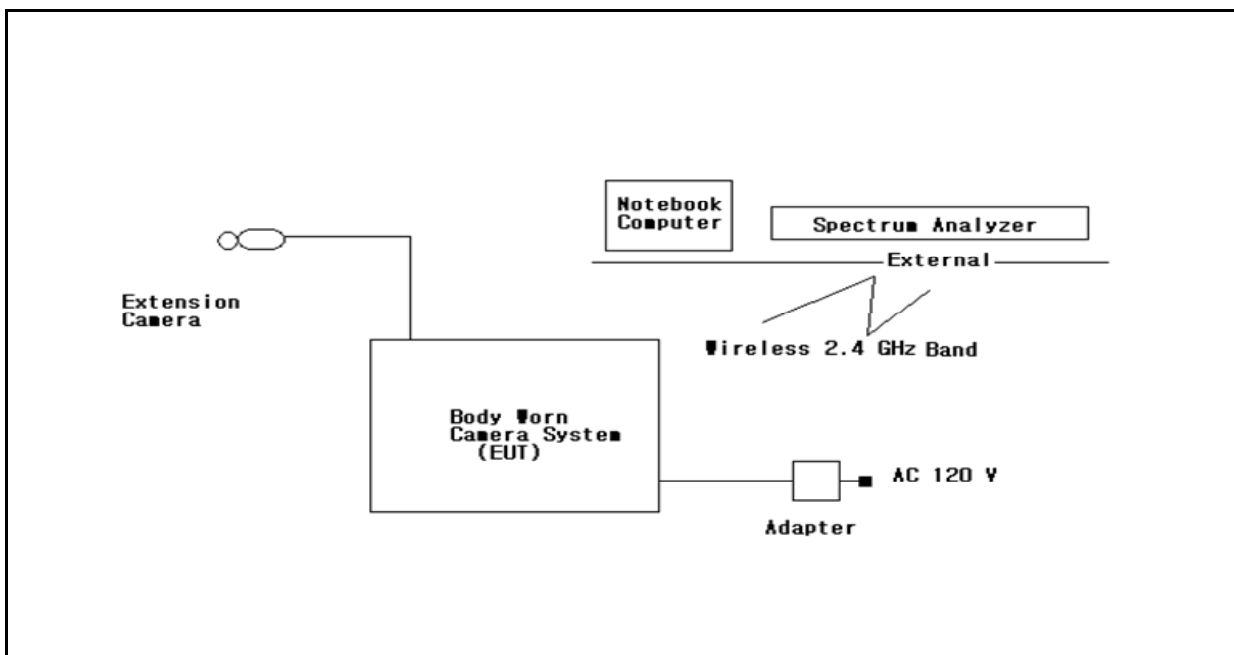
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4.2 EUT Operation.

- The EUT was in the following operation mode during all testing
 - * Execute a RF test program to enable EUT under transmission/receiving condition continuously at specific channel frequency.
 - * Transmit mode were measured each channels(Low, Middle, High)
 - * The EUT was measured up to tenth harmonic or 40 GHz of the highest operating frequency.
 - * To check normal operating used the note pc and spectrum analyzer.

4.3 Configuration and Peripherals



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4.4 EUT and Support equipment

Equipment Name	Model Name	S/N	Manufacturer	Remark (FCC ID)
Body Worn Camera System	ARB-SA366	NONE	Trinus Systems Inc.	EUT
Extension Camera(SUB)	NONE	NONE	Trinus Systems Inc.	
Adapter	ETA-U90KWK	RT4D530V/B-E	SAMSUNG	

4.5 Cable Connecting

Start Equipment		End Equipment		Cable Standard		Remark
Name	I/O port	Name	I/O port	Length	Shielded	
Body Worn Camera System	WIRELESS (2.4 GHz)	Spectrum Analyzer (External)	WIRELESS (2.4 GHz)	—	—	
Body Worn Camera System	WIRELESS (2.4 GHz)	Notebook Computer	WIRELESS (2.4 GHz)	—	—	
Body Worn Camera System	Mini-HDMI	Extension Camera	—	1.0	Shielded	SUB Camera
Body Worn Camera System	5 PIN-USB	Adapter	USB	1.0	Shielded	Charging Mode (Conducted)

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5. Emissions in non-restricted frequency bands

5.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r03 11.0 Emissions in non-restricted frequency

5.2 Test instruments and measurement setup

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions(15.247(d))

- Set instrument center frequency to DTS channel center frequency.
- Set the span to ≥ 1.5 times the DTS bandwidth.
- Set the RBW = 100 kHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum PSD level.

Limits FCC § 15.247

Band Edge&Out of Emission Test Instruments

Description	Model	Serial Number	Cal. Due Date
Spectrum Analyzer	E4440A	US42041291	15-Jan-16
RF Cable	Length: 6cm		—
—Spectrum Analyzer <=> EUT	Loss: 0.5dB		—

5.3 Measurement results of band-edge & out of emission

EUT	Body Worn Camera System	MODEL	ARB-SA366
MODE	OFDM	ENVIRONMENTAL CONDITION	23.0 °C, 43.0 % R.H.
INPUT POWER	3.7 Vd.c.		

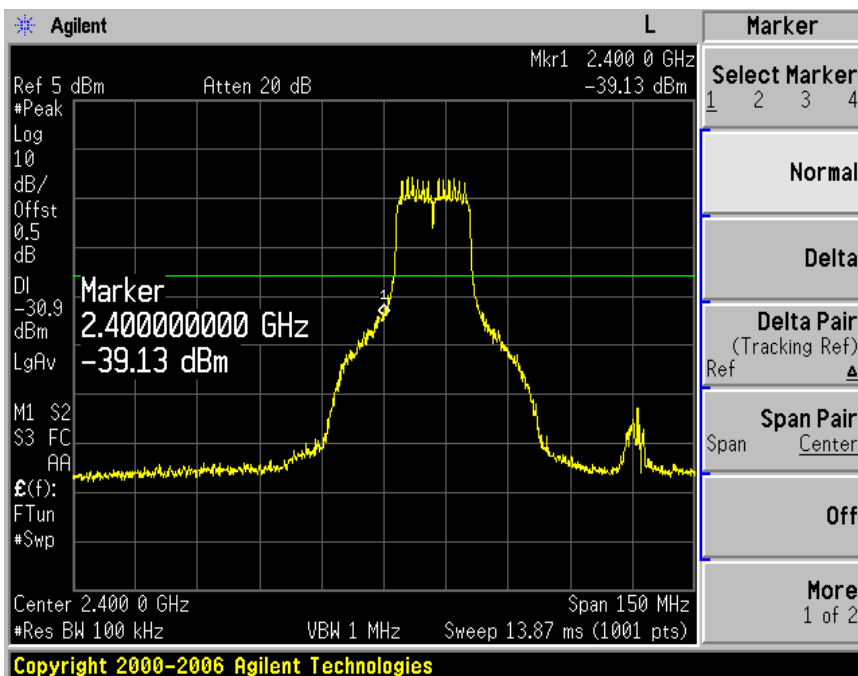
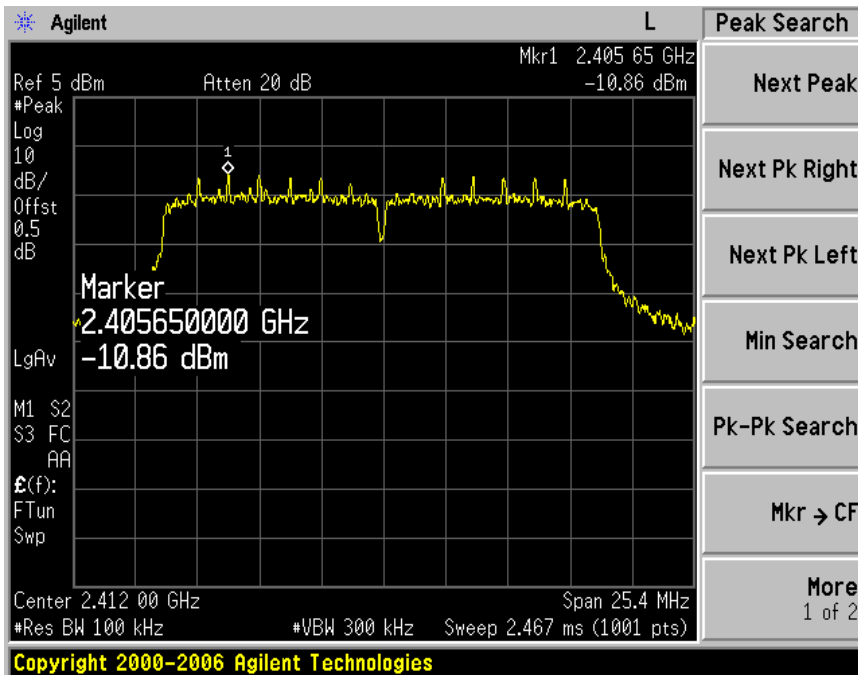
CHANNEL	Channel Frequency (MHz)	limit	PASS/FAIL
1	2 412	20dBc	PASS
11	2 462	20dBc	PASS



