

EVALUATION REPORT

for Certification

Manufacturer: Summit Technology
130, Digital-ro, Namsung Plaza suite 611,
Geumcheon-gu, Seoul, South Korea
Attn: Mr. Yong-seong Park / Senior Director

Date of Issue: Dec. 27, 2019
Order Number: GETEC-C1-19-476
Test Report Number: GETEC-E3-19-026-R1
Test Site: GUMI UNIVERSITY EMC CENTER
CAB Designation Number: KR0033

RESPONSIBLE PARTY : Summit Technology

ADDRESS : 130, Digital-ro, Namsung Plaza suite 611, Geumcheon-gu, Seoul, South Korea

CONTACT PERSON : Mr. Yong-seong Park / Senior Director

Rule Part(s) : FCC Part 15 Subpart C-Intentional Radiator § 15.249
Test Method : ANSI C63.10 (2013)
Equipment Class : Low Power Transceiver, Rx Verified (DXT)
EUT Type : Z-Wave Gateway
Type of Authority : Certification
Model Name : TRF-ZW10

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10 (2013)

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Reviewed by,


Hyun Kim, Senior Engineer
GUMI UNIVERSITY EMC CENTER


Jae-Hoon Jeong, Technical Manager
GUMI UNIVERSITY EMC CENTER



Version

Test Report No.	Date	Description
GETEC-E3-19-026	Dec. 16, 2019	- First Approval Report
GETEC-E3-19-026-R1	Dec. 27, 2019	- Added 20 dB bandwidth measurement - Corrected typos - Changed the section 13.6





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Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: Summit Technology

Applicant Address: 130, Digital-ro, Namsung Plaza suite 611, Geumcheon-gu, Seoul, South Korea

Manufacturer: Summit Technology

Manufacturer Address: 130, Digital-ro, Namsung Plaza suite 611, Geumcheon-gu, Seoul, South Korea

Contact Person: Mr. Yong-seong Park / Senior Director

Telephone Number: +82-2-6929-3161

- **FCC ID.** 2AT6QTRFZW10
- **Equipment Class** Low Power Transceiver, Rx Verified (DXT)
- **EUT Type** Z-Wave Gateway
- **Model Name** TRF-ZW10
- **Rule Part(s)** FCC Part 15 Subpart C-Intentional Radiator § 15.249
- **Test Method** ANSI C63.10 (2013)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.10 (2013)
- **Dates of Test** Nov. 14, 2019 ~ Dec. 05, 2019
- **Place of Test** GUMI UNIVERSITY EMC CENTER (FCC Test firm Registration No.: 269701)
37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea
- **Test Report Number** GETEC-E3-19-026-R1
- **Dates of Issue** Dec. 27, 2019



2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2009) was used in determining radiated and conducted emissions emanating from **Summit Technology Z-Wave Gateway (Model name: TRF-ZW10)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**.

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 730-711, Republic of Korea

This test site is one of the highest point of GUMI UNIVERSITY at about 200 kilometers away from Seoul city and 40 kilometers away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.10 (2013)

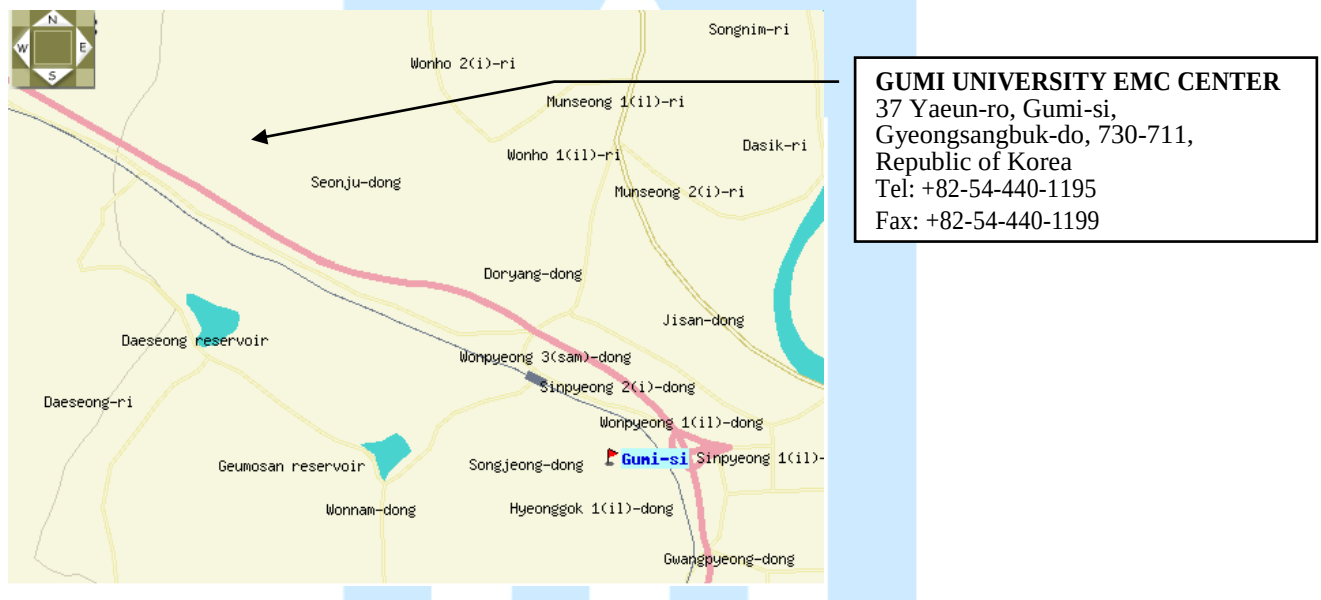


Fig 1. The map above shows the Gumi University in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **Summit Technology Z-Wave Gateway**(Model Name: TRF-ZW10) FCC ID.: 2AT6QTRFZW10

- Equipment	: Z-Wave Gateway
- Model name	: TRF-ZW10
- Serial number	: Proto type
- Electrical Rating	: DC 12 V
- Manufacturer	: Summit Technology
- Frequency Range	: 908.4 MHz - 916 MHz
- Antenna Specification	: Manufacturer: Mobinus Antenna type : PCB antenna Gain : 0.83 dBi

3.2 Definition of models

-None.



3.3 Support Equipment / Cables used

3.3.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Notebook Computer ¹⁾	SAMSUNG	NT500R3W	S/N: 0Q2V91JJ100096T FCC ID.: N/A

Note)

1) The Support Equipment use only setting to the test mode.

