

Test Report No. 7191165730-EEC17/01

dated 06 Jul 2017

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH 47 CFR FCC Parts B & C OF AN ULTRASYNC Z-WAVE EXPANSION MODULE [Model : UM-ZW] [FCC ID : 2ADG2UM-ZW]

TEST FACILITY

TÜV SÜD PSB Pte Ltd
Electrical & Electronics Centre (EEC), Product Services,
13 International Business Park #01-01, Singapore 609932

FCC REG. NO.

994109 (Test Firm Registration Number)
SG0002 (Designation Number)

IND. CANADA REG. NO.

2932N-1 (10m Semi-Anechoic Chamber, International Business Park)

PREPARED FOR

UHS Pty Ltd
Level 1, Unit 2, 5-9 Ricketty St
Mascot, NSW NSW 2020
Australia

Tel : +61 2 9663 2299

Fax : +61 2 9663 2288

QUOTATION NUMBER

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JOB NUMBER

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TEST PERIOD

04 Jul 2017

PREPARED BY

Quek Keng Huat
Higher Associate Engineer

APPROVED BY

Foo Kai Maun
Executive Engineer



LA-2007-0380-A LA-2007-0384-G
LA-2007-0381-F LA-2007-0385-E
LA-2007-0382-B LA-2007-0386-C
LA-2007-0383-G LA-2010-0464-D

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
No.1 Science Park Drive
Singapore 118221

Phone : +65-6885 1333
Fax : +65-6776 8670
E-mail: enquiries@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TUV SÜD Asia Pacific Pte. Ltd.
1 Science Park Drive, #02-01
Singapore 118221



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TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

Test Standard	Description	Pass / Fail
47 CFR FCC Part 15		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.249(a)	Radiated Emissions (Fundamental and Harmonics)	Pass

Notes

1. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.
2. All test measurement procedures are according to ANSI C63.4: 2014 and ANSI C63.10: 2013.

Modifications

No modifications were made.



PRODUCT DESCRIPTION

Description	: The Equipment Under Test (EUT) is an UltraSync Z-Wave Expansion Module . The module allows users to add and control Z-Wave certified devices on an xGen series control panel.
Manufacturer	: UTC FIRE & SECURITY MEXICO CORPORATION SRL DE CV Blvd. Eje 1 Lote No. 7 Manzana No. 2 Entre Eje B y Eje C Parque Industrial Navojoa, Sonora, Mexico 85895 Mexico
FCC ID	: 2ADG2UM-ZW
Model Number	: UM-ZW
Serial Number	: 982108711541 (Normal operation unit) 2255127767987 (40kHz Modulation unit) 325865941136 (9.6kHz Modulation unit) 012520657826 (9.6kHz and 40kHz carrier unit)
Microprocessor	: dsPIC33EP512MU810
Operating Frequency	: 908.42MHz
Clock / Oscillator Frequency	: 120MHz (CPU internal clock)
Port / Connectors	: Refer to manufacturer's user manual / operating manual
Rated Input Power	: 12VDC 80mA (via connected host)
Accessories	: Refer to manufacturer's user manual / operating manual



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SUPPORTING EQUIPMENT DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Interlogix UltraSync Cellular Module	M/N: UM-C-H1 S/N: 063662844514 FCC ID: XPYSARAU260	1.8m unshielded JSC.5 security cable
ADI Plug In Class 2 Transformer	M/N: MGT1640CC S/N: Nil FCC ID: Verification	1.5m unshielded AC power cable



