FCC HAC (T-Coil) Test Report

Report No.	**: PSZ-NQN2303280110SA02**
Applicant	**: HMD Global Oy**
Address	**: Bertel Jungin aukio 9 Espoo 02600 Finland**
Product	**: Smart Phone**
FCC ID	**: 2AJOTTA-1584**
Brand	**: NOKIA**
Model No.	**: TA-1584**
Standards	**: FCC 47 CFR Part 20.19 / ANSIC63.19-2011** **KDB 285076 D01 v05 / KDB 285076 D02 v03 / KDB 285076 D03 v01**
Sample Received Date	**: Apr. 25, 2023**
Date of Testing	**: Apr. 25, 2023 ~ May. 18, 2023**
Summary T-Rating	**: T4**
FCC Designation No.	**: CN1325**
FCC Site Registration No.	**: 434559**

CERTIFICATION: The above equipment have been tested by **Huarui 7layers High Technology (Suzhou) Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's HAC characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement any government agencies.

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Table of Contents

Release Control Record **3**
1. Summary of Maximum T-Rating **4**
2. Description of Equipment Under Test **5**
3. HAC T-Coil Measurement System **7**
3.1 SPEAG DASY System 7
3.1.1 Robot 8
3.1.2 AM1D Probe 8
3.1.3 Audio Magnetic Calibration Coil (AMCC) 9
3.1.4 Audio Magnetic Measuring Instrument (AMMI) 9
3.1.5 Data Acquisition Electronics (DAE) 9
3.1.6 Phantoms 10
3.1.7 Device Holder 10
3.2 System Calibration 11
3.3 EUT Measurements Reference and Plane 12
3.4 HAC T-Coil Measurement Procedure 13
3.5 Test System Setup and Audio Input Level 15
4. HAC Measurement Evaluation **18**
4.1 Measurement Criteria 18
4.1.1 Field Intensity 18
4.1.2 Frequency Response 18
4.1.3 Signal Quality 19
4.2 EUT Configuration and Setting 19
4.3 HAC T-Coil Testing Results 19
4.3.1 GSM CMRS Voice Testing Results 19
4.3.2 WCDMA CMRS Voice Testing Results 19
4.3.3 VoLTE Testing Results 21
4.3.4 VoWiFi Testing Results 22
5. Calibration of Test Equipment **24**
6. Measurement Uncertainty **25**
7. Information of the Testing Laboratories **26**

Appendix A. Plots of HAC T-Coil Measurement
Appendix B. Calibration Certificate for Probe
Appendix C. Photographs of EUT and Setup

Release Control Record

Report No.	Reason for Change	Date Issued
PSZ-NQN2303280110SA02	Initial release	Jun. 09, 2023

1. Summary of Maximum T-Rating

Mode	Band	T-Rating	Frequency Response	Magnetic Intensity
GSM	GSM850	T4	PASS	PASS
	GSM1900	T4	PASS	PASS
WCDMA	Band II	T4	PASS	PASS
	Band IV	T4	PASS	PASS
	Band V	T4	PASS	PASS
FDD-LTE	Band 2	T4	PASS	PASS
	Band 4	T4	PASS	PASS
	Band 5	T4	PASS	PASS
	Band 12	T4	PASS	PASS
	Band 25	T4	PASS	PASS
	Band 26	T4	PASS	PASS
	Band 66	T4	PASS	PASS
	Band 71	T4	PASS	PASS
TDD-LTE	Band 41	T4	PASS	PASS
WLAN	2.4G	T4	PASS	PASS
	5.2G	T4	PASS	PASS
	5.3G	T4	PASS	PASS
	5.6G	T4	PASS	PASS
	5.8G	T4	PASS	PASS
Summary		T4		

Note:

1. The HAC T-Coil limit **(T-Rating Category T3)** is specified in FCC 47 CFR part 20.19 and ANSI C63.19.
2. The device T-Coil rating is determined by the minimum rating.

2. Description of Equipment Under Test

EUT Type	Smart Phone
Brand Name	NOKIA
Model Name	TA-1584
Sample 1 IMEI Code	IMEI 1: 354668350020950
Sample 2 IMEI Code	IMEI 1: 354668350023111
HW Version	V1.0
SW Version	04US_0_023
Tx Frequency Bands (Unit: MHz)	GSM850 : 824 ~ 849 GSM1900 : 1850 ~ 1910 WCDMA Band II : 1850 ~ 1910 WCDMA Band IV : 1710 ~ 1755 WCDMA Band V : 824 ~ 849 LTE Band 2 : 1850 ~ 1910 LTE Band 4 : 1710 ~ 1755 LTE Band 5 : 824 ~ 849 LTE Band 12 : 699 ~ 716 LTE Band 25 : 1850 ~ 1915 LTE Band 26 : 814 ~ 849 LTE Band 41 : 2496 ~ 2690 LTE Band 66 : 1710 ~ 1780 LTE Band 71 : 663 ~ 698 WLAN : 2412 ~ 2462, 5180 ~ 5240, 5260 ~ 5320, 5500 ~ 5720, 5745 ~ 5825 Bluetooth : 2402 ~ 2480
Uplink Modulations	GSM & GPRS & EDGE : GMSK, 8PSK WCDMA : QPSK LTE : QPSK, 16QAM, 64QAM 802.11b : DSSS 802.11a/g/n/ac : OFDM Bluetooth : GFSK, π/4-DQPSK, 8-DPSK, LE
Maximum Tune-up Conducted Power (Unit: dBm)	Please refer to section 4.5.1 of this report.
Antenna Type	WLAN: PIFA Antenna WWAN: Fixed Internal Antenna
EUT Stage	Identical Prototype

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.
2. According to the document <Difference of change> provided by the manufacturer, these changes do not affect the RF parameters, so sample 1 is fully tested, and sample 2 verifies the worst case.

Air Interface and Operational Mode:

Air Interface	Bands	Transport Type	ANSI C63.19 Tested	Simultaneous But Not Tested	Name of Voice Service	Power Reduction
GSM	850	VO	YES	WLAN or BT	CMRS Voice(1)	No
	1900					No
	EGPRS	DT	No	WLAN or BT	N/A	No
WCDMA	II	VO	YES	WLAN or BT	CMRS Voice(1)	No
	IV					No
	V					No
	HSPA	DT	No	WLAN or BT	N/A	No
FDD-LTE	2	VD	YES	WLAN or BT	VoLTE(1)	No
	4					No
	5					No
	12					No
	25					No
	26					No
	66					No
	71					No
TDD-LTE	41	VD	YES	WLAN or BT	VoLTE(1)	No
WLAN	2.4G	VD	YES	WWAN	VoWiFi(2)	No
	5.2G	VD	YES		VoWiFi(2)	No
	5.3G					No
	5.6G					No
	5.8G					No
Bluetooth	2.4G	DT	No	WWAN	N/A	No

Transport Type
VO = Legacy Cellular Voice Service
DT = Digital Transport Only (No Voice)
VD = IP Voice Service over Digital Transport