3.3.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
-	-	-	-

3.3.3 Used Cable(s)

Cable Name	Condition	Description
-	-	-

3.4 Modification Item(s)

-. None



4. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

4.1 Description of Antenna

The **Summit Technology Z-Wave Gateway**. comply with the requirement of §15.203 with a PCB antenna permanently attached to the transmitter.

5. Description of tests

5.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used.

The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency: 12 V / DC
- Operating condition during the test(s) :
 - Continuous RF transmitting mode with nominal maximum RF output power.
 - Operating channel frequency and modulation technology

Method/System	Number of Channels	Frequency	Data Rate	Modulation Technology
Low Power Transceiver, Rx Verified (DXT)	3	908.4 MHz 916 MHz	9.6 kbit & 40 kbit 100 kbit	GFSK

- EUT set condition (Test Software)

Test Software	Simplicity Studio
Test Software version	SV4.1.11.8

6. References Standards

- FCC Part 15 (2009) Subpart C-Intentional Radiator §15.249
- ANSI C 63.10 (2013): American National Standard for Testing Unlicensed Wireless Devices



7. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Result
§2.1049	Occupied Bandwidth	Pass
§2.1046	Transmitter Output Power	Pass
§15.215(c)	20 dB Bandwidth	Pass
§15.249(a)(e)	Fundamental Field Strength Level	Pass
§15.207	AC Power line Conducted Emissions	Pass
§15.249(d)(e), 15.205, 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Pass

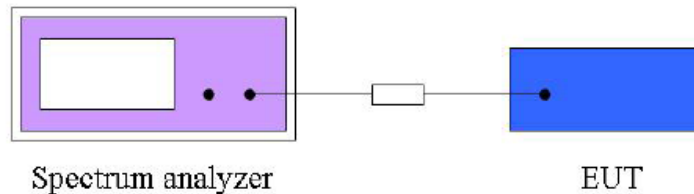


8. Occupied Bandwidth Measurement

8.1 Operating environment

Temperature : 20.6 °C
Relative Humidity : 26.6 % R.H.

8.2 Test Set-up (Layout)



8.3 Limit

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

8.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10. 2020

8.5 Test Test Procedure

- Set RBW = 5 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The spectrum analyzers' "occupied bandwidth" measurement function was used to record the occupied bandwidth.

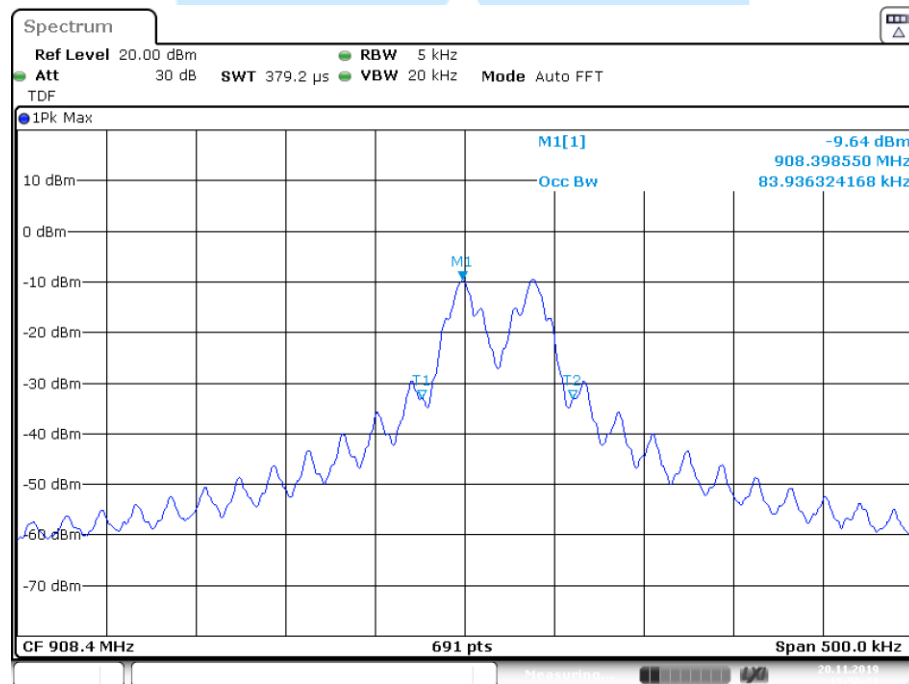


8.6 Test result

- Test Date : Nov. 20, 2019
- Reference Standard : §2.1049
- Test Procedure(s) : ANSI C63.10 (2013)
- Operating Condition : RF transmitting mode
- Power Source : DC 12 V

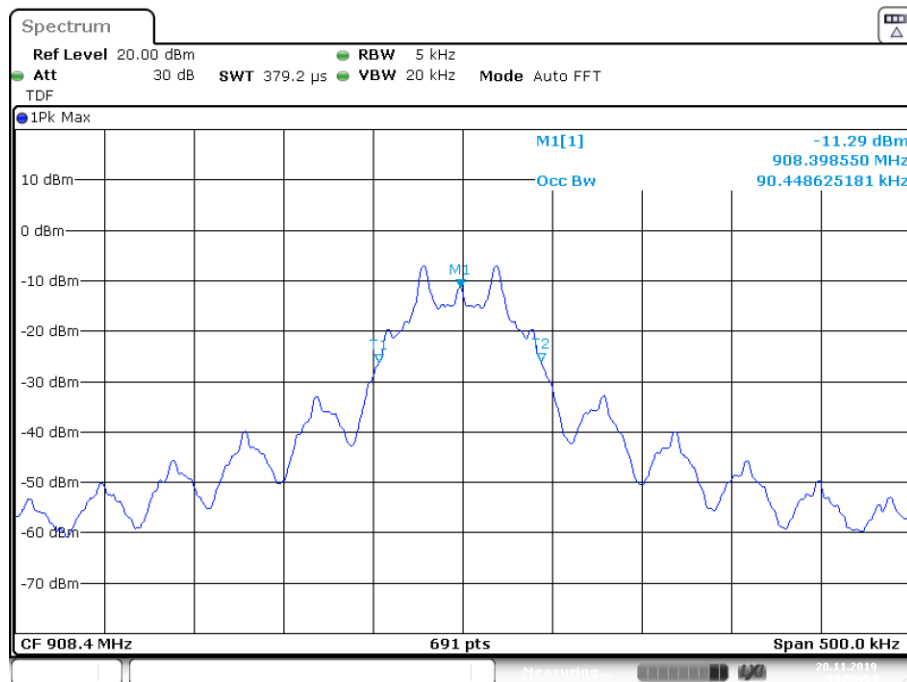
Frequency (MHz)	Channel	Data Rate (kbit)	OBW (kHz)	Result
908.4	1	9.6	83.93	Complies
	2	40	90.44	Complies
916	3	100	114.32	Complies

