HEARING AID COMPATIBILITY T-COIL TEST REPORT

FCC ID	**: 2ADLJ-CG65**
Equipment	**: smart phone**
Brand Name	**: Vortex**
Model Name	**: CG65**
T-Rating	**: T3**
Applicant	**: Xwireless LLC 11565 Old Georgetown Road,Rockvilla,MD,USA**
Manufacturer	**: BOPEL MOBILE TECHNOLOGY CO., LTD. RM603,6/F,HANG PONT COMM BLDG,31 TONKIN ST,CHEUNG SHA WAN,KOWLOON,HONG KONG**
Standard	**: FCC 47 CFR §20.19 ANSI C63.19-2011**

We, Sporton International Inc. (Shenzhen), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

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ACCREDITED
Cert #5145.01

Sporton International Inc. (Shenzhen)
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History of this test report

Report No.	Version	Description	Issued Date
HA3O0801B	Rev. 01	Initial issue of report	Nov. 02, 2023

1. Attestation of Test Results

Air Interface	Band MHz	T-Rating	Frequency Response	Magnetic Intensity
GSM CMRS Voice	GSM850	T3	Pass	Pass
	GSM1900	T4	Pass	Pass
UMTS CMRS Voice	Band II	T4	Pass	Pass
	Band IV	T4	Pass	Pass
	Band V	T4	Pass	Pass
VoLTE	Band 12/17	T4	Pass	Pass
	Band 13	T4	Pass	Pass
	Band 25/2	T4	Pass	Pass
	Band 26/5	T4	Pass	Pass
	Band 41	T4	Pass	Pass
	Band 66/4	T4	Pass	Pass
	Band 71	T4	Pass	Pass
VoWiFI	2450	T4	Pass	Pass
	5200	T4	Pass	Pass
	5300	T4	Pass	Pass
	5500	T4	Pass	Pass
	5800	T4	Pass	Pass
Date Tested	2023/10/20 ~ 2023/10/25			

1. The device is compliance with HAC limits specified in guidelines FCC 47CFR §20.19 and ANSI Standard ANSI C63.19.
2. This is partial report for CMRS voice T-Coil testing . VOIP test report will be separately submitted.

2. General Information

Product Feature & Specification	
Applicant Name	Xwireless LLC
Equipment Name	smart phone
Brand Name	Vortex
Model Name	CG65
IMEI Code	352078504080003
FCC ID	2ADLJ-CG65
HW	J527G_6761&6762_D3F_1.0
SW	Vortex_CG65_V01_20231013_userdebug
EUT Stage	Production Unit
Frequency Band	GSM850: 824 MHz ~ 849 MHz GSM1900: 1850 MHz ~ 1910 MHz WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz LTE Band 17: 704 MHz ~ 716 MHz LTE Band 25: 1850 MHz ~ 1915 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 66: 1710 MHz ~ 1780 MHz LTE Band 71: 663 MHz ~ 698 MHz LTE Band 41: 2496 MHz ~ 2690 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5700 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	GSM/GPRS AMR / RMC 12.2Kbps HSDPA HSUPA DC-HSDPA HSPA+ (16QAM uplink is supported) LTE: QPSK, 16QAM, 64QAM WLAN 2.4GHz : 802.11b/g/n HT20 WLAN 5GHz : 802.11a/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
Remark: LTE Band 41 supports HPUE mode only (Declared by Manufacturer).	

3. Testing Location

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	SAR01-SZ	CN1256	421272

4. Applied Standards

- FCC CFR47 Part 20.19
- ANSI C63.19-2011
- FCC KDB 285076 D01 HAC Guidance v06r04
- FCC KDB 285076 D02 T-Coil testing v04
- FCC KDB 285076 D03 HAC FAQ v01r06

5. Air Interface and Operating Mode

Air Interface	Band MHz	Type	C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
GSM	GSM850	VO	Yes	WLAN, BT	CMRS Voice	No
	GSM1900			WLAN, BT		No
UMTS	Band II	VO	Yes	WLAN, BT	CMRS Voice	No
	Band IV			WLAN, BT		No
	Band V			WLAN, BT		No
	HSPA	VD	Yes	WLAN, BT	Google Meet(1)	No
LTE (FDD)	Band 2	VD	Yes	WLAN, BT	VoLTE / Google Meet(1)	No
	Band 4			WLAN, BT		No
	Band 5			WLAN, BT		No
	Band 12			WLAN, BT		No
	Band 13			WLAN, BT		No
	Band 17			WLAN, BT		No
	Band 25			WLAN, BT		No
	Band 26			WLAN, BT		No
	Band 66			WLAN, BT		No
	Band 71			WLAN, BT		No
LTE (TDD)	Band 41	VD	Yes	WLAN, BT	VoLTE / Google Meet(1)	No
Wi-Fi	2450	VD	Yes	GSM,WCDMA,LTE, WLAN5GHz, BT	VoWiFi(1) / Google Meet(1)	No
	5200	VD	Yes	GSM,WCDMA,LTE, WLAN2.4GHz, BT		No
	5300					No
	5500					No
	5800					No
BT	2450	DT	No	GSM,WCDMA,LTE, WLAN2.4GHz, WLAN5GHz	NA	No

Type Transport:
VO= Voice only
DT= Digital Transport only (no voice)
VD= CMRS and IP Voice Service over Digital Transport

Remark:
1. For protocols not listed in Table 7.1 of ANSI C63.19-2011 or the ANSI C63.19-2011 VoLTE interpretation, the average speech level of −20 dBm0 should be used.
2. The device have similar frequency in some LTE bands: LTE B2/B25, B4/B66, B5/B26, B12/B17 since the supported frequency spans for the smaller LTE bands are completely cover by the larger LTE bands, therefore, only larger LTE bands were required to be tested for hearing-aid compliance.
3. This is partial report for CMRS voice T-Coil testing . VOIP test report will be separately submitted.

6. Measurement standards for T-Coil

6.1 Frequency Response

The frequency response of the perpendicular component of the magnetic field, measured in 1/3 octave bands, shall follow the response curve specified in this sub-clause, over the frequency range 300 Hz to 3000 Hz.
Figure 1.1 and Figure 1.2 provide the boundaries as a function of frequency. These response curves are for true field-strength measurements of the T-Coil signal. Thus, the 6 dB/octave probe response has been corrected from the raw readings.

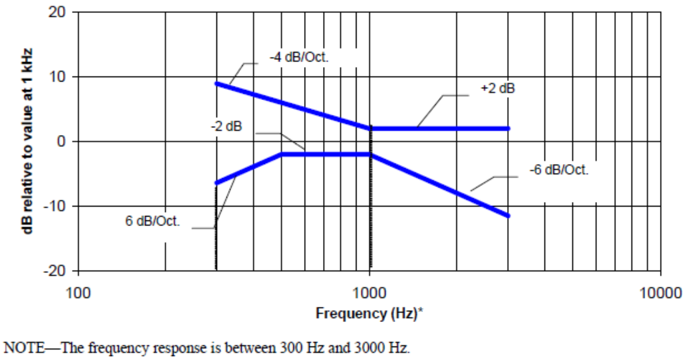


Fig. 1.1 Magnetic field frequency response for WDs with field strength≤-15dB at 1 KHz

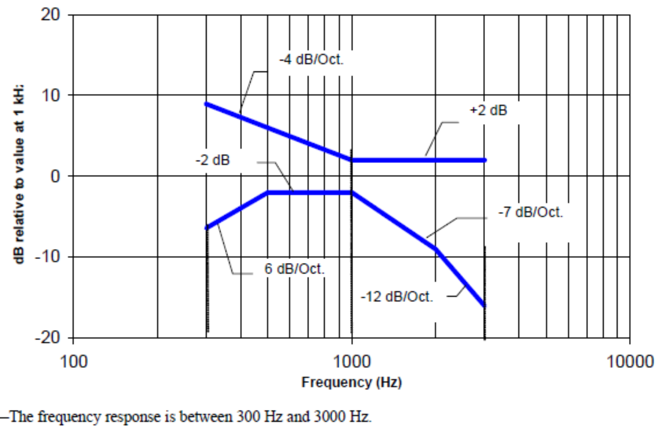


Fig. 1.2 Magnetic field frequency response for WDs with a field that exceeds –15 dB(A/m) at 1 kHz

6.2 T-Coil Signal Quality Categories

This section provides the signal quality requirement for the intended T-Coil signal from a WD. Only the RF immunity of the hearing aid is measured in T-Coil mode. It is assumed that a hearing aid can have no immunity to an interference signal in the audio band, which is the intended reception band for this mode. A device is assessed beginning by determining the category of the RF environment in the area of the T-Coil source.
The RF measurements made for the T-Coil evaluation are used to assign the category T1 through T4. The limitation is given in Table 1. This establishes the RF environment presented by the WD to a hearing aid.

Category	Telephone parameters WD signal quality ((signal + noise) to noise ratio in dB)
Category T1	0 to 10 dB
Category T2	10 to 20 dB
Category T3	20 to 30 dB
Category T4	> 30 dB

Table 1 T-Coil Signal Quality Categories

6.3 Description of EUT Test Position

Fig.3 illustrate the references and reference plane that shall be used in a typical EUT emissions measurement. The principle of this section is applied to EUT with similar geometry. Please refer to Appendix C for the setup photographs.

- The area is 5 cm by 5 cm.
- The area is centered on the audio frequency output transducer of the EUT.
- The area is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the EUT handset, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 10 mm in front of, the reference plane.

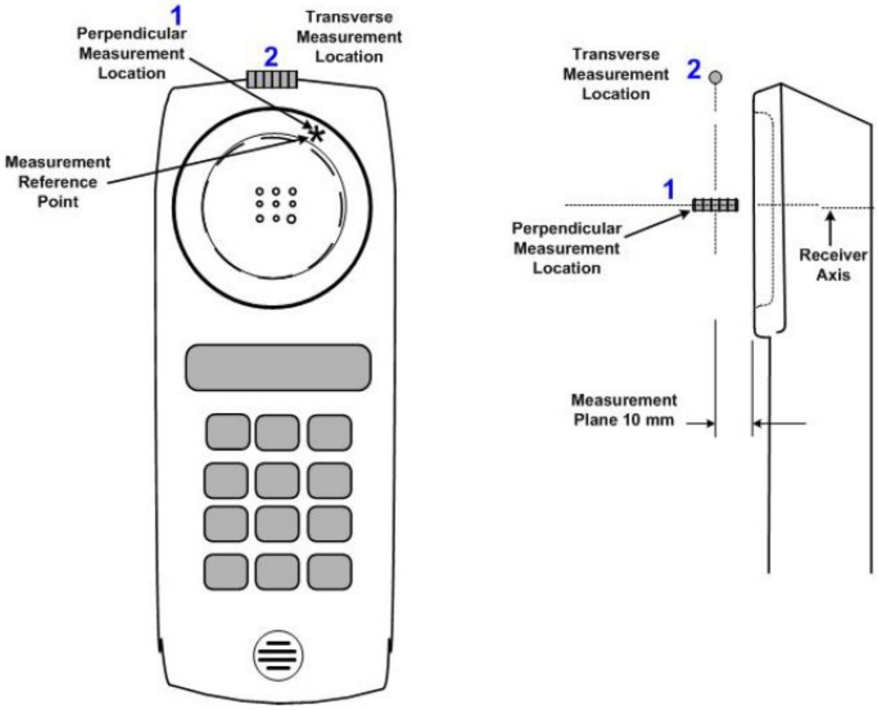


Fig.3 A typical EUT reference and plane for T-Coil measurements

7. T-Coil Test Procedure

Referenced to ANSI C63.19-2011, Section 7.4

This section describes the procedures used to measure the ABM (T-Coil) performance of the WD. In addition to measuring the absolute signal levels, the A-weighted magnitude of the unintended signal shall also be determined. To assure that the required signal quality is measured, the measurement of the intended signal and the measurement of the unintended signal must be made at the same location for each measurement position. In addition, the RF field strength at each measurement location must be at or below that required for the assigned category.

Measurements shall not include undesired properties from the WD's RF field; therefore, use of a coaxial connection to a base station simulator or non-radiating load, there might still be RF leakage from the WD, which can interfere with the desired measurement. Pre-measurement checks should be made to avoid this possibility. All measurements shall be performed with the WD operating on battery power with an appropriate normal speech audio signal input level given in ANSI C63.19-2011 Table 7.1. If the device display can be turned off during a phone call, then that may be done during the measurement as well,

Measurement shall be performed at two locations specified in ANSI C63.19-2011 A.3, with the correct probe orientation for a particular location, in a multistage sequence by first measuring the field intensity of the desired T-Coil signal the same location as the desired ABM or T-Coil signal (ABM1), and the ratio of desired to undesired magnetic components (ABM2) must be measured at the same location as the desired ABM or T-Coil signal (ABM1), and the ratio of desired to undesired ABM signals must be calculated. For the perpendicular field location, only the ABM1 frequency response shall be determined in a third measurement stage.

The following steps summarize the basic test flow for determining ABM1 and ABM2. These steps assume that a sine wave or narrowband 1/3 octave signal can be used for the measurement of ABM1.

a. A validation of the test setup and instrumentation may be performed using a TMFS or Helmholtz coil Measure the emissions and confirm that they are within the specified tolerance.
b. Position the WD in the test setup and connect the WD RF connector to a base station simulator or a non-radiating load. Confirm that equipment that requires calibration has been calibrated, and that the noise level meets the requirements given in ANSI C63.19-2011 clause 7.3.1.
c. The drive level to the WD ise set such that the reference input level specified in ANSI C63.19-2011 Table 7.1 is input to the base station simulator (or manufacturer's test mode equivalent) in 1 kHz, 1/3 octave band. This drive level shall be used for the T-Coil signal test (ABM1) at f = 1 kHz. Either a sine wave at 1025 Hz or a voice-like signal, band-limited to the 1 kHz 1/3 octave, as defined in ANSI C63.19-2011 clause 7.4.2, shall be used for the reference audio signal. If interference is found at 1025 Hz an alternative nearby reference audio signal frequency may be used. The same drive level shall be used for the ABM1 frequency response measurements at each 1/3 octave band center frequency. The WD volume control may be set at any level up to maximum, provided that a signal at any frequency at maximum modulation would not result in clipping or signal overload.
d. Determine the magnetic measurement locations for the WD device (A.3), if not already specified by the manufacturer, as described in ANSI C63.19-2011 clause 7.4.4.1.1 and 7.4.4.2.
e. At each measurement location, measure and record the desired T-Coil magnetic signals (ABM1 at fi) as described in ANSI C63.19-2011 clause 7.4.4.2 in each individual ISO 266-1975 R10 standard 1/3 octave band. The desired audio band input frequency (fi) shall be centered in each 1/3 octave band maintaining the same drive level as determined in item c) and the reading taken for that band.
f. Equivalent methods of determining the frequency response may also be employed, such as fast Fourier transform (FFT) analysis using noise excitation or input-output comparison using simulated speech. The full-band integrated probe output, as specified in D.9, may be used, as long as the appropriate calibration curve is applied to the measured result, so as to yield an accurate measurement of the field magnitude. (The resulting measurement shall be an accurate measurement in dB A/m.)
g. All Measurements of the desired signal shall be shown to be of the desired signal and not of an undesired signal. This may be shown by turning the desired signal ON and OFF with the probe measuring the same location. If the scanning method is used the scans shall show that all measurement points selected for the ABM1 measurement meet the ambient and test system noise criteria in ANSI C63.19-2011 clause 7.3.1.
h. At the measurement location for each orientation, measure and record the undesired broadband audio magnetic signal (ABM2) as specified in ANSI C63.19-2011 clause 7.4.4.4 with no audio signal applied (or digital zero applied, if appropriate) using A-weighting and the half-band integrator. Calculate the ratio of the desired to undesired signal strength (i,e., signal quality).
i. Obtain the data from the postprocessor, SEMCAD, and determine the category that properly classifies the signal quality based on ANSI C63.19-2011 Table 8.5.

7.1 Test Flow Chart

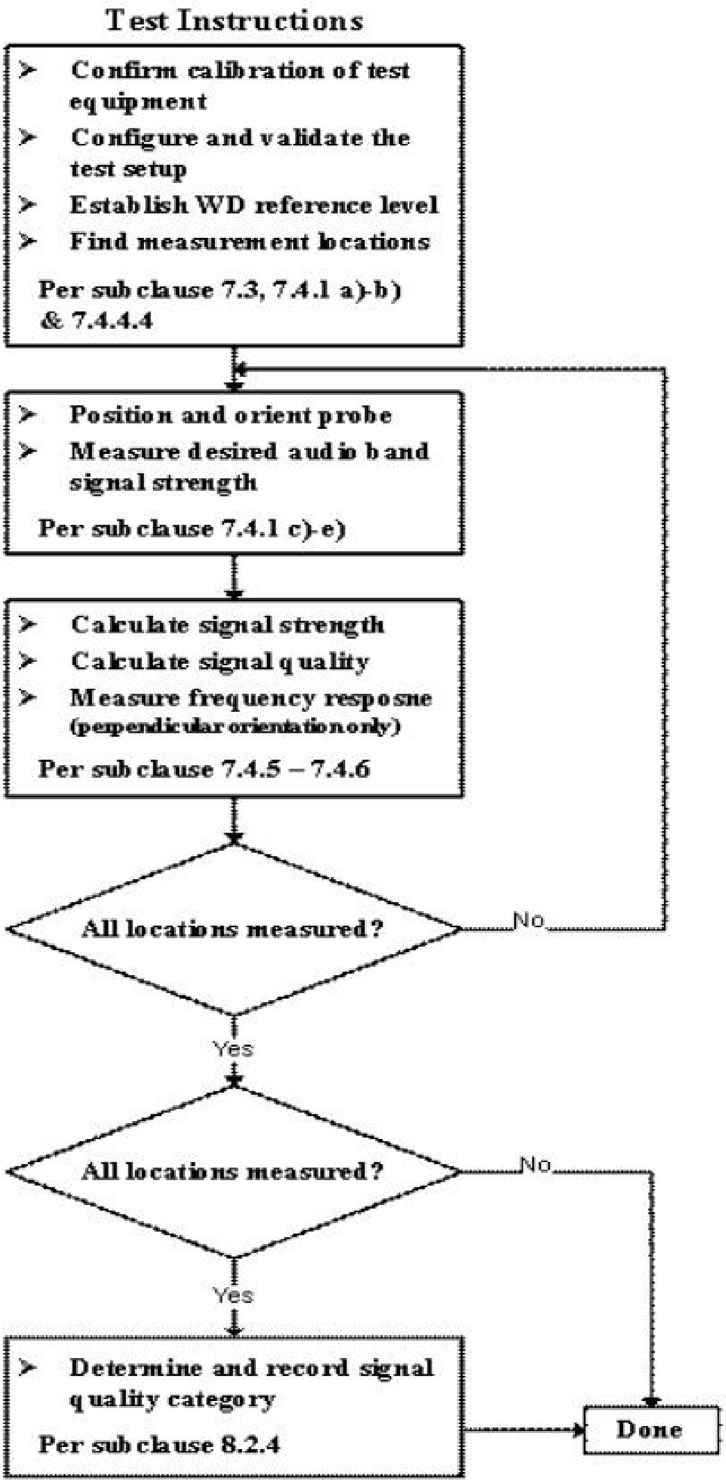
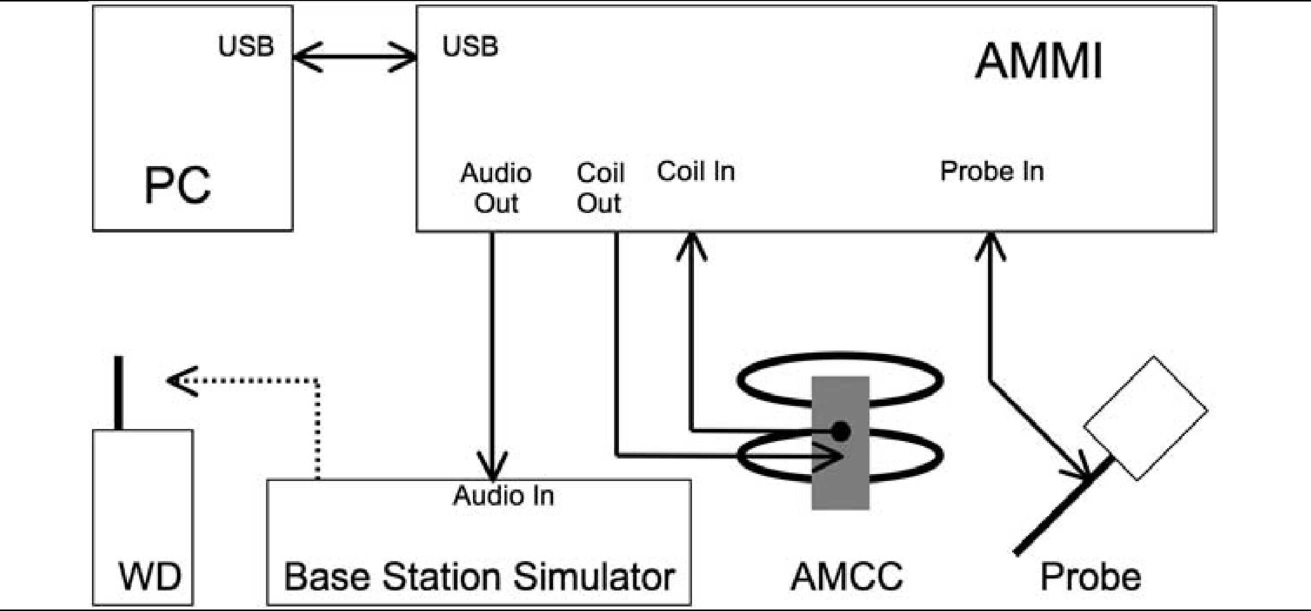


Fig. 2 T-Coil Signal Test flowchart

7.2 Test Setup Diagram for GSM/UMTS/VoLTE/VoWiFi

Test Setup for GSM / UMTS/ VoLTE/VoWiFi



General Note:

1. Define the all applicable input audio level as below according to C63 and KDB 285076 D02v04:
   - GSM input level: -16dBm0
   - UMTS input level: -16dBm0
   - VoLTE input level: -16dBm0
   - VoWiFi input level: -20dBm0
2. For GSM / UMTS test setup and input level, the correct input level definition is via a communication tester CMU200’s “Decoder Cal” and “Codec Cal” with audio option B52 and B85 to set the correct audio input levels.
3. CMU200 is able to output 1kHz audio signal equivalent to 3.14dBm0 at "Decoder Cal." confuguration, the signal reference is used to adjust the AMMI gain setting to reach -16dBm0 for GSM/UMTS and -18dBm0 for CDMA. CMW500 input is calibrated and the relation between the analog input voltage and the internal level in dBm0 can be determined
4. Voice over Long-Term Evolution (VoLTE) is a standard for high-speed wireless communication for mobile phones and data terminals — including IoT devices and wearables. It is based on the IP Multimedia Subsystem (IMS) network, with specific profiles for control and media planes of voice service on LTE defined by GSMA in PRD IR.92. This approach results in the voice service (control and media planes) being delivered as data flows within the LTE data bearer. This means that there is no dependency on the legacy circuit-switched voice network to be maintained
5. The test setup used for VoLTE and VoWiFI over IMS is via the callbox of CMW500 for T-coil measurement, The data application unit of the CMW500 was used to simulate the IP multimedia subsystem server. The CMW500 can be manually configured to ensure and control the speech input level result is -16dBm0 for VoLTE, -20dBm0 for VoWiFi when the device during the IMS connection.
6. According to KDB 285076 D02, T-Coil testing for VoLTE and VoWiFi requires test instrumentation that can (1) for the system to be able to establish an IP call from/to the handset under test, (2) through an IMS (IP Multimedia Subsystem) and SIP/IP server, (3) to an analog audio adapter containing the permissible set of codecs used by the device under test, and (4) inject the necessary C63.19 test tones at the average speech level for the measurement The test setup is illustrated in Figure 3.9. The R&S CMW500 was used as system simulator for VoLTE and VoWiFi T-Coil testing. The DAU (Data Application Unit) in CMW500 integrates IMS and SIP/IP server that can establish VoLTE and Wi-Fi calling, and transport the test tones from AMMI (Audio Magnetic Measuring Instrument) to EUT.
7. T-coil performance assessment for 5G FR1 was performed according to KDB 285076 D03 v01r06, Q&A 9, details are illustrated in section 7.3.