Remark:
1. Reference level in accordance with 7.4.2.1 of ANSI C63.19-2011 and the July 2012 VoLTE interpretation.
2. Reference level is −20 dBm0 in accordance with FCC KDB 285076
3.The device have similar frequency in some bands: LTE B5/26, 4/66, 2/25, since the supported frequency spans for the smaller bands are completely cover by the larger bands, therefore, only larger bands were required to be tested for hearing-aid compliance

3. HAC T-Coil Measurement System

3.1 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

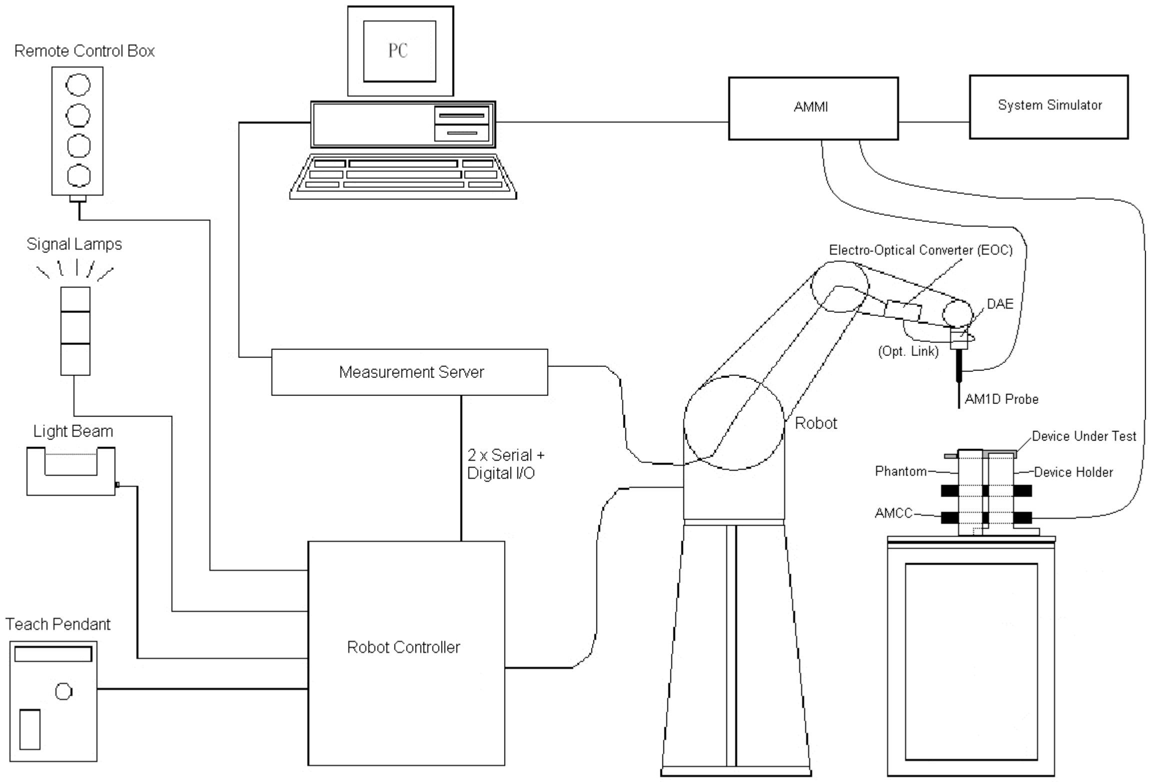


Fig-3.1 DASY System Setup

3.1.1 Robot

The DASY6 system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY6: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

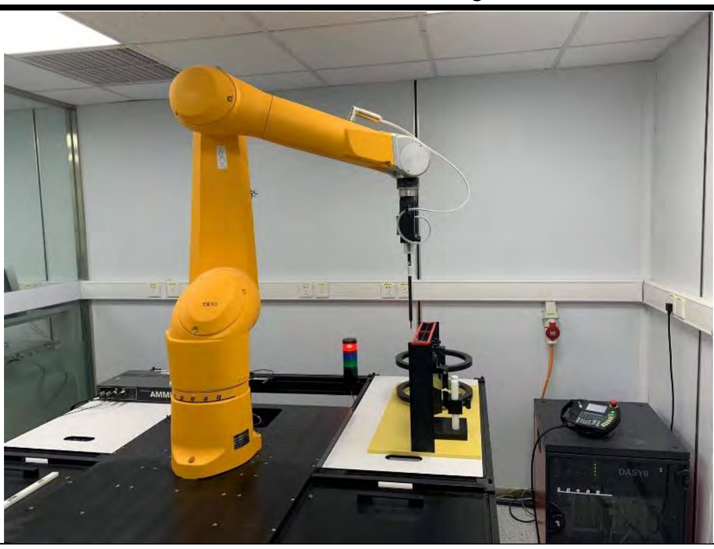


Fig-3.2 DASY6 Measurement System

3.1.2 AM1D Probe

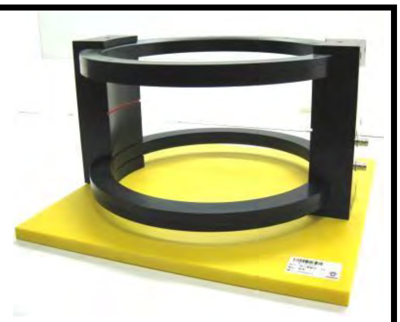
The AM1D probe is an active probe with a single sensor. It is fully RF-shielded and has a rounded tip 6 mm in diameter incorporating a pickup coil with its center offset 3 mm from the tip and the sides. The symmetric signal preamplifier in the probe is fed via the shielded symmetric output cable from the AMMI with a 48V "phantom" voltage supply. The 7-pin connector on the back in the axis of the probe does not carry any signals. It is mounted to the DAE for the correct orientation of the sensor. If the probe axis is tilted 54.7 degrees from the vertical, the sensor is approximately vertical when the signal connector is at the underside of the probe (cable hanging downwards).

Model	AM1DV3	
Sampling Rate	0.1 kHz to 20 kHz RF sensitivity < -100 dB	
Preamplifier	Symmetric, 40 dB	
Dynamic Range	-60 to 40 dB A/m	
Calibration	at 1kHz	
Dimensions	Tip diameter : 6 mm Length : 290 mm	

3.1.3 Audio Magnetic Calibration Coil (AMCC)

The AMCC is a Helmholtz Coil designed for calibration of the AM1D probe. The two horizontal coils generate a homogeneous magnetic field in the z direction. The DC input resistance is adjusted by a series resistor to approximately 50 Ohm, and a shunt resistor of 10 Ohm permits monitoring the current with a scale of 1:10.

Signal	Connector	Resistance
Coil In	BNC	Typically 50 Ohm
Coil Monitor	BNO	10 Ohm ±1% (100mV corresponding to 1 A/m)
Dimensions	370 x 370 x 196 mm	



3.1.4 Audio Magnetic Measuring Instrument (AMMI)

The AMMI is a desktop 19-inch unit containing a sampling unit, a waveform generator for test and calibration signals, and a USB interface.

