

Certification Test Report

**FCC ID: 2AELXBTR1
IC: 20120-BTR1**

**FCC Rule Part: 15.247
IC Radio Standards Specification: RSS-247**

ACS Report Number: 15-3004.W06.1B

**Manufacturer: SmallHD, LLC
Model: ACC-REMOTE-BT-1**

**Test Begin Date: April 14, 2015
Test End Date: May 14, 2015**

Report Issue Date: October 8, 2015



FOR THE SCOPE OF ACCREDITATION UNDER LAB Code AT-1921

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

Reviewed by:

A handwritten signature in black ink, appearing to read 'M. R. de Aranzeta'.

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Lab Manager Durham (RTP)
ACS Inc.**

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This report contains 18 pages

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1 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations and Industry Canada's Radio Standards Specification RSS-247 Certification.

1.2 Product Description

The EUT is a handheld remote control BTLE transceiver to control the functions of the 500 series monitor.

Technical Information:

Detail	Description
Frequency Range	2402 to 2480 MHz
Number of Channels	3 advertising and 37 data
Modulation Format	GFSK (F1D)
Data Rates	To 1 Mbps
Number of Inputs/Outputs	1 RF output to an integral antenna
Operating Voltage	12 Vdc
Antenna Type / Gain	Copper Wire / -10.4dBi Peak

Manufacturer Information:

SmallHD, LLC
118 MacKenan Drive, Ste 400
Cary, NC 27511

EUT Serial Numbers: N/A

Test Sample Condition: The test samples were provided in good working order with no visible defects.

1.3 Test Methodology and Considerations

For radiated emissions three orientations of the EUT were evaluated to determine worst case. The worst case orientation was determined to be the Y orientation. The EUT was powered with a DC bench supply due to current restrictions with the coin cell battery while in test mode.

The EUT is a battery operated handheld device therefore AC power line conducted emissions testing was not performed.

2 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
2320 Presidential Drive, Suite 101
Durham, NC 27703
Phone: (919) 381-4235

2.2 Laboratory Accreditations/Recognitions/Certifications

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1921 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 18' x 28' x 18' shielded enclosure. The chamber is lined with Samwha Electronics Co. LTD Ferrite Absorber, model number SFA300 (HSN-1). The ferrite tile is 10cm x 10 cm and weighs approximately 1.4lbs. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber. On top of the ferrite tiles is DMAS HT-45 (Dutch Microwave Absorber Solutions) hybrid absorber on all walls except the wall behind the antenna mast which has a shorter DMAS HT-25 absorber.

The turntable is 1.50m in diameter and is located 150cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using short #6 copper wire. The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the turntable. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane.

Behind the turntable is a 2' x 6' x 1.5' deep shielded pit used for support equipment if necessary. The pit is equipped with 2 - 4" PVC chase from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

To comply with the requirements of the test methods given on page 4, RF absorbing foam was placed inside the chamber in a configuration that provided the best results. First, a 12ft X 12ft. patch of 10" tall absorber was placed on the floor between the turntable and the receiving antenna. This absorber meets the absorption requirements specified in ANSI C63.4:2009.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