<Define the input level for GSM/UMTS>

1. The Required gain factor for the specific signal shall typically be multiplied by this factor to achieve approx. the same level as for the 1kHz sine signal
2. The below calculation formula is an example and showing how to determine the input level for the device.

The predefined signal types have the following differences / factors compared to the 1kHz sine signal:

Signal [file name]	Duration [s]	Peak-to-RMS [dB]	RMS [dB]	Required gain factor *)	Gain setting
1kHz sine	---	3.0	0.0	1.00	
48k_1.025kHz_10s.wav	10	3.0	0.0	1.00	
48k_1kHz_3.15kHz_10s.wav	10	6.0	-3.0	1.42	
48k_315Hz_1kHz_10s.wav	10	6.0	-2.9	1.40	
48k_csek_8k_441_white_10s.wav	10	13.8	-10.5	3.34	
48k_multisine_50-5000_10s.wav	10	11.1	-7.9	2.49	
48k_voice_1kHz_1s.wav	1	16.2	-12.7	4.33	
48k_voice_300-3000_2s.wav	2	21.6	-18.6	8.48	

(*) The gain for the specific signal shall typically be multiplied by this factor to acheive approx. the same level as for the 1kHz sine signal.

Insert the gain applicable for your setup in the last column of the table.

<Example define the input level for GSM/UMTS>

Gain Value	20* log(gain)	AMCC Coil In	Level
(linear)	dB	(dBv RMS)	dBm0
		-2.47	3.14
10	20	-19.85	-14.24
8.17	18.24	-21.61	-16

Signal Type	Duration (s)	Peak to RMS (dB)	RMS (dB)	Required Gain Factor	Calculated Gain Setting
1kHz sine	-	3	0	1	8.17
48k_voice_1kHz	1	16.2	-12.7	4.33	35.36
48k_voice_300Hz ~ 3kHz	2	21.6	-18.6	8.48	69.25

<Example define the input level for VoLTE>

Gain Value	dBm0	Full scal Voltage	dB	AMMI audio out dBv (RMS)	AMCC Coil Out (dBv (RMS)
	3.14	1.5		0.51	
100	5.57		40	2.94	3.09
8.35	-16		18.43		-18.48
Signal Type	**Duration (s)**	**Peak to RMS (dB)**	**RMS (dB)**	**Gain Factor**	**Gain Setting**
1kHz sine	-	3	0	1	8.35
48k_voice_1kHz	1	16.2	-12.7	4.33	36.15
48k_voice_300-3000	2	21.6	-18.6	8.48	70.79

<Example define the input level for VoWiFi>

Gain Value	dBm0	Full scal Voltage	dB	AMMI audio out dBv (RMS)	AMCC Coil Out (dBv (RMS)
	3.14	1.5		0.51	
100	5.57		40	2.94	3.09
5.27	-20		14.43		-22.48
Signal Type	**Duration (s)**	**Peak to RMS (dB)**	**RMS (dB)**	**Gain Factor**	**Gain Setting**
1kHz sine	-	3	0	1	5.27
48k_voice_1kHz	1	16.2	-12.7	4.33	22.81
48k_voice_300-3000	2	21.6	-18.6	8.48	44.67

8. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Audio Magnetic 1D Field Probe	AM1DV3	3106	Dec. 13, 2022	Dec. 12, 2023
SPEAG	Data Acquisition Electronics	DAE4	1386	Jul. 17, 2023	Jul. 16, 2024
SPEAG	Audio Magnetic Calibration Coil	AMCC	1128	NCR	NCR
SPEAG	Audio Measuring Instrument	AMMI	1137	NCR	NCR
SPEAG	Test Arch Phantom	N/A	N/A	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Base Station(Measure)	CMU200	108440	Dec. 27, 2022	Dec. 26, 2023
R&S	Base Station(Measure)	CMW500	157651	Jan. 04, 2023	Jan. 03, 2024
Anymetre	Thermo-Hygrometer	JR593	2020062101	Jul. 08, 2023	Jul. 07, 2024

Note:
1. NCR: “No-Calibration Required”

9. T-Coil testing for CMRS Voice

General Note:

1. Codec Investigation: For a voice service/air interface, investigate the variations of codec configurations (WB, NB bit rate) and document the parameters (ABM1, ABM2, S+N/N, frequency response) for that voice service. It is only necessary to document this for one channel/band, the following worst investigation codec would be remarked to be used for the testing for the handset.
2. Air Interface Investigation:
   a. Use the worst-case codec test and document a limited set of bands/channel/bandwidths. Observe the effect of changing the band and bandwidth to ensure that there are no unexpected variations. Using the knowledge of the observed variations, it is necessary to report only a set band/channel/bandwidth for each orientation for a voice service/air interface.
   b. According to the ANSI C63.19 2011 section 7.3.2, test middle channel of each frequency band for HAC testing for each orientation to determine worst HAC T-Coil rating.

9.1 GSM Tests Results

<Codec Investigation>

GSM Codec					
Codec	**AMR NB FR**	**AMR WB FR**	**GSM EFR (FR V2)**	**Orientation**	**Band / Channel**
ABM 1 (dBA/m)	3.83	3.06	3.69	Axial	GSM850 / 189
ABM 2 (dBA/m)	-24	-24.61	-24.33		
Signal Quality (dB)	27.83	27.67	28.02		
Freq. Response	PASS	PASS	PASS		

Remark: According to codec investigation, the worst codec is AMR WB FR.

<Air Interface Investigation>

Plot No.	Air Interface	Mode	Channel	Probe Position	ABM1 dB (A/m)	ABM2 dB (A/m)	Signal Quality dB	T Rating	Ambient Noise dB (A/m)	Freq. Response Variation dB	Frequency Response
1	GSM850	Voice	189	Axial (Z)	3.06	-24.61	27.67	T3	-53.59	2	PASS
				Transversal (Y)	-5.57	-42.44	36.87	T4	-54.08		
2	GSM1900	Voice	661	Axial (Z)	4.07	-28.26	32.33	T4	-53.53	1.88	PASS
				Transversal (Y)	-5.19	-44.19	39.00	T4	-54.25		

9.2 UMTS Tests Results

<Codec Investigation>

UMTS AMR Codec						
Codec	NB AMR 4.75Kbps	WB AMR 6.60Kbps	NB AMR 12.2Kbps	WB AMR 23.85Kbps	Orientation	Band / BW / Channel
ABM 1 (dBA/m)	2.63	4.21	4.57	4.75	Axial	B5 / 4182
ABM 2 (dBA/m)	-40.34	-40.84	-40.78	-41.17		
Signal Quality (dB)	42.97	45.05	45.35	45.92		
Freq. Response	PASS	PASS	PASS	PASS		

Remark: According to codec investigation, the worst codec is NB AMR 4.75Kbps.

<Air Interface Investigation>

Plot No.	Air Interface	Mode	Channel	Probe Position	ABM1 dB (A/m)	ABM2 dB (A/m)	Signal Quality dB	T Rating	Ambient Noise dB (A/m)	Freq. Response Variation dB	Frequency Response
3	WCDMA V	Voice	4182	Axial (Z)	2.63	-40.34	42.97	T4	-54.30	1.68	PASS
				Transversal (Y)	-6.49	-46.59	40.10	T4	-53.61		
4	WCDMA IV	Voice	1413	Axial (Z)	2.12	-39.92	42.04	T4	-53.33	1.34	PASS
				Transversal (Y)	-6.45	-46.73	40.28	T4	-53.54		
5	WCDMA II	Voice	9400	Axial (Z)	2.27	-39.94	42.21	T4	-53.97	1.82	PASS
				Transversal (Y)	-6.03	-46.30	40.27	T4	-53.14		

10. T-Coil testing for CMRS IP Voice

10.1 VoLTE Tests Results

General Note:

1. Codec Investigation: For a voice service/air interface, investigate the variations of codec configurations (WB, NB bit rate) and document the parameters (ABM1, ABM2, S+N/N, frequency response) for that voice service. It is only necessary to document this for one channel / band, the following worst investigation codec would be remarked to be used for the testing for the handset.
2. Air Interface Investigation:
   a. Use the worst-case codec test and document a limited set of bands / channel / bandwidths. Observe the effect of changing the band and bandwidth to ensure that there are no unexpected variations. Using the knowledge of the observed variations, it is necessary to report only a set band/channel/bandwidth for each orientation for a voice service/air interface and the following worst configure would be remarked to be used for the testing for the handset.
   b. Select LTE FDD/TDD one frequency band to do measurement at the worst SNR position was additionally performed with varying the BWs/Modulations/RB size to verify the variation to find out worst configuration , the observed variation is very little to be within 1.5 dB which is much less than the margin from the rating threshold.
   c. According to the ANSI C63.19 2011 section 7.3.2, test middle channel of each frequency band for HAC testing for each orientation to determine worst HAC T-Coil rating.

<Codec Investigation>

LTE FDD

VoLTE AMR Codec						
Codec	**NB AMR 4.75Kbps**	**WB AMR 6.60Kbps**	**NB AMR 12.2Kbps**	**WB AMR 23.85Kbps**	**Orientation**	**Band / BW / Channel**
ABM 1 (dBA/m)	2.16	4.51	2.44	5.04	Axial	B25 / 20M / 26340
ABM 2 (dBA/m)	-37.25	-36.79	-36.69	-37.54		
Signal Quality (dB)	39.41	41.3	39.13	42.58		
Freq. Response	PASS	PASS	PASS	PASS		

VoLTE EVS Codec								
Codec	**EVS SWB 9.6Kbps**	**EVS SWB 128Kbps**	**EVS WB 5.9Kbps**	**EVS WB 128Kbps**	**EVS NB 5.9Kbps**	**EVS NB 24.4Kbps**	**Orientation**	**Band / BW / Channel**
ABM 1 (dBA/m)	4.95	4.79	7.9	4.24	7.84	8.17	Axial	B25 / 20M / 26340
ABM 2 (dBA/m)	-34.92	-34.6	-35.46	-35.29	-35.65	-35.43		
Signal Quality (dB)	39.87	39.39	43.36	39.53	43.49	43.6		
Freq. Response	PASS	PASS	PASS	PASS	PASS	PASS		

Remark: According to codec investigation, the worst codec is NB AMR 12.2Kbps

LTE TDD

VoLTE AMR Codec						
Codec	**NB AMR 4.75Kbps**	**WB AMR 6.60Kbps**	**NB AMR 12.2Kbps**	**WB AMR 23.85Kbps**	**Orientation**	**Band / BW / Channel**
ABM 1 (dBA/m)	1.36	4.23	1.66	4.12	Axial	B41 / 20M / 40620
ABM 2 (dBA/m)	-29.1	-28.66	-28.96	-28.85		
Signal Quality (dB)	30.46	32.89	30.62	32.97		
Freq. Response	PASS	PASS	PASS	PASS		

VoLTE EVS Codec								
Codec	**EVS SWB 9.6Kbps**	**EVS SWB 128Kbps**	**EVS WB 5.9Kbps**	**EVS WB 128Kbps**	**EVS NB 5.9Kbps**	**EVS NB 24.4Kbps**	**Orientation**	**Band / BW / Channel**
ABM 1 (dBA/m)	4.51	4.44	1.35	2.07	4.84	5.15	Axial	B41 / 20M / 40620
ABM 2 (dBA/m)	-28.7	-29.41	-30.63	-31.01	-30.69	-30.77		
Signal Quality (dB)	33.21	33.85	31.98	33.08	35.53	35.92		
Freq. Response	PASS	PASS	PASS	PASS	PASS	PASS		

Remark: According to codec investigation, the worst codec is NB AMR 4.75Kbps

<Air Interface Investigation>

Air Interface		BW (MHz)	Modulation	RB Size	RB offset	Channel	UL-DL Configuration	ABM1 dB (A/m)	ABM2 dB (A/m)	Signal Quality dB
FDD	LTE B25	20	QPSK	1	0	26340		0.18	-36.25	36.43
	LTE B25	20	QPSK	50	0	26340		-0.51	-38.20	37.69
	LTE B25	20	QPSK	100	0	26340		-0.57	-37.78	37.21
	LTE B25	20	16QAM	1	0	26340		-0.51	-37.19	36.68
	LTE B25	20	64QAM	1	0	26340		-0.43	-38.10	37.67
	LTE B25	15	QPSK	1	0	26340		-1.20	-37.67	36.47
	LTE B25	10	QPSK	1	0	26340		-1.19	-37.76	36.57
	LTE B25	5	QPSK	1	0	26340		-0.41	-37.33	36.92
	LTE B25	3	QPSK	1	0	26340		-0.51	-38.04	37.53
	LTE B25	1.4	QPSK	1	0	26340		-1.29	-38.96	37.67
TDD	LTE B41_PC2	20	QPSK	1	0	40620	1	-2.29	-32.80	30.51
	LTE B41_PC2	20	QPSK	1	0	40620	2	-2.36	-32.96	30.60
	LTE B41_PC2	20	QPSK	1	0	40620	3	-2.38	-33.96	31.58
	LTE B41_PC2	20	QPSK	1	0	40620	4	-2.09	-33.62	31.53
	LTE B41_PC2	20	QPSK	1	0	40620	5	-2.30	-33.65	31.35

Plot No.	Air Interface	BW (MHz)	Modulation / Mode	RB Size	RB offset	Channel	Probe Position	ABM1 dB (A/m)	ABM2 dB (A/m)	Signal Quality dB	T Rating	Ambient Noise dB (A/m)	Freq. Response Variation dB	Frequency Response
6	LTE Band 12	10	QPSK	1RB	0	23095	Axial (Z)	1.35	-37.46	38.81	T4	-54.10	1.96	PASS
							Transversal (Y)	-6.15	-43.34	37.19	T4	-54.07		
7	LTE Band 13	10	QPSK	1RB	0	23230	Axial (Z)	1.17	-38.19	39.36	T4	-53.31	1.95	PASS
							Transversal (Y)	-6.25	-43.22	36.97	T4	-53.14		
8	LTE Band 25	20	QPSK	1RB	0	26340	Axial (Z)	2.44	-36.69	39.13	T4	-53.04	1.99	PASS
							Transversal (Y)	-8.09	-44.18	36.09	T4	-53.11		
9	LTE Band 26	15	QPSK	1RB	0	26865	Axial (Z)	1.27	-38.48	39.75	T4	-53.51	1.89	PASS
							Transversal (Y)	-6.20	-42.41	36.21	T4	-53.68		
10	LTE Band 66	20	QPSK	1RB	0	132322	Axial (Z)	-0.32	-37.11	36.79	T4	-53.45	1.86	PASS
							Transversal (Y)	-7.14	-43.43	36.29	T4	-54.30		
11	LTE Band 71	20	QPSK	1RB	0	133297	Axial (Z)	-0.74	-39.93	39.19	T4	-53.26	1.95	PASS
							Transversal (Y)	-9.02	-44.64	35.62	T4	-53.93		
12	LTE Band 41	20	QPSK	1RB	0	40620	Axial (Z)	1.36	-29.10	30.46	T4	-53.50	1.01	PASS
							Transversal (Y)	-9.66	-41.55	31.89	T4	-54.14		

10.2 VoWiFi Tests Results

General Note:

1. Codec Investigation: For a voice service/air interface, investigate the variations of codec configurations (WB, NB bit rate) and document the parameters (ABM1, ABM2, S+N/N, frequency response) for that voice service. It is only necessary to document this for one channel/band, the following worst investigation codec would be remarked to be used for the testing for the handset.
2. Air Interface Investigation:
   a. Use the worst-case codec test and document a limited set of bands/channel/bandwidths. Observe the effect of changing the band and bandwidth to ensure that there are no unexpected variations. Using the knowledge of the observed variations, it is necessary to report only a set band/channel/bandwidth for each orientation for a voice service/air interface and the following worst configure would be remarked to be used for the testing for the handset.
   b. Select WLAN 2.4GHz and WLAN 5GHz one frequency band to do measurement at the worst SNR position was additionally performed with varying the BWs/Modulations/data rate to verify the variation to find out worst configuration , the observed variation is very little to be within 1 dB which is much less than the margin from the rating threshold.
   c. According to the ANSI C63.19 2011 section 7.3.2, test middle channel of each frequency band for HAC testing for each orientation to determine worst HAC T-Coil rating.

<Codec Investigation>

VoWIFI AMR Codec						
Codec	**NB AMR 4.75Kbps**	**WB AMR 6.60Kbps**	**NB AMR 12.2Kbps**	**WB AMR 23.85Kbps**	**Orientation**	**Band / Channel**
ABM 1 (dBA/m)	-1.14	0.66	-1.24	1.20	Axial	2.4GHz WLAN / 6
ABM 2 (dBA/m)	-40.73	-38.38	-41.2	-38.10		
Signal Quality (dB)	39.59	39.04	39.96	39.3		
Freq. Response	PASS	PASS	PASS	PASS		

VoWIFI EVS Codec								
Codec	**EVS SWB 9.6Kbps**	**EVS SWB 128Kbps**	**EVS WB 5.9Kbps**	**EVS WB 128Kbps**	**EVS NB 5.9Kbps**	**EVS NB 24.4Kbps**	**Orientation**	**Band / BW / Channel**
ABM 1 (dBA/m)	0.34	0.22	-1.67	-0.08	-7.31	-1.59	Axial	2.4GHz WLAN / 6
ABM 2 (dBA/m)	-41.23	-38.97	-41.54	-38.74	-41.46	-41.36		
Signal Quality (dB)	41.57	39.19	39.87	38.66	34.15	39.77		
Freq. Response	PASS	PASS	PASS	PASS	PASS	PASS		

Remark: According to codec investigation, the worst codec is EVS NB 5.9Kbps.

<Air Interface Investigation>

Frequency Bands	Modulation	Bandwidth	Data Rate	Channel	ABM1 dB (A/m)	ABM2 dB (A/m)	Signal Quality dB
WLAN 2.4GHz	802.11b	20	1M	6	-7.31	-41.46	34.15
	802.11b	20	11M	6	-6.23	-40.66	34.43
	802.11g	20	6M	6	-5.62	-42.61	36.99
	802.11g	20	54M	6	-6.65	-41.71	35.06
	802.11n-HT20	20	MCS0	6	-5.98	-40.47	34.49
	802.11n-HT20	20	MCS7	6	-5.17	-40.58	35.41
WLAN 5GHz	802.11a	20	6M	40	-4.41	-42.14	37.73
	802.11a	20	54M	40	-5.04	-41.65	36.61
	802.11an-HT20	20	MCS0	40	-5.17	-42.00	36.83
	802.11an-HT20	20	MCS7	40	-5.62	-43.33	37.71
	802.11an-HT40	40	MCS0	38	-7.61	-41.70	34.09
	802.11an-HT40	40	MCS7	38	-6.81	-42.71	35.90
	802.11ac-VHT20	20	MCS0	40	-4.49	-42.41	37.92
	802.11ac-VHT20	20	MCS8	40	-6.45	-43.57	37.12
	802.11ac-VHT40	40	MCS0	38	-7.36	-43.49	36.13
	802.11ac-VHT40	40	MCS8	38	-7.07	-43.42	36.35
	802.11ac-VHT80	80	MCS0	42	-7.40	-41.86	34.46
	802.11ac-VHT80	80	MCS8	42	-6.10	-41.02	34.92

Plot No.	Air Interface	BW (MHz)	Modulation / Mode	Channel	Probe Position	ABM1 dB (A/m)	ABM2 dB (A/m)	Signal Quality dB	T Rating	Ambient Noise dB (A/m)	Freq. Response Variation dB	Frequency Response
13	WLAN2.4GHz	20	802.11b-1Mbps	6	Axial (Z)	-5.22	-40.77	35.55	T4	-53.95	1.61	Pass
					Transversal (Y)	-17.38	-48.83	31.45	T4	-53.55		
14	WLAN5GHz	40	802.11n-HT40 MCS0	38	Axial (Z)	-5.59	-43.34	37.75	T4	-53.25	1.38	Pass
					Transversal (Y)	-12.69	-47.57	34.88	T4	-53.36		
15	WLAN5GHz	40	802.11n-HT40 MCS0	54	Axial (Z)	-6.53	-42.36	35.83	T4	-53.38	1.35	Pass
					Transversal (Y)	-12.19	-47.98	35.79	T4	-53.41		
16	WLAN5GHz	40	802.11n-HT40 MCS0	110	Axial (Z)	-1.21	-44.00	42.79	T4	-53.39	1.47	Pass
					Transversal (Y)	-12.20	-49.94	37.74	T4	-53.35		
17	WLAN5GHz	40	802.11n-HT40 MCS0	159	Axial (Z)	-6.66	-43.85	37.19	T4	-53.29	1.07	Pass
					Transversal (Y)	-12.04	-46.27	34.23	T4	-53.25		

Remark:

1. Phone Condition: Mute on; Backlight off; Max Volume
2. The detail frequency response results please refer to appendix A.