Sampling Rate	48 kHz / 24 bit
Dynamic Range	100 dB (with AM1DV3 probe)
Test Signal Generation	User selectable and predefined (via PC)
Calibration	Auto-calibration / full system calibration using AMCC with monitor output
Dimensions	482 x 65 x 270 mm

3.1.5 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

3.1.6 Phantoms

Model	Test Arch	
Construction	Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot.	
Dimensions	Length : 370 mm Width : 370 mm Height : 370 mm	

3.1.7 Device Holder

Model	Mounting Device	
Construction	The Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to ANSI C63.19.	
Material	POM	

3.2 System Calibration

For correct and calibrated measurement of the voltages and ABM field, DASY will perform a calibration job as below. In phase 1, the audio output is switched off, and a 200 mV_{pp} symmetric rectangular signal of 1 kHz is generated and internally connected directly to both channels of the sampling unit (Coil in, Probe in).

In phase 2, the audio output is off, and a 20 mV_{pp} symmetric 100 Hz signal is internally connected. The signals during phases 1 and 2 are available at the output on the rear panel of the AMMI. However, the output must not be loaded, in order to avoid influencing the calibration. An RMS voltmeter would indicate 100 mV_{RMS} during the first phase and 10 mV_{RMS} during the second phase. After the first two phases, the two input channels are both calibrated for absolute measurements of voltages. The resulting factors are displayed above the multi-meter window.

After phases 1 and 2, the input channels are calibrated to measure exact voltages. This is required to use the inputs for measuring voltages with their peak and RMS value.

In phase 3, a multi-sine signal covering each third-octave band from 50 Hz to 10 kHz is generated and applied to both audio outputs. The probe should be positioned in the center of the AMCC and aligned in the z-direction, the field orientation of the AMCC. The "Coil In" channel is measuring the voltage over the AMCC internal shunt, which is proportional to the magnetic field in the AMCC. At the same time, the "Probe In" channel samples the amplified signal picked up by the probe coil and provides it to a numerical integrator. The ratio of the two voltages in each third-octave filter leads to the spectral representation over the frequency band of interest. The Coil signal is scaled in dBV, and the Probe signal is first integrated and normalized to show dB A/m. The ratio probe-to-coil at the frequency of 1 kHz is the sensitivity which will be used in the consecutive T-Coil jobs.

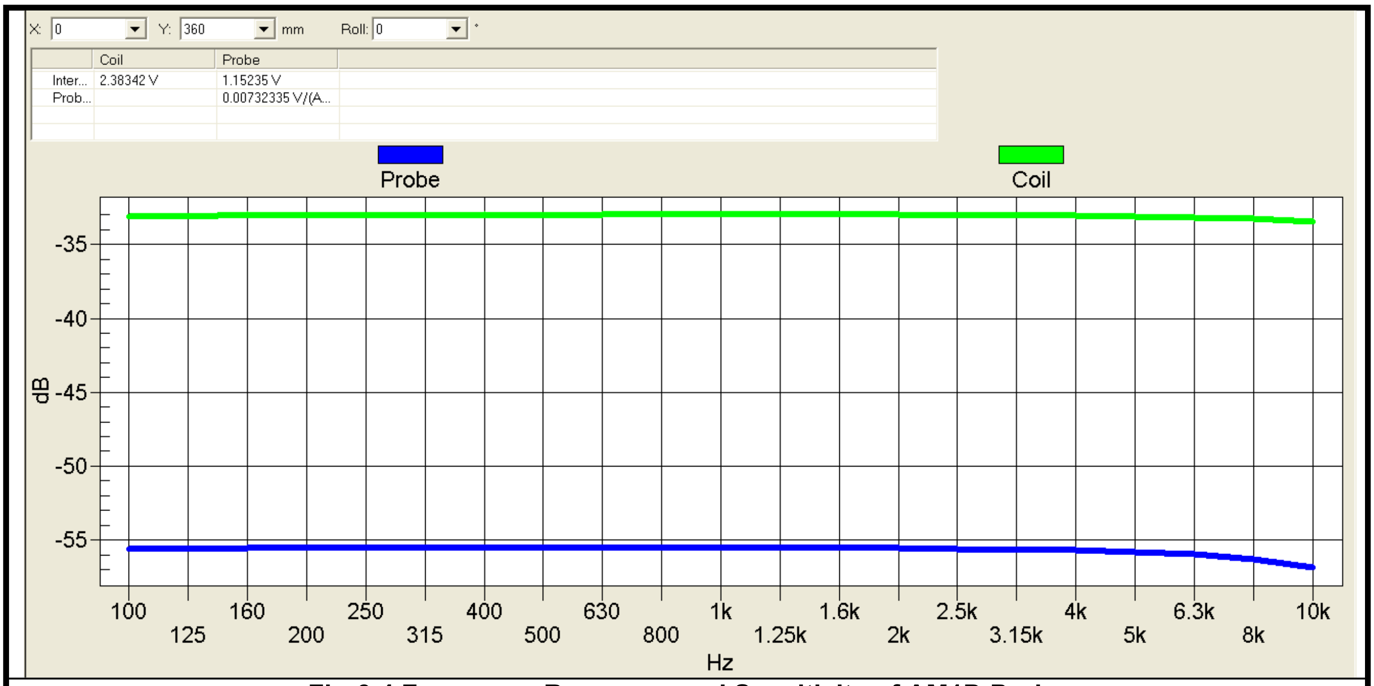


Fig-3.4 Frequency Response and Sensitivity of AM1D Probe

3.3 EUT Measurements Reference and Plane

The EUT is mounted in the device holder. The acoustic output of the EUT will coincide with the center point of the area formed by the dielectric wire and the middle bar of the arch's top frame. Then EUT will be moved vertically upwards until it touches the frame.

Figure 3.5 illustrates the three standard probe orientations. Position 1 is the perpendicular (axial) orientation of the probe coil. Orientation 2 is the transverse (radial) orientation. The space between the measurement positions is not fixed. It is recommended that a scan of the EUT be done for each probe coil orientation and that the maximum level recorded be used as the reading for that orientation of the probe coil.

(1) The reference plane is 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 that, in normal handset use, rest against the ear.
(2) The measurement plane is parallel to, and 10 mm in front of the reference plane.
(3) The reference axis is normal to the reference plane and passes through the center of the receiver speaker section or it may be centered on a secondary inductive source.
(4) The measurement points may be located where the perpendicular (axial) and transverse (radial) field intensity measurements are optimum with regard to the requirements. However, the measurement points should be near the acoustic output of the EUT and shall be located in the same half of the phone as the EUT receiver. In a EUT handset with a centered receiver and a circularly symmetrical magnetic field, the measurement axis and the reference axis would coincide.
(5) The relative spacing of each measurement orientations is not fixed. The perpendicular (axial) and transverse (radial) orientations should be chosen to select the optimal position.
(6) The measurement point for the axial position is located 10 mm from the reference plane on the measurement axis.