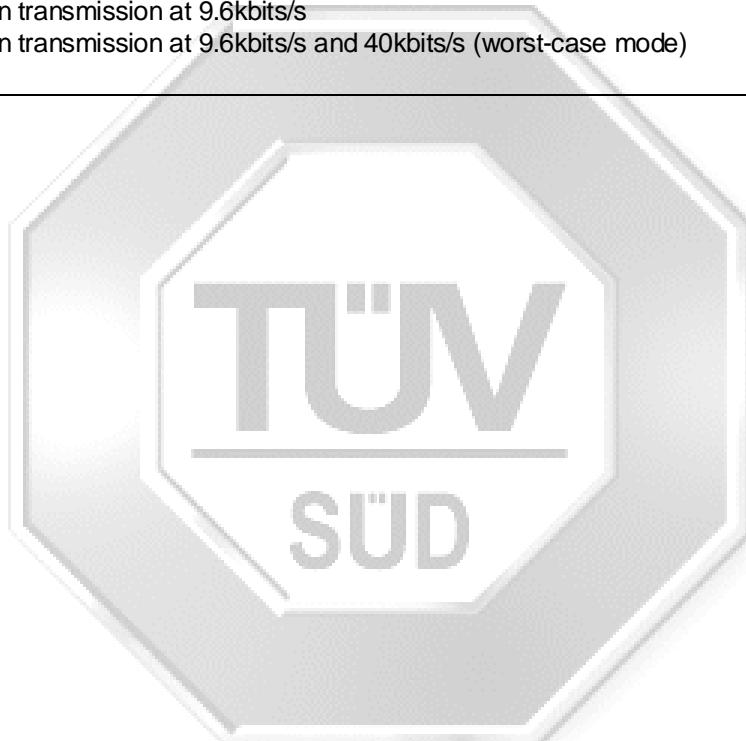
EUT OPERATING CONDITIONS

47 CFR FCC Part 15

1. Conducted Emissions
2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)
3. Radiated Emissions (Fundamental and Harmonics)

The EUT was exercised in by continuous transmitting at its maximum RF power at the carrier frequency (908.42MHz) throughout the tests. For type of transmission (modulation) modes as shown below were evaluated. The worst-case mode was selected for the final evaluations.

- Normal operation
- Modulation transmission at 40kbits/s
- Modulation transmission at 9.6kbits/s
- Modulation transmission at 9.6kbits/s and 40kbits/s (worst-case mode)





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CONDUCTED EMISSION TEST

47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

AC Port

Frequency Range (MHz)	Limit Values (dB μ V)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreasing linearly with the logarithm of the frequency

47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

Instrument	Model	S/No	Cal Due Date
Rohde & Schwarz EMI Test Receiver (9kHz - 3GHz)	ESCI	100477	06 Apr 2018
Schaffner LISN 2-Line V-Network (9kHz-30MHz)	NNB41	04/10151	31 Oct 2017



CONDUCTED EMISSION TEST

AC Port

47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a $50\Omega/50\mu\text{H}$ EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz

Q-P limit = $60.0 \text{ dB}\mu\text{V}$

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = $40.0 \text{ dB}\mu\text{V}$
(Calibrated for system losses)

Therefore, Q-P margin = $60.0 - 40.0 = 20.0$

i.e. 20.0 dB below Q-P limit

CONDUCTED EMISSION TEST

47 CFR FCC Parts 15.107(a) and 15.207 Conducted Emission Results

Operating Mode	Continuous carrier transmission	Temperature	20°C
Test Input Power	120V 60Hz	Relative Humidity	54%
Line Under Test	AC Mains	Atmospheric Pressure	1017mbar
		Tested By	Derrick Ng

Frequency (MHz)	Q-P Value (dB μ V)	Q-P Limit (dB μ V)	Q-P Margin (dB)	AV Value (dB μ V)	AV Limit (dB μ V)	AV Margin (dB)	Line
0.1574	58.8	65.6	6.8	27.6	55.6	28.0	Live
0.1670	59.6	65.1	5.5	28.5	55.1	26.6	Neutral
0.1780	58.8	64.6	5.8	28.0	54.6	26.6	Neutral
0.1832	57.5	64.3	6.8	26.8	54.3	27.5	Live
0.1842	57.9	64.3	6.4	27.2	54.3	27.1	Neutral
0.1908	56.3	64.0	7.7	25.8	54.0	28.2	Live

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
150kHz - 30MHz
RBW: 9kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz is $\pm 2.2\text{dB}$.

RADIATED EMISSION TEST

47 CFR FCC Part 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090	-	0.110	16.42
0.495	-	0.505	16.69475
2.1735	-	2.1905	16.80425
4.125	-	4.128	25.5
4.17725	-	4.17775	37.5
4.20725	-	4.20775	73
6.215	-	6.218	74.8
6.26775	-	6.26825	108
6.31175	-	6.31225	123
8.291	-	8.294	149.9
8.362	-	8.366	156.52475
8.37625	-	8.38675	156.7
8.41425	-	8.41475	162.0125
12.29	-	12.293	167.72
12.51975	-	12.52025	240
12.57675	-	12.57725	322
13.36	-	13.41	
			Above 38.6

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBμV/m)
0.009 - 0.490	20 log [2400 / F (kHz)] @ 300m
0.490 - 1.705	20 log [24000 / F (kHz)] @ 30m
1.705 - 30.0	30.0 @ 30m
30 - 88	40.0 @ 3m
88 - 216	43.5 @ 3m
216 - 960	46.0 @ 3m
Above 960	54.0* @ 3m