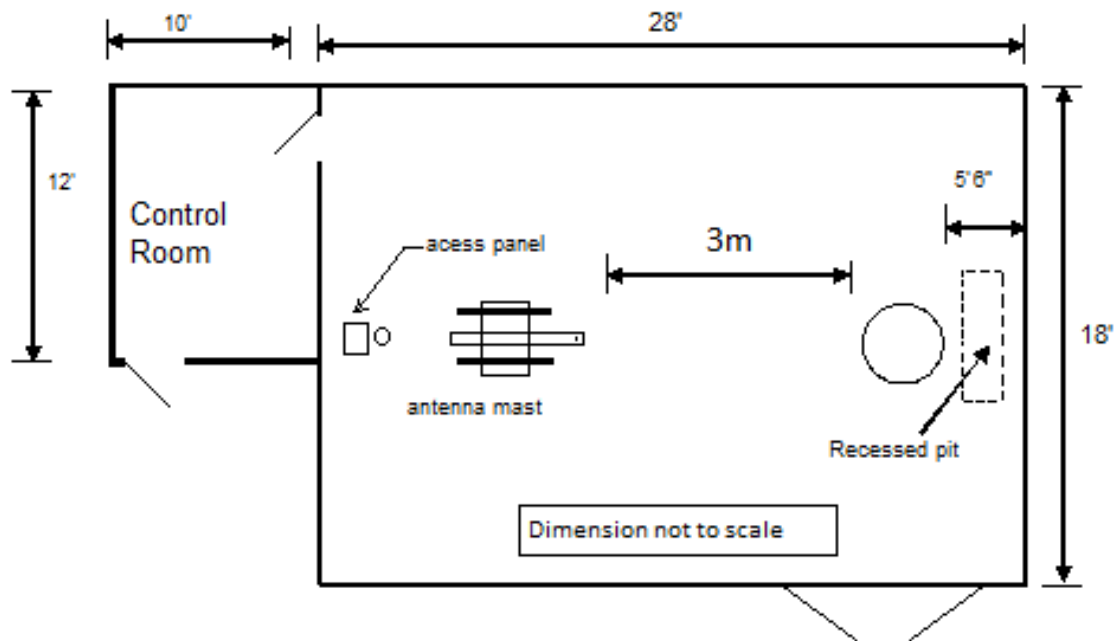


Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 10' sheet galvanized steel horizontal ground reference plane (GRP) bonded every 6" to an 8' X 8' aluminum vertical ground plane.

A diagram of the room is shown below in figure 2.4-1:

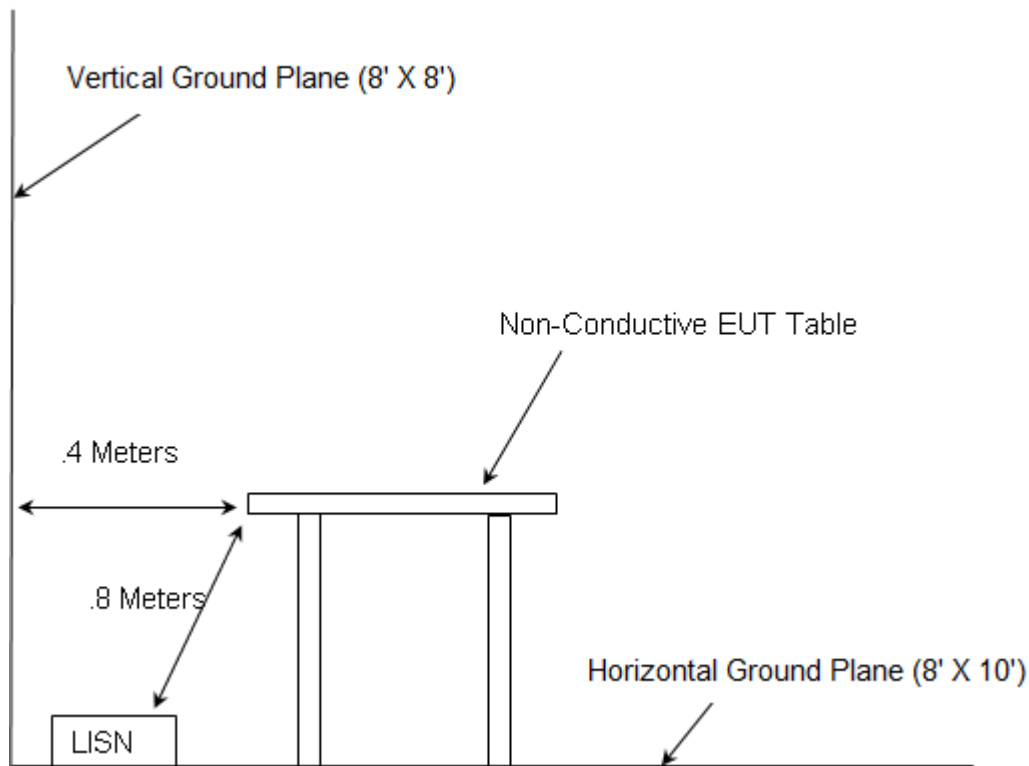


Figure 2.4-1: AC Mains Conducted EMI Site

3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2015
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2015
- ❖ FCC KDB 558074 D01 DTS Meas Guidance v03r03 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, June 9, 2015
- ❖ Industry Canada Radio Standards Specification: RSS-247, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015
- ❖ Industry Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, Nov 2014