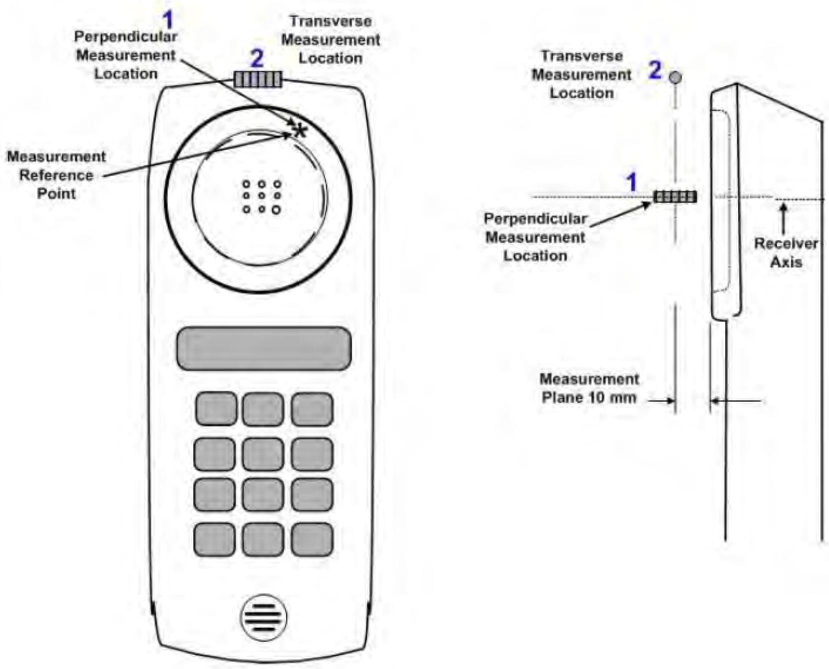


Fig-3.5 Axis and Planes

3.4 HAC T-Coil Measurement Procedure

According to ANSI C63.19-2011, the T-Coil test procedure for wireless communications device is as below.

1. Position the EUT in the test setup and connect the EUT RF connector to a base station simulator.
2. The drive level to the EUT is set such that the reference input level specified in Table 7.1 is input to the base station simulator in the 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 7.4.2, shall be used for the reference audio signal. If interference is found at 1025 Hz, an alternate nearby reference audio signal frequency may be used. The same drive level will be used for the ABM1 frequency response measurements at each 1/3 octave band center frequency. The EUT 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.
3. Determine the magnetic measurement locations for the EUT, if not already specified by the manufacturer, as described in 7.4.4.1.1 and 7.4.4.2.
4. At each measurement location, measure and record the desired T-Coil magnetic signals (ABM1 at f_i) as described in 7.4.4.2 in each individual ISO 266-1975 R10 standard 1/3 octave band. The desired audio band input frequency (f_i) shall be centered in each 1/3 octave band maintaining the same drive level as determined in Step 2 and the reading taken for that band. 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 or half-band integrated probe output, as described 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.) 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 criterion in 7.3.1.
5. At the measurement location for each orientation, measure and record the undesired broadband audio magnetic signal (ABM2) as described in 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).
6. Determine the category that properly classifies the signal quality based on Table 8.5.