* For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Rohde & Schwarz EMI Test Receiver (20Hz – 26.5GHz)	ESMI	829214/005 829179/005	21 Apr 2018
TDK RF Solutions Hybrid Log Periodic Antenna (30MHz-3GHz)	HLP-3003C	130237	21 Oct 2017
Sonoma Preamplifier (9kHz – 1GHz)	310N	270640	14 Jul 2017
Miteq Preamplifier (500M-8GHz)	AMF-2D-00500800-25-13P	2000252	28 Nov 2017
Eletro-Metrics Double Ridged Antenna (Horn) Antenna (1-18GHz)	EM-6961	6525	08 Apr 2018
Schwarzbeck Horn Antenna (6-18GHz) / Pre-amplifier assembly HAP-series	BBHA 9120 C / HAP06-18W	9120C-372 / 00000004	15 Jan 2018
ETS-LINDGREN Active Loop Antenna (9kHz – 30MHz) _ Red	6502	134413	28 Oct 2017

RADIATED EMISSION TEST

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in the range of 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10th harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz

Q-P limit = 46.0 dB μ V/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dB μ V/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 46.0 - 40.0 = 6.0

i.e. 6.0 dB below Q-P limit



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RADIATED EMISSION TEST

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Results

Operating Mode	Continuous carrier transmission	Temperature	22°C
Test Input Power	120V 60Hz	Relative Humidity	55%
Test Distance	3m	Atmospheric Pressure	1017mbar
		Tested By	Derrick Ng

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) *See Note 6

Freq (GHz)	Peak Value (dB μ V/m)	Peak Limit (dB μ V/m)	Peak Margin (dB)	AV Value (dB μ V/m)	AV Limit (dB μ V/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 9kHz – 30MHz *See Note 6

Frequency (MHz)	Q-P Value (dB μ V/m)	Q-P Limit (dB μ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
2.1210	2.4	30.0	28.0	120	269	V
2.1220	3.0	30.0	27.0	120	275	V
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Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB μ V/m)	Q-P Limit (dB μ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarisation (H/V)
143.9870	26.6	43.5	16.9	249	190	H
156.0080	25.5	43.5	18.0	101	85	V
168.0130	26.9	43.5	16.6	105	0	V
317.0690	27.6	46.0	18.4	102	167	H
443.9460	29.1	46.0	16.9	102	337	V
456.0060	27.3	46.0	18.7	102	329	V



RADIATED EMISSION TEST

47 CFR FCC Parts 15.109(a) and 15.209 Radiated Emission Results

Emissions above 1GHz - 10GHz

Freq (GHz)	Peak Value (dB μ V/m)	Peak Limit (dB μ V/m)	Peak Margin (dB)	AV Value (dB μ V/m) *See Note 3	AV Limit (dB μ V/m)	AV Margin (dB) *See Note 4	Height (cm)	Azimuth (Degrees)	Pol (H/V)
2.7282	49.8	74.0	24.2	--	54.0	4.2	199	20	V
5.0737	51.5	74.0	22.5	--	54.0	2.5	199	3	V
5.2869	52.3	74.0	21.7	--	54.0	1.7	101	199	V
5.5618	52.5	74.0	21.5	--	54.0	1.5	101	18	V
5.7694	52.0	74.0	22.0	--	54.0	2.0	199	22	V
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Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A closer test distance of 10m was used for the measurement instead of 30m as the fundamental (carrier) electric field strength of the EUT at the 10m distance shows compliance to the limit of 30m test distance.
3. As the measured peak shows compliance to the average limit, as such no average measurement was required.
4. The average margin indicates the margin of the measured peak value below the average limit.
5. "--" indicates no emissions were found and shows compliance to the limits.
6. The measurement was done at 3m. The measured results were extrapolated to the specified test limits as specified in § 15.209 (a) based on 40dB/decade.
7. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
8. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
9. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:

9kHz - 150kHz

RBW: 100Hz VBW: 300Hz

150kHz - 30MHz

RBW: 10kHz VBW: 30kHz

30MHz - 1GHz

RBW: 120kHz VBW: 1MHz

>1GHz

RBW: 1MHz VBW: 3MHz

10. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.

Radiated Emissions Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is $\pm 4.0\text{dB}$.

RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

47 CFR FCC Part 15.249(a) Radiated Emission (Fundamental and Harmonics) Limits

Fundamental Frequency (MHz)	Field Strength of Fundamental Limit Values @ 3m (dB μ V/m) *	Field Strength of Harmonics Limit Values @ 3m (dB μ V/m) *
902 - 928	94.0	54.0
2400 - 2483.5	94.0	54.0
5725 - 5875	94.0	54.0
24000 - 24250	108.0	68.0

* Quasi peak detector was employed for frequency up to 1GHz. For above 1GHz frequency, average detector was used. A peak limit of 20dB above the average limit does apply.