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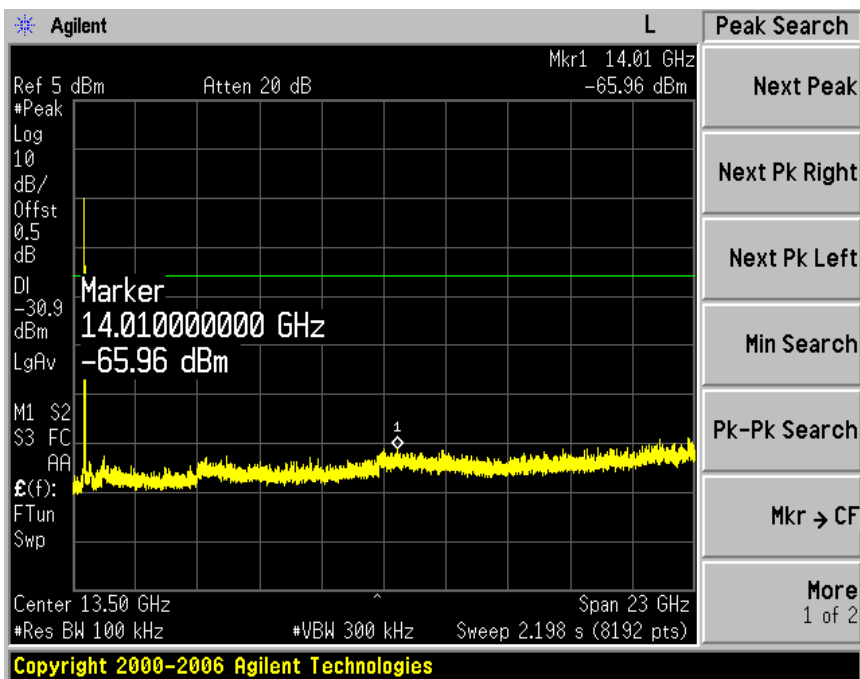
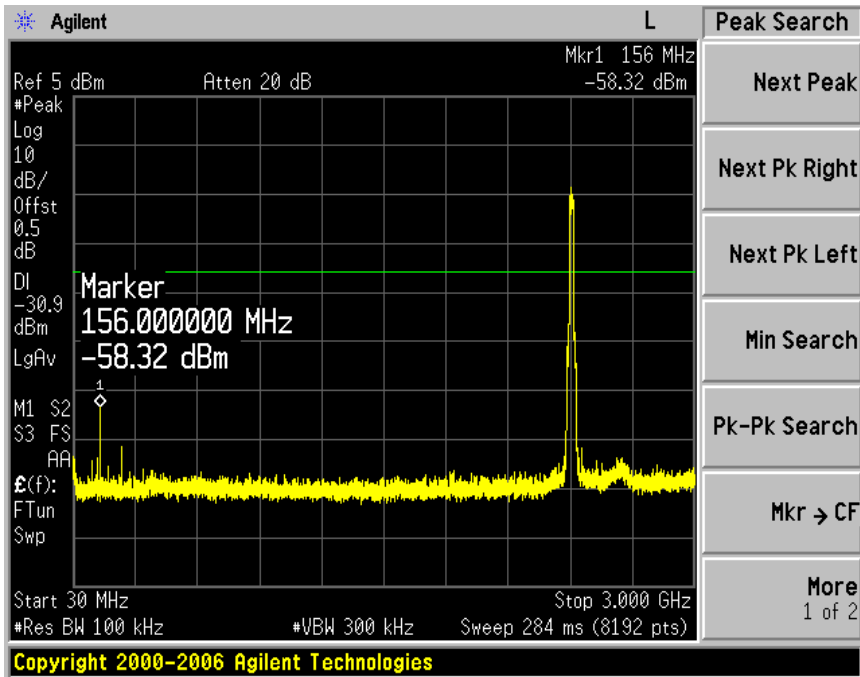
5.4 Trace data of band-edge & Out of Emission (ch_1)





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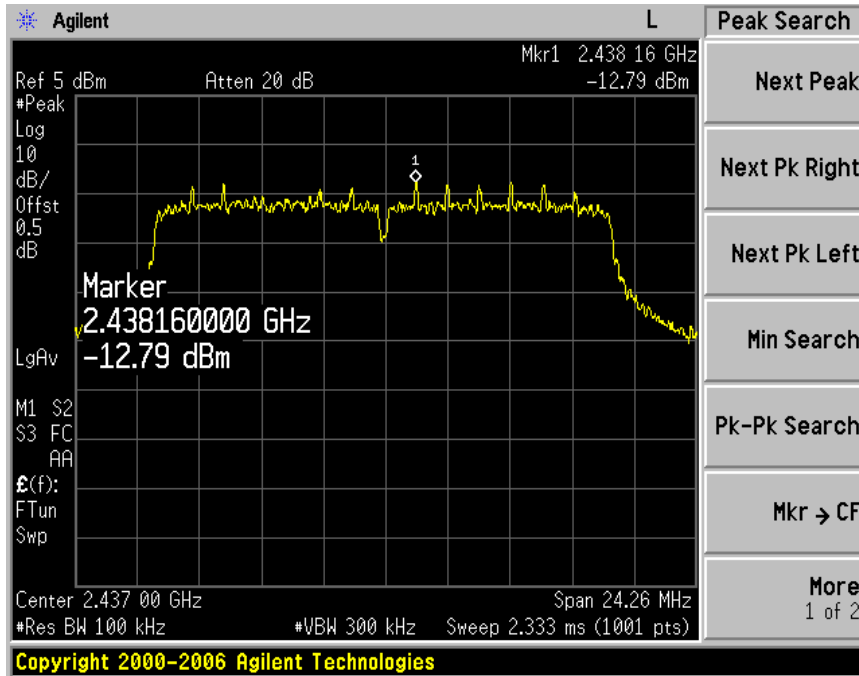