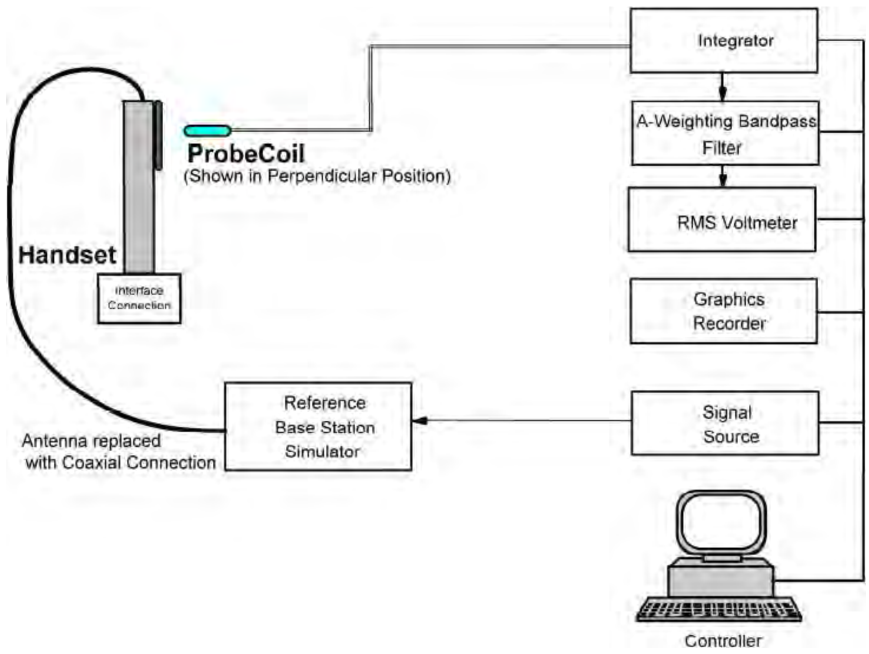


Fig-3.6 T-Coil Measurement Test Setup

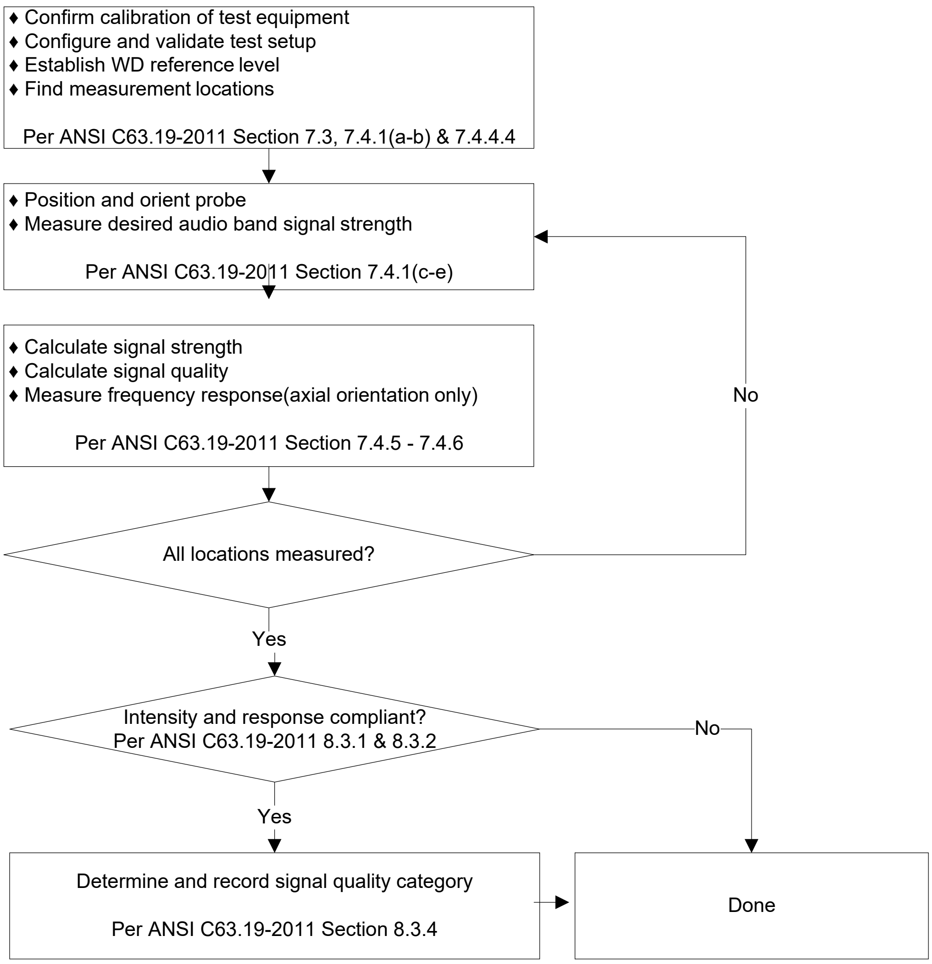


Fig-3.7 T-Coil Signal Test Flowchart

3.5 Test System Setup and Audio Input Level

The test setup shown in below is to extend DASY system with the capability of Audio Band Magnetic (ABM) measurements according to standard ANSI C63.19-2011. Together with the HAC RF extension, it permits complete characterization of the emissions of a wireless device (WD). The signals measured during these tests represent the field picked up by the T-Coil of a hearing aid. Using DASY software, these orthogonal axes can be scanned with a probe incorporating a single sensor coil. The WD is mounted on the Test Arch Phantom. The acoustic center of the WD is mounted in such a way that it is centered, and this represents the reference for the combination of ABM and RF field evaluation. The ABM fields of the WD (frequency range <20 kHz) are scanned with a fully RF-shielded active 1-D probe. The probe axis is oriented in the space diagonal to the three orthogonal axes, and its single sensor can be oriented to the axes by 120 degree rotation. The probe signal is evaluated by an Audio Magnetic Measurement Instrument (AMMI) which is interfaced to the DASY computer via USB. The AMMI also provides test and calibration signals and interfaces to the Helmholtz Audio Magnetic Calibration Coil (AMCC). Through the connector at the AMMI, predefined or user-definable audio signals are available for injection into the WD during the test.

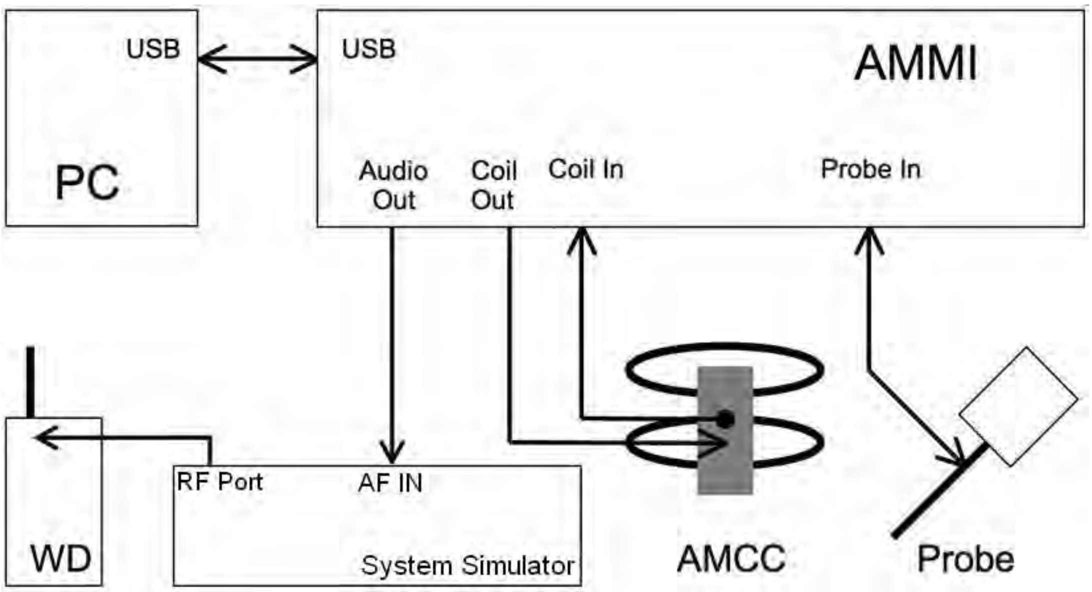


Fig-3.8 System Setup for T-Coil Testing

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.

The speech levels with the settings at the AF connector of R&S CMW500 have been calibrated, and it can be set manually to ensure the specific full-scale speech level during T-Coil testing. For an example, the gain setting for -16 dBm0 has been calculated through below formula.

3.14 dBm0 = ***X*** dBV = -3.01 dBV
-16 dBm0 = $\boldsymbol{L_{-16dBm0}}$ dBV = -22.00 dBV
Gain 100 = ***G*** dBV = 3.13 dBV
Difference for -16 dBm0 = $\boldsymbol{D_{-16dBm0}}$ = $\boldsymbol{L_{-16dBm0}}$ – ***G*** = -22 – 3.13 = -25.13 dBV
Resulting Gain for -16 dBm0 = 10 ^ ($\boldsymbol{D_{-16dBm0}}$ / 20) x 100 = 5.54
Gain Setting = Resulting Gain x Required Gain Factor
Gain setting for voice 1kHz = 5.54 x 4.33 = 23.99
Gain setting for voice 300-3kHz = 5.54 x 8.48 = 46.98

The gain setting for other signal types need to be adjusted to achieve the same average level. Those signal types have the following differences/factors compared to the 1 kHz sine signal:

Signal Type	Duration (s)	BWC (dB)	Required Gain Factor
1 kHz sine	-	0.0	1.00
48k_voice_1kHz	1	0.16	4.33
48k_voice_300-3000	2	10.8	8.48

4. HAC Measurement Evaluation

4.1 Measurement Criteria

The HAC Standard ANSI C63.19-2011 represents performance requirements for acceptable interoperability of hearing aids with wireless communications devices. When these parameters are met, a hearing aid operates acceptably in close proximity to a wireless communications device.

4.1.1 Field Intensity

When measured as specified in this standard, the T-Coil signal shall be ≥ –18 dB (A/m) at 1 kHz, in a 1/3 octave band filter for all orientations.

4.1.2 Frequency Response

The frequency response of the axial component of the magnetic field, measured in 1/3 octave bands, shall follow the below response curve, over the frequency range 300 Hz to 3000 Hz. Figure 4.1 and Figure 4.2 provide the boundaries for the specified 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.