47 CFR FCC Parts 15.249(a) Radiated Emission (Fundamental and Harmonics) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Rohde & Schwarz EMI Test Receiver (20Hz – 26.5GHz)	ESMI	829214/005 829179/005	21 Apr 2018
TDK RF Solutions Hybrid Log Periodic Antenna (30MHz-3GHz)	HLP-3003C	130237	21 Oct 2017
Sonoma Preamplifier (9kHz – 1GHz)	310N	270640	14 Jul 2017

RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

47 CFR FCC Part 15.249(a) Radiated Emission (Fundamental and Harmonics) Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

47 CFR FCC Part 15.249(a) Radiated Emission (Fundamental and Harmonics) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the fundamental and harmonics emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from the EUT fundamental frequency until its 10th harmonics, using the Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz

Q-P limit (Class B) = 200 μ V/m = 46.0 dB μ V/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dB μ V/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 40.0 - 46.0 = -6.0

i.e. 6 dB below Q-P limit



RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

47 CFR FCC Part 15.249(a) Radiated Emission (Fundamental and Harmonics) Results

Operating Mode	Continuous carrier transmission	Temperature	22°C
Test Input Power	120V 60Hz	Relative Humidity	55%
Test Distance	3m	Atmospheric Pressure	1017mbar

Fundamental and harmonics field strengths up to 1GHz

Frequency (GHz)	Q-P Value (dB μ V/m)	Q-P Limit (dB μ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Note
908.4200	92.4	94.0	1.6	200	169	H	F
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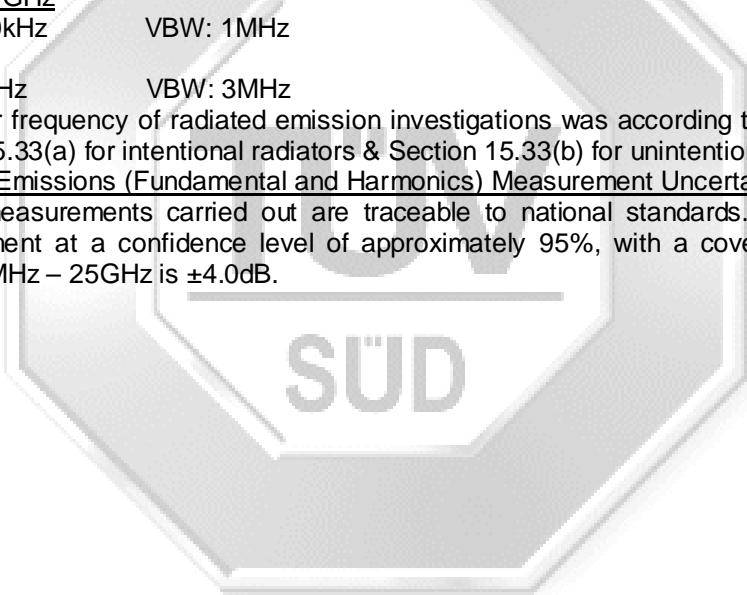
Fundamental and harmonics field strength above 1GHz – 10GHz

Freq (GHz)	Peak Value (dB μ V/m)	Peak Limit (dB μ V/m)	Peak Margin (dB)	AV Value (dB μ V/m) *See Note 2	AV Limit (dB μ V/m)	AV Margin (dB) *See Note 3	Height (cm)	Azimuth (Degrees)	Pol (H/V)	Note
1.8192	42.9	74.0	31.1	--	54.0	11.1	101	20	V	Hr
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RADIATED EMISSION (FUNDAMENTAL AND HARMONICS) TEST

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. As the measured peak shows compliance to the average limit, as such no average measurement was required.
3. The average margin indicates the margin of the measured peak value below the average limit.
4. “--” indicates no emissions were found and shows compliance to the limits.
5. “F” denotes fundamental and “Hr” denotes harmonics.
6. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
7. A “positive” margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a “negative” margin indicates a FAIL.
8. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
30MHz - 1GHz
RBW: 120kHz VBW: 1MHz
>1GHz
RBW: 1MHz VBW: 3MHz
9. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
10. Radiated Emissions (Fundamental and Harmonics) Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is $\pm 4.0\text{dB}$.



SÜD

Please note that this Report is issued under the following terms :

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