Test Engineer : Hank Huang, Kevin Xu, David Dai, Bin He

11. Uncertainty Assessment

The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance. The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances. Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is showed in Table 8.2.
The judgment of conformity in the report is based on the measurement results excluding the measurement uncertainty.

Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) ABM1	(Ci) ABM2	Standard Uncertainty (ABM1) (±%)	Standard Uncertainty (ABM2) (±%)
Probe Sensitivity							
Reference Level	3.0	N	1	1	1	3.0	3.0
AMCC Geometry	0.4	R	1.732	1	1	0.2	0.2
AMCC Current	1.0	R	1.732	1	1	0.6	0.6
Probe Positioning during Calibr.	0.1	R	1.732	1	1	0.1	0.1
Noise Contribution	0.7	R	1.732	0.014	1	0.0	0.4
Frequency Slope	5.9	R	1.732	0.1	1	0.3	3.4
Probe System							
Repeatability / Drift	1.0	R	1.732	1	1	0.6	0.6
Linearity / Dynamic Range	0.6	R	1.732	1	1	0.3	0.3
Acoustic Noise	1.0	R	1.732	0.1	1	0.1	0.6
Probe Angle	2.3	R	1.732	1	1	1.3	1.3
Spectral Processing	0.9	R	1.732	1	1	0.5	0.5
Integration Time	0.6	N	1	1	5	0.6	3.0
Field Distribution	0.2	R	1.732	1	1	0.1	0.1
Test Signal							
Ref. Signal Spectral Response	0.6	R	1.732	0	1	0.0	0.3
Positioning							
Probe Positioning	1.9	R	1.732	1	1	1.1	1.1
Phantom Thickness	0.9	R	1.732	1	1	0.5	0.5
DUT Positioning	1.9	R	1.732	1	1	1.1	1.1
External Contributions							
RF Interference	0.0	R	1.732	1	0.3	0.0	0.0
Test Signal Variation	2.0	R	1.732	1	1	1.2	1.2
Combined Std. Uncertainty						4.0%	6.1%
Coverage Factor for 95 %						K=2	K=2
Expanded STD Uncertainty						8.1%	12.2%

Table 8.2 Uncertainty Budget of audio band magnetic measurement

12. References

[1] ANSI C63.19-2011, “American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids”, 27 May 2011.

[2] FCC KDB 285076 D01v06r04, “Equipment Authorization Guidance for Hearing Aid Compatibility”, September 29, 2023

[3] FCC KDB 285076 D02 v04, “Guidance for performing T-Coil tests for air interfaces supporting voice over IP (e.g., LTE and WiFi) to support CMRS based telephone services”, Feb. 23, 2022

[4] FCC KDB 285076 D03v01r06, “Hearing aid compatibility frequently asked questions”, July 20, 2022

[5] SPEAG DASY System Handbook

------THE END------

Appendix A. Plots of T-Coil Measurement

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

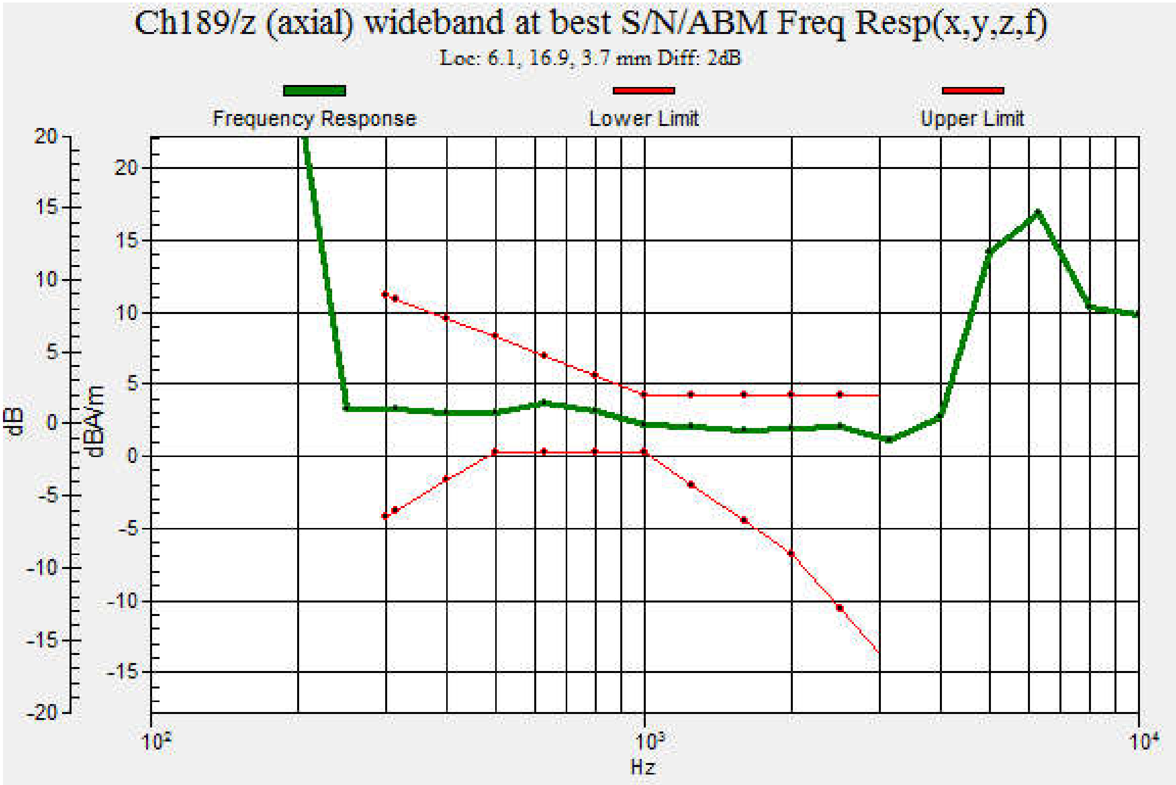
01_HAC T-Coil_GSM850_Voice_Ch189_Z

Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz;Duty Cycle: 1:8.30042
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch189/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 27.67 dB
ABM1 comp = 3.06 dBA/m
Location: 6.3, 17.1, 3.7 mm

0 dB = 24.19 = 27.67 dB



Ch189/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 6.1, 16.9, 3.7 mm Diff: 2dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

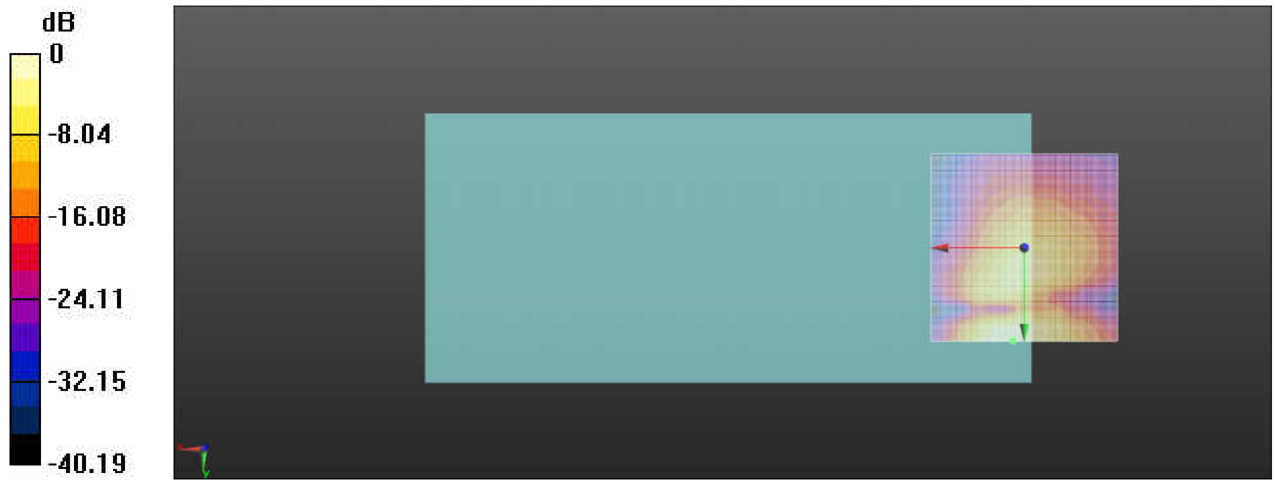
01_HAC T-Coil_GSM850_Voice_Ch189_Y

Communication System: UID 0, Generic GSM (0); Frequency: 836.4 MHz;Duty Cycle: 1:8.30042
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch189/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 36.87 dB
ABM1 comp = -5.57 dBA/m
Location: 2.9, 25, 3.7 mm



0 dB = 69.71 = 36.87 dB

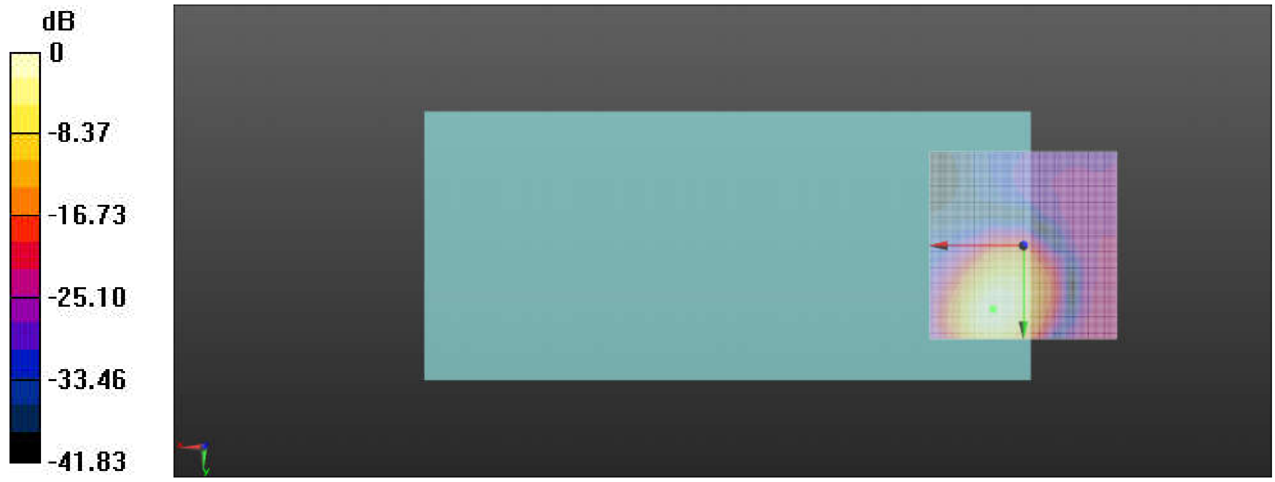
02_HAC T-Coil_GSM1900_Voice_Ch661_Z

Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz;Duty Cycle: 1:8.30042
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

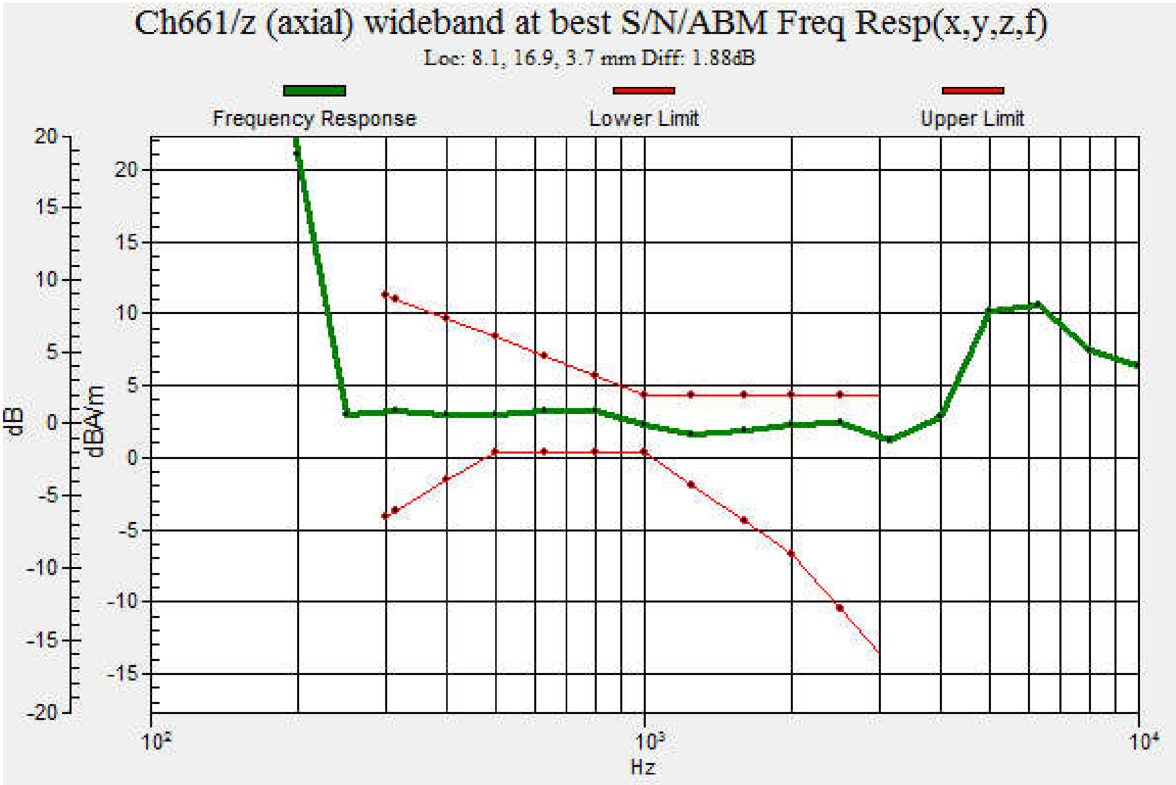
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch661/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 32.33 dB
ABM1 comp = 4.07 dBA/m
Location: 7.9, 17.1, 3.7 mm



0 dB = 41.36 = 32.33 dB


Ch661/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 8.1, 16.9, 3.7 mm Diff: 1.88dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz
20
15
10
5
0
-5
-10
-15
-20
10^2
10^3
10^4

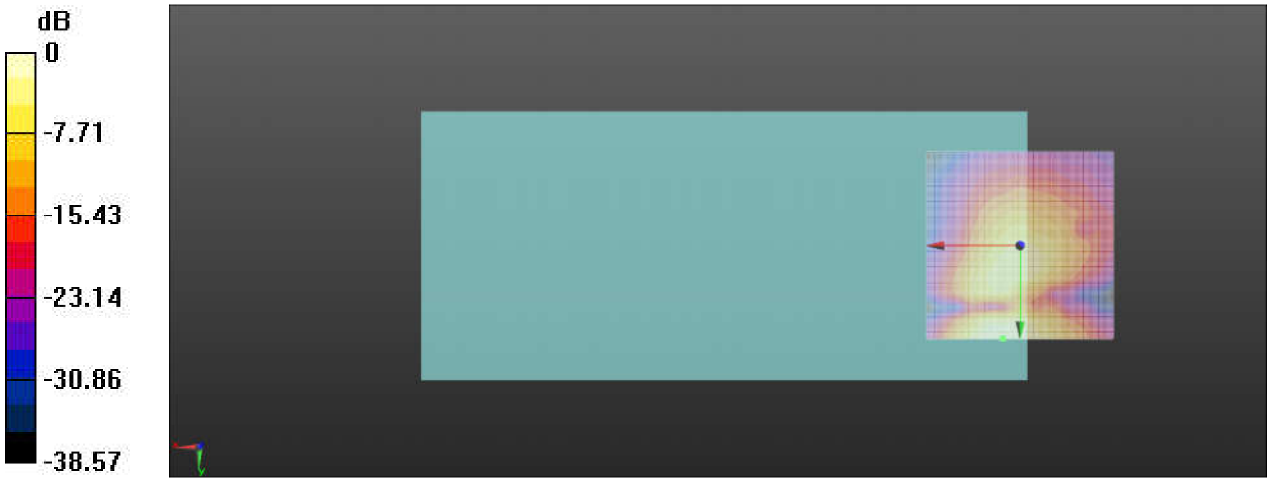
02_HAC T-Coil_GSM1900_Voice_Ch661_Y

Communication System: UID 0, Generic GSM (0); Frequency: 1880 MHz;Duty Cycle: 1:8.30042
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch661/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 39.00 dB
ABM1 comp = -5.19 dBA/m
Location: 4.6, 25, 3.7 mm



0 dB = 89.07 = 38.99 dB

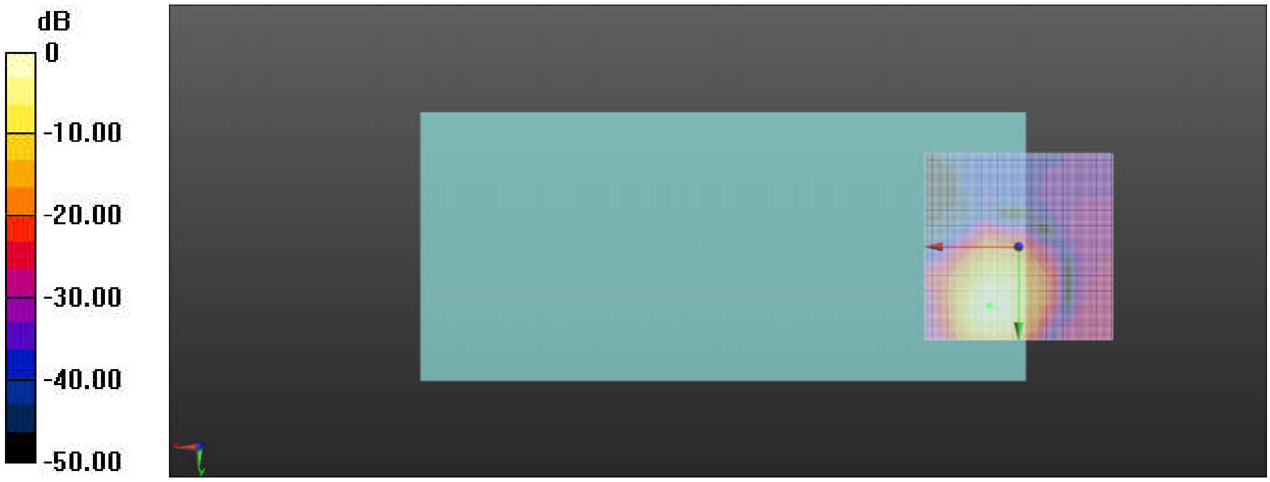
03_HAC T-Coil_WCDMA V_Voice_Ch4182_Z

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

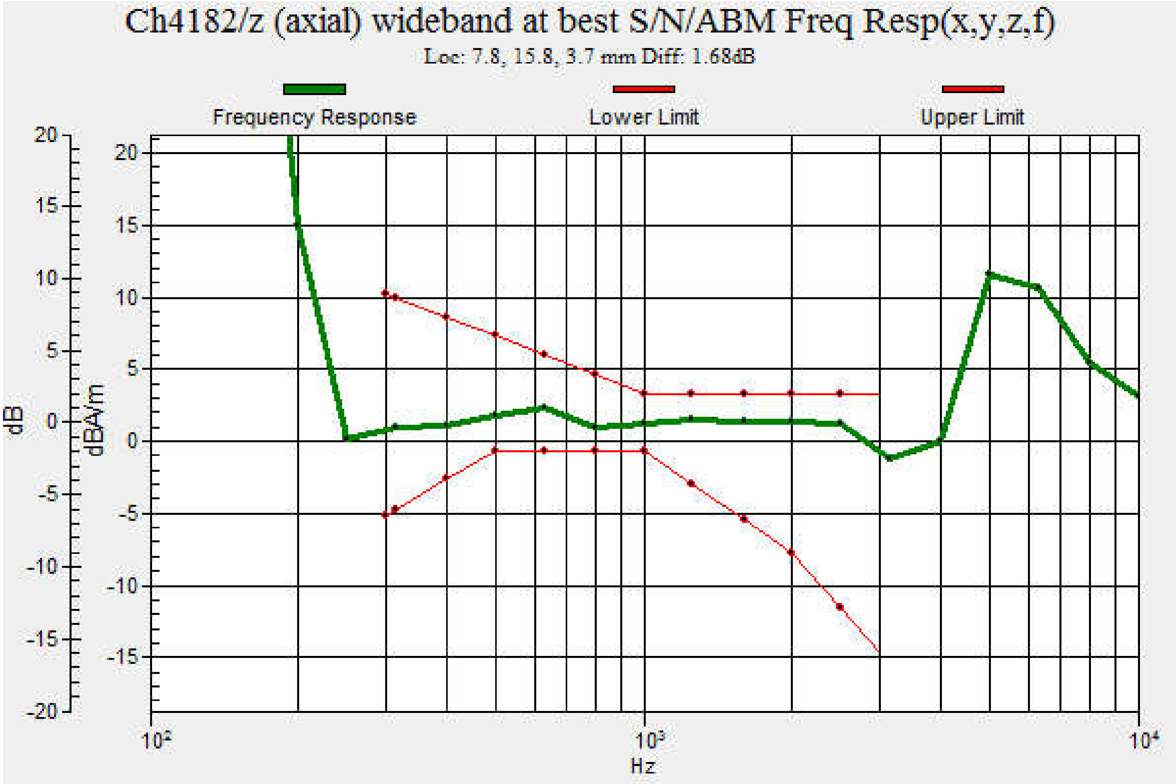
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch4182/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 42.97 dB
ABM1 comp = 2.63 dBA/m
Location: 7.9, 15.8, 3.7 mm



0 dB = 140.8 = 42.97 dB



Ch4182/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.8, 15.8, 3.7 mm Diff: 1.68dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