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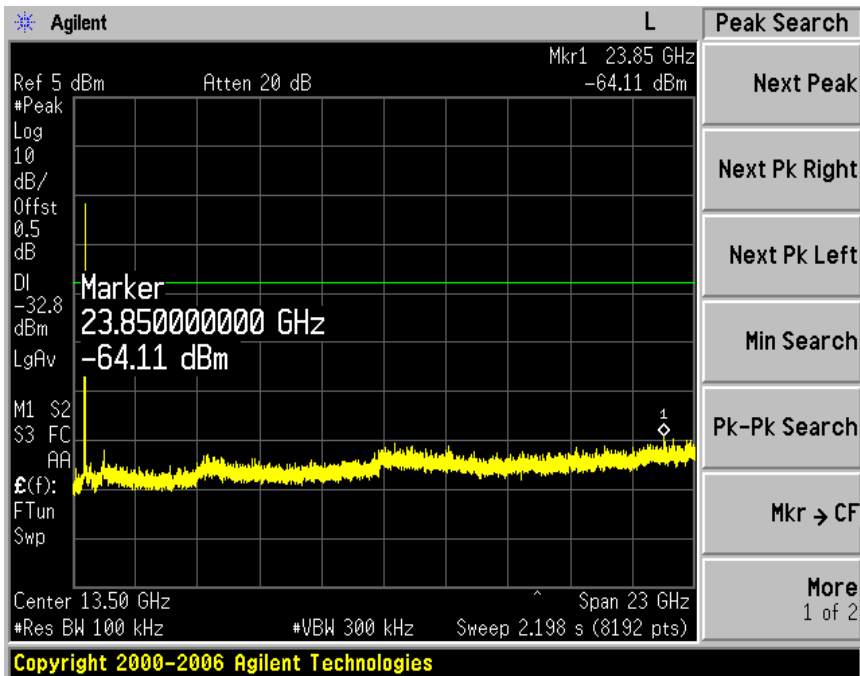
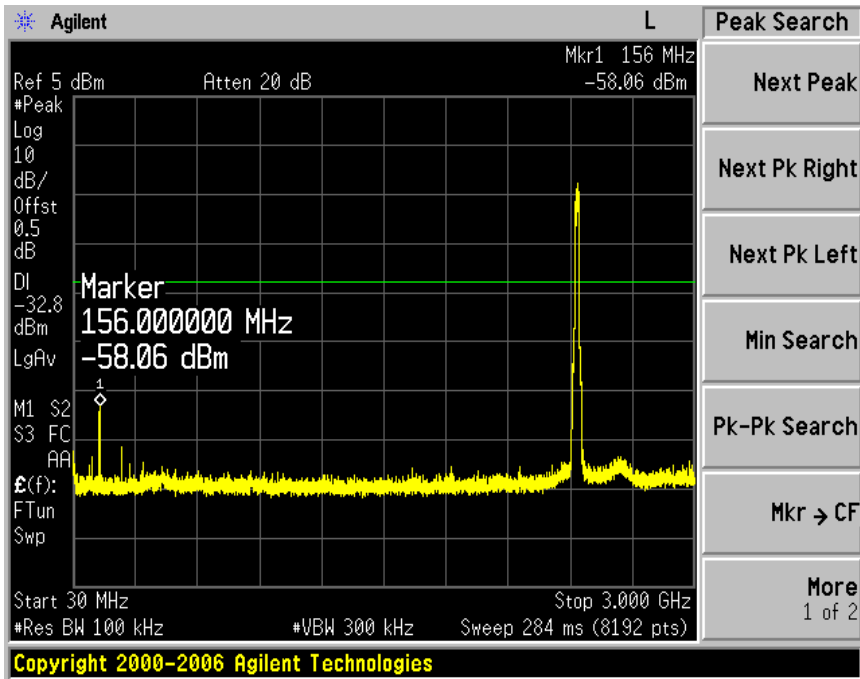
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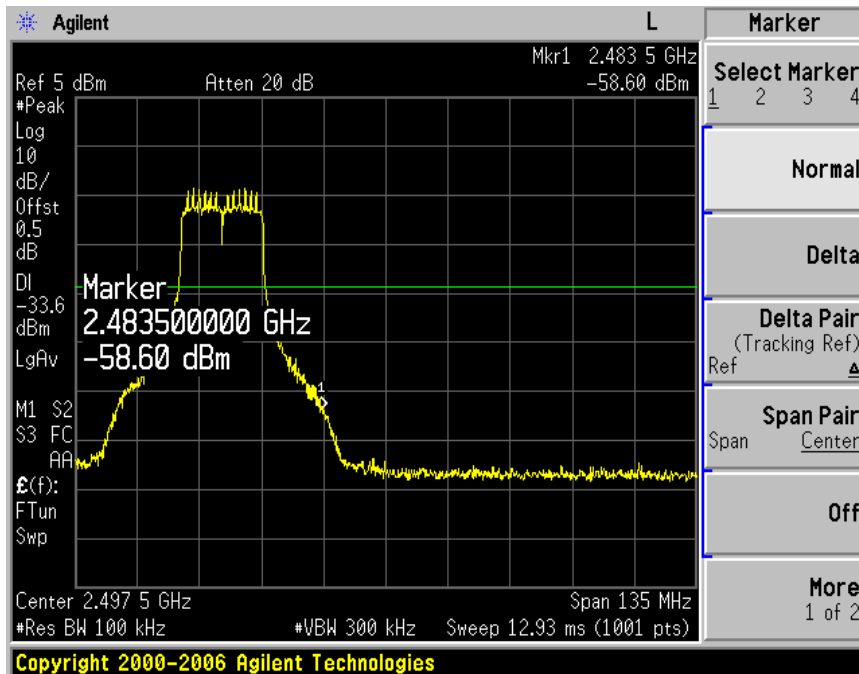
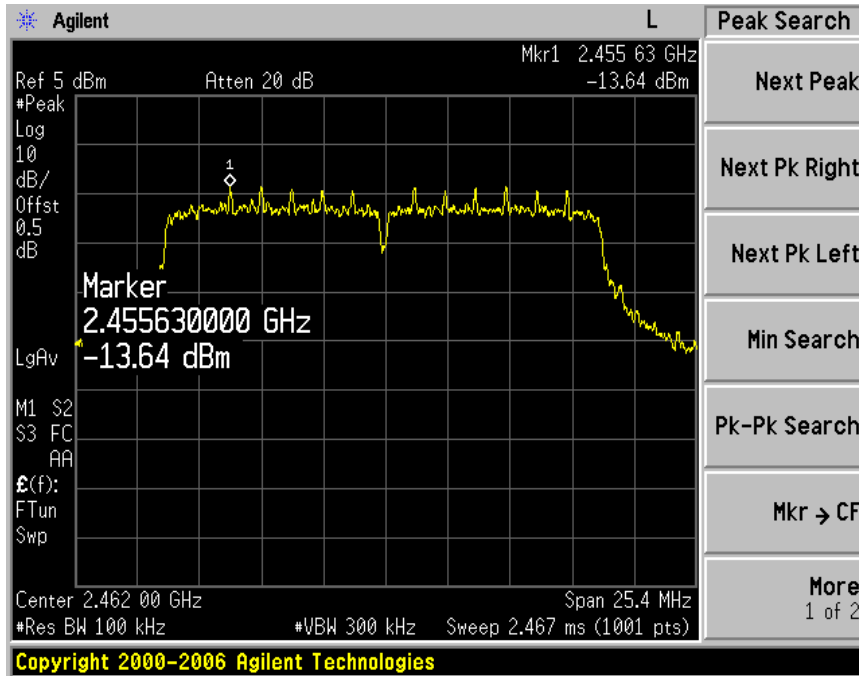




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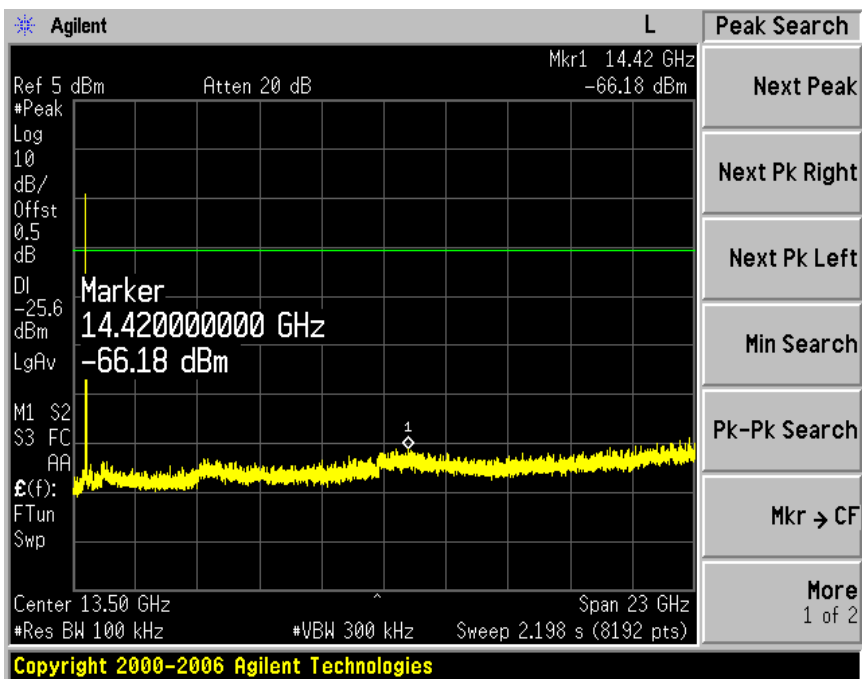
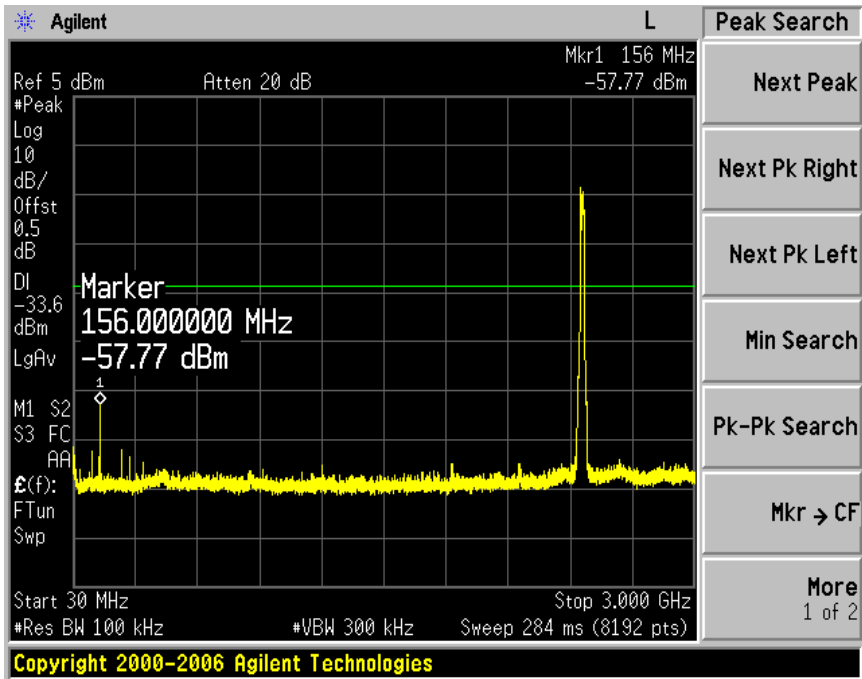
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6. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209 . The test setup was made according to ANSI C 63.10 (2009) & KDB 558074 D01 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam. turntable. 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.