4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

Table 4-1: Test Equipment

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
3002	Rohde & Schwarz	ESU40	Receiver	100346	7/25/2014	7/25/2015
3038	Florida RF Labs	NMSE-290AW-60.0-NMSE	Cable Set	1448	1/12/2015	1/12/2016
3039	Florida RF Labs	NMSE-290AW-396.0-NMSE	Cable Set	1447	1/12/2015	1/12/2016
3016	Fei Teng Wireless Technology	HA-07M18G-NF	Antennas	2013120203	1/14/2015	1/14/2016
3057	Advanced Technical Materials	42-441-6/BR	Antennas	R110602	NCR	NCR
626	EMCO	3110B	Antennas	9411-1945	2/26/2014	2/26/2016
277	Emco	93146	Antennas	9904-5199	9/2/2014	9/2/2016
3006	Rohde & Schwarz	TS-PR18	Amplifiers	122006	7/24/2014	7/24/2015
3007	Rohde & Schwarz	TS-PR26	Amplifiers	100051	7/14/2014	7/14/2015
3054	Mountain View Cable	BMS-RG400-36.0-BMS	Cables	3054	1/12/2015	1/12/2016
3020	Rohde & Schwarz	SMB100A	Signal Generators	175943	7/24/2014	7/24/2015
3008	Rohde & Schwarz	NRP2	Meter	103131	1/15/2015	1/15/2016
3009	Rohde & Schwarz	NRP-Z81	Meter	102397	1/15/2015	1/15/2016
3046	Aeroflex Inmet	26AH-10	Attenuator	1443	1/15/2015	1/15/2016
3033	Hasco, Inc.	HLL142-S1-S1-36	Cables	1435	1/15/2015	1/15/2016
3034	Hasco, Inc.	HLL142-S1-S1-12	Cables	3076	1/18/2015	1/18/2016
3012	Rohde & Schwarz	EMC32-EB	Software	100731	1/19/2015	7/19/2016

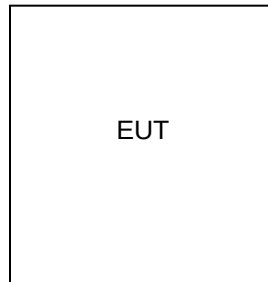
NCR = No Calibration Required

Firmware Version: ESU40 is 4.73 SP1

Software Version: EMC32-B is 9.15

5 SUPPORT EQUIPMENT**Table 5-1: Support Equipment**

Item	Equipment Type	Manufacturer	Model Number	Serial Number
1	Power Supply	Sorenson	QRD 20-4	N/A

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM**Figure 6-1: Test Setup Block Diagram****Table 6-1: EUT Description**

Item #	Type Device	Manufacturer or Responsible Party	Model/Part #	Serial #
1	EUT	SmallHD, LLC	ACC-REMOTE-BT-1	N/A

Table 6-2: Cable Description – Radiated Emissions

Cable #	Cable Type	Length	Shield	Termination
The EUT is a standalone battery operated device with no support equipment utilized.				

7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement – FCC 15.203

The EUT utilizes a copper wire antenna. The antenna is integral to the device and cannot be removed or replaced by the end user. The peak gain of the antenna is -10.4dBi.

7.2 Power Line Conducted Emissions – FCC 15.207, IC: RSS-Gen 8.8

The EUT is a battery operated handheld device therefore AC power line conducted emissions testing was not performed.

7.3 6dB / 99% Bandwidth – FCC 15.247(a)(2), IC: RSS-247 5.2(1)

7.3.1 Measurement Procedure

The 6dB bandwidth was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v03r03. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 3 times the RBW. The trace was set to max hold with a peak detector active. The marker-delta function of the spectrum analyzer was utilized to determine the 6 dB bandwidth of the emission.

The occupied bandwidth measurement function of the spectrum analyzer was used to measure the 99% bandwidth. The span of the analyzer was set to capture all products of the modulation process, including the emission sidebands. The resolution bandwidth was set to 1% to 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth.