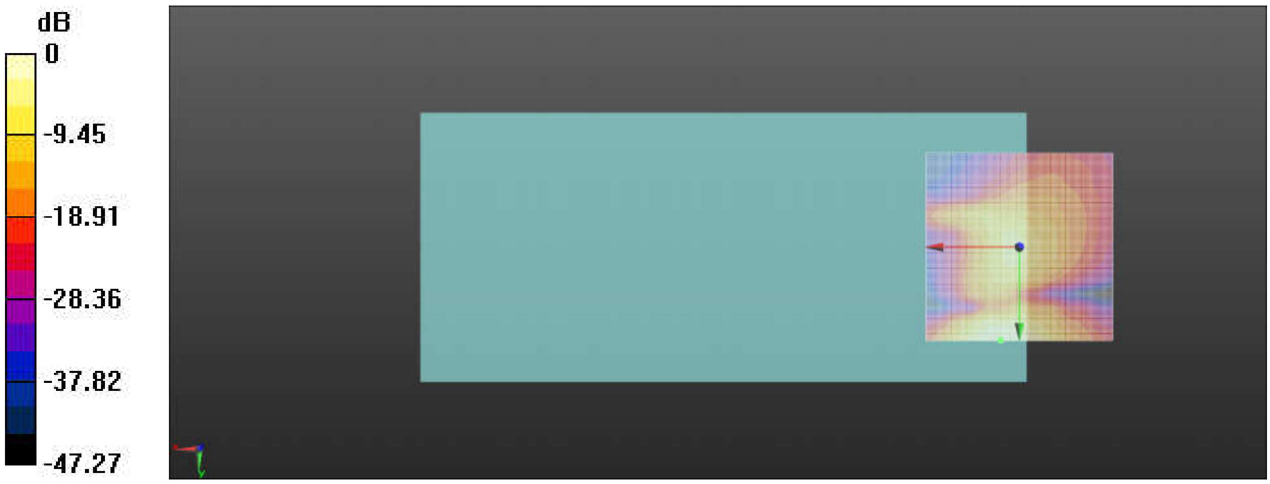
03_HAC T-Coil_WCDMA V_Voice_Ch4182_Y

Communication System: UID 0, UMTS (0); Frequency: 836.4 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 0 kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch4182/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 40.10 dB
ABM1 comp = -6.49 dBA/m
Location: 5, 25, 3.7 mm



0 dB = 101.2 = 40.10 dB

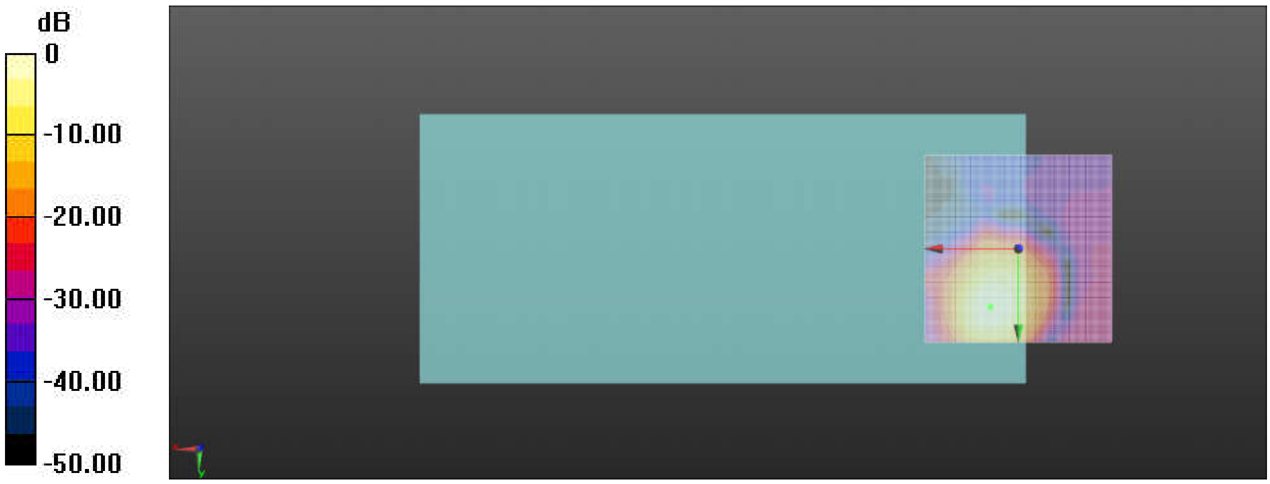
04_HAC T-Coil_WCDMA IV_Voice_Ch1413_Z

Communication System: UID 0, UMTS (0); Frequency: 1732.6 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

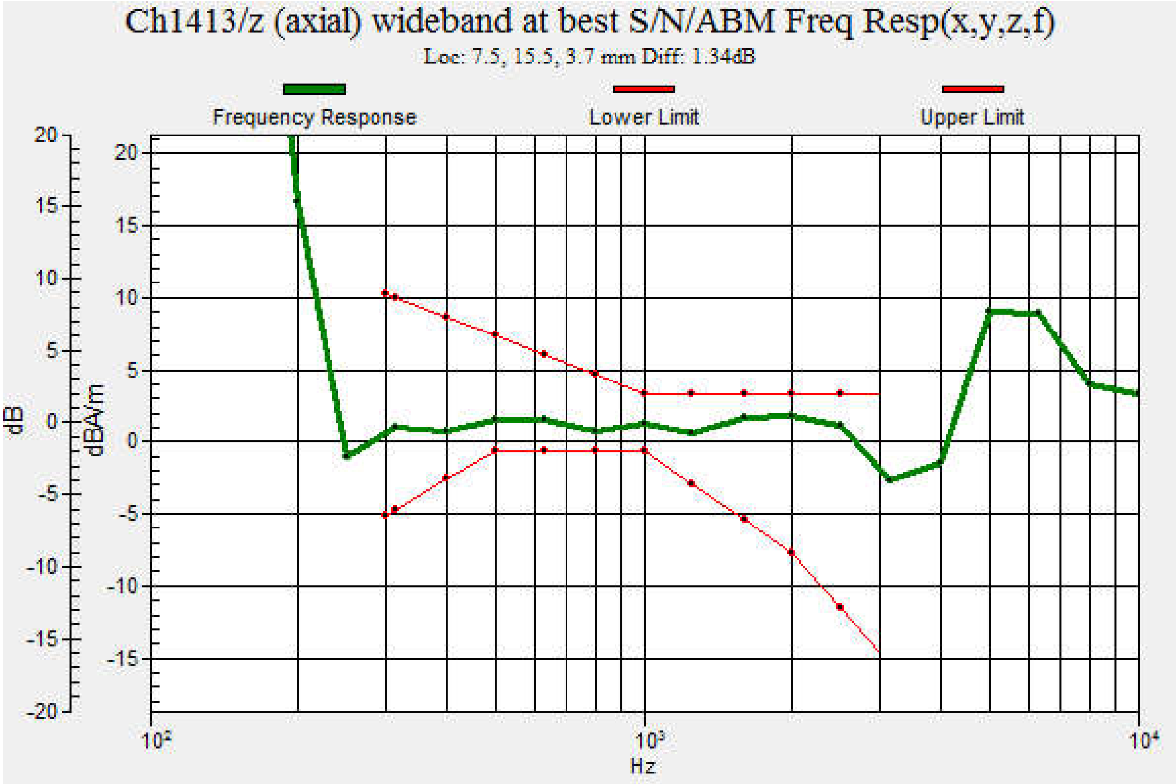
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch1413/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 42.04 dB
ABM1 comp = 2.12 dBA/m
Location: 7.5, 15.4, 3.7 mm



0 dB = 126.5 = 42.04 dB



Ch1413/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.5, 15.5, 3.7 mm Diff: 1.34dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

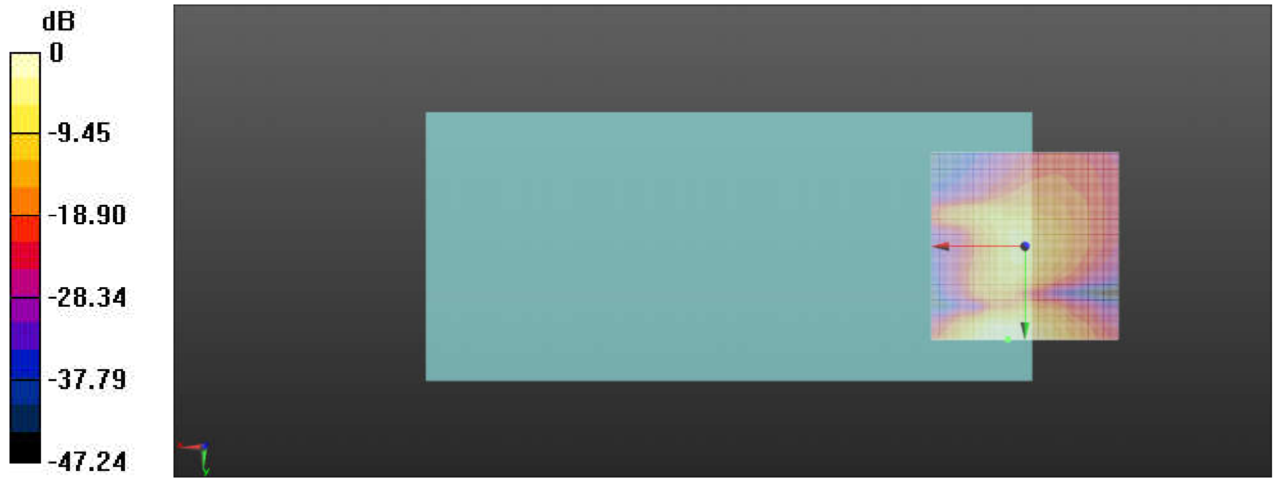
Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

04_HAC T-Coil_WCDMA IV_Voice_Ch1413_Y

Communication System: UID 0, UMTS (0); Frequency: 1732.6 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch1413/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 40.28 dB
ABM1 comp = -6.45 dBA/m
Location: 4.6, 25, 3.7 mm



0 dB = 103.3 = 40.28 dB

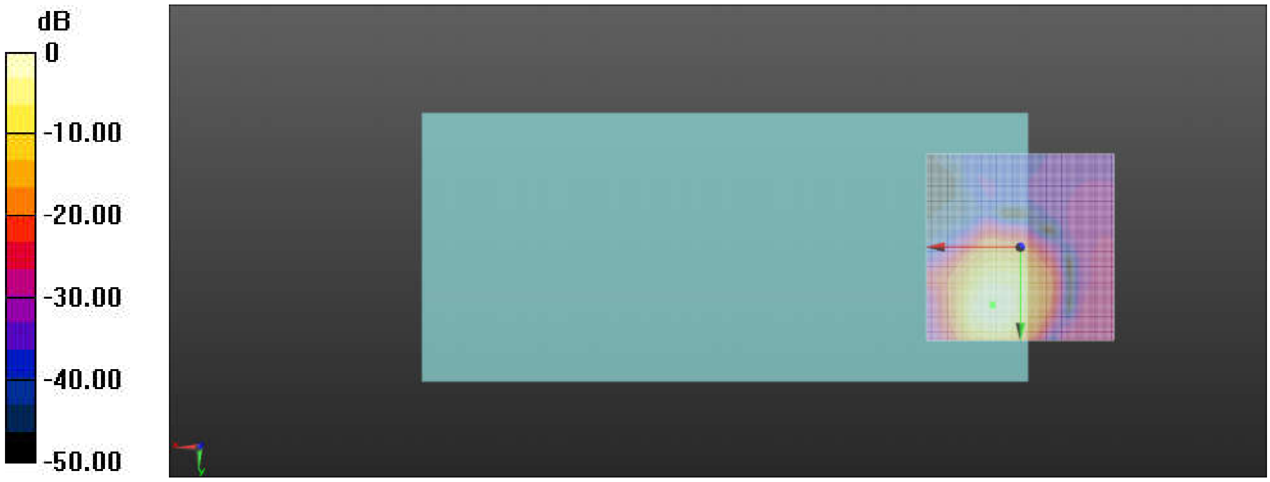
05_HAC T-Coil_WCDMA II_Voice_Ch9400_Z

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

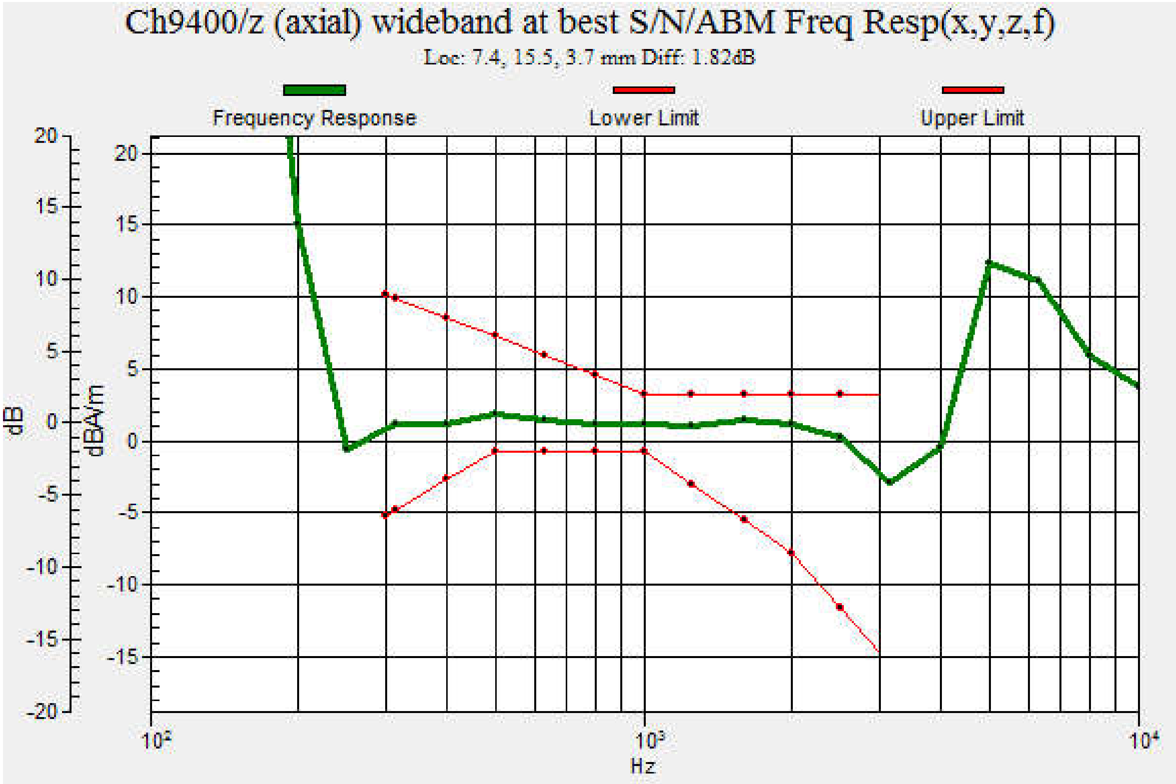
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch9400/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 42.21 dB
ABM1 comp = 2.27 dBA/m
Location: 7.5, 15.4, 3.7 mm



0 dB = 129.0 = 42.21 dB


Ch9400/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.4, 15.5, 3.7 mm Diff: 1.82dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz
10^2
10^3
10^4

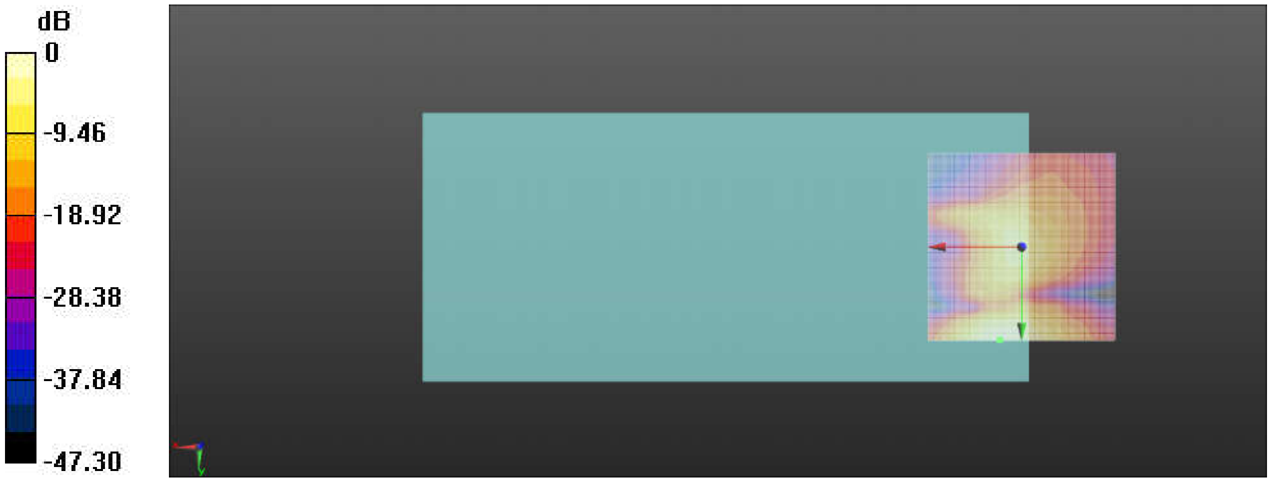
05_HAC T-Coil_WCDMA II_Voice_Ch9400_Y

Communication System: UID 0, UMTS (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch9400/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 40.27 dB
ABM1 comp = -6.03 dBA/m
Location: 5.8, 25, 3.7 mm



0 dB = 103.2 = 40.27 dB

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

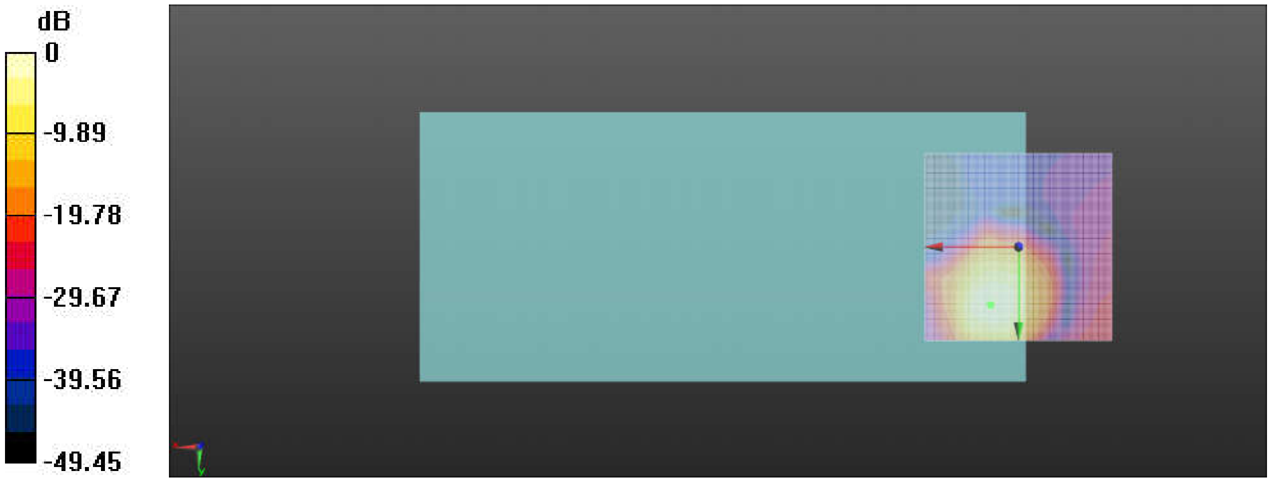
06_HAC T-Coil_LTE Band 12_10M_QPSK_1RB_0Offset_Ch23095_Z

Communication System: UID 0, LTE (0); Frequency: 707.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

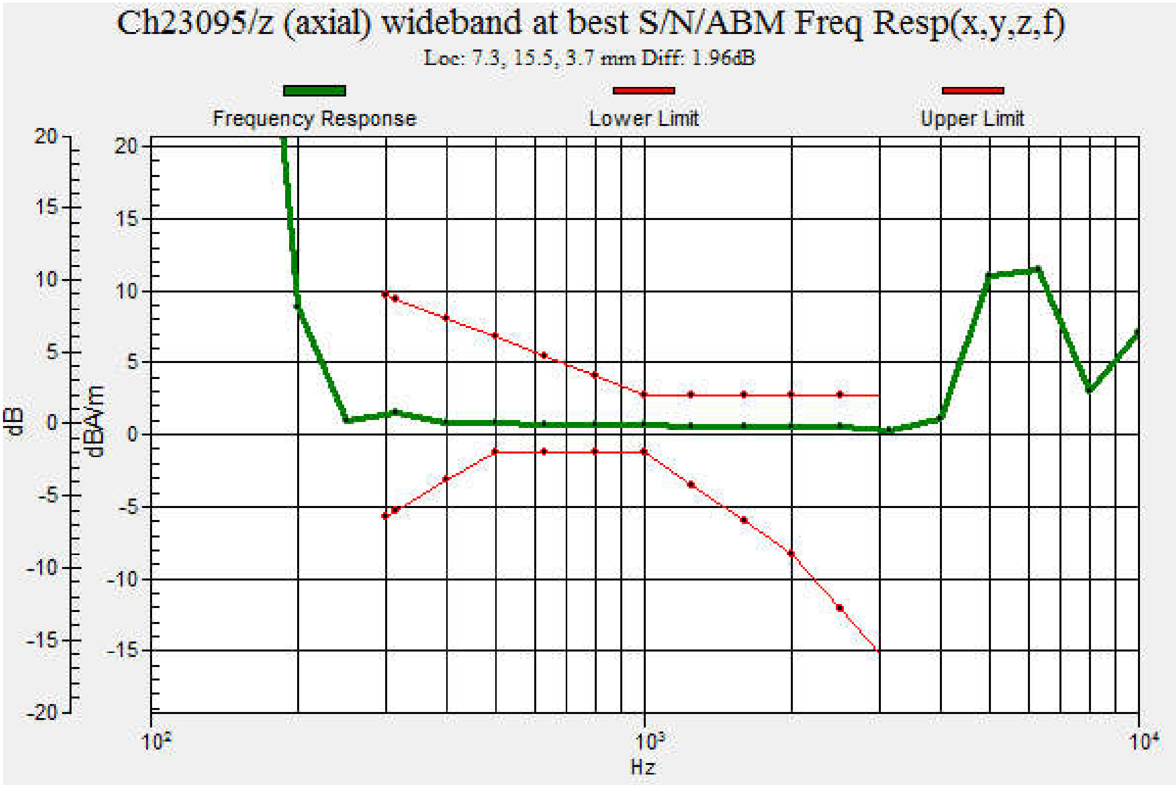
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch23095/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 38.81 dB
ABM1 comp = 1.35 dBA/m
Location: 7.5, 15.4, 3.7 mm