6.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST Receiver	ESC17	ROHDE & SCHWARZ	100916	13-Jan-16
Logbicon Antenna	VULB 9168	SCHWARZBECK	237	4-Mar-16
Turn Table	DT3000-2t	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
PREAMPLIFIER	8449B	AGILENT	3008A00595	13-Jan-16
Horn Antenna	BBHA9120D	SCHWARZBECK	352	7-May-16
Test Receiver	ESPI7	ROHDE & SCHWARZ	100185	13-Jan-16
Spectrum Analyzer	R3273	ADVANTEST	110600592	13-Jan-16
Turn Table	DT1500-S	Innco System GmbH	N/A	-
Antenna Mast	MA4000-EP	Innco System GmbH	N/A	-
Pyramidal Horn Antenna	3160-09-01	EST-LINDGREN	102642	14-Nov-15
Antenna Master & Turn table controller	C02000-P	Innco System GmbH	CO2000/642 /28051111/L	-

6.2 Environmental Condition

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

802.11n MODE(6 CH)

Temperature (°C) : 22.0 °C

Humidity (% R.H.) : 52.7 % R.H.

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

802.11n MODE(1/6/11 CH)

Temperature (°C) : 22.1 °C

Humidity (% R.H.) : 54.7 % R.H.

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6.3 Measurement Instrument setting for Radiated Emission

6.3.1 Frequency range below 1 GHz

Detector : Quasi-Peak

6.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 558074 section 12.2.4)

- a. RBW : 1 MHz , VBW : 3 MHz
- b. Trace mode = max hold
- c. Detector : Peak
- d. Sweep time = auto

Average Power Measurement Procedures (KDB 558074 section 12.2.5.2)

- a. Set analyzer center frequency to the frequency associated with the emission
- b. RBW : 1 MHz , VBW : 3 MHz
- c. Detector : RMS
- d. Sweep time = auto

Note

Band	Duty cycle(%)	Ton (ms)	Ton + Toff (ms)	DCF=10*log(1/Duty) (dB)
802.11n	99.0	1.936	1.954	0.04

* This was not applied of duty cycle factor for average value because of measured with the EUT transmitting continuously more than 98 % duty cycle at its maximum power control level.

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6.4 Test Data

Test Date : 24-Sep-15

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Result Value		
				Ant Factor (dB)	Cable (dB)	Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
199.70	24.71	H	3.4	9.19	2.42	43.50	36.32	7.18
599.00	17.91	V	1.8	20.00	4.18	46.00	42.09	3.91
742.80	11.09	V	1.9	21.83	4.68	46.00	37.59	8.41
790.70	8.55	V	2.6	22.64	4.82	46.00	36.01	9.99
998.40	10.50	V	2.0	24.65	5.49	54.00	40.63	13.37
Remark	H : Horizontal, V : Vertical TEST MODE : 802.11n (CH : 6 - 2 437 MHz) *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) *CL = Cable Loss(In case of below 1 000 MHz) *Result Value = Reading + Ant Factor + Cable loss *The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.							

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6.4-1 Test Data

Test Date : 30-Sep-15

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	AMP & Cable (dB)		Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2390.00	52.94	H	1.0	27.27	-28.24	0.00	74.00	51.97	22.03
2390.00	51.81	V	1.1	27.27	-28.24	0.00	74.00	50.84	23.16
4826.01	44.71	H	1.2	31.40	-24.14	0.00	74.00	51.97	22.03
4826.01	45.55	V	1.0	31.40	-24.14	0.00	74.00	52.81	21.19
AV(RBW: 1 MHz VBW: 3 MHz)									
2390.00	37.78	H	1.0	27.27	-28.24	0.00	54.00	36.81	17.19
2390.00	37.78	V	1.1	27.27	-28.24	0.00	54.00	36.81	17.19
4826.01	32.94	H	1.2	31.40	-24.14	0.00	54.00	40.20	13.80
4826.01	33.01	V	1.0	31.40	-24.14	0.00	54.00	40.27	13.73
Remark	H : Horizontal, V : Vertical TEST MODE : CH : 1 – 2 412 MHz(802.11n)								
	*The TX signal wasn't detected from 3th harmonics.								
	*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)								
	*Total = Reading Value + Antenna Factor + Cable Loss – Amp Gain + Duty Cycle Correction								



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6.4-2 Test Data

Test Date : 30-Sep-15

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	AMP & Cable (dB)		Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2389.00	51.94	H	1.4	27.27	-28.24	0.00	74.00	50.97	23.03
2389.00	51.24	V	1.2	27.27	-28.24	0.00	74.00	50.27	23.73
4876.02	46.12	H	1.2	31.50	-23.99	0.00	74.00	53.64	20.36
4876.02	47.02	V	1.3	31.50	-23.99	0.00	74.00	54.54	19.46
AV(RBW: 1 MHz VBW: 3 MHz)									
2389.00	37.44	H	1.4	27.27	-28.24	0.00	54.00	36.47	17.53
2389.00	38.96	V	1.2	27.27	-28.24	0.00	54.00	37.99	16.01
4876.02	33.71	H	1.2	31.50	-23.99	0.00	54.00	41.23	12.77
4876.02	34.02	V	1.3	31.50	-23.99	0.00	54.00	41.54	12.46
Remark	H : Horizontal, V : Vertical TEST MODE : CH : 6 – 2 437 MHz(802.11n)								
	*The TX signal wasn't detected from 3th harmonics.								
	*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)								
	*Total = Reading Value + Antenna Factor + Cable Loss – Amp Gain + Duty Cycle Correction								

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6.4-3 Test Data

Test Date : 30-Sep-15

Measurement Distance : 3 m

Frequency (MHz)	Reading (dB μ V)	Position (V/H)	Height (m)	Correction Factor		Duty Cycle Correction(dB)	Result Value		
				Ant Factor (dB)	AMP & Cable (dB)		Limit (dB μ V/m)	Result (dB μ V/m)	Margin (dB)
PEAK(RBW: 1 MHz VBW: 3 MHz)									
2483.60	48.58	H	1.0	27.55	-28.11	0.00	74.00	48.02	25.98
2483.60	47.59	V	1.2	27.55	-28.11	0.00	74.00	47.03	26.97
2487.60	46.88	H	1.0	27.56	-28.11	0.00	74.00	46.34	27.66
2487.60	47.95	V	1.4	27.56	-28.11	0.00	74.00	47.41	26.59
4926.10	47.18	H	1.1	31.61	-23.90	0.00	74.00	54.90	19.10
4926.10	47.94	V	1.2	31.61	-23.90	0.00	74.00	55.66	18.34
AV(RBW: 1 MHz VBW: 3 MHz)									
2483.60	42.00	H	1.0	27.55	-28.11	0.00	54.00	41.44	12.56
2483.60	38.78	V	1.0	27.55	-28.11	0.00	54.00	38.22	15.78
2487.60	42.46	H	1.0	27.56	-28.11	0.00	54.00	41.92	12.08
2487.60	37.12	V	1.0	27.56	-28.11	0.00	54.00	36.58	17.42
4926.10	34.96	H	1.1	31.61	-23.90	0.00	54.00	42.67	11.33
4926.10	36.11	V	1.2	31.61	-23.90	0.00	54.00	43.83	10.17
Remark	H : Horizontal, V : Vertical TEST MODE : CH : 11 - 2 462 MHz(802.11n)								
	*The TX signal wasn't detected from 3th harmonics.								
	*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)								
	*Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Duty Cycle Correction								