OBW Plot on Configuration : 908.4 MHz (9.6 kbit)



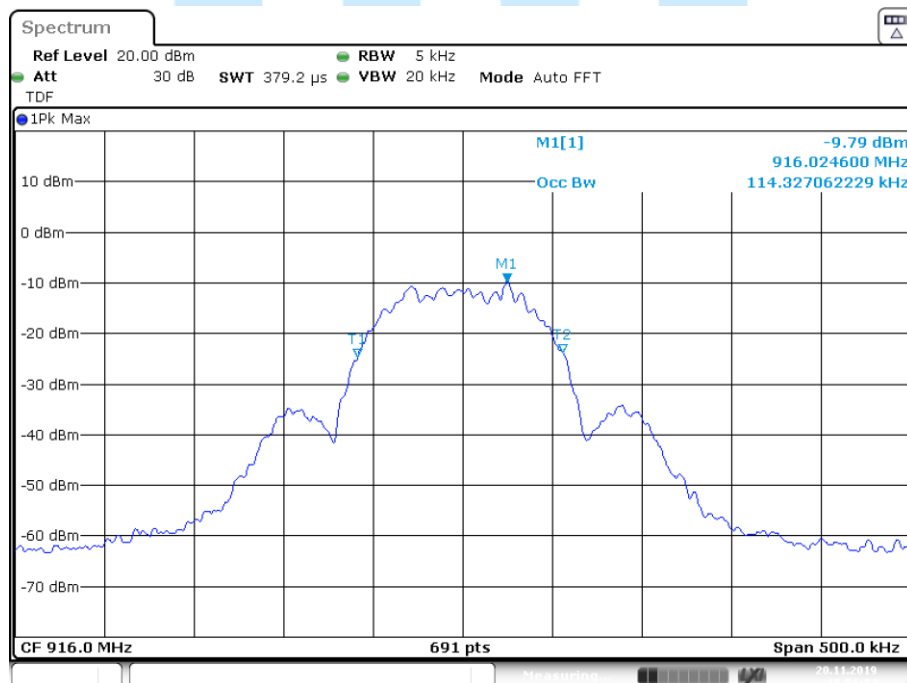


OBW Plot on Configuration : 908.4 MHz (40 kbit)



Date: 20.NOV.2019 15:50:55

OBW Plot on Configuration : 916 MHz (100 kbit)



Date: 20.NOV.2019 15:51:34

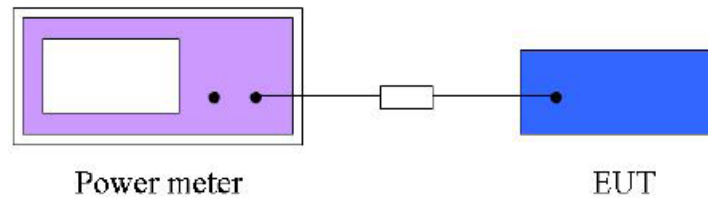


9. Output Power Measurement

9.1 Operating environment

Temperature : 20.6 °C
Relative Humidity : 26.6 % R.H.

9.2 Test Set-up (Layout)



9.3 Limit

The transmitter antenna terminal of the EUT is connected to the input of a spectrum analyzer. Measurements are made while the EUT is operating at maximum power and at the appropriate frequencies.

9.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10, 2020

9.5 Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

- Set RBW = 1 MHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.

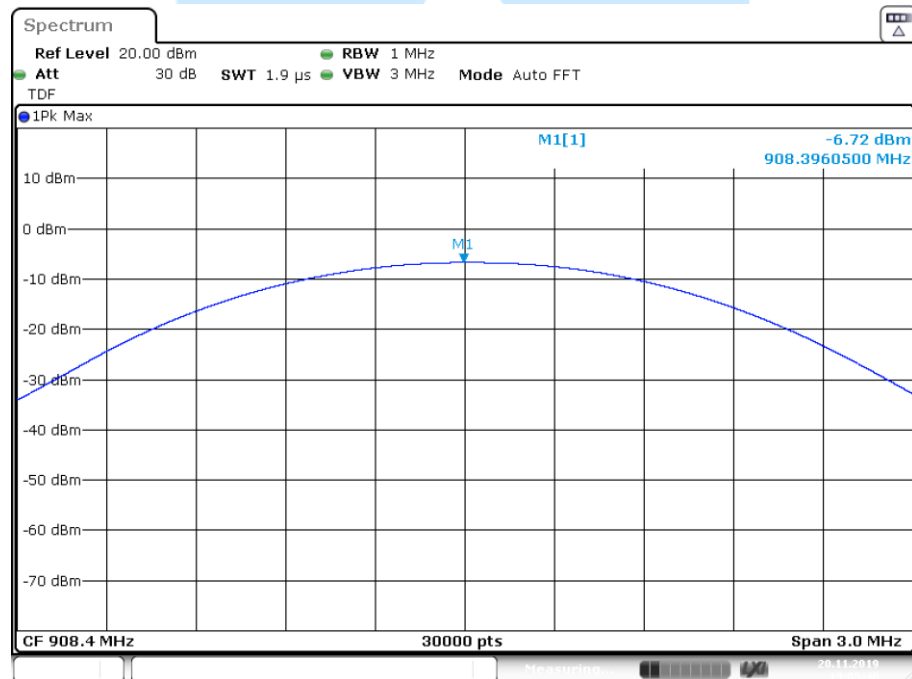


9.6 Test Result

- Test Date : Nov. 20, 2019
- Reference Standard : §2.1046
- Test Procedure(s) : ANSI C63.10 (2013)
- Operating Condition : RF transmitting mode
- Power Source : DC 12 V

Frequency (MHz)	Channel	Data Rate (kbit)	Peak Conducted Power (dBm)	Result
908.4	1	9.6	- 6.72	Complies
	2	40	- 6.74	Complies
916	3	100	- 6.71	Complies