0 dB = 87.21 = 38.81 dB

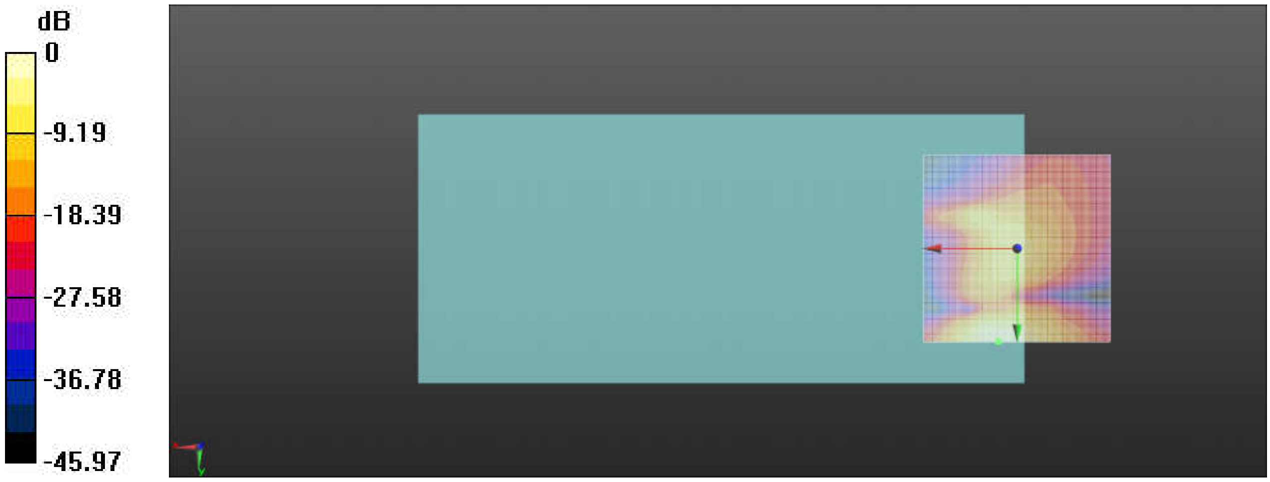

Ch23095/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.3, 15.5, 3.7 mm Diff: 1.96dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
20
15
10
5
0
-5
-10
-15
-20
10^2
10^3
10^4
Hz

06_HAC T-Coil_LTE Band 12_10M_QPSK_1RB_0Offset_Ch23095_Y

Communication System: UID 0, LTE (0); Frequency: 707.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch23095/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 37.19 dB
ABM1 comp = -6.15 dBA/m
Location: 5, 25, 3.7 mm



0 dB = 72.34 = 37.19 dB

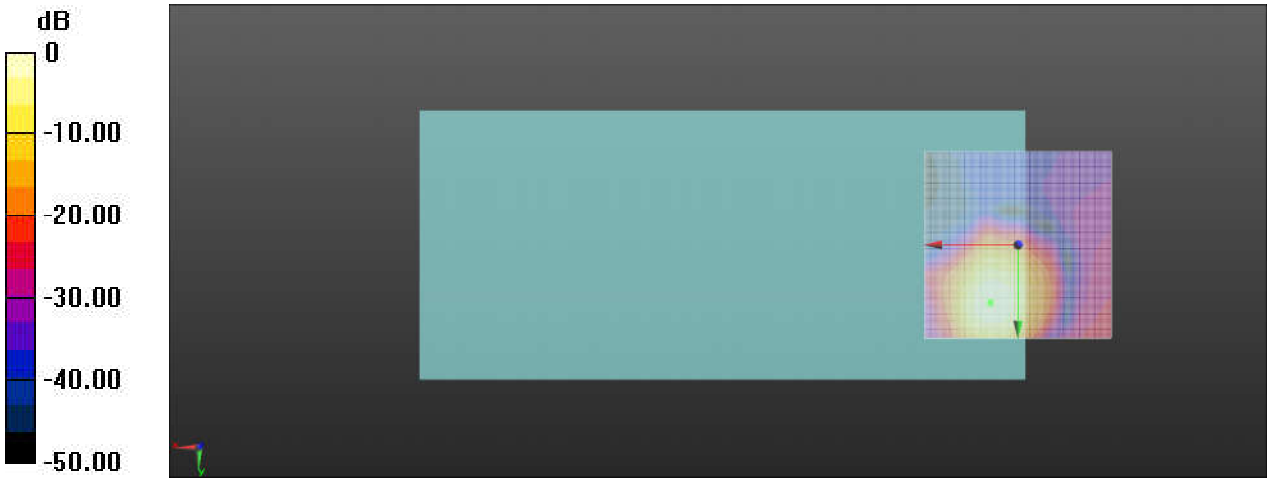
07_HAC T-Coil_LTE Band 13_10M_QPSK_1RB_0Offset_Ch23230_Z

Communication System: UID 0, LTE (0); Frequency: 782 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 0 kg/m^3
Ambient Temperature：23.4 ℃

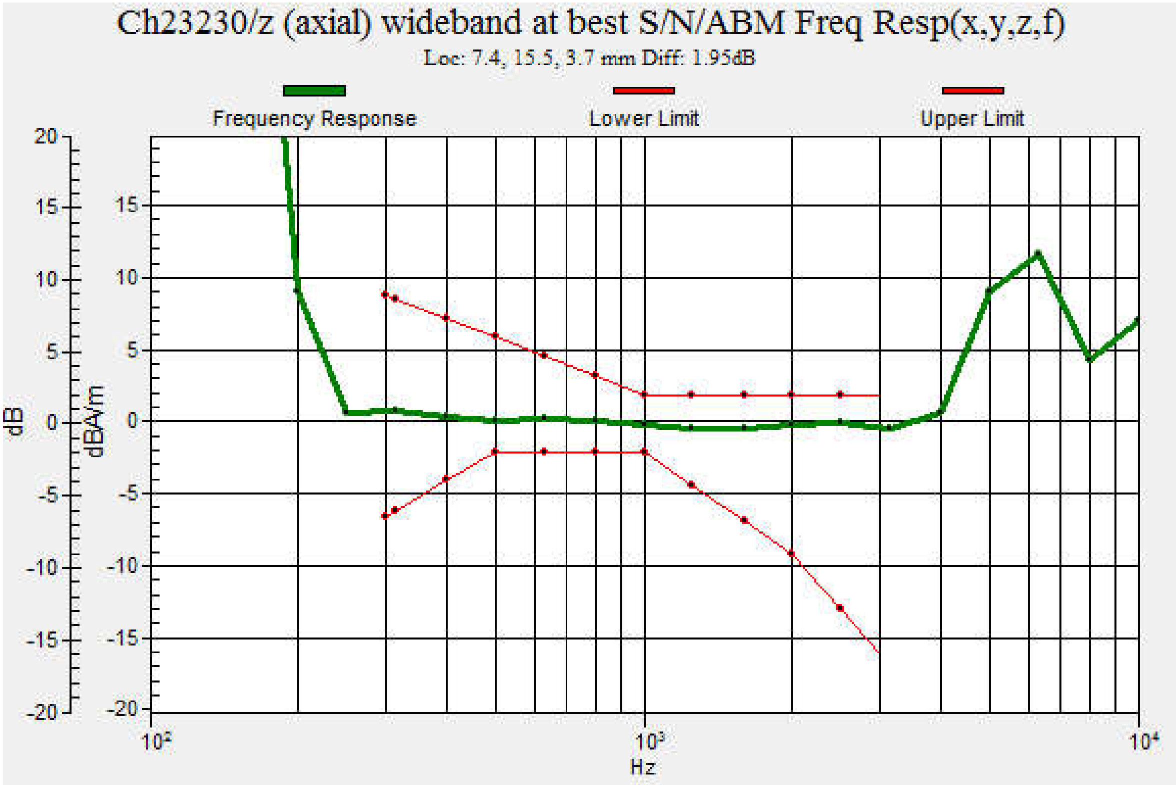
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch23230/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 39.36 dB
ABM1 comp = 1.17 dBA/m
Location: 7.5, 15.4, 3.7 mm



0 dB = 92.92 = 39.36 dB


Ch23230/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.4, 15.5, 3.7 mm Diff: 1.95dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
20
15
10
5
0
-5
-10
-15
-20
10²
10³
10⁴
Hz

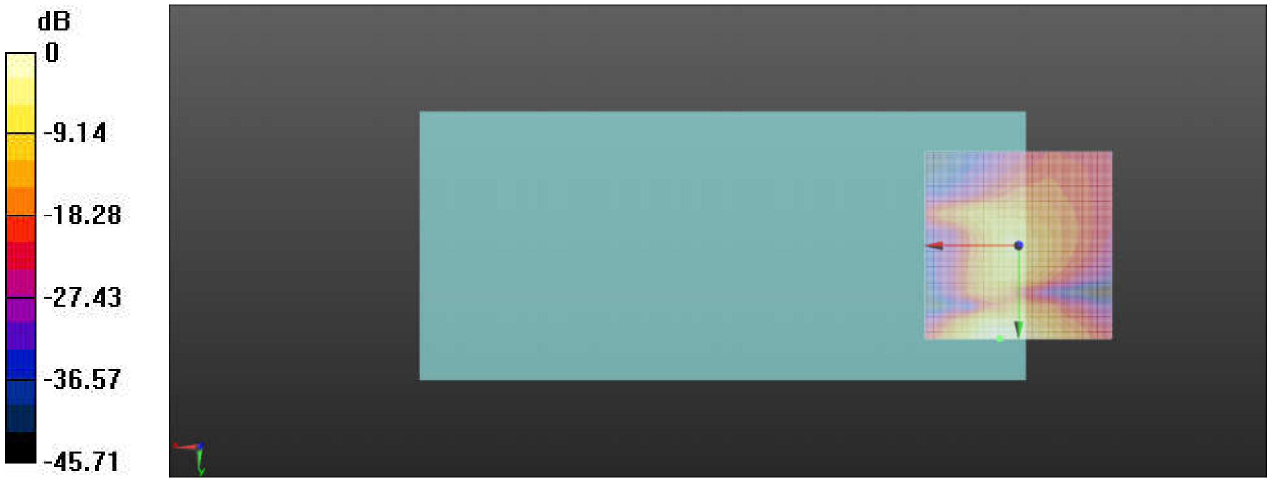
07_HAC T-Coil_LTE Band 13_10M_QPSK_1RB_0Offset_Ch23230_Y

Communication System: UID 0, LTE (0); Frequency: 782 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 0 kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch23230/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 36.97 dB
ABM1 comp = -6.25 dBA/m
Location: 5, 25, 3.7 mm



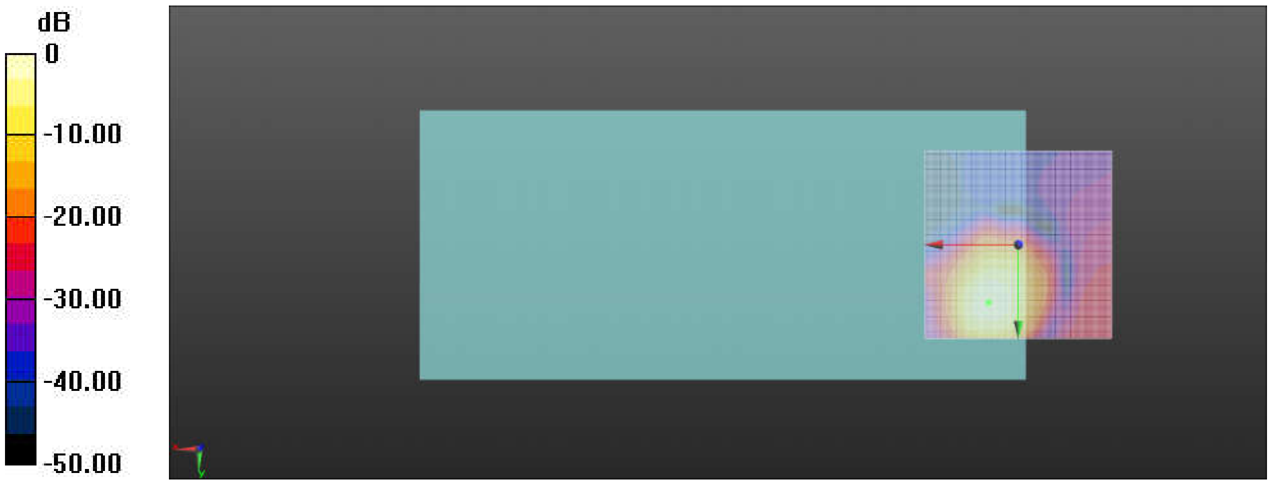
0 dB = 70.51 = 36.97 dB

08_HAC T-Coil_LTE Band 25_20M_QPSK_1RB_0Offset_Ch26340_Z

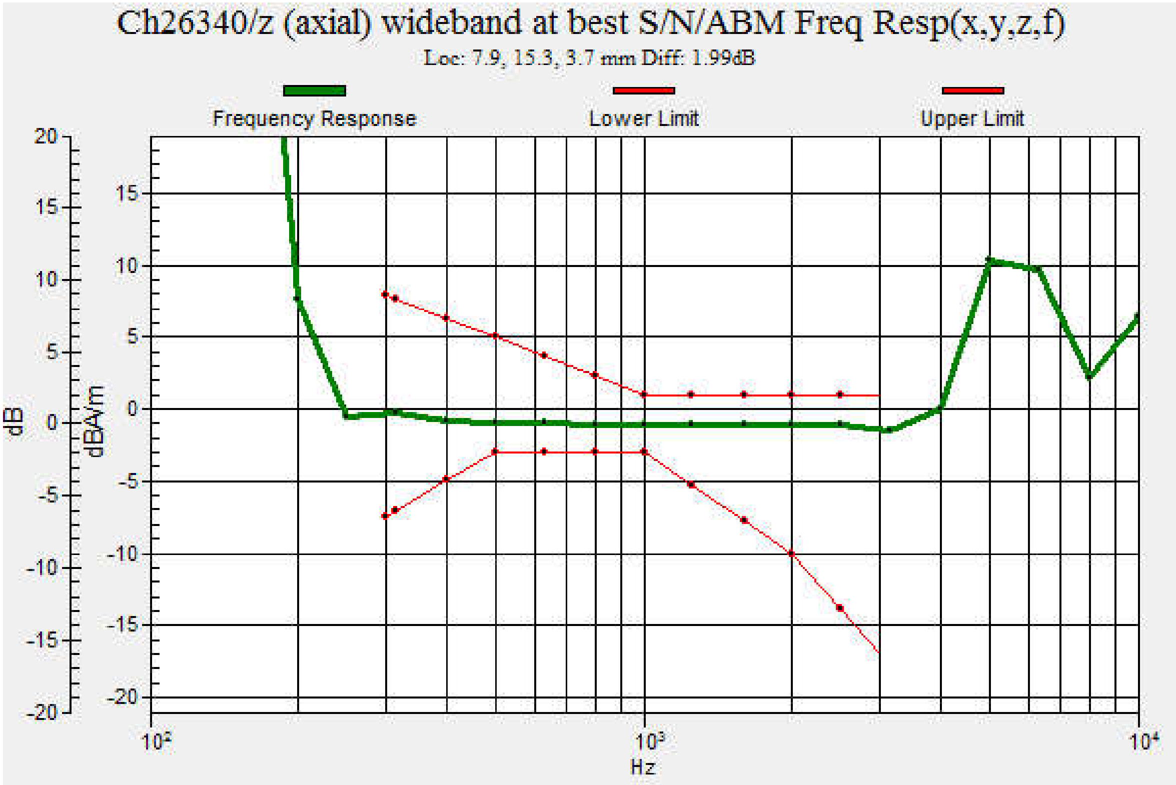
Communication System: UID 0, LTE (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 0 kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch26340/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 39.13 dB
ABM1 comp = 2.44 dBA/m
Location: 7.9, 15.4, 3.7 mm



0 dB = 90.52 = 39.13 dB



Ch26340/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.9, 15.3, 3.7 mm Diff: 1.99dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

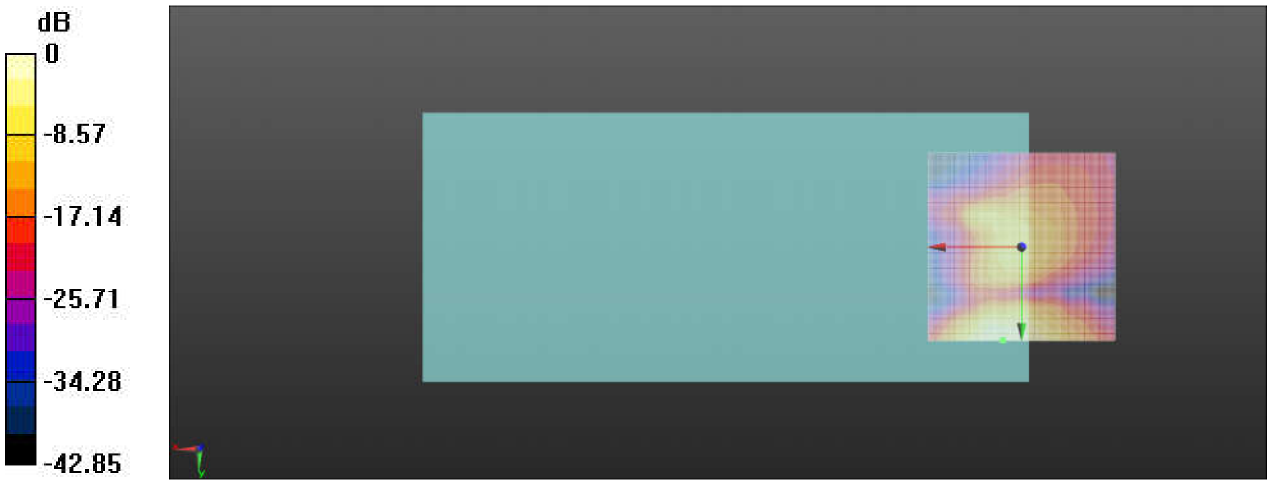
Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

08_HAC T-Coil_LTE Band 25_20M_QPSK_1RB_0Offset_Ch26340_Y

Communication System: UID 0, LTE (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch26340/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 36.09 dB
ABM1 comp = -8.09 dBA/m
Location: 5, 25, 3.7 mm



0 dB = 63.74 = 36.09 dB

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

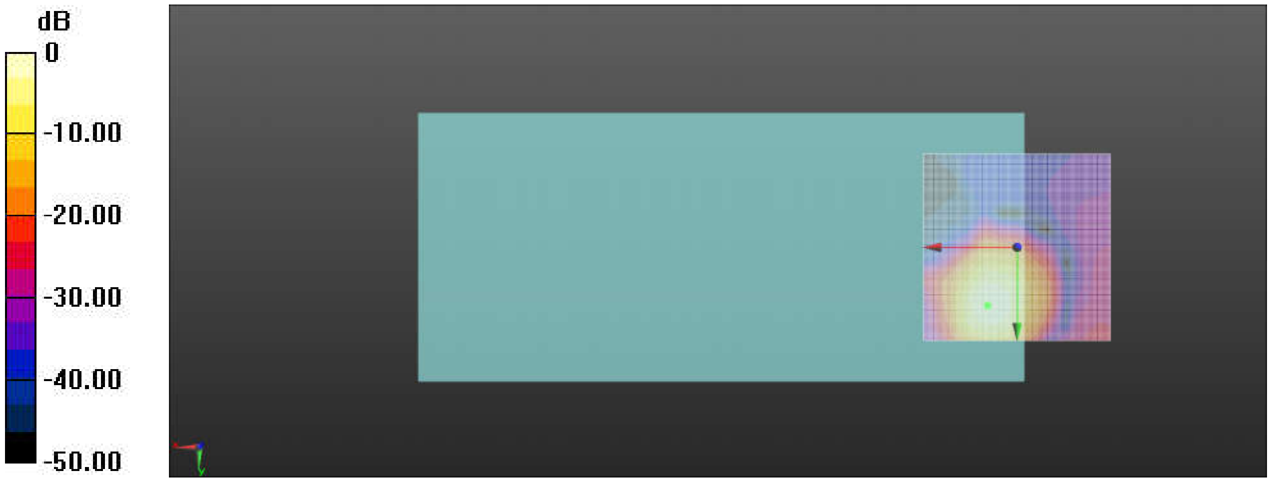
09_HAC T-Coil_LTE Band 26_15M_QPSK_1RB_0Offset_Ch26865_Z

Communication System: UID 0, LTE (0); Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