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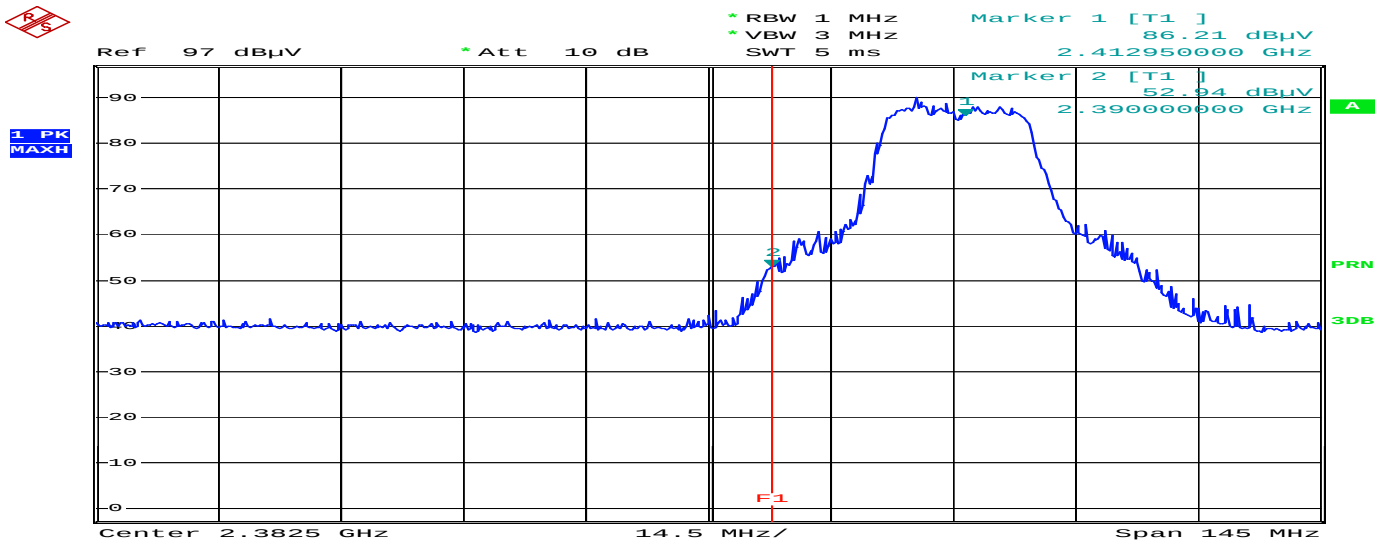
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6.4-4 Restricted Band Edges

Band Edges(CH Low)

Detector mode:Peak

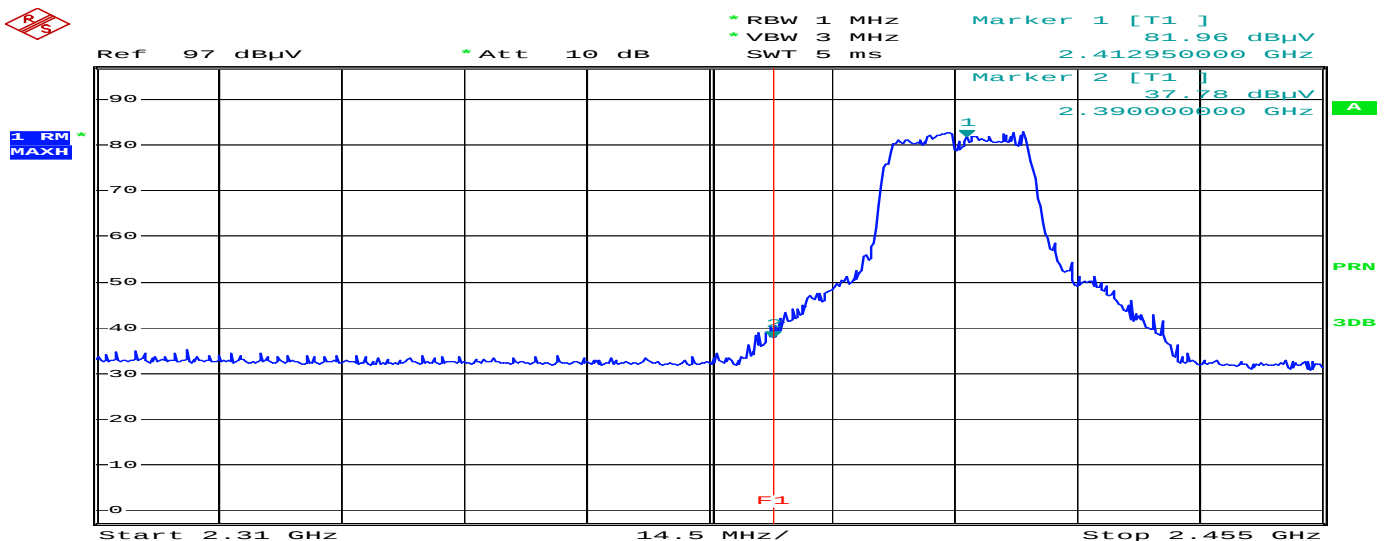
Polarity:Horizontal



Comment : 15-01970_H0R(2412_PEAK)
Date: 30.SEP.2015 11:11:08

Detector mode:Average

Polarity:Horizontal



Comment : 15-01970_H0R(2412_RMS)
Date: 30.SEP.2015 11:10:01



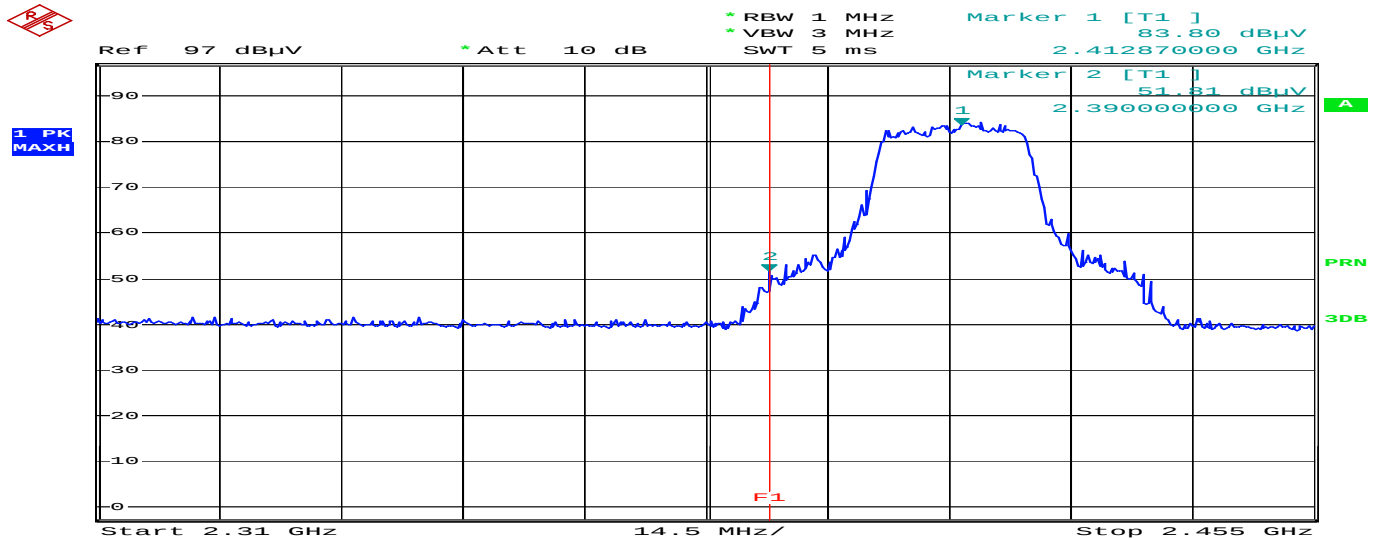
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Band Edges(CH Low)