7.3.2 Measurement Results

Table 7.3.2-1: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	99% Bandwidth [MHz]
2402	0.681	1.409
2440	0.681	1.409
2480	0.681	1.336

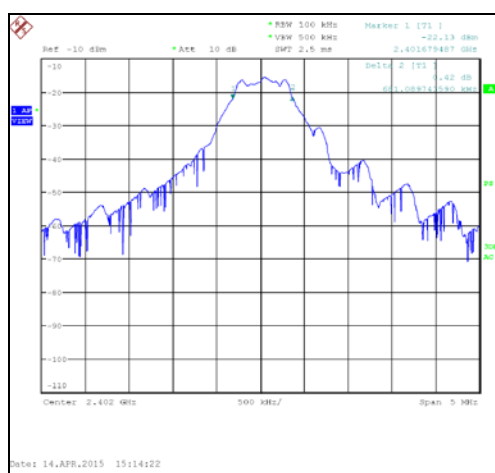


Figure 7.3.2-1: 6dB Bandwidth Low Channel

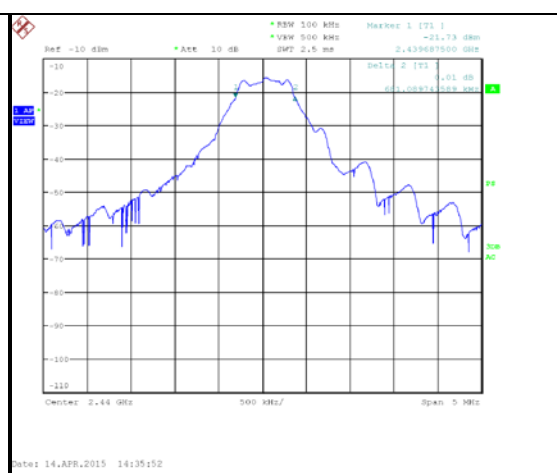


Figure 7.3.2-2: 6dB Bandwidth Mid Channel

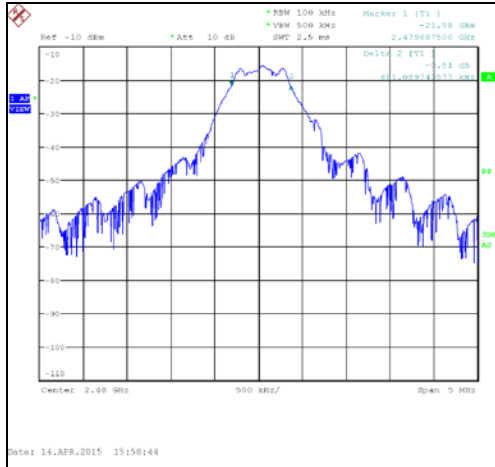


Figure 7.3.2-3: 6dB Bandwidth High Channel

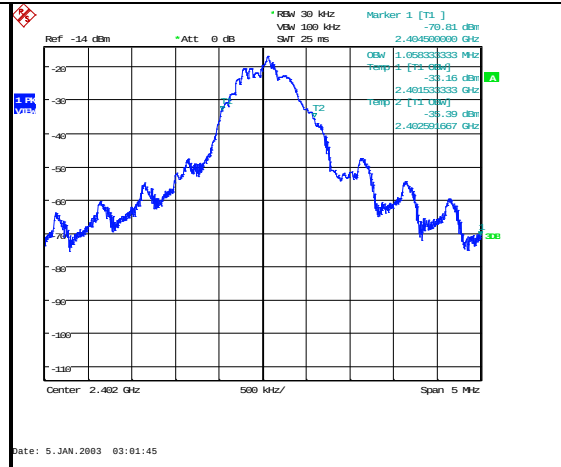


Figure 7.3.2-4: 99% Bandwidth Low Channel

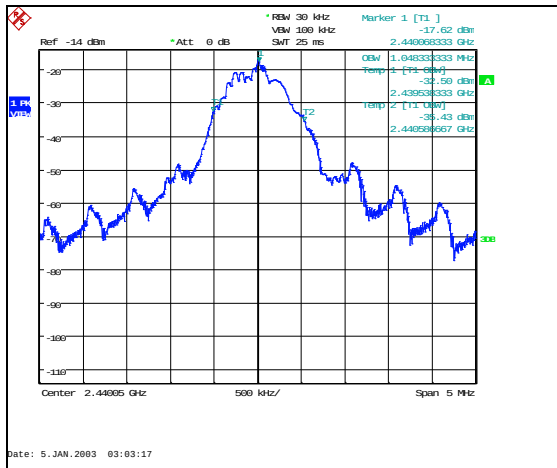


Figure 7.3.2-5: 99% Bandwidth Mid Channel

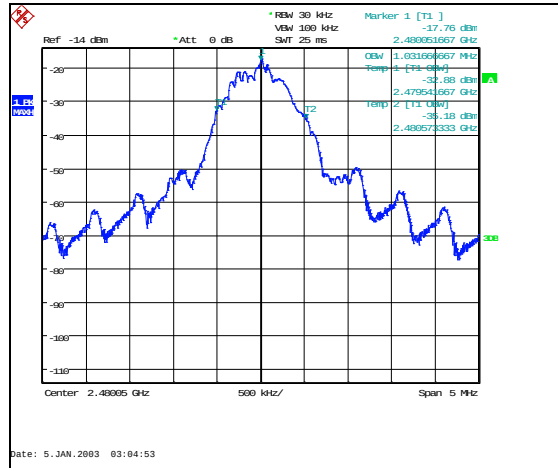


Figure 7.3.2-6: 99% Bandwidth High Channel

7.4 Fundamental Emission Output Power – FCC 15.247(b)(3), IC: RSS-247 5.4(4)**7.4.1 Measurement Procedure**

The maximum peak conducted output power was measured in accordance with FCC KDB 558074 D01 DTS Measurement Guidance v03r02 utilizing the PKPM1 Peak power meter method. The RF output of the equipment under test was directly connected to the input of the peak power meter applying suitable attenuation.