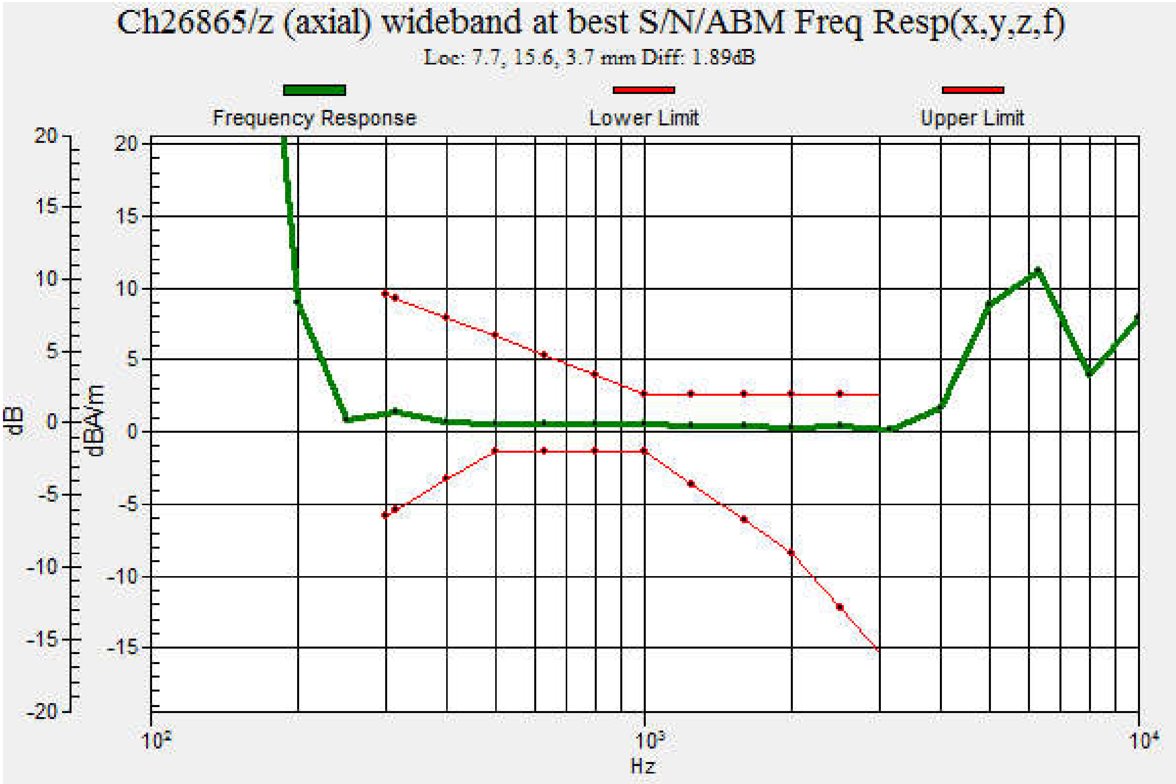
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch26865/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 39.75 dB
ABM1 comp = 1.27 dBA/m
Location: 7.9, 15.4, 3.7 mm



0 dB = 97.16 = 39.75 dB



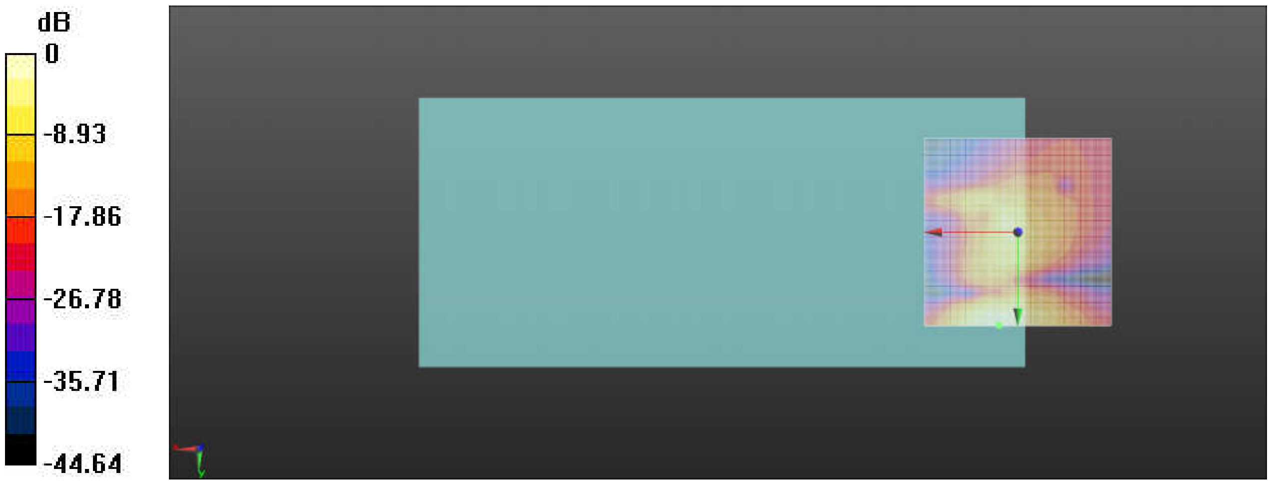
Ch26865/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.7, 15.6, 3.7 mm Diff: 1.89dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

09_HAC T-Coil_LTE Band 26_15M_QPSK_1RB_0Offset_Ch26865_Y

Communication System: UID 0, LTE (0); Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch26865/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 36.21 dB
ABM1 comp = -6.20 dBA/m
Location: 5, 25, 3.7 mm



0 dB = 64.64 = 36.21 dB

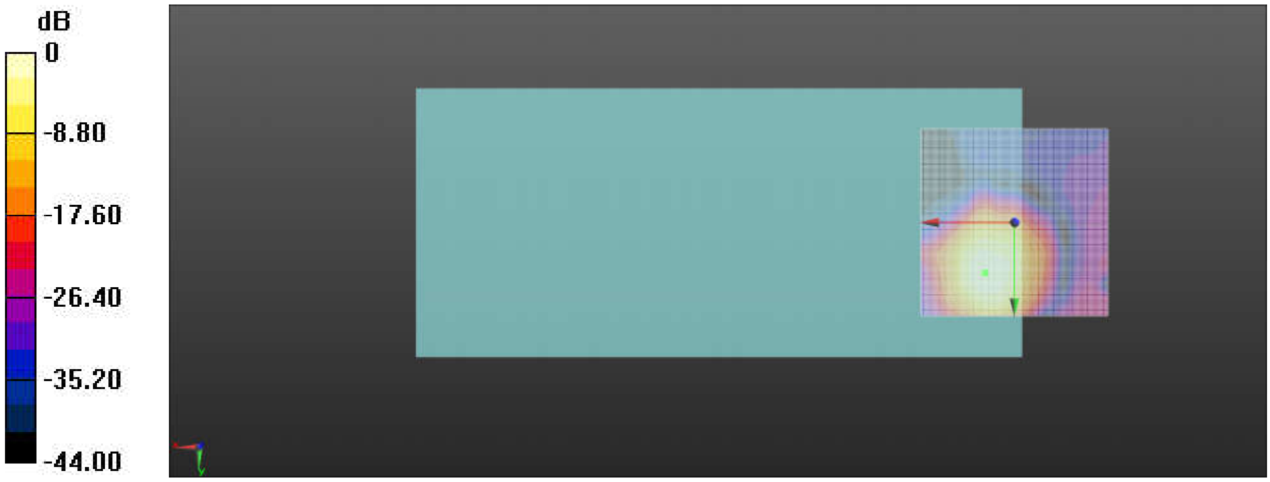
10_HAC T-Coil_LTE Band 66_20M_QPSK_1RB_0Offset_Ch132322_Z

Communication System: UID 0, LTE (0); Frequency: 1745 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

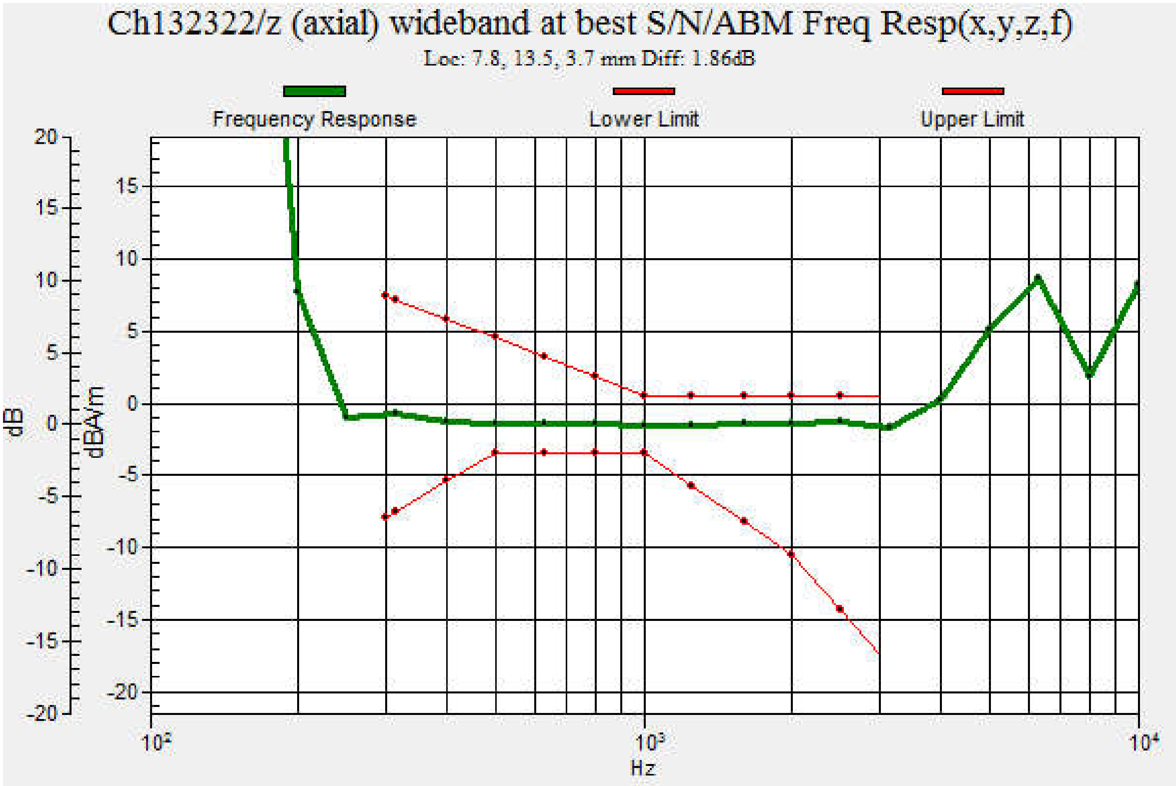
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch132322/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 36.79 dB
ABM1 comp = -0.32 dBA/m
Location: 7.9, 13.3, 3.7 mm



0 dB = 69.11 = 36.79 dB



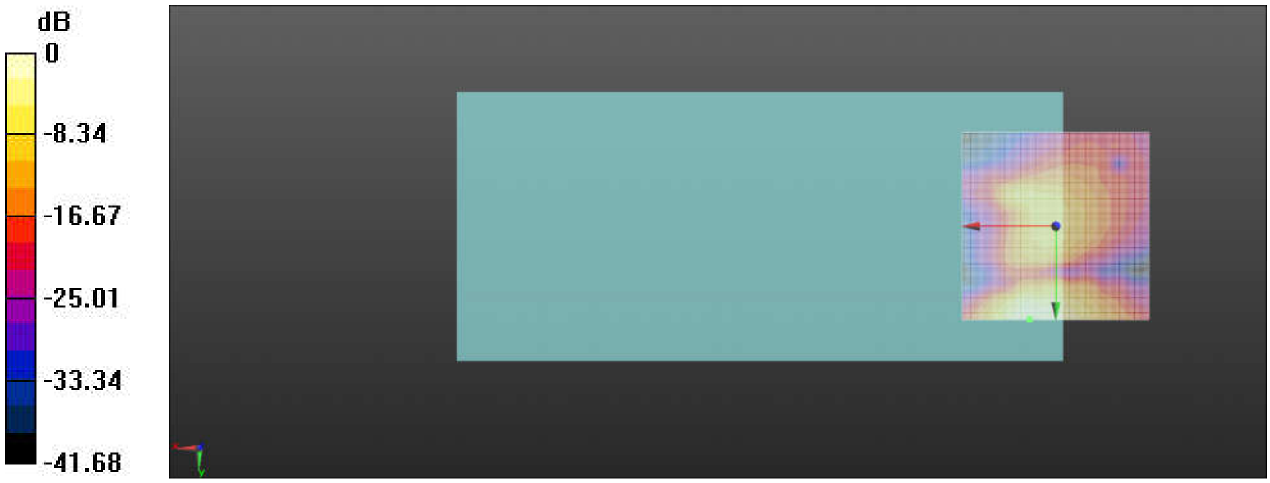
Ch132322/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.8, 13.5, 3.7 mm Diff: 1.86dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

10_HAC T-Coil_LTE Band 66_20M_QPSK_1RB_0Offset_Ch132322_Y

Communication System: UID 0, LTE (0); Frequency: 1745 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch132322/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 36.29 dB
ABM1 comp = -7.14 dBA/m
Location: 7.1, 25, 3.7 mm



0 dB = 65.26 = 36.29 dB

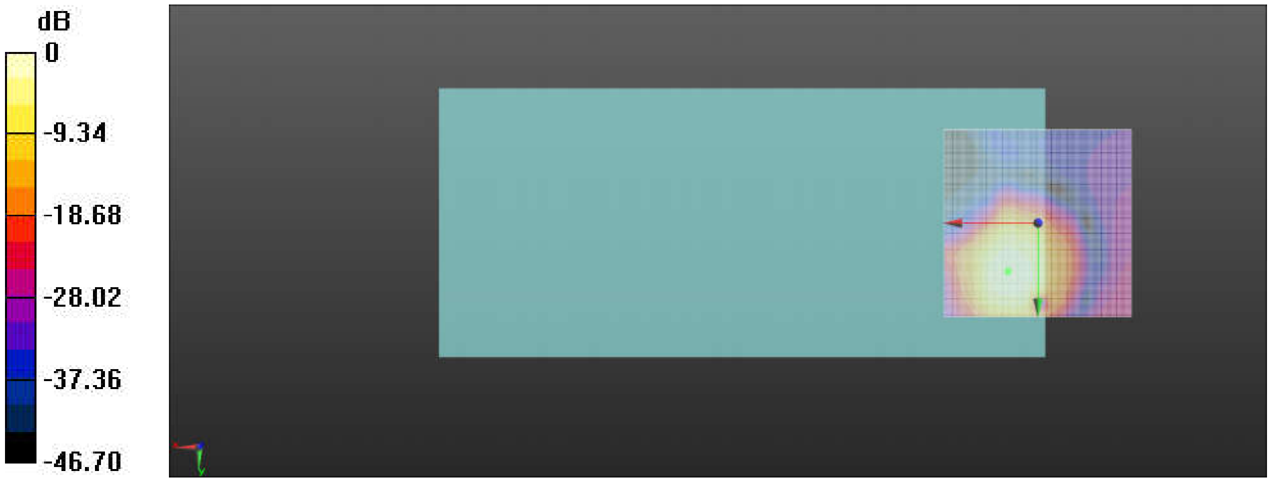
Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/20

11_HAC T-Coil_LTE Band 71_20M_QPSK_1RB_0Offset_Ch133297_Z

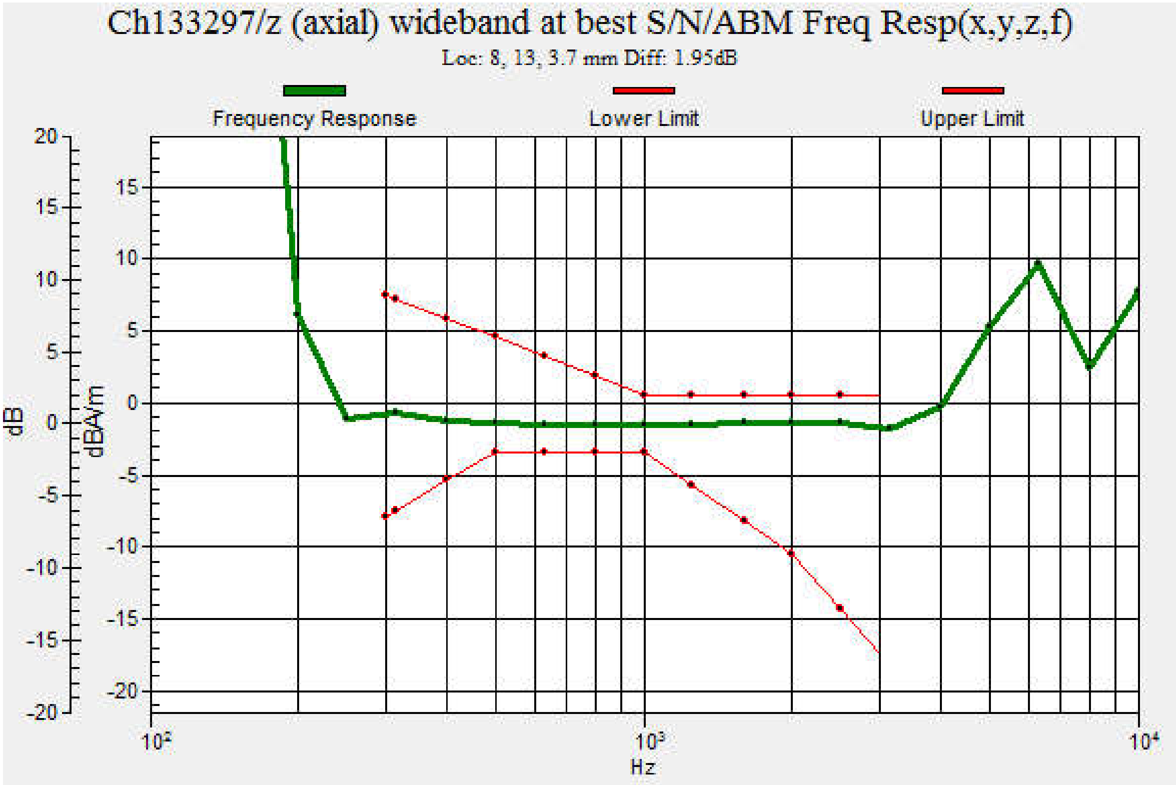
Communication System: UID 0, LTE (0); Frequency: 680.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch133297/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 39.19 dB
ABM1 comp = -0.74 dBA/m
Location: 7.9, 12.9, 3.7 mm



0 dB = 91.15 = 39.20 dB



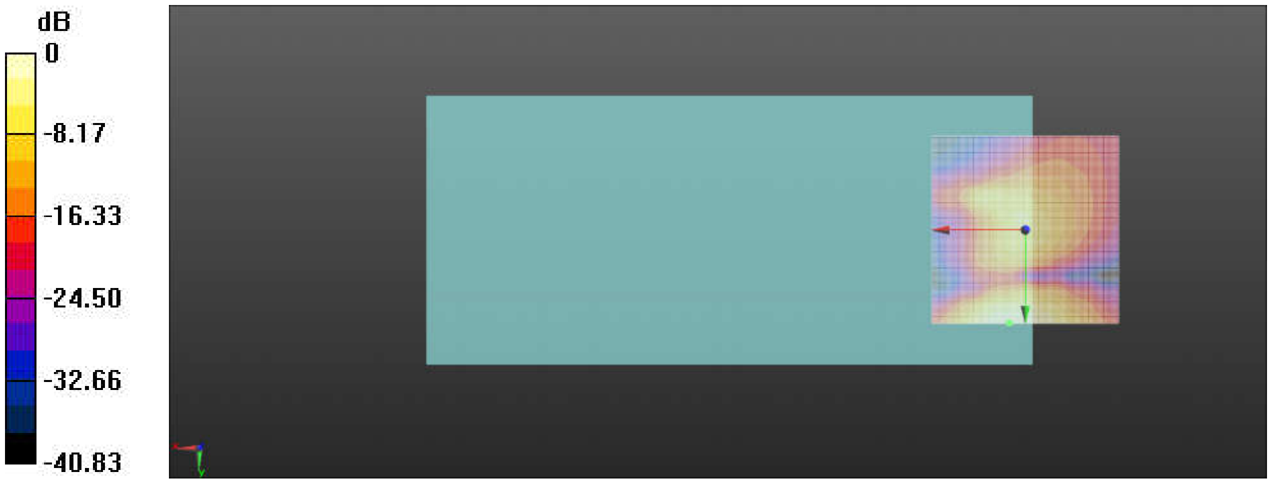
Ch133297/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 8, 13, 3.7 mm Diff: 1.95dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

11_HAC T-Coil_LTE Band 71_20M_QPSK_1RB_0Offset_Ch133297_Y

Communication System: UID 0, LTE (0); Frequency: 680.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch133297/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 35.62 dB
ABM1 comp = -9.02 dBA/m
Location: 4.2, 25, 3.7 mm