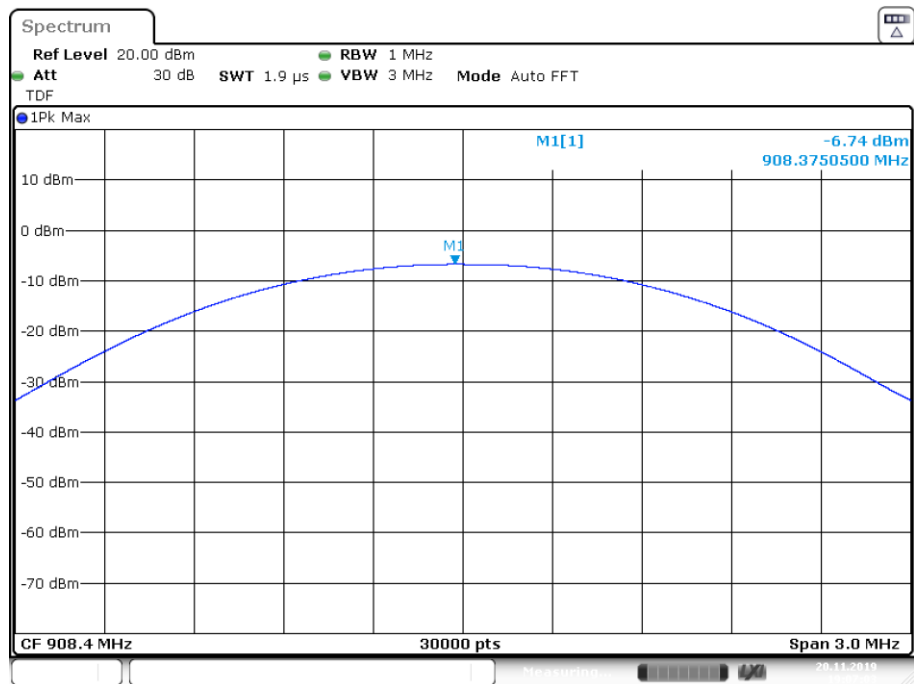
Output Power Plot on Configuration : 908.4 MHz (9.6 kbit)



Date: 20.NOV.2019 19:05:40

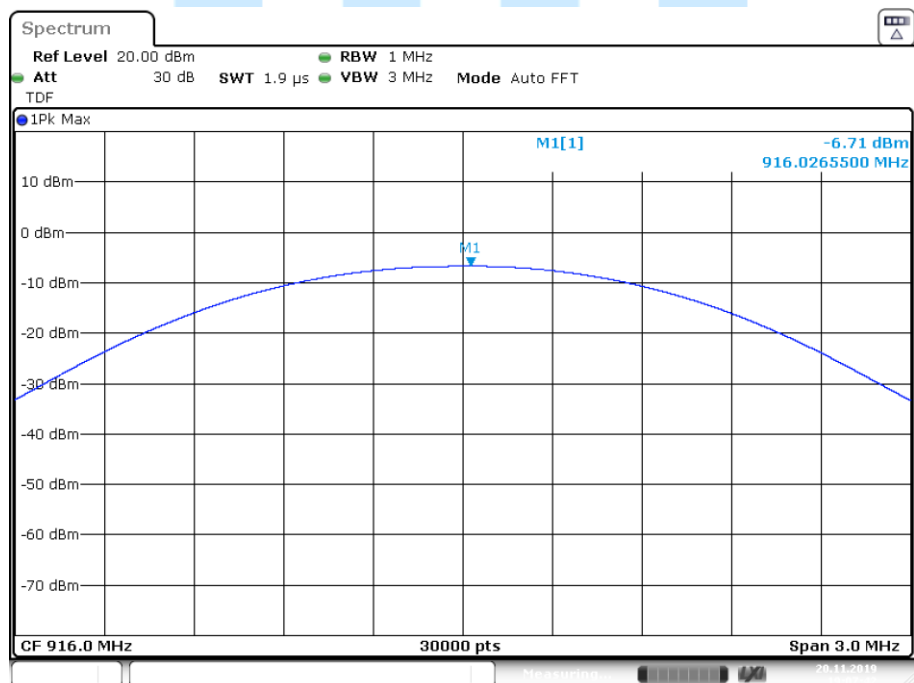


Output Power Plot on Configuration : 908.4 MHz (40 kbit)



Date: 20.NOV.2019 19:07:03

Output Power Plot on Configuration : 916 MHz (100 kbit)



Date: 20.NOV.2019 19:07:43

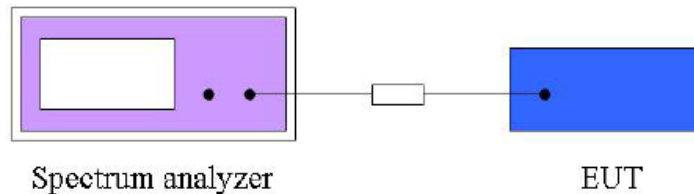


10. 20 dB Bandwidth Measurement

10.1 Operating environment

Temperature : 20.6 °C
Relative Humidity : 26.6 % R.H.

10.2 Test Set-up (Layout)



10.3 Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through §15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

10.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - FSV	Rohde & Schwarz	Spectrum Analyzer	101552	Apr. 11, 2020
■ - 10 dB Attenuator	Rohde & Schwarz	Attenuator 10 dB	SEP-10-14-046	Apr. 10, 2020