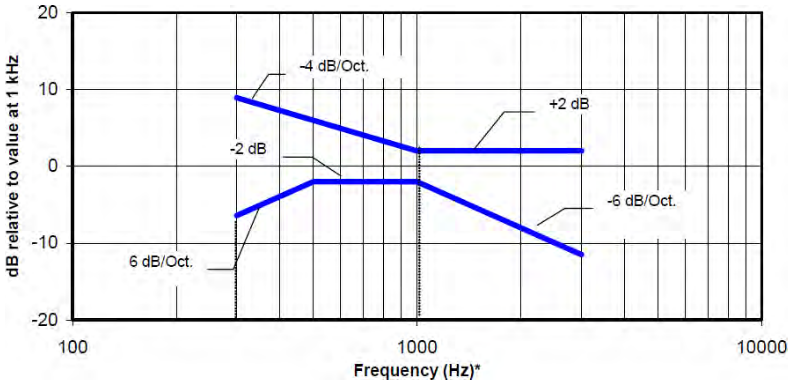


Fig-4.1 Boundaries for EUT with a field ≤ -15 dB (A/m) at 1 kHz

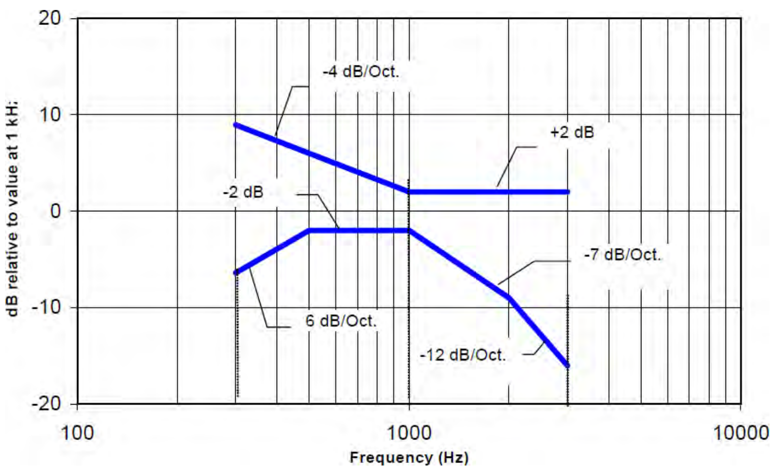


Fig-4.2 Boundaries for EUT with a field > -15 dB (A/m) at 1 kHz

4.1.3 Signal Quality

The worst signal quality of the three T-Coil signal measurements shall be used to determine the T-Coil mode category per below table.

Category	Telephone Parameters WD Signal Quality (Signal to Noise Ratio, in dB)
Category T1	0 – 10
Category T2	10 – 20
Category T3	20 – 30
Category T4	> 30

4.2 EUT Configuration and Setting

For HAC T-Coil testing, the EUT was linked and controlled by base station emulator. Communication between the EUT and the emulator was established by coaxial connection. The EUT was set from the emulator to radiate maximum output power during HAC testing. Also EUT was set to mute on, maximum volume, and backlight off during T-Coil testing.

4.3 HAC T-Coil Testing Results

4.3.1 GSM CMRS Voice Testing Results

General Note:

1. Codec Investigation: For a voice service/air interface, investigate the variations of codec configurations (:NB, 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.

Codec Investigation

Band	Channel	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Frequency Response	SNR (dB)
GSM850	189	FR V1	Axial (Z)	7.06	-26.02	PASS	**33.08**
GSM850	189	HR V1	Axial (Z)	7.86	-28.45	PASS	36.31

Test Summary

Plot No.	Band	Channel	Sample	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Ambient Noise (dB A/m)	Frequency Response Margin (dB)	Frequency Response	SNR (dB)	T-Rating
01	GSM850	189	1	FR V1	Axial (Z)	7.06	-26.02	-50.23	1.72	PASS	**33.08**	T4
	GSM850	189		FR V1	Radial (Y)	-10.07	-49.01				38.94	T4
02	GSM1900	661	1	FR V1	Axial (Z)	-9.90	-50.66	-50.31	1.75	PASS	**35.94**	T4
	GSM1900	661		FR V1	Radial (Y)	5.37	-30.57				40.76	T4
	GSM850	189	2	FR V1	Axial (Z)	6.99	-28.27	-50.44	1.65	PASS	**35.26**	T4
	GSM850	189		FR V1	Radial (Y)	-9.69	-51.65				41.96	T4

4.3.2 WCDMA CMRS Voice Testing Results

Codec Investigation

Band	Channel	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Frequency Response	SNR (dB)
WCDMA V	4182	AMR 4.75kbps	Axial (Z)	5.00	-49.50	PASS	54.50
WCDMA V	4182	AMR 7.95kbps	Axial (Z)	5.08	-49.24	PASS	**54.32**
WCDMA V	4182	AMR 12.2kbps	Axial (Z)	5.25	-49.36	PASS	54.61

Test Summary

Plot No.	Band	Channel	Sample	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Ambient Noise (dB A/m)	Frequency Response Margin (dB)	Frequency Response	SNR (dB)	T-Rating
03	WCDMA II	9400	1	AMR 7.95Kbps	Axial (Z)	5.01	-49.83	-50.46	1.68	PASS	54.84	T4
	WCDMA II	9400		AMR 7.95Kbps	Radial (Y)	-2.97	-49.25				**46.28**	T4
04	WCDMA IV	1413	1	AMR 7.95Kbps	Axial (Z)	5.08	-49.24	-50.38	1.51	PASS	54.32	T4
	WCDMA IV	1413		AMR 7.95Kbps	Radial (Y)	-3.93	-50.6				**46.67**	T4
05	WCDMA V	4182	1	AMR 7.95Kbps	Axial (Z)	5.17	-49.68	-50.52	1.87	PASS	54.85	T4
	WCDMA V	4182		AMR 7.95Kbps	Radial (Y)	-5.15	-50.99				**45.84**	T4
	WCDMA V	4182	2	AMR 7.95Kbps	Axial (Z)	4.75	-53.07	-50.16	1.87	PASS	57.82	T4
	WCDMA V	4182		AMR 7.95Kbps	Radial (Y)	-2.56	-52.69				**50.13**	T4

4.3.3 VoLTE Testing Results

General Note:

1. Codec Investigation: For a voice service/air interface, investigate the variations of codec configurations r,NB, 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 L TE 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. The TDD L TE power class 3 supports uplink-downlink configuration O and 6 and power class 2 supports uplink-downlink configuration1 to 5 for this device, an investigation was performed to determine the worst-case uplink-downlink configuration to be used for the testing for the handset.
   d. 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.