Detector mode:Peak

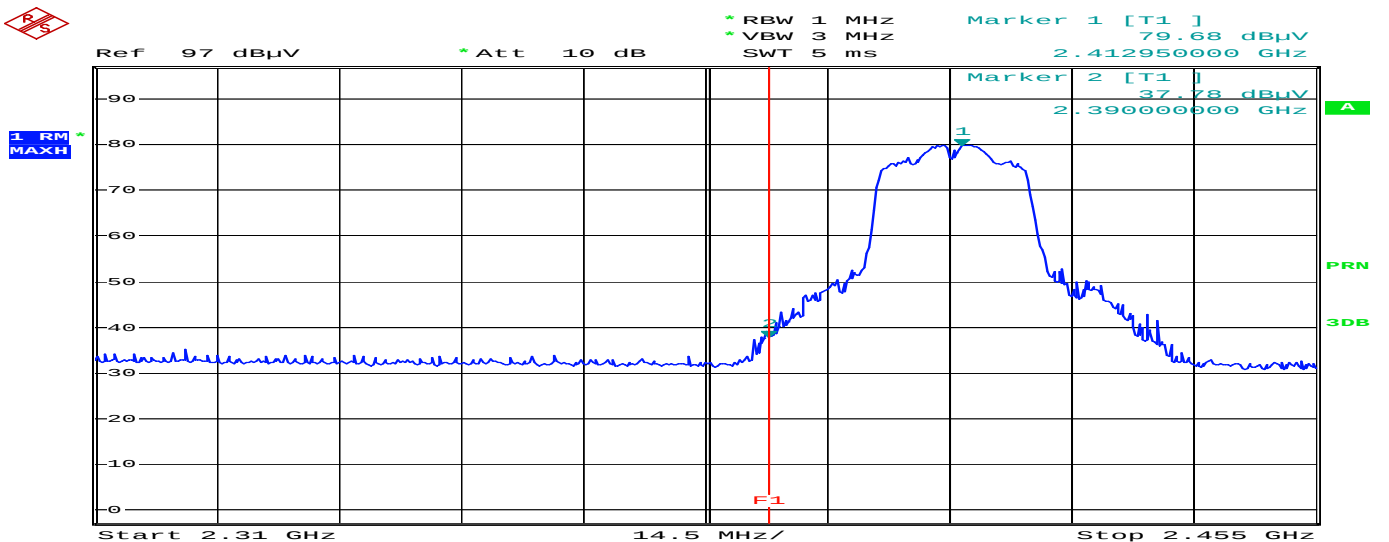
Polarity:Vertical



Comment : 15-01970_VER(2412_PEAK)
Date : 30.SEP.2015 10:59:50

Detector mode:Average

Polarity:Vertical



Comment : 15-01970_VER(2412_RMS)
Date : 30.SEP.2015 11:08:56



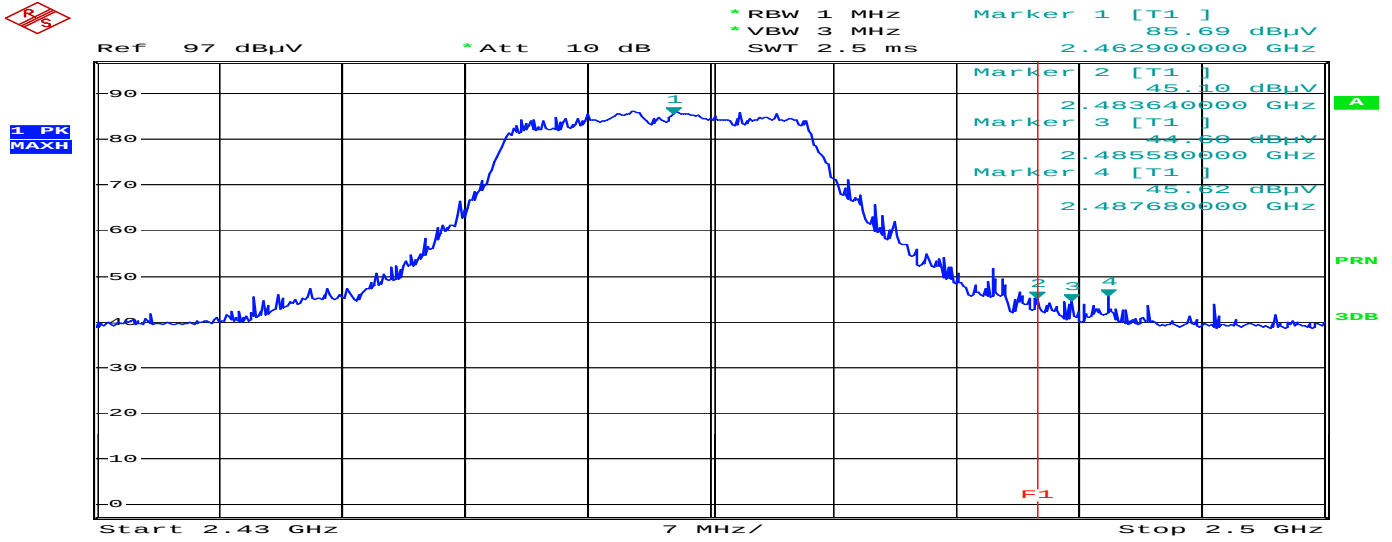
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Band Edges(CH High)

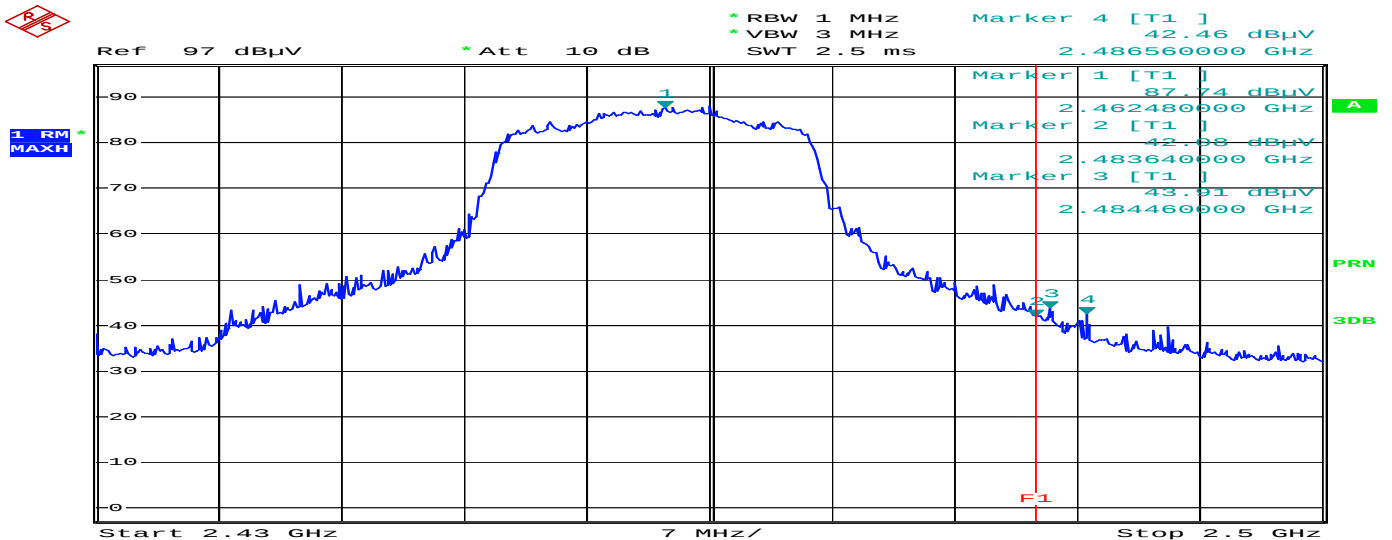
Detector mode:Peak

Polarity:Horizontal



Detector mode:Average

Polarity:Horizontal





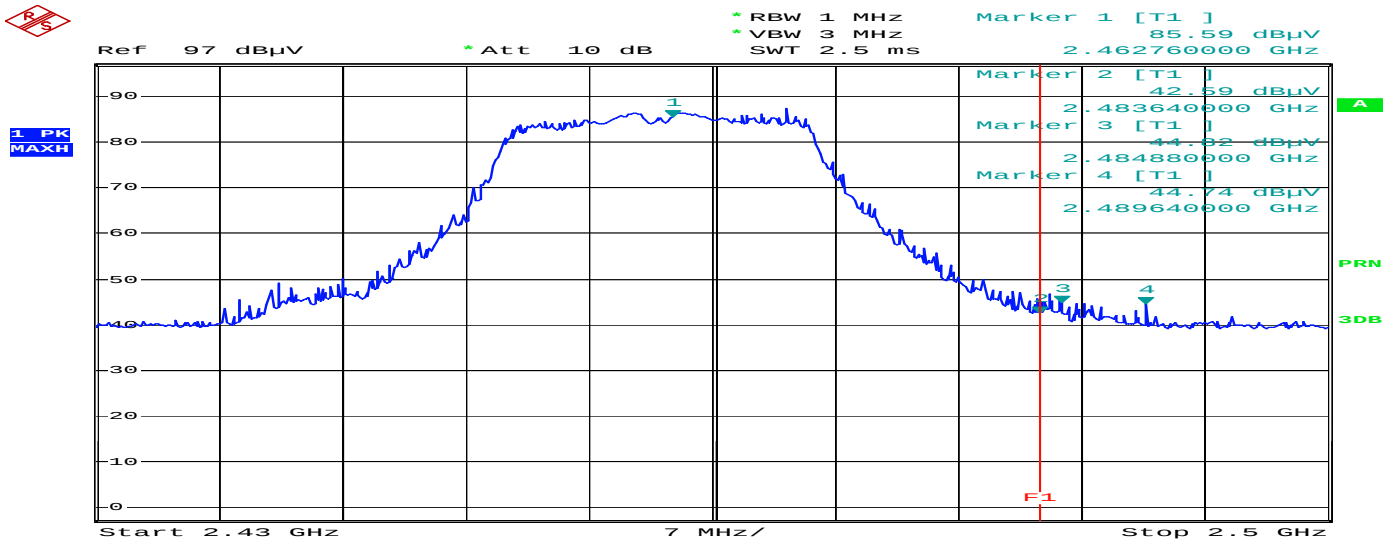
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Band Edges(CH High)