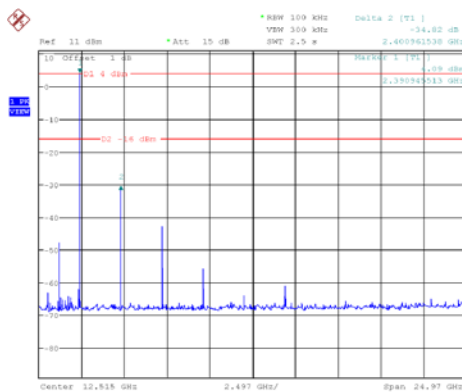
7.4.2 Measurement Results**Table 7.4.2-1: Maximum Peak Conducted Output Power**

Frequency (MHz)	Output Power (dBm)
2402	1.05
2440	-0.36
2480	-1.38

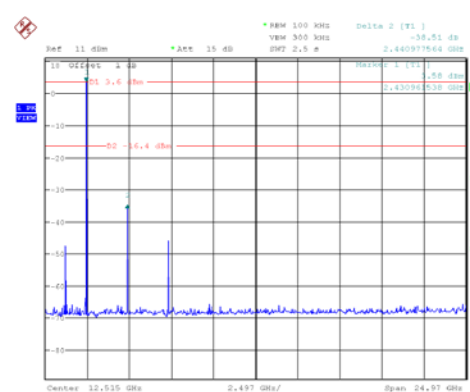
7.5 Emission Levels – FCC 15.247(d), 15.205, 15.209; IC RSS-247 5.5, RSS-Gen 8.9/8.10**7.5.1 Emissions into Non-restricted Frequency Bands****7.5.1.1 Measurement Procedure**

The unwanted emissions into non-restricted bands were measured conducted in accordance with FCC KDB 558074 D01 DTS Measurement Guidance v03r02. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 100 kHz. The Video Bandwidth (VBW) was set to ≥ 300 kHz. Span was set to 1.5 times the DTS bandwidth. The trace was set to max hold with a peak detector active. The resulting spectrum analyzer peak level was used to determine the reference level with respect to the 20 dBc limit. The spectrum span was then adjusted for the measurement of spurious emissions from 30MHz to 25GHz, 10 times the highest fundamental frequency.