Radio Configuration Investigation

Air Interface	Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel	UL-DL Configuration	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	SNR (dB)
FDD-LTE	LTE B2	20	QPSK	1	0	18900	N/A	Axial (Z)	1.97	-46.91	**48.88**
FDD-LTE	LTE B2	20	QPSK	50	0	18900	N/A	Axial (Z)	-2.64	-52.22	49.58
FDD-LTE	LTE B2	20	QPSK	100	0	18900	N/A	Axial (Z)	1.55	-47.85	49.40
FDD-LTE	LTE B2	20	16QAM	1	0	18900	N/A	Axial (Z)	2.68	-47.43	50.11
FDD-LTE	LTE B2	20	64QAM	1	0	18900	N/A	Axial (Z)	2.42	-47.11	49.53
FDD-LTE	LTE B2	15	QPSK	1	0	18900	N/A	Axial (Z)	-0.41	-49.72	49.31
FDD-LTE	LTE B2	10	QPSK	1	0	18900	N/A	Axial (Z)	2.99	-46.94	49.93
FDD-LTE	LTE B2	5	QPSK	1	0	18900	N/A	Axial (Z)	-3.11	-52.76	49.65
FDD-LTE	LTE B2	3	QPSK	1	0	18900	N/A	Axial (Z)	2.56	-47.21	49.77
FDD-LTE	LTE B2	1.4	QPSK	1	0	18900	N/A	Axial (Z)	2.93	-47.35	50.28
TDD-LTE	LTE B41	20	QPSK	1	0	40620	0	Axial (Z)	4.28	-43.88	**48.16**
TDD-LTE	LTE B41	20	QPSK	1	0	40620	6	Axial (Z)	4.35	-44.03	48.38
TDD-LTE	UL CA B41_PC3	20	QPSK	1	0	PCC: 40521 SCC: 40719	0	Axial (Z)	4.83	-43.90	48.73
TDD-LTE	LTE B41	20	QPSK	1	0	40620	1	Axial (Z)	5.36	-43.16	48.52
TDD-LTE	LTE B41	20	QPSK	1	0	40620	2	Axial (Z)	4.64	-44.11	48.75
TDD-LTE	LTE B41	20	QPSK	1	0	40620	3	Axial (Z)	4.04	-44.93	48.97
TDD-LTE	LTE B41_PC2	20	QPSK	1	0	40620	4	Axial (Z)	3.97	-44.85	48.82
TDD-LTE	LTE B41_PC2	20	QPSK	1	0	40620	5	Axial (Z)	7.99	-40.26	48.25

Codec Investigation

Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Frequency Response	SNR (dB)
LTE B2	20	QPSK	1	0	18900	AMR NB 4.75kbps	Axial (Z)	4.38	-51.99	PASS	56.37
LTE B2	20	QPSK	1	0	18900	AMR NB 12.2kbps	Axial (Z)	4.64	-48.05	PASS	52.69
LTE B2	20	QPSK	1	0	18900	AMR WB 6.6kbps	Axial (Z)	4.69	-48.14	PASS	52.83
LTE B2	20	QPSK	1	0	18900	AMR WB 23.85kbps	Axial (Z)	4.67	-47.26	PASS	51.93
LTE B2	20	QPSK	1	0	18900	EVS SWB 9.6kbps	Axial (Z)	5.04	-47.1	PASS	52.14
LTE B2	20	QPSK	1	0	18900	EVS SWB 128kbps	Axial (Z)	5.11	-47.68	PASS	52.79
LTE B2	20	QPSK	1	0	18900	EVS WB 5.9kbps	Axial (Z)	1.97	-46.91	PASS	**48.88**
LTE B2	20	QPSK	1	0	18900	EVS WB 128kbps	Axial (Z)	4.82	-47.1	PASS	51.92
LTE B2	20	QPSK	1	0	18900	EVS NB 5.9kbps	Axial (Z)	4.29	-47.89	PASS	52.18
LTE B2	20	QPSK	1	0	18900	EVS NB 24.4kbps	Axial (Z)	5.54	-46.7	PASS	52.24
LTE B41	20	QPSK	1	0	40620	AMR NB 4.75kbps	Axial (Z)	4.33	-44.54	PASS	48.87
LTE B41	20	QPSK	1	0	40620	AMR NB 12.2kbps	Axial (Z)	4.47	-44.47	PASS	48.94
LTE B41	20	QPSK	1	0	40620	AMR WB 6.6kbps	Axial (Z)	4.28	-43.88	PASS	**48.16**
LTE B41	20	QPSK	1	0	40620	AMR WB 23.85kbps	Axial (Z)	4.35	-43.84	PASS	48.19
LTE B41	20	QPSK	1	0	40620	EVS SWB 9.6kbps	Axial (Z)	5.45	-43.56	PASS	49.01
LTE B41	20	QPSK	1	0	40620	EVS SWB 128kbps	Axial (Z)	5.43	-43.25	PASS	48.68
LTE B41	20	QPSK	1	0	40620	EVS WB 5.9kbps	Axial (Z)	5.32	-43.74	PASS	49.06
LTE B41	20	QPSK	1	0	40620	EVS WB 128kbps	Axial (Z)	5.86	-43.26	PASS	49.12
LTE B41	20	QPSK	1	0	40620	EVS NB 5.9kbps	Axial (Z)	5.84	-43.30	PASS	49.14
LTE B41	20	QPSK	1	0	40620	EVS NB 24.4kbps	Axial (Z)	5.27	-43.78	PASS	49.05

Test Summary

Plot No.	Band	Bandwidth (MHz)	Modulation	RB Size	RB Offset	Channel	Sample	UL-DL Configuration	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Ambient Noise (dB A/m)	Frequency Response Margin (dB)	Frequency Response	SNR (dB)	T-Rating
P06	LTE B12	10	QPSK	1	0	23095	1	N/A	EVS WB 5.9kbp	Axial (Z)	0.33	-48.87	-50.25	0.97	PASS	49.20	T4
	LTE B12	10	QPSK	1	0	23095		N/A	EVS WB 5.9kbp	Radial (Y)	-9.38	-49.51				**40.13**	T4
P07	LTE B25	20	QPSK	1	0	26340	1	N/A	EVS WB 5.9kbp	Axial (Z)	3.23	-47.5	-50.33	1.50	PASS	50.73	T4
	LTE B25	20	QPSK	1	0	26340		N/A	EVS WB 5.9kbp	Radial (Y)	-4.35	-47.57				**43.22**	T4
P08	LTE B26	15	QPSK	1	0	26865	1	N/A	EVS WB 5.9kbp	Axial (Z)	-1.33	-48.84	-50.41	1.24	PASS	47.51	T4
	LTE B26	15	QPSK	1	0	26865		N/A	EVS WB 5.9kbp	Radial (Y)	-10.37	-50.34				**39.97**	T4
P09	LTE B41	20	QPSK	1	0	40620	1	0	AMR WB 6.6kbps	Axial (Z)	4.77	-43.16	-50.19	1.45	PASS	47.93	T4
	LTE B41	20	QPSK	1	0	40620		0	AMR WB 6.6kbps	Radial (Y)	-7.30	-48.49				**41.19**	T4
P10	LTE B66	20	QPSK	1	0	132322	1	N/A	EVS WB 5.9kbp	Axial (Z)	2.25	-52.27	-50.46	1.81	PASS	54.52	T4
	LTE B66	20	QPSK	1	0	132322		N/A	EVS WB 5.9kbp	Radial (Y)	-5.31	-51.19				**45.88**	T4
P11	LTE B71	20	QPSK	1	0	133322	1	N/A	EVS WB 5.9kbp	Axial (Z)	-3.59	-50.78	-50.11	1.02	PASS	47.19	T4
	LTE B71	20	QPSK	1	0	133322		N/A	EVS WB 5.9kbp	Radial (Y)	-9.15	-49.35				**40.20**	T4
	LTE B26	15	QPSK	1	0	26865	2	N/A	EVS WB 5.9kbp	Axial (Z)	1.32	-49.69	-50.48	1.24	PASS	51.01	T4
	LTE B26	15	QPSK	1	0	26865		N/A	EVS WB 5.9kbp	Radial (Y)	-5.38	-51.37				**45.99**	T4

4.3.4 VoWiFi Testing Results

Radio Configuration Investigation

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.