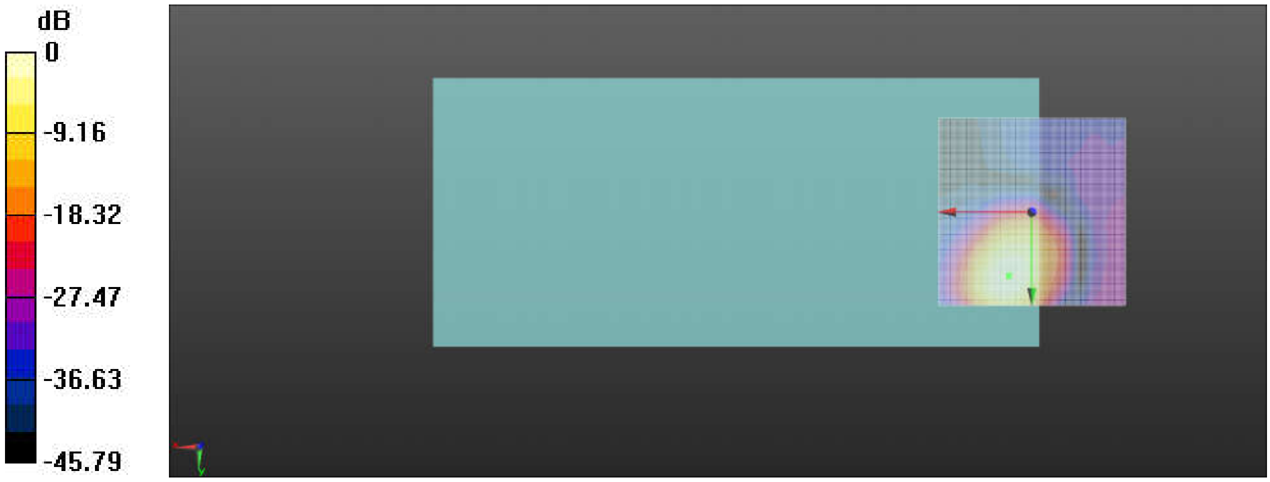
0 dB = 60.37 = 35.62 dB

12_HAC T-Coil_LTE Band 41_20M_QPSK_1RB_0Offset_Ch40620_Z

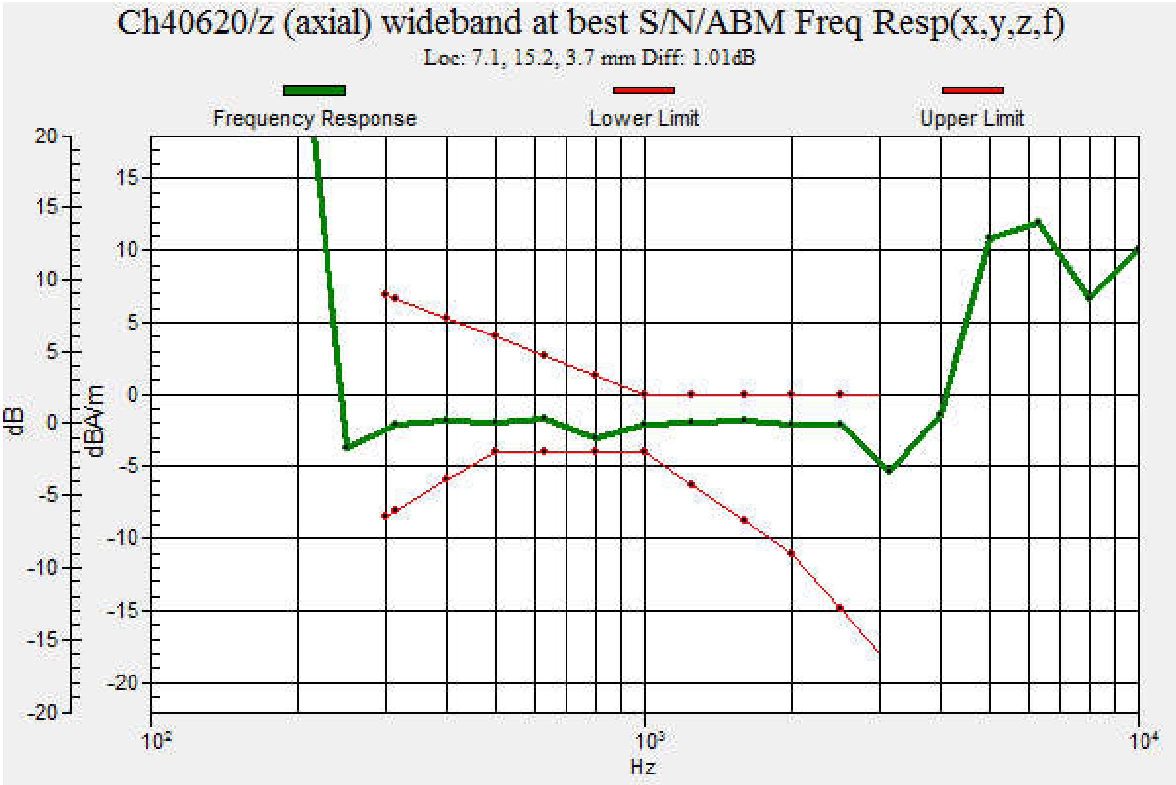
Communication System: UID 0, LTE (0); Frequency: 2593 MHz;Duty Cycle: 1:2.331
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch40620/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 30.46 dB
ABM1 comp = 1.36 dBA/m
Location: 7.1, 15, 3.7 mm



0 dB = 33.35 = 30.46 dB



Ch40620/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 7.1, 15.2, 3.7 mm Diff: 1.01dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

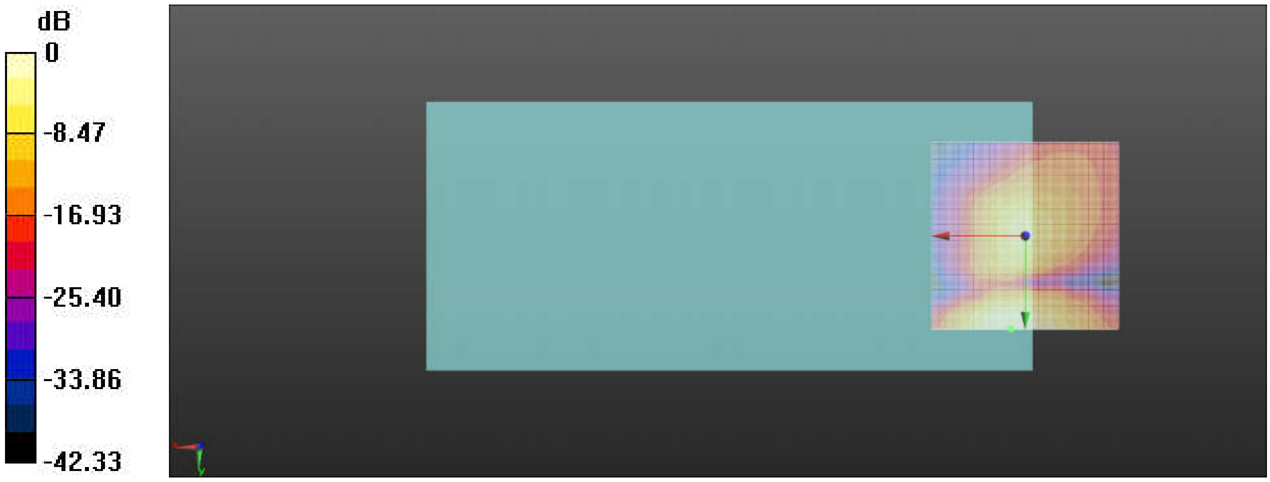
12_HAC T-Coil_LTE Band 41_20M_QPSK_1RB_0Offset_Ch40620_Y

Communication System: UID 0, LTE (0); Frequency: 2593 MHz;Duty Cycle: 1:2.331
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch40620/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 31.89 dB
ABM1 comp = -9.66 dBA/m
Location: 3.8, 25, 3.7 mm



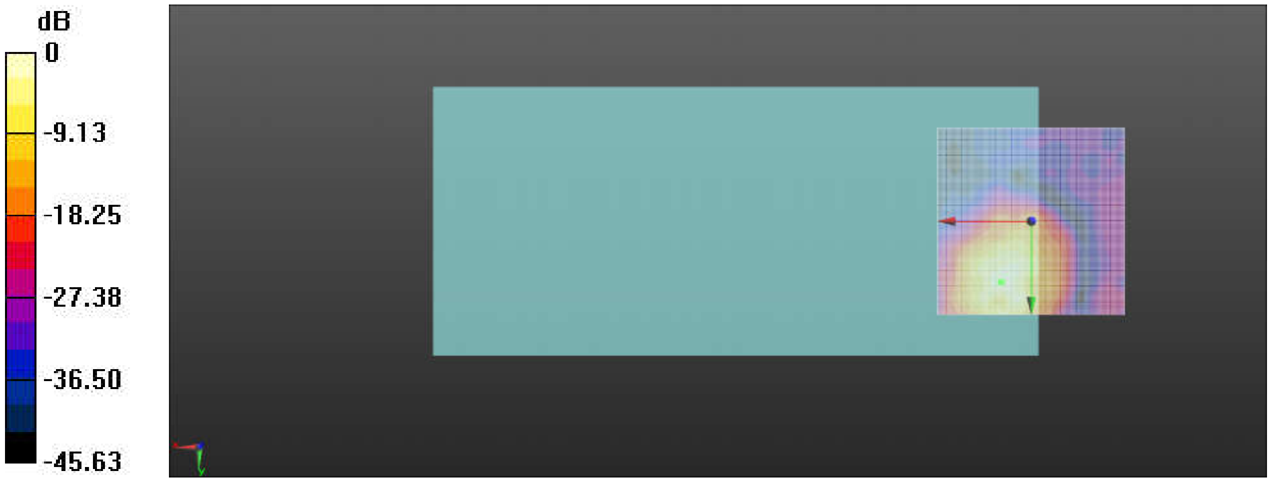
0 dB = 39.29 = 31.89 dB

13_HAC T-Coil_WLAN 2.4GHz_802.11b 1Mbps_Ch6_Z

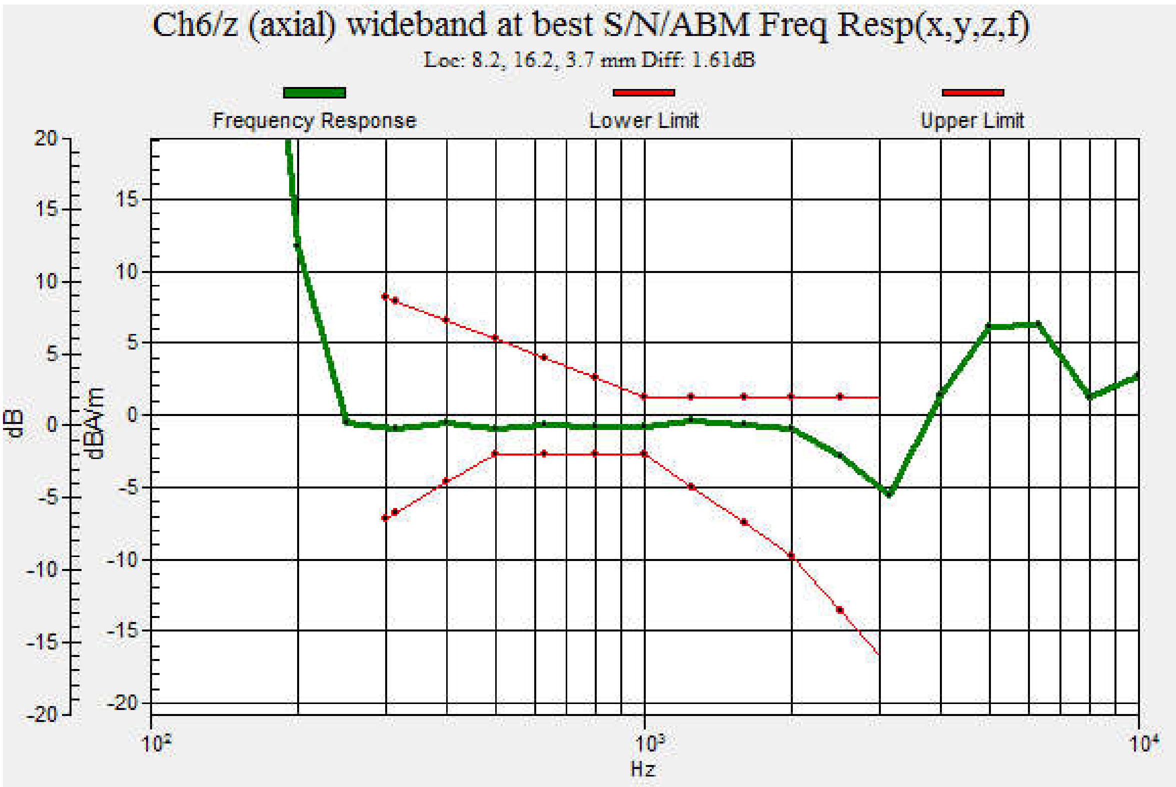
Communication System: UID 0, WIFI (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch6/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 35.55 dB
ABM1 comp = -5.22 dBA/m
Location: 7.9, 16.2, 3.7 mm



0 dB = 59.88 = 35.55 dB



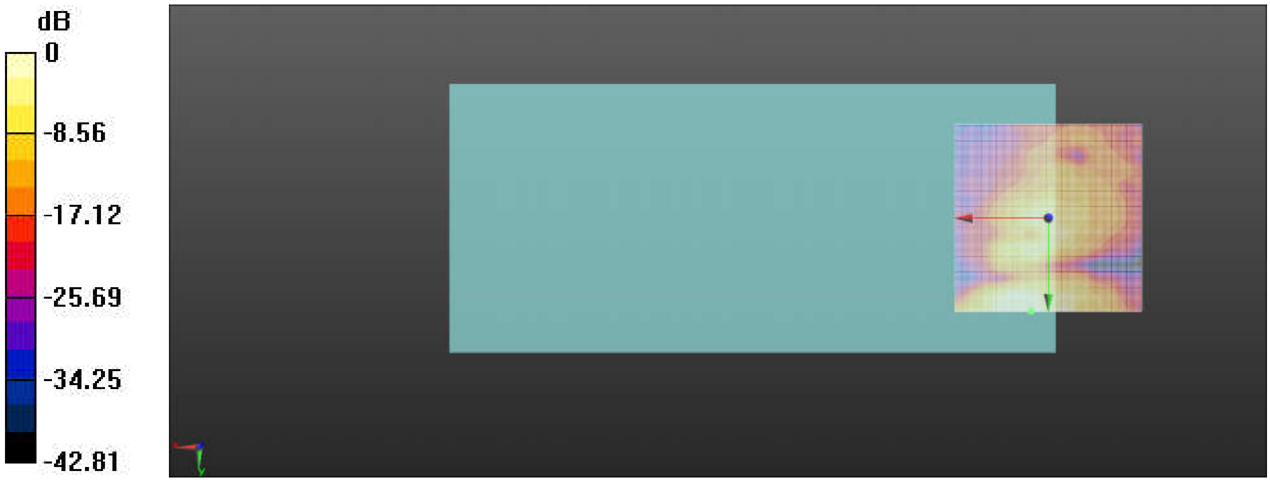
Ch6/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 8.2, 16.2, 3.7 mm Diff: 1.61dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
20
15
10
5
0
-5
-10
-15
-20
10²
10³
10⁴
Hz

13_HAC T-Coil_WLAN 2.4GHz_802.11b 1Mbps_Ch6_Y

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch6/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 31.45 dB
ABM1 comp = -17.38 dBA/m
Location: 4.6, 25, 3.7 mm



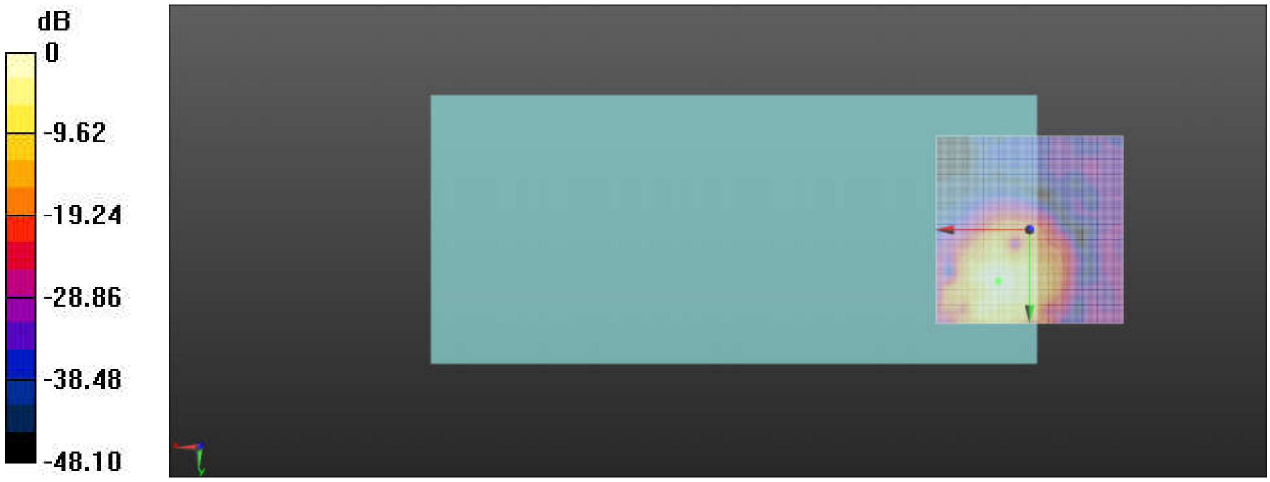
0 dB = 37.38 = 31.45 dB

14_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch38_Z

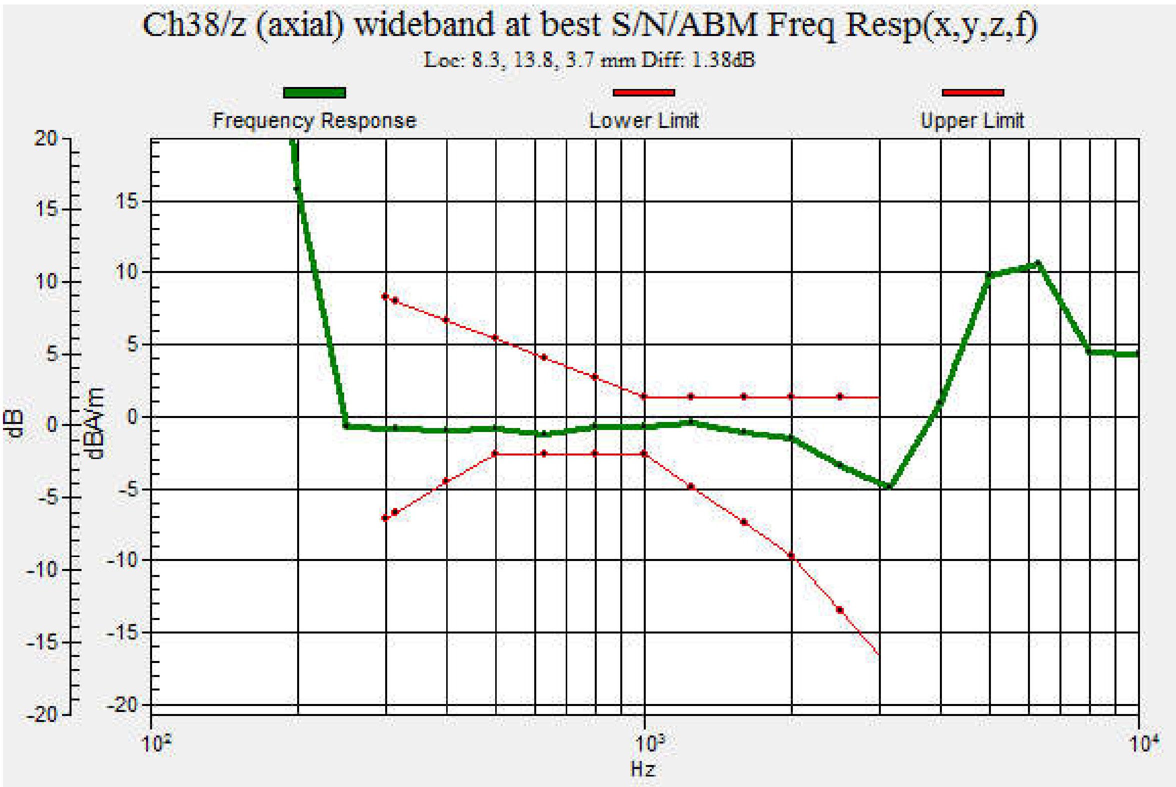
Communication System: UID 0, WIFI (0); Frequency: 5190 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch38/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 37.75 dB
ABM1 comp = -5.59 dBA/m
Location: 8.3, 13.7, 3.7 mm



0 dB = 77.15 = 37.75 dB



Ch38/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 8.3, 13.8, 3.7 mm Diff: 1.38dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

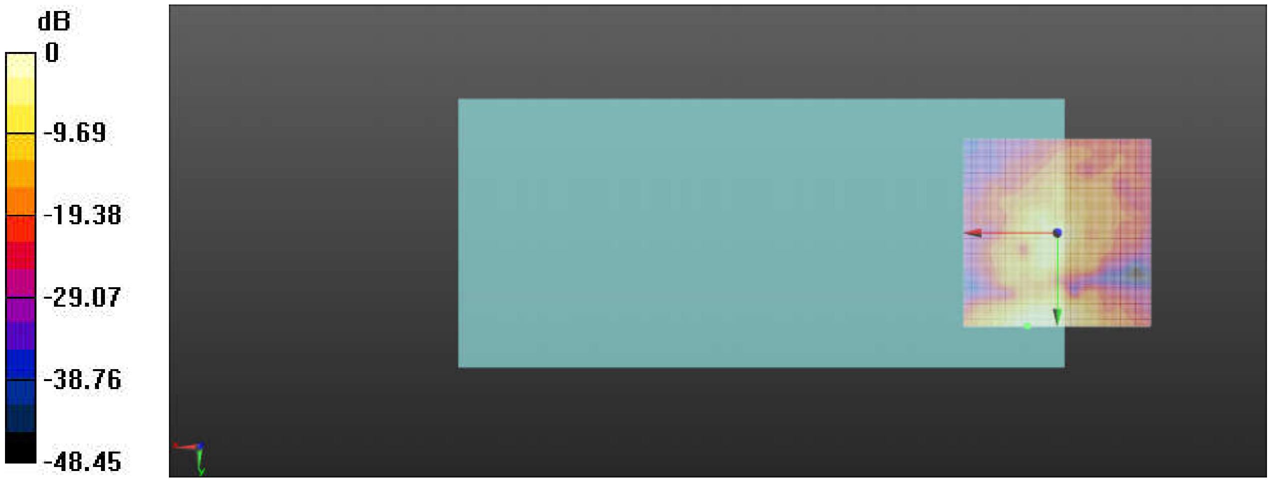
Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/25

14_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch38_Y

Communication System: UID 0, WIFI (0); Frequency: 5190 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch38/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):
Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 34.88 dB
ABM1 comp = -12.69 dBA/m
Location: 7.9, 25, 3.7 mm