10.5 Test Test Procedure

- Set RBW = 5 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

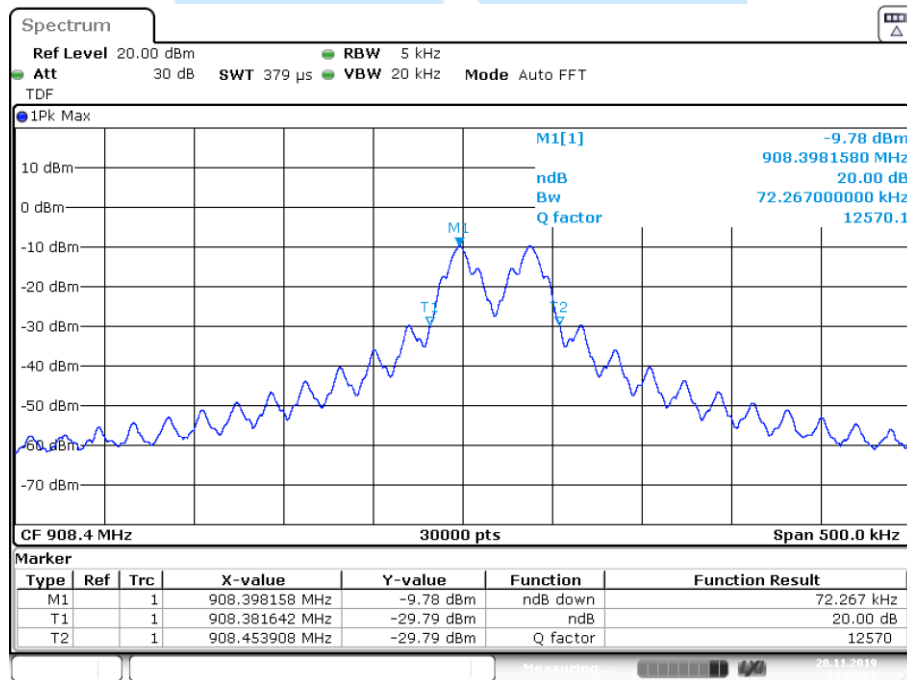


10.6 Test result

- Test Date : Nov. 20, 2019
- Reference Standard : Part 15 Subpart C, Sec. 15.215(c)
- Test Procedure(s) : ANSI C63.10 (2013)
- Operating Condition : RF transmitting mode
- Power Source : DC 12 V

Frequency (MHz)	Channel	Data Rate (kbit)	20 dB Bandwidth (kHz)	Result
908.4	1	9.6	72.26	Complies
	2	40	92.3	Complies
916	3	100	124.21	Complies

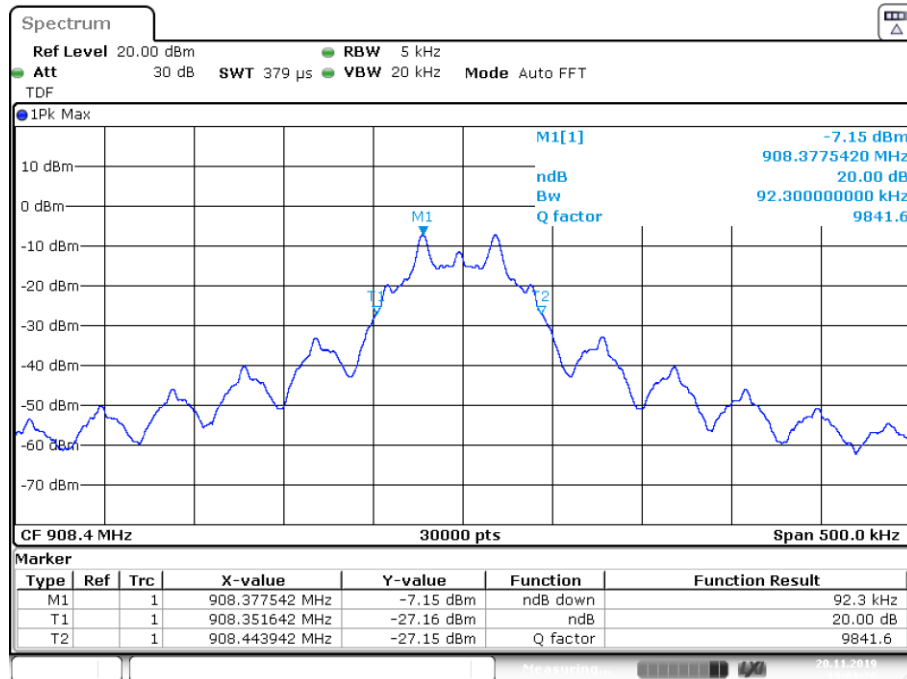
20 dB bandwidth Plot on Configuration : 908.4 MHz (9.6 kbit)



Date: 20.NOV.2019 19:02:03

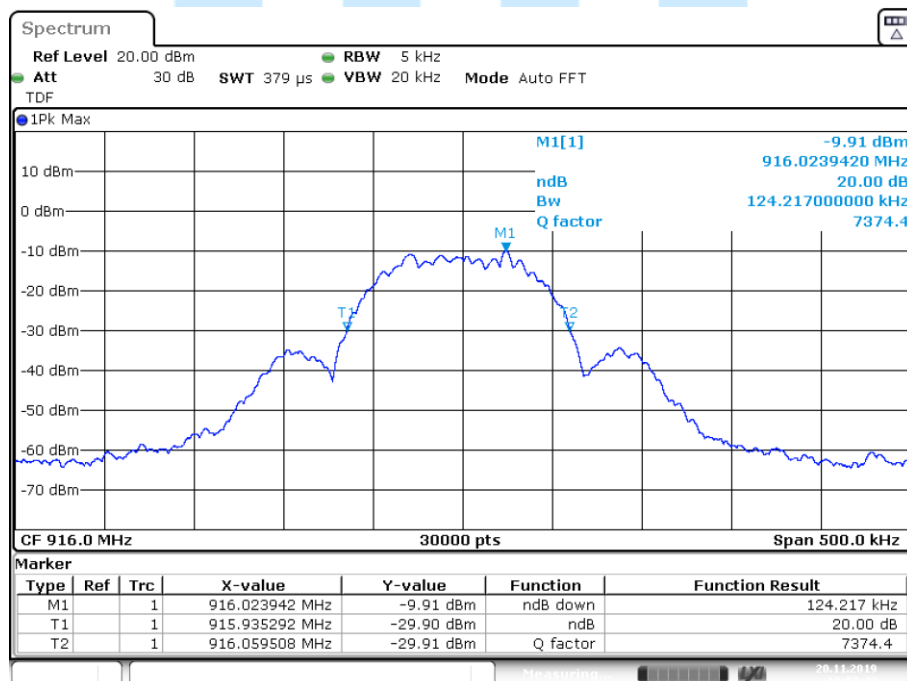


20 dB bandwidth Plot on Configuration : 908.4 MHz (40 kbit)



Date: 20.NOV.2019 19:01:28

20 dB bandwidth Plot on Configuration : 916 MHz (100 kbit)