Detector mode:Peak

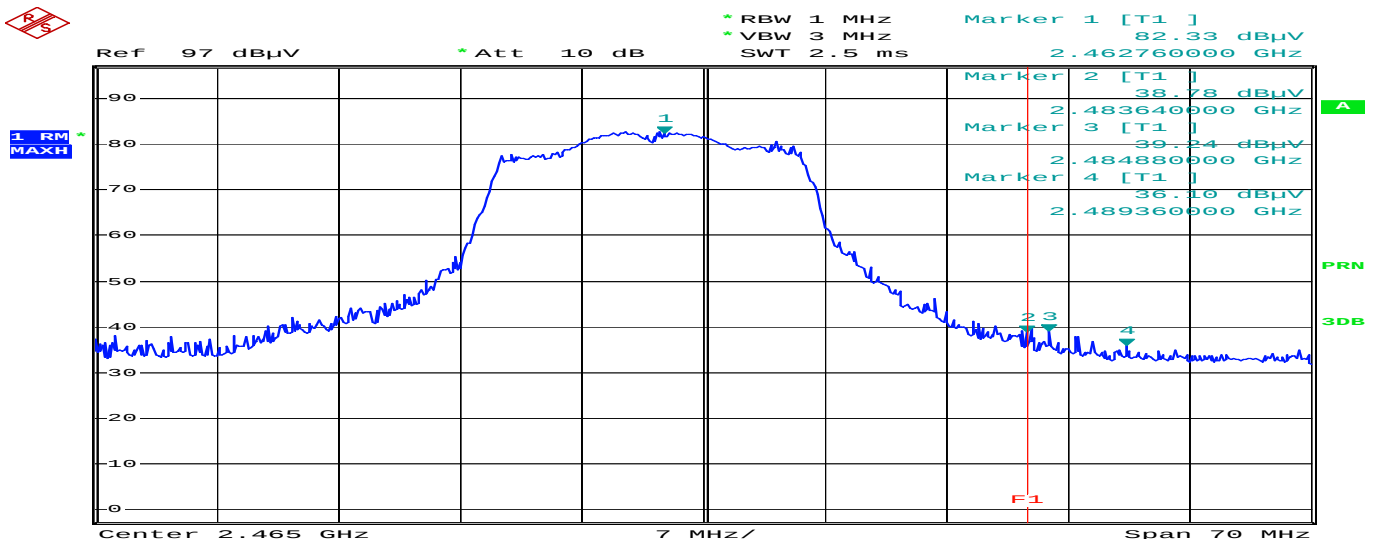
Polarity:Vertical



Comment : 15-01970_VER(2462_PEAK)
Date: 30.SEP.2015 10:38:00

Detector mode:Average

Polarity:Vertical



Comment : 15-01970_VER(2462_RMS)
Date: 30.SEP.2015 10:41:15

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7. 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 15.207. The test setup was made according to ANSI C 63.10 (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.

7.1 Measurement equipments

Equipment Name	Type	Manufacturer	Serial No.	Next Calibration date
TEST RECEIVER	ESPI	Rohde & Schwarz	100005	13-Jan-16
LISN	ESH3-Z5	Rohde & Schwarz	836679/025	13-Jan-16
Pulse Limiter	ESH3Z2	Rohde & Schwarz	NONE	13-Jan-16

7.2 Environmental Condition

Test Place : Shielded Room

Temperature (°C) : 22.5 °C

Humidity (% R.H.) : 34.9 % R.H.

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7.3 Test Data

Test Date : 30-Sep-15

Frequency (MHz)	Correction Factor		Line (H/N)	Quasi-peak Value			Average Value		
	Lisn (dB)	Cable (dB)		Limit (dB μ V)	Reading (dB μ V)	Result (dB μ V)	Limit (dB μ V)	Reading (dB μ V)	Result (dB)
0.17	0.10	0.12	N	64.96	46.46	46.68	54.96		
0.18	0.11	0.13	H	64.49	46.80	47.04	54.49		
0.22	0.10	0.13	N	62.82	45.74	45.97	52.82		
7.51	0.33	0.30	H	60.00	45.40	46.02	50.00		
8.50	0.34	0.31	H	60.00	45.71	46.36	50.00		
22.80	0.56	0.44	N	60.00	45.96	46.96	50.00		
Remark	H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading								



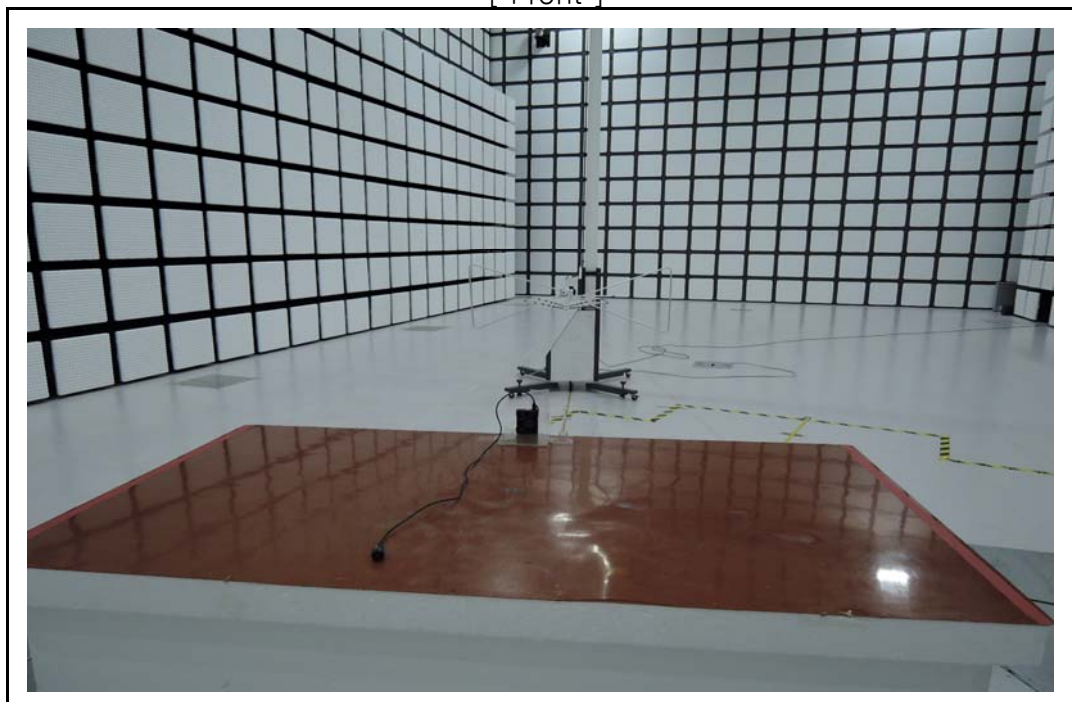
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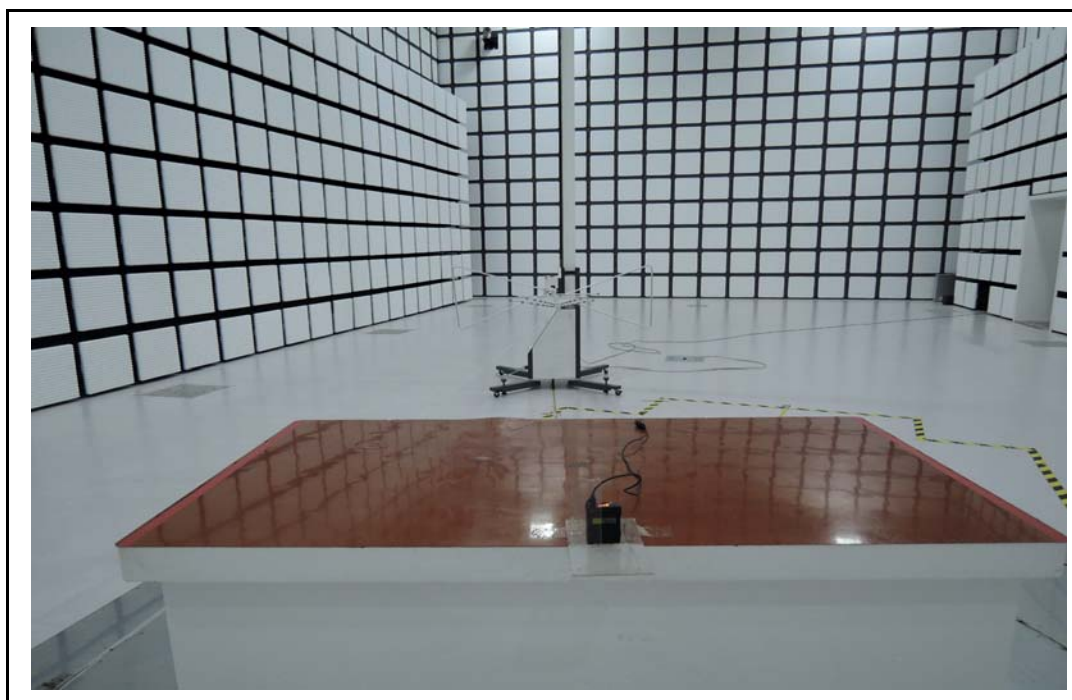
8. Photographs of test setup

8.1. Setup for Radiated Test : (30 ~ 1 000) MHz

[Front]



[Rear]