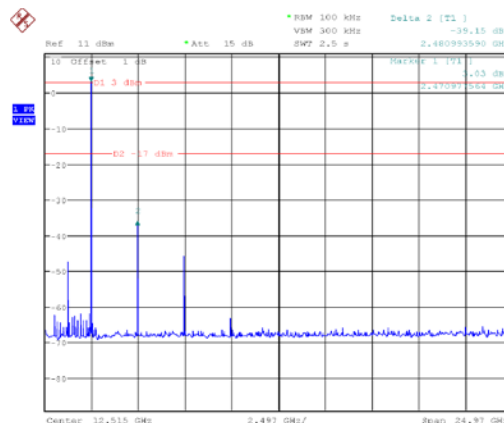
Band-edge compliance was determined using the conducted marker-delta method in which the radio frequency power that is produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power.

7.5.1.2 Measurement Results

Date: 16.APR.2015 10:11:01

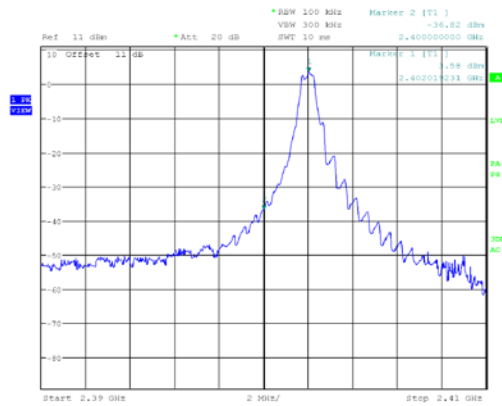
Figure 7.5.1.2-1: 30 MHz – 25 GHz – LCH

Date: 16.APR.2015 10:15:37

Figure 7.5.1.2-2: 30 MHz – 25 GHz – MCH

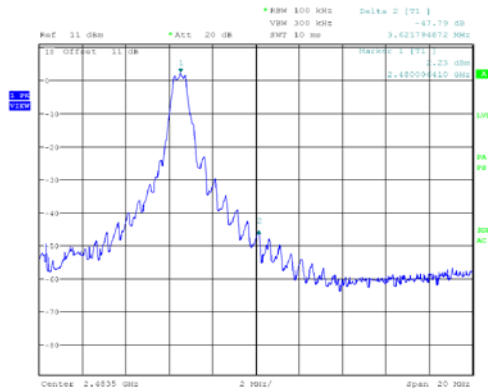
Date: 16.APR.2015 10:22:58

Figure 7.5.1.2-3: 30 MHz – 25 GHz – HCH



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Figure 7.5.1.2-4: Lower Band-edge - LCH



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Figure 7.5.1.2-5: Upper Band-edge - HCH

Frequency MHz	Fund. Reading dBμV/m	Antenna Polarity V/H	Correction From Plot dB	Field Strength dBμV/m	Margin dB
2400		V	36.82	20 (dBc)	16.82
2483.5	87.7	V	47.79	39.91	14.09

7.5.2 Emissions into Restricted Frequency Bands

7.5.2.1 Measurement Procedure

The unwanted emissions into restricted bands were measured radiated over the frequency range of 9 kHz to 25GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz.

Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209.

7.5.2.2 Duty Cycle Correction

There was no duty cycle correction factor required.

7.5.2.3 Measurement Results

Table 7.5.2.3-1: Radiated Spurious Emissions Tabulated Data

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel										
4804	54.30	39.30	H	6.10	60.40	45.40	74.0	54.0	13.6	8.6
4804	51.60	34.20	V	6.10	57.70	40.30	74.0	54.0	16.3	13.7
Middle Channel										
4880	53.00	30.20	H	6.00	59.00	36.20	74.0	54.0	15.0	17.8
4880	54.80	31.20	V	6.00	60.80	37.20	74.0	54.0	13.2	16.8
7320	44.70	32.40	H	10.25	54.95	42.65	74.0	54.0	19.1	11.4
7320	46.70	35.70	V	10.25	56.95	45.95	74.0	54.0	17.1	8.1
High Channel										
2483.5	41.85		V	-1.94	39.91		74.0	54.0		14.1
4960	52.80	32.40	H	5.89	58.69	38.29	74.0	54.0	15.3	15.7
4960	52.00	29.20	V	5.89	57.89	35.09	74.0	54.0	16.1	18.9
7440	45.00	33.50	H	10.35	55.35	43.85	74.0	54.0	18.7	10.2

No significant emissions were noted in the restricted band 2310 to 2390 MHz.