Band	Mode	Data Rate	Channel	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	SNR (dB)
WLAN 2.4G	802.11b	1Mbps	6	Axial (Z)	5.66	-47.06	**52.72**
WLAN 2.4G	802.11b	11Mbps	6	Axial (Z)	4.86	-49.51	54.37
WLAN 2.4G	802.11g	6Mbps	6	Axial (Z)	4.56	-50.32	54.88
WLAN 2.4G	802.11g	54Mbps	6	Axial (Z)	4.69	-50.29	54.98
WLAN 2.4G	802.11n HT20	MCS0	6	Axial (Z)	5.03	-49.86	54.89
WLAN 2.4G	802.11n HT20	MCS7	6	Axial (Z)	5.13	-49.84	54.97
WLAN 2.4G	802.11n HT40	MCS0	6	Axial (Z)	5.13	-49.68	54.81
WLAN 2.4G	802.11n HT40	MCS7	6	Axial (Z)	4.89	-49.19	54.08
WLAN 5G	802.11a	6Mbps	40	Axial (Z)	4.73	-50.12	54.85
WLAN 5G	802.11a	54Mbps	40	Axial (Z)	4.82	-49.92	54.74
WLAN 5G	802.11n HT20	MCS0	40	Axial (Z)	4.93	-49.12	**54.05**
WLAN 5G	802.11n HT20	MCS7	40	Axial (Z)	4.87	-49.87	54.74
WLAN 5G	802.11n HT40	MCS0	38	Axial (Z)	5.47	-49.91	55.38
WLAN 5G	802.11n HT40	MCS7	38	Axial (Z)	5.04	-49.62	54.66
WLAN 5G	802.11ac-VHT20	MCS0	40	Axial (Z)	5.12	-49.46	54.58
WLAN 5G	802.11ac-VHT20	MCS8	40	Axial (Z)	5.05	-49.68	54.73
WLAN 5G	802.11ac-VHT40	MCS0	38	Axial (Z)	5.02	-49.29	54.31
WLAN 5G	802.11ac-VHT40	MCS8	38	Axial (Z)	5.28	-49.5	54.78
WLAN 5G	802.11ac-VHT80	MCS0	50	Axial (Z)	5.00	-49.58	54.58
WLAN 5G	802.11ac-VHT80	MCS8	50	Axial (Z)	5.01	-49.81	54.82

Codec Investigation

Band	Mode	Data Rate	Channel	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Frequency Response	SNR (dB)
WLAN 2.4G	802.11b	1Mbps	6	AMR NB 4.75kbps	Axial (Z)	5.23	-48.7	PASS	53.93
WLAN 2.4G	802.11b	1Mbps	6	AMR NB 12.2kbps	Axial (Z)	5.45	-48.45	PASS	53.9
WLAN 2.4G	802.11b	1Mbps	6	AMR WB 6.6kbps	Axial (Z)	5.66	-47.06	PASS	**52.72**
WLAN 2.4G	802.11b	1Mbps	6	AMR WB 23.85kbps	Axial (Z)	5.65	-48.68	PASS	54.33
WLAN 2.4G	802.11b	1Mbps	6	EVS SWB 9.6Kbps	Axial (Z)	5.75	-48.57	PASS	54.32
WLAN 2.4G	802.11b	1Mbps	6	EVS SWB 128Kbps	Axial (Z)	5.34	-49.06	PASS	54.4
WLAN 2.4G	802.11b	1Mbps	6	EVS WB 5.9Kbps	Axial (Z)	5.83	-48.52	PASS	54.35
WLAN 2.4G	802.11b	1Mbps	6	EVS WB 128Kbps	Axial (Z)	5.65	-48.22	PASS	53.87
WLAN 2.4G	802.11b	1Mbps	6	EVS NB 5.9Kbps	Axial (Z)	5.56	-48.46	PASS	54.02
WLAN 2.4G	802.11b	1Mbps	6	EVS NB 24.4Kbps	Axial (Z)	4.67	-48.76	PASS	53.43

Test Summary

Plot No.	Band	Mode	Data Rate	Channel	Sample	Codec Setting	Probe Orientation	ABM1 (dB A/m)	ABM2 (dB A/m)	Ambient Noise (dB A/m)	Frequency Response Margin (dB)	Frequency Response	SNR (dB)	T-Rating
P12	WLAN2.4G	802.11b	1Mbps	6	1	AMR WB 6.6kbps	Axial (Z)	4.18	-49.55	-50.17	1.57	PASS	53.73	T4
	WLAN2.4G	802.11b	1Mbps	6		AMR WB 6.6kbps	Radial (Y)	-3.94	-47.42				**43.48**	T4
P13	WLAN5G	802.11n HT20	MCS0	40	1	AMR WB 6.6kbps	Axial (Z)	5.88	-48.52	-50.66	1.94	PASS	54.40	T4
	WLAN5G	802.11n HT20	MCS0	40		AMR WB 6.6kbps	Radial (Y)	-5.65	-50.03				**44.38**	T4
P14	WLAN5G	802.11n HT20	MCS0	60	1	AMR WB 6.6kbps	Axial (Z)	5.88	-49.03	-50.42	1.83	PASS	54.91	T4
	WLAN5G	802.11n HT20	MCS0	60		AMR WB 6.6kbps	Radial (Y)	-5.47	-49.43				**44.64**	T4
P15	WLAN5G	802.11n HT20	MCS0	124	1	AMR WB 6.6kbps	Axial (Z)	5.88	-47.23	-50.23	1.89	PASS	53.11	T4
	WLAN5G	802.11n HT20	MCS0	124		AMR WB 6.6kbps	Radial (Y)	-3.12	-47.06				**43.96**	T4
P16	WLAN5G	802.11n HT20	MCS0	157	1	AMR WB 6.6kbps	Axial (Z)	5.79	-47.93	-50.39	1.93	PASS	53.72	T4
	WLAN5G	802.11n HT20	MCS0	157		AMR WB 6.6kbps	Radial (Y)	-5.72	-50.22				**44.50**	T4
	WLAN2.4G	802.11b	1Mbps	6	2	AMR WB 6.6kbps	Axial (Z)	4.12	-49.20	-50.22	1.84	PASS	53.32	T4
	WLAN2.4G	802.11b	1Mbps	6		AMR WB 6.6kbps	Radial (Y)	-3.25	-51.06				**47.81**	T4

Test Engineer: Chang Gao and Zixiao Xia

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
Audio Band Magnetic Probe	SPEAG	AM1DV3	3144	Feb.16,2023	1 Year
Data Acquisition Electronics	SPEAG	DAE	1633	Feb.08,2023	1 Year
Universal Radio Communication Tester	R&S	CMW500	169210	Jun.27,2022	1 Year
Audio Measuring Instrument	SPEAG	AMMI	1180	N/A	N/A
Audio Magnetic Calibration Coil	SPEAG	AMCC	1158	N/A	N/A
Test Arch Phantom	SPEAG	Arch	N/A	N/A	N/A

6. Measurement Uncertainty

HAC Uncertainty Budget for T-Coil 2011 version According to ANSI C63.