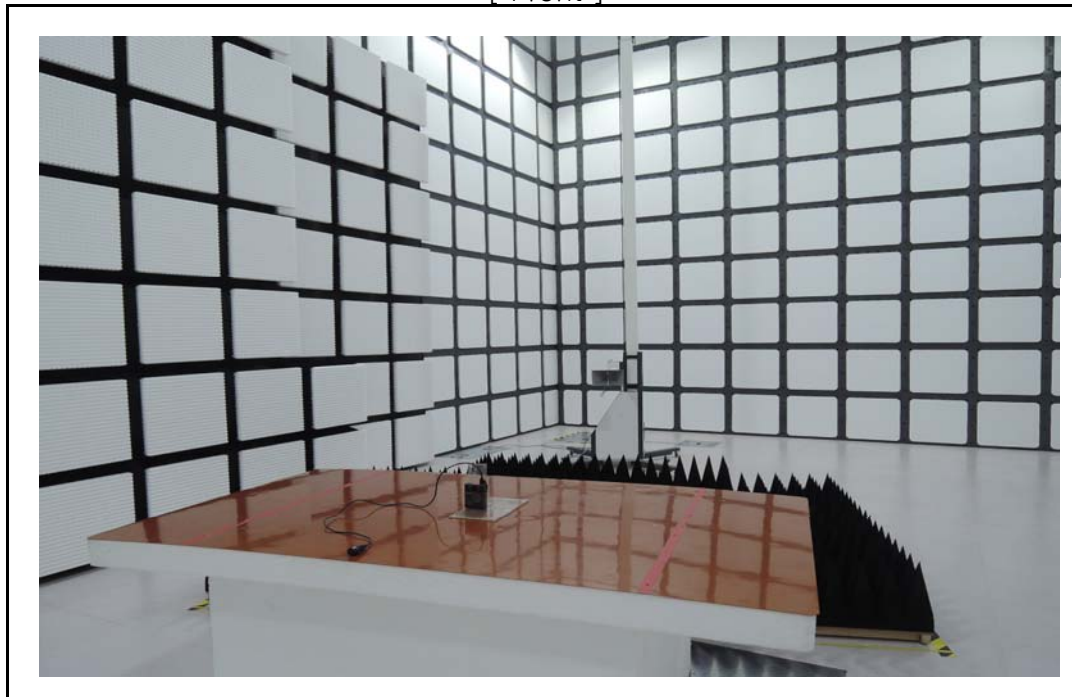


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8.2. Setup for Radiated Test : Above 1 GHz

[Front]



[Rear]





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8.3. Setup for Conducted Test : (0.15 ~ 30) MHz

[Front]



[Rear]





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8.4. Photographs of EUT

[Front]

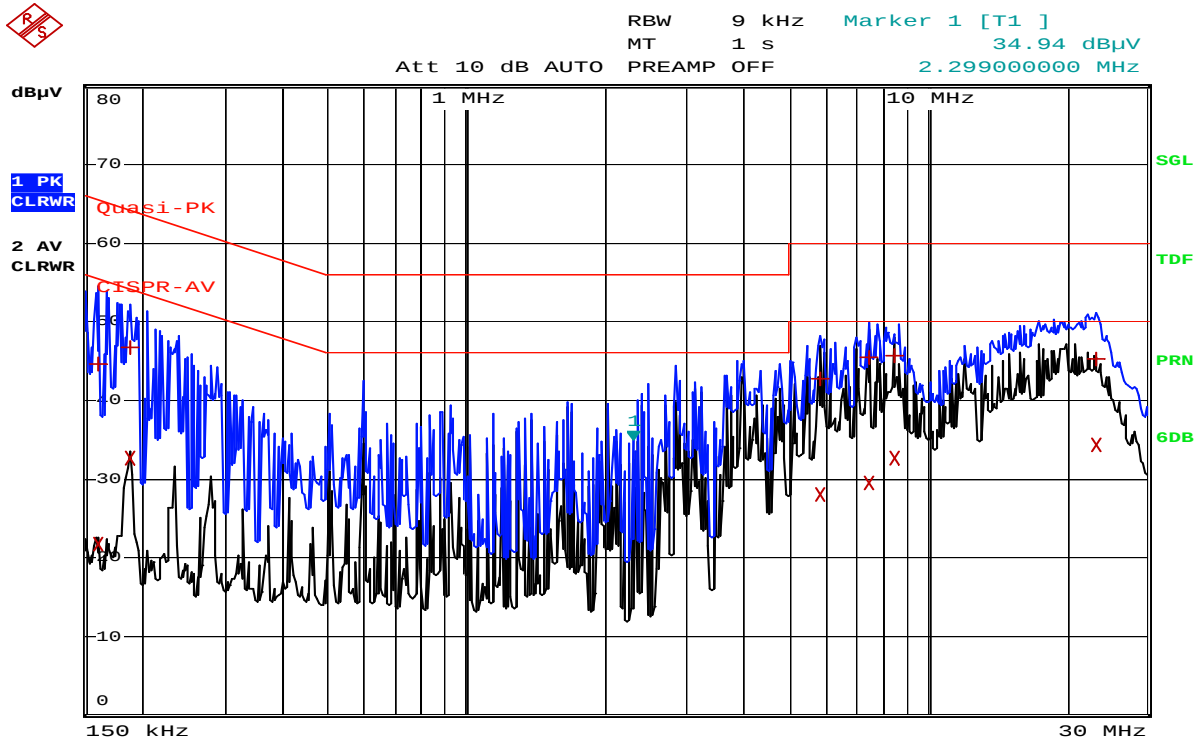


[Rear]



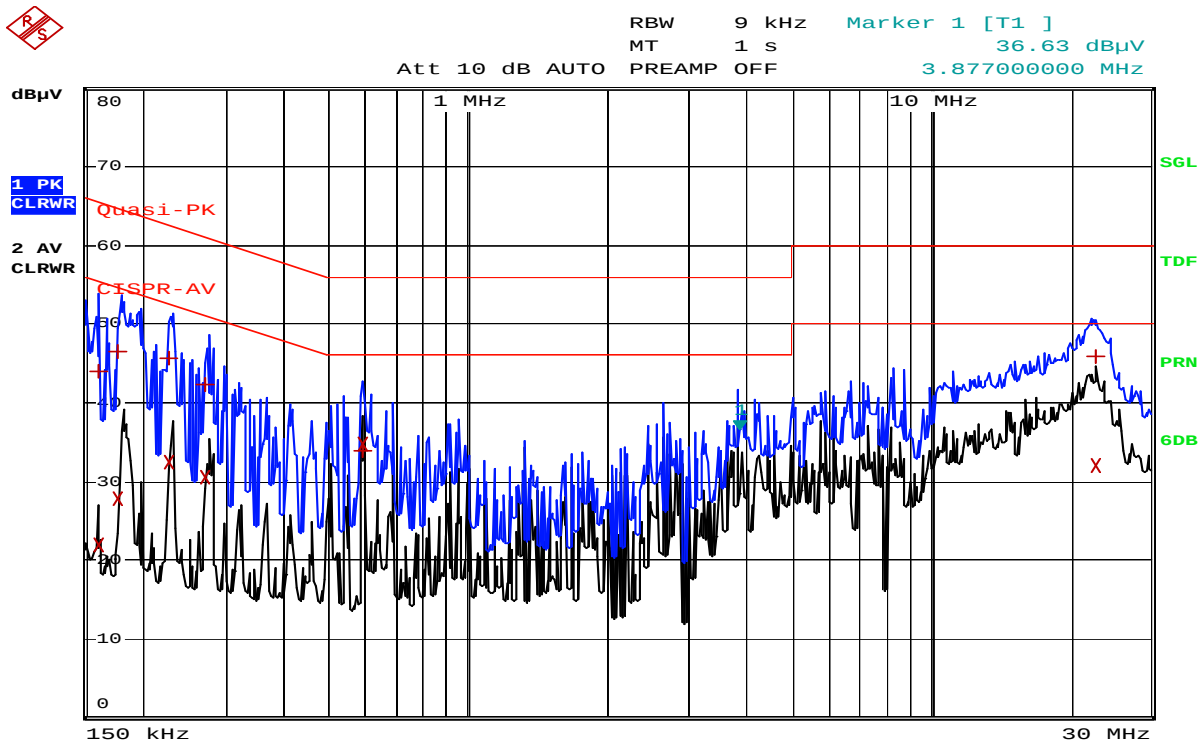
Appendix 1. Special diagram

* HOT LINE



Comment: 15-01970_HOT
Date: 30.SEP.2015 09:39:36

* NEUTRAL LINE



Comment: 15-01970_NEUTRAL
Date: 30.SEP.2015 09:36:45

Appendix 2. Antenna Requirement

1. Antenna Requirement

1.1 Standard Applicable

For intentional device, according to FCC 47 CFR 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.

And according to FCC 47 CFR Section 15.204

1.2 Antenna Connected Construction

The antenna types used in this product are Intergrated Chip antenna . The maximum Gain of this antenna is 1.55 dBi.