Date: 20.NOV.2019 18:57:43

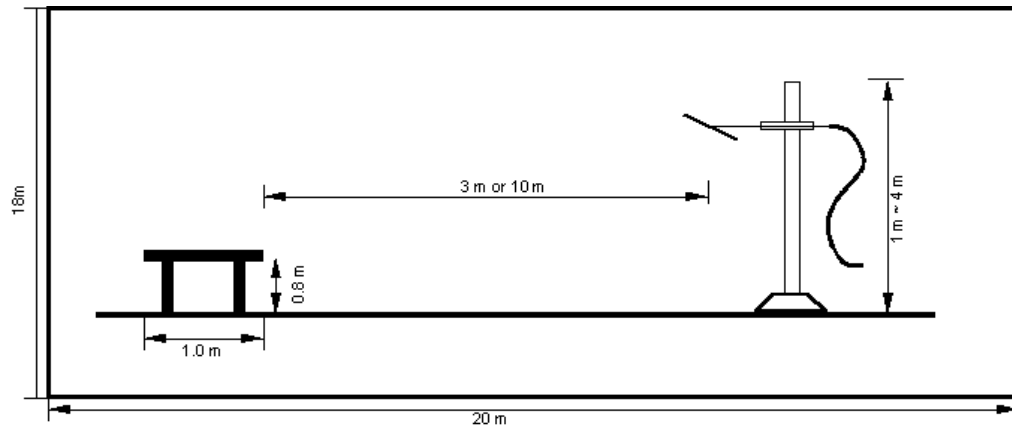


11. Fundamental Field Strength Level Measurement

11.1 Operating Environment

Temperature : 23.1 °C
Relative Humidity : 32.3 % R.H.

11.2 Test Set-up (Layout)



Dimensions of test site (Below 1GHz)

A preliminary and final measurement was at 3 m anechoic chamber.

The EUT was placed on a non-conducting table.

For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.



11.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test items(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	5.14 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	5.10 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	6.05 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.19 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H)	5.20 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H)	5.20 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (18 000 MHz ~ 26 000 MHz, 3 m, V/H)	5.53 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



11.4 Limit

The maximum permissible peak field strength level is 50mV/m (93.98dB μ V/m)

11.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESU40	Rohde & Schwarz	EMI Test Receiver	100266	Apr. 12, 2020
■ - HFH2-Z2	Rohde & Schwarz	Loop Antenna	100041	Dec. 06, 2019
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3376	May 02, 2020
■ - BBHA9120D	Schwarzbeck	Horn Antenna	207	Sep. 14, 2019
■ - 3160-09	Schwarzbeck	Horn Antenna	218457	Feb. 12, 2020
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - CO3000	Innco system GmbH	Position Controller	CO3000/1804/4	N/A
			2760218/P	
■ - MA4640-XP-ET	Innco system GmbH	Antenna Mast	5580916	N/A
■ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	Apr. 10, 2020
■ - SCU-F1826-G47-BZ42-CSS	BONN Elektronik	Preamplifier	10003	Apr. 15, 2020
■ - WHKX1.0/15G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN36	Apr. 12, 2020
■ - EMC 32	Rohde & Schwarz	Testing Software	VER10.50.10	N/A

11.6 Test data for Radiated Spurious Emission

- Test Date : Dec. 05, 2019
- Reference Standard : Part 15 Subpart C, Sec. 15.249(a)(e)
- Measuring Distance : 3 m
- Resolution Bandwidth : 120 kHz
- Detector mode : Peak detector mode
- Power Source : DC 12 V
- Note : Through three orthogonal axes were investigated and the worst case is report

Frequency [MHz]	Ch.	Data Rate [kbit]	Measure Frequency [MHz]	Pol.	Reading [dB μ V]	Transducer Factor [dB]	Test Result [dB μ V/m]	Limits [dB μ V/m]	Margin [dB]	Detector Type
908.4	1	9.6	908.43	H	59.45	30.80	90.25	93.98	3.73	PK
	2	40	908.41	H	59.17	30.80	89.97	93.98	4.01	PK
916	3	100	916.02	H	60.28	30.90	91.18	93.98	2.80	PK

Note:

Test Result = Reading + Transducer Factor

Where, Transducer Factor = ACF + CL

ACF : Antenna Collection Factor,

CL = Cable loss + High Pass Filter

Pol.: H(Horizontal), V(Vertical)



12. AC Power line Conducted emission

-Test Description

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure. (Test firm Registration Number: 269701)

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for 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 EMI test receiver (Rohde & Schwarz, ESCI).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

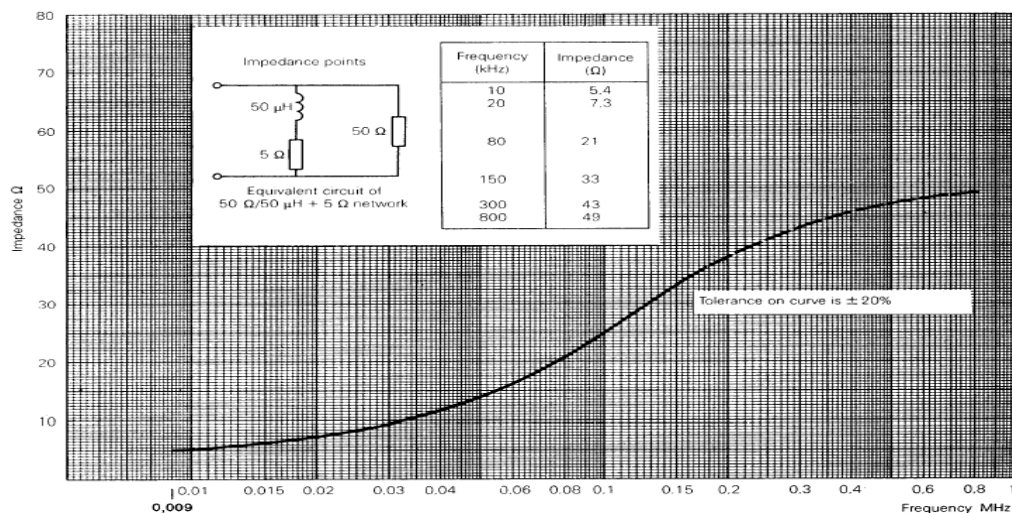


Fig 2. Impedance of LISN



12.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 34.0 % R.H.

12.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

12.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement.”