7.5.2.4 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $54.30 + 6.10 = 60.40\text{dBuV/m}$

Margin: $74\text{dBuV/m} - 60.40\text{dBuV/m} = 13.60\text{dB}$

Example Calculation: Average

Corrected Level: $39.30 + 6.10 - 0 = 45.40\text{dBuV}$

Margin: $54\text{dBuV} - 45.40\text{dBuV} = 8.60\text{dB}$

7.6 Maximum Power Spectral Density in the Fundamental Emission – FCC 15.247(e) IC: RSS-247 5.2(2)

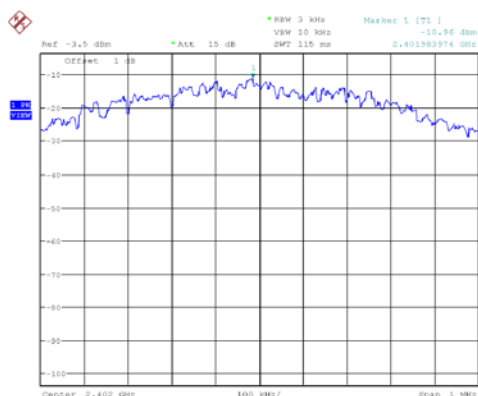
7.6.1 Measurement Procedure

The power spectral density was measured in accordance with the FCC KDB 558074 D01 DTS Meas Guidance v03r02 utilizing the PKPSD (peak PSD) method. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer applying suitable attenuation. The Resolution Bandwidth (RBW) of the spectrum analyzer was set to 3 kHz. The Video Bandwidth (VBW) was set to 10 kHz. Span was set to 1.5 times the DTS bandwidth. The trace was set to max hold with a peak detector active.

7.6.2 Measurement Results

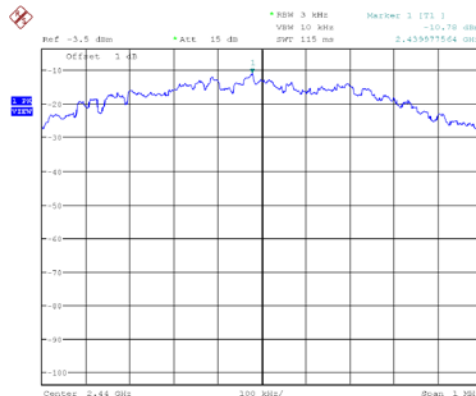
Table 7.6.2-1: Peak Power Spectral Density

Frequency (MHz)	PSD Level (dBm)
2402	-10.96
2440	-10.78
2480	-11.02



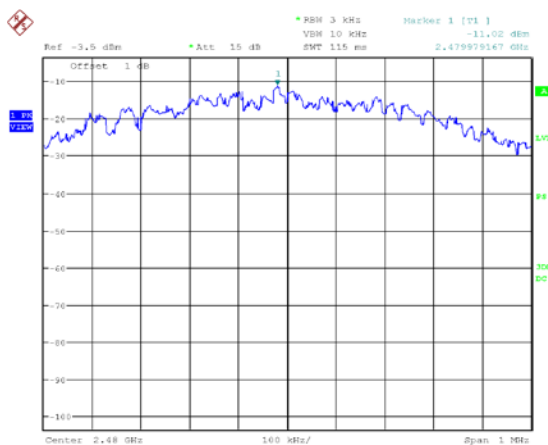
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Figure 7.6.2-1: PSD Plot –LCH



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Figure 7.6.2-2: PSD Plot – MCH



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Figure 7.6.2-3: PSD Plot – HCH

8 CONCLUSION

In the opinion of ACS, Inc. the ACC-REMOTE-BT-1, manufactured by SmallHD, LLC meets the requirements of FCC Part 15 subpart C and Industry Canada's Radio Standards Specification RSS-247.

END REPORT