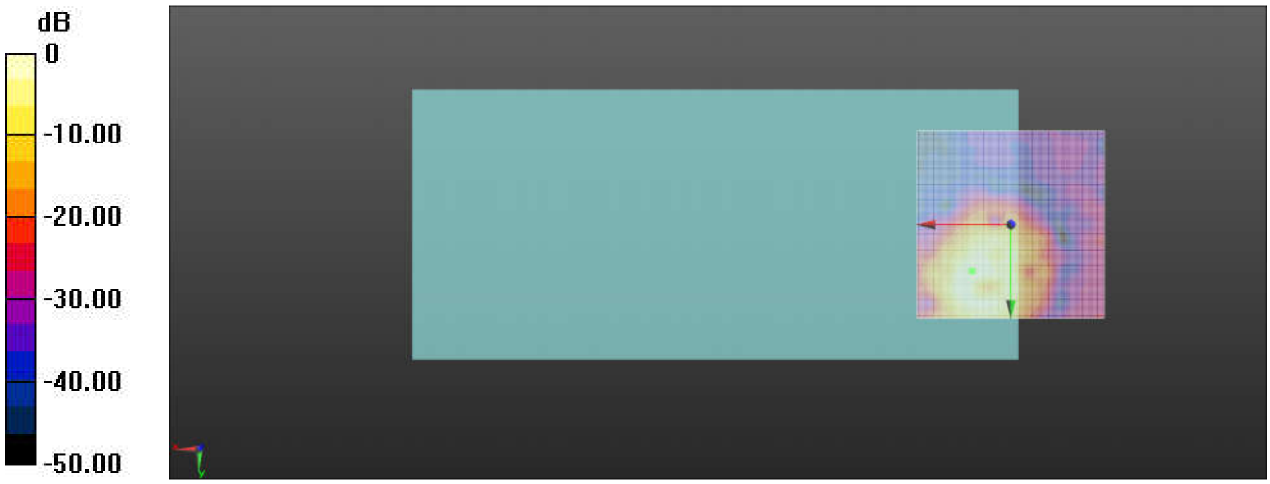
0 dB = 55.47 = 34.88 dB

15_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch54_Z

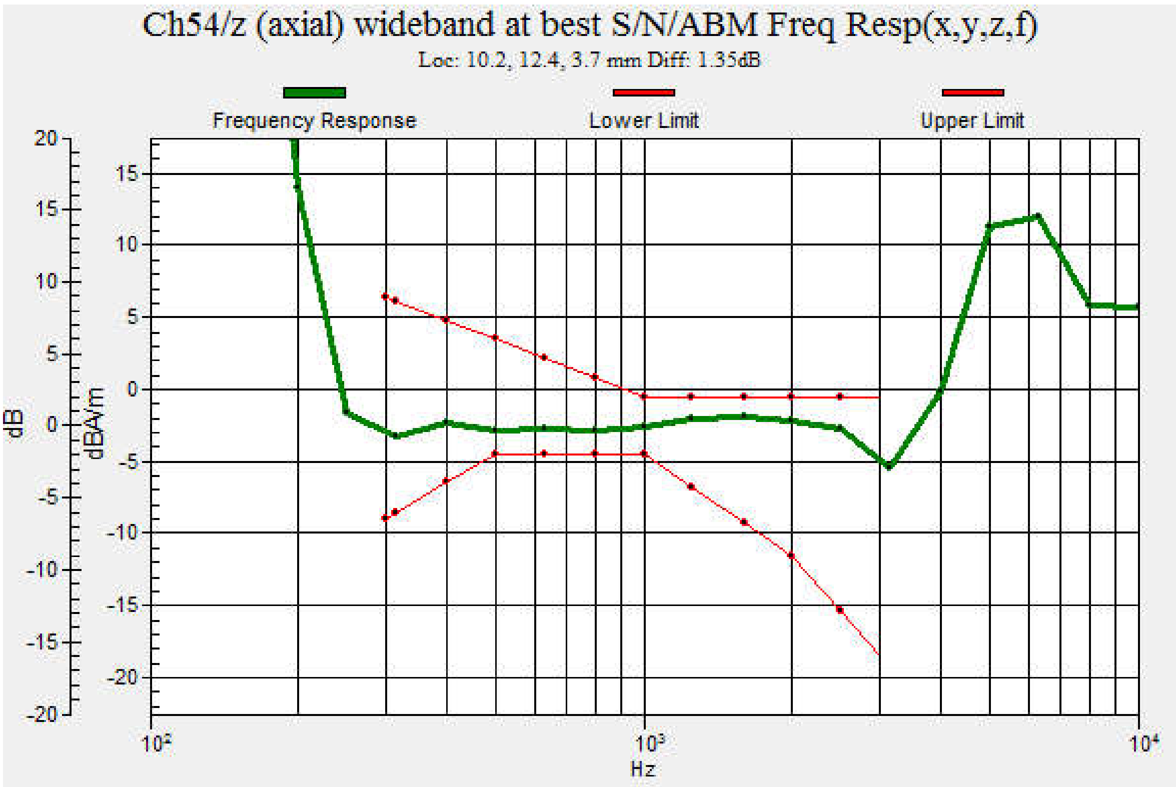
Communication System: UID 0, WIFI (0); Frequency: 5270 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch54/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 35.83 dB
ABM1 comp = -6.53 dBA/m
Location: 10.4, 12.5, 3.7 mm



0 dB = 61.90 = 35.83 dB



Ch54/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 10.2, 12.4, 3.7 mm Diff: 1.35dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

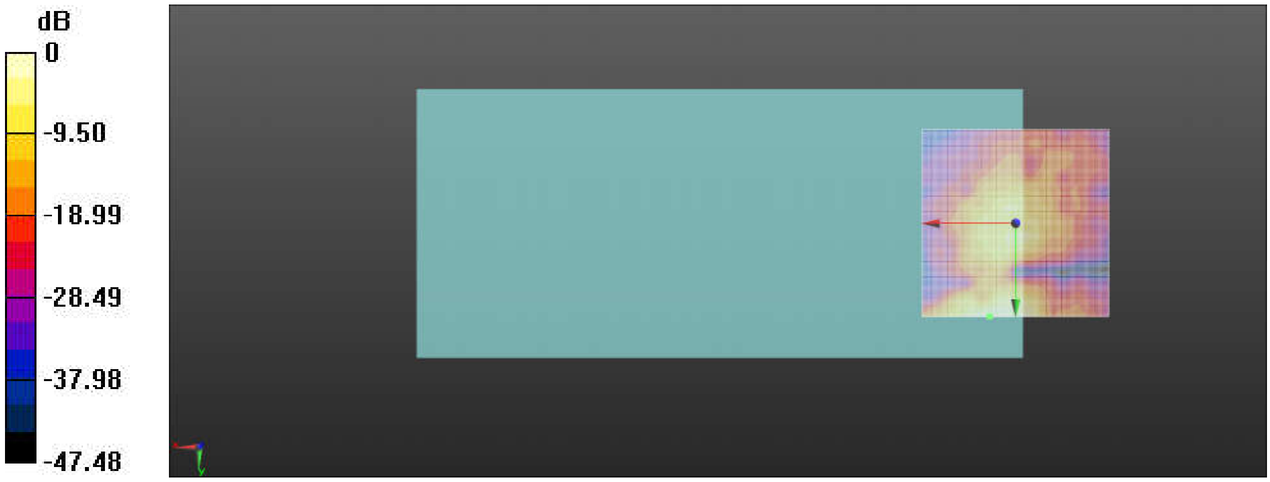
15_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch54_Y

Communication System: UID 0, WIFI (0); Frequency: 5270 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 0 kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch54/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 35.79 dB
ABM1 comp = -12.19 dBA/m
Location: 7.1, 25, 3.7 mm



0 dB = 61.57 = 35.79 dB

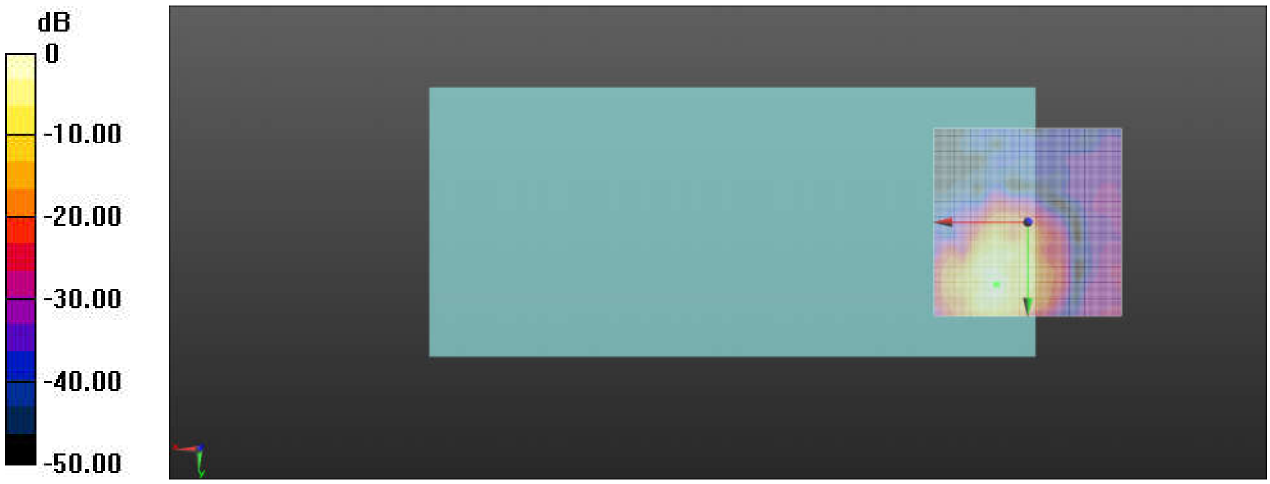
16_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch110_Z

Communication System: UID 0, WIFI (0); Frequency: 5550 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

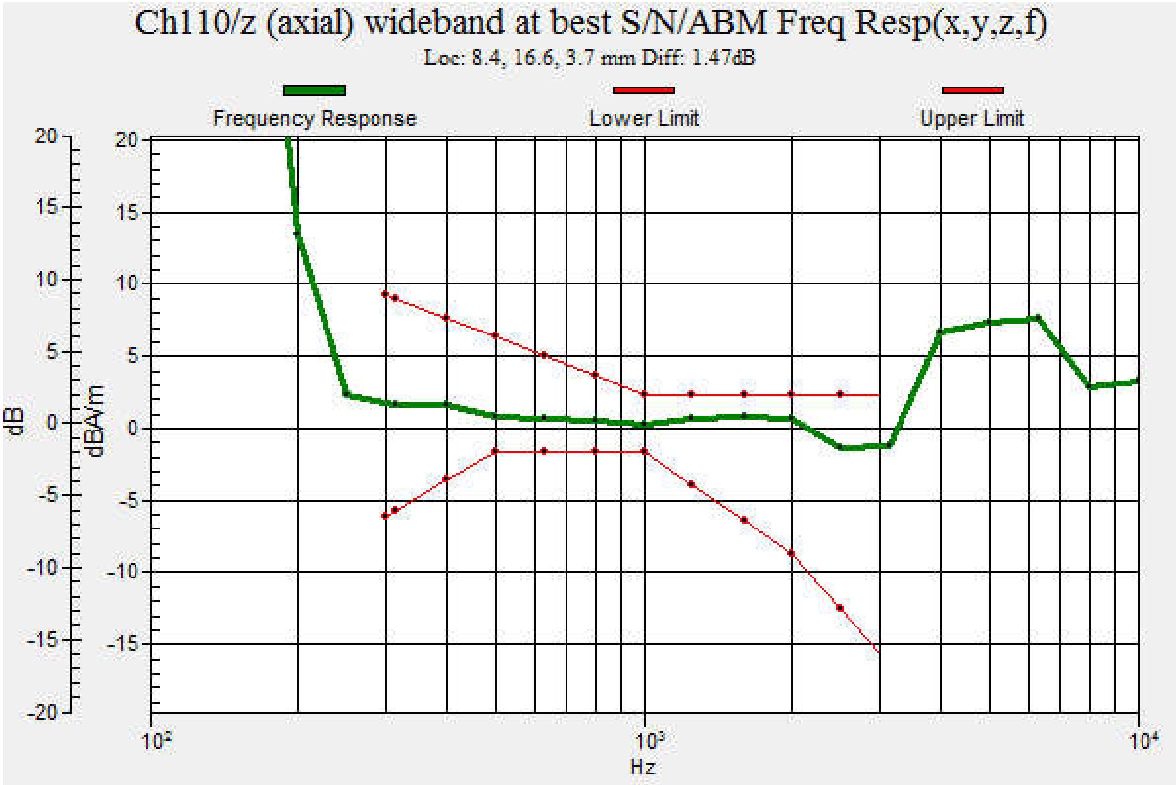
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch110/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 42.79 dB
ABM1 comp = -1.21 dBA/m
Location: 8.3, 16.7, 3.7 mm



0 dB = 137.8 = 42.78 dB



Ch110/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 8.4, 16.6, 3.7 mm Diff: 1.47dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
20
15
10
5
0
-5
-10
-15
-20
10²
10³
10⁴
Hz

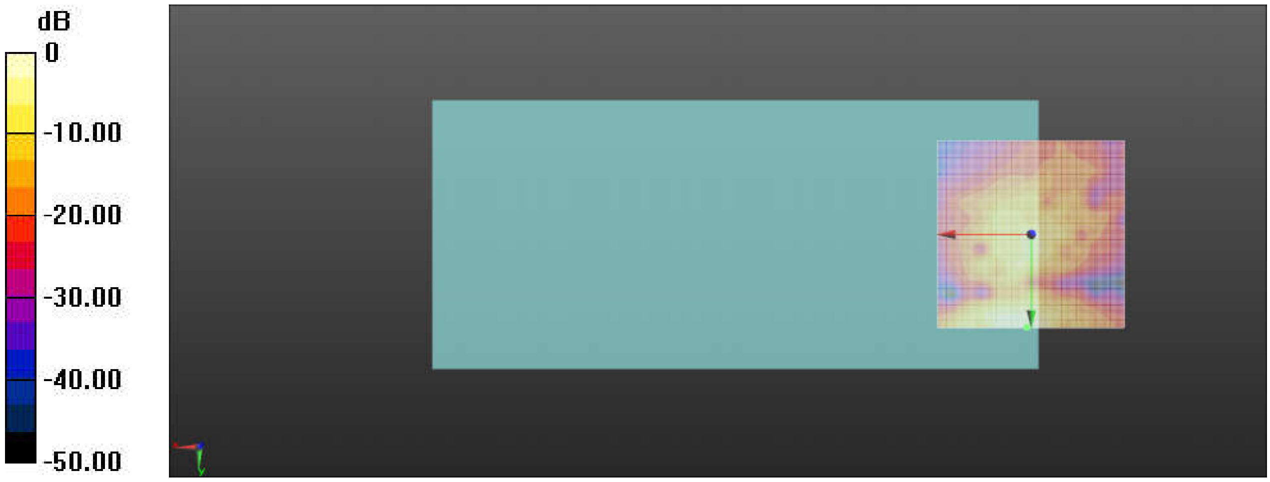
16_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch110_Y

Communication System: UID 0, WIFI (0); Frequency: 5550 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch110/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 37.74 dB
ABM1 comp = -12.20 dBA/m
Location: 1.3, 25, 3.7 mm



0 dB = 77.05 = 37.74 dB

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2023/10/25

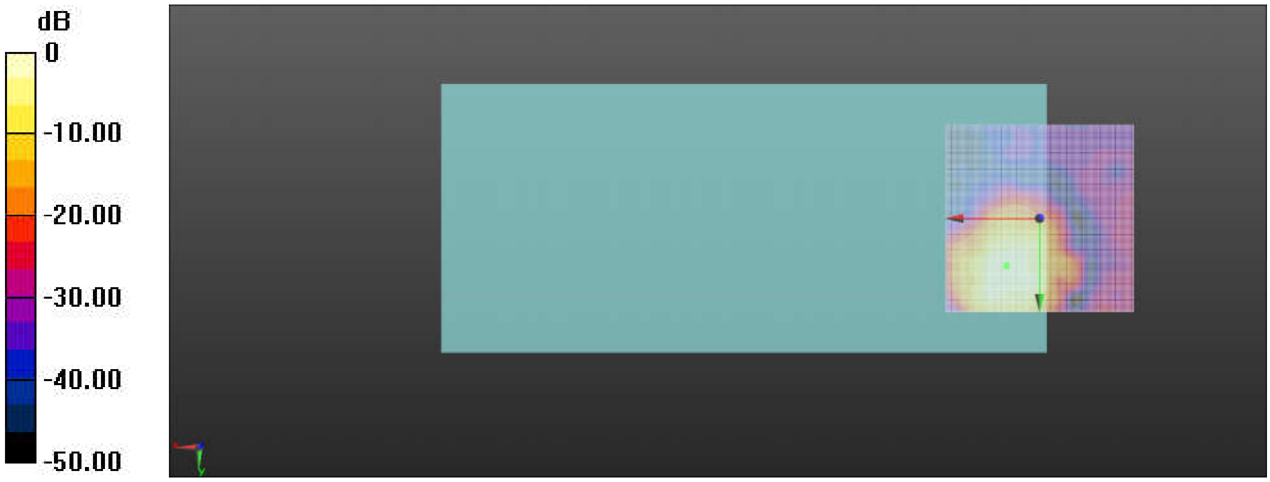
17_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch159_Z

Communication System: UID 0, WIFI (0); Frequency: 5795 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

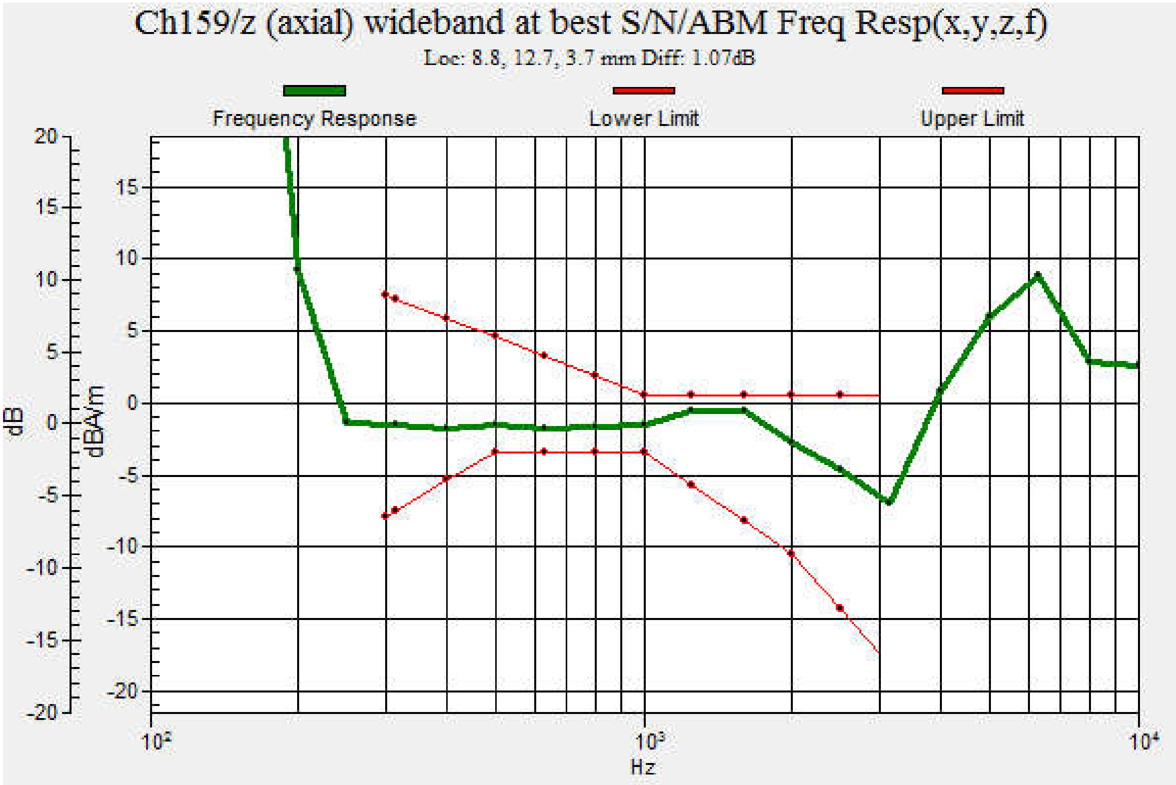
DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch159/z (axial) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 37.19 dB
ABM1 comp = -6.66 dBA/m
Location: 8.8, 12.5, 3.7 mm



0 dB = 72.32 = 37.19 dB



Ch159/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f)
Loc: 8.8, 12.7, 3.7 mm Diff: 1.07dB
Frequency Response
Lower Limit
Upper Limit
dB
dBA/m
Hz

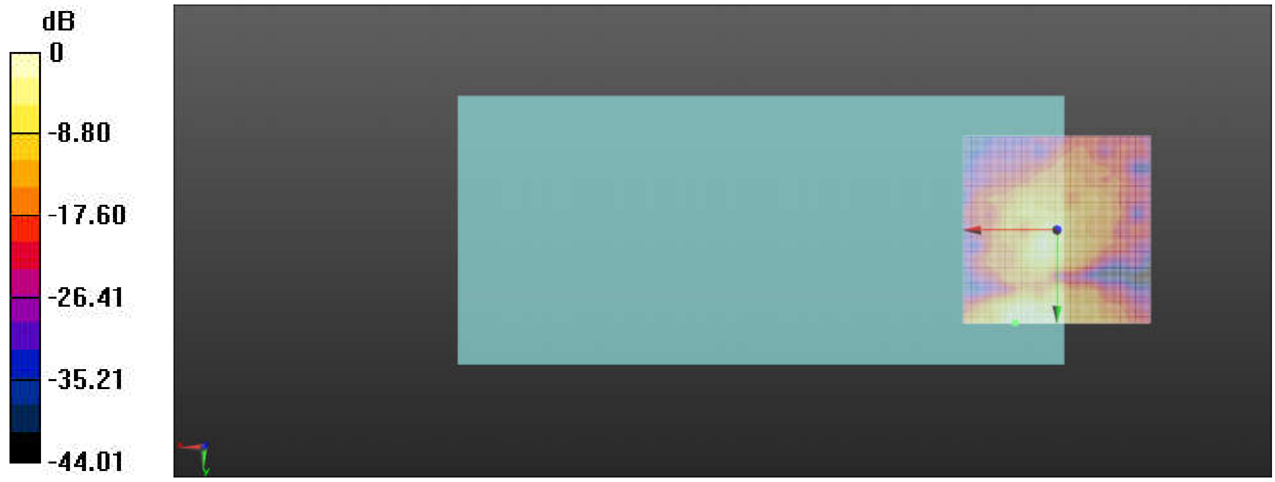
17_HAC T-Coil_WLAN 5GHz_802.11n-HT40 MCS0_Ch159_Y

Communication System: UID 0, WIFI (0); Frequency: 5795 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.4 ℃

DASY5 Configuration:
- Probe: AM1DV3 - 3106; ; Calibrated: 2022/12/13
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1386; Calibrated: 2023/7/17
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch159/y (transversal) 4.2mm 50 x 50/ABM Interpolated SNR(x,y,z) (121x121x1):

Interpolated grid: dx=1.000 mm, dy=1.000 mm
ABM1/ABM2 = 34.23 dB
ABM1 comp = -12.04 dBA/m
Location: 11.3, 25, 3.7 mm



0 dB = 51.44 = 34.23 dB

Appendix B. Calibration Data

The DASY calibration certificates are shown as follows.