The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	3.78 dB	Confidence level of approximately 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	3.31 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



12.4 Limit

RFI Conducted	FCC Limit(dBμV/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

12.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■- ESCI	Rohde & Schwarz	EMI test receiver	100237	Apr. 13, 2020
□- ENV216	Rohde & Schwarz	LISN	100172	Apr. 10, 2020
■- ENV216	Rohde & Schwarz	LISN	100173	Apr. 09, 2020
■- ST08	TESEQ	ISN	42870	Apr. 11, 2020
■- EMC 32	Rohde & Schwarz	Testing Software	VER8.53	N/A

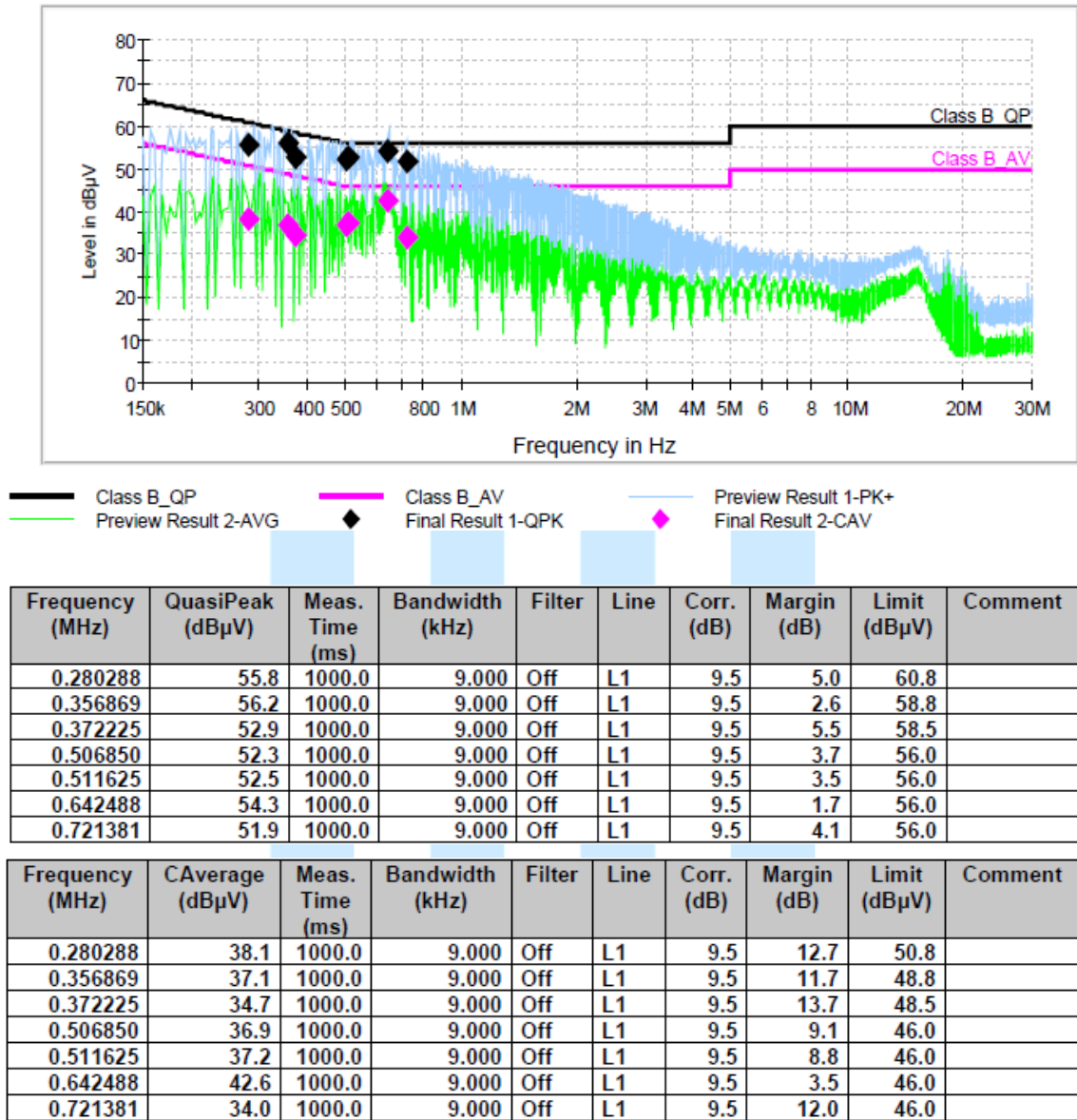
12.6 Test data for Conducted Emission

- Test Date : Dec. 04, 2019
- Reference Standard : Part 15 Subpart C, Sec. 15.207
- Test Procedure(s) : ANSI C63.10 (2013)
- Operating Condition : Maximum operating mode
- Power Source : AC 120 V / 60 Hz
- Frequency range : 0.15 MHz to 30 MHz
- Line : AC Power Line (Live and Neutral)
- Comment :



12.7 Test Result

AC Power line Conducted emission





13. Radiated Spurious & Restricted Band Edge Emission

Exploratory Radiated measurements were conducted at the 3m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Final measurements of below 1GHz were made at 3m or 10 m Chamber that complies with CISPR 16/ANSI C63.10. Above 1GHz final measurements were conducted at the 3m Chamber only.

For measurements above 1GHz, the bottom side of 3m chamber was installed with absorbers in order to meet SVSWR Limit.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1GHz) and Peak & Average mode (Above 1GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

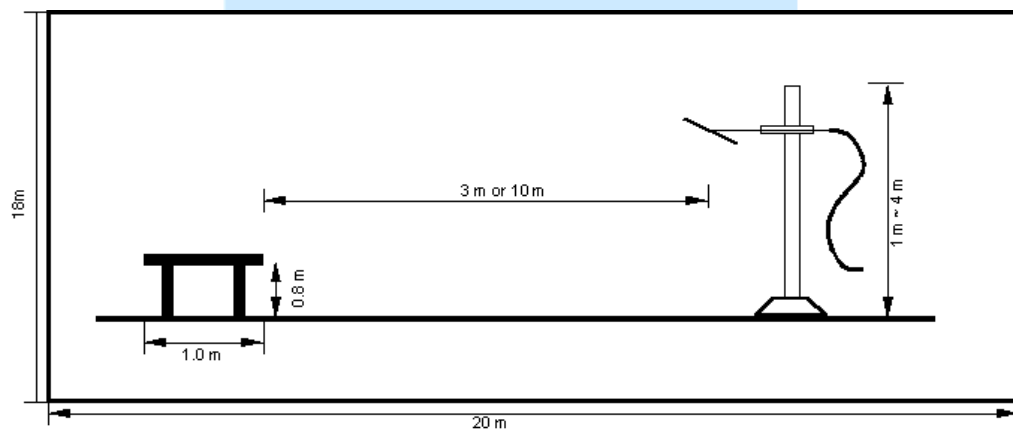


Fig 3. Dimensions of test site (Below 1GHz)

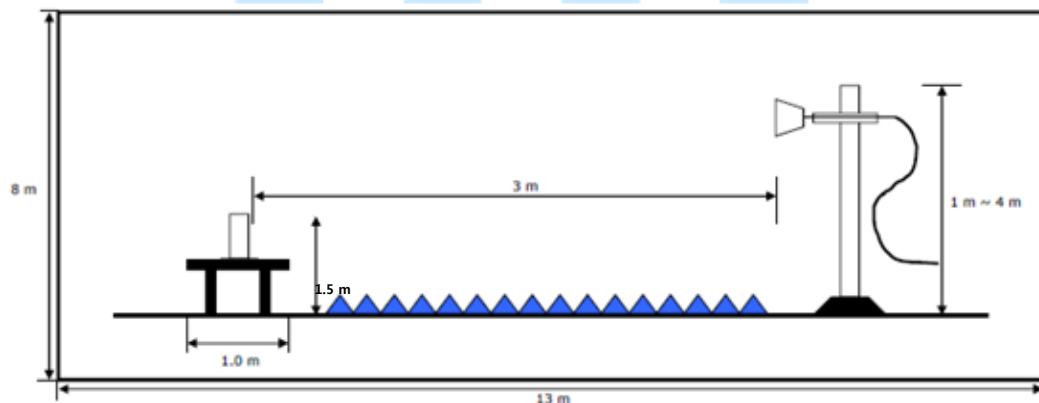


Fig 4. Dimensions of test site (Above 1GHz)



13.1 Operating environment

Temperature : 23.7 °C
Relative humidity : 31.0 % R.H.

13.2 Test set-up

A preliminary and final measurement was at 3 m anechoic chamber.

The EUT was placed on a non-conducting table.

For emissions testing at or below 1 GHz, the table height is 80 cm above the reference ground plane.

For emission measurements above 1 GHz, the table height is 1.5 m above the reference ground plane.

The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

13.3 Measurement uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

The measurement uncertainty was given with a confidence of 95 %.

Test items(Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	5.14 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	5.10 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	6.05 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.19 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m, V/H)	5.20 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m, V/H)	5.20 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (18 000 MHz ~ 26 000 MHz, 3 m, V/H)	5.53 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



13.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2 400/F (kHz)	300
0.490 ~ 1.705	2 400/F (kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

13.5 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESU40	Rohde & Schwarz	EMI Test Receiver	100266	Apr. 12, 2020
■ - HFH2-Z2	Rohde & Schwarz	Loop Antenna	100041	Dec. 06, 2019
■ - VULB9160	Schwarzbeck	Broadband Test Antenna	3376	May 02, 2020
■ - BBHA9120D	Schwarzbeck	Horn Antenna	207	Sep. 17, 2020
■ - 3160-09	Schwarzbeck	Horn Antenna	218457	Feb. 12, 2020
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - CO3000	Innco system GmbH	Position Controller	CO3000/1804/4 2760218/P	N/A
■ - MA4640-XP-ET	Innco system GmbH	Antenna Mast	5580916	N/A
■ - AFS 44 00101800-25-10P-44	MITEQ	Preamplifier	1258943	Apr. 10, 2020
■ - SCU-F1826-G47-BZ42-CSS	BONN Elektronik	Preamplifier	10003	Apr. 15, 2020
■ - WHKX1.0/15G-10SS	WAINWRIGHT INSTRUMENTS	High pass filter	SN36	Apr. 12, 2020
■ - EMC 32	Rohde & Schwarz	Testing Software	VER10.50.10	N/A



13.6 Test data for Radiated Spurious Emission

- Test Date : Nov. 14 ~ 15, 2019
- Reference Standard : Part 15 Subpart C, Sec. 15.247(d)(e)
- Measuring Distance : 3 m
- Resolution Bandwidth : 200 Hz, 9 kHz(Below 30 MHz) / 120 kHz(30 MHz ~ 1GHz) / 1 MHz(Above 1GHz)
- Detector mode : Quasi Peak detector mode / Peak detector mode / Average detector mode
- Power Source : DC 12 V
- Note : Through three orthogonal axes were investigated and the worst case is report

Radiated Spurious Emission (9 kHz to 30 MHz)

※ The reading of emissions are attenuated more than 10 dB below the permissible limits or the field strength is too small to be measured.

Radiated Spurious Emission (30 MHz to 1 000 MHz)

Frequency [MHz]	Ch.	Data Rate [kbit]	Measure Frequency [MHz]	Pol.	Reading [dBμV]	Transducer Factor [dB]	Test Result [dBμV/m]	Limits [dBμV/m]	Margin [dB]	Detector Type
908.4	1	9.6	159.71	H	19.06	15.7	34.76	43.50	8.74	QPK
			299.98	H	22.14	17.4	39.54	46.00	6.46	QPK
	2	40	161.56	H	19.6	15.6	35.20	43.50	8.30	QPK
			294.27	H	21.6	17.1	38.70	46.00	7.30	QPK
916	3	100	159.66	H	20.13	15.7	35.83	43.50	7.67	QPK
			293.22	H	21.41	17.1	38.51	46.00	7.49	QPK
			480.02	H	4.26	22.4	26.66	46.00	9.34	QPK

Note:

Test Result = Reading + Transducer Factor

Where, Transducer Factor = ACF + CL

ACF : Antenna Collection Factor,

CL = Cable loss + High Pass Filter

Pol.: H(Horizontal), V(Vertical)

Radiated Spurious Emission (1 GHz to 10 GHz)

※ If the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.



14. Sample Calculations

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

14.1 Example 1 :

■ 20.3 MHz

Class B Limit = 250 μV = 48 dB μV
Reading = 39.2 dB μV
10 ^(39.2dB μV /20) = 91.2 μV
Margin = 48 dB μV - 39.2 dB μV
= 8.8 dB

14.2 Example 2 :

■ 66.7 MHz

Class B Limit = 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$
Reading = 31.0 dB μV
Antenna Factor + Cable Loss = 5.8 dB
Total = 36.8 dB $\mu\text{V}/\text{m}$
Margin = 40.0 dB $\mu\text{V}/\text{m}$ – 36.8 dB $\mu\text{V}/\text{m}$
= 3.2 dB



15. Recommendation & Conclusion

The data collected shows that the **Summit Technology Z-Wave Gateway (Model Name: TRF-ZW10)** was complies with §15.249 of the FCC Rules.

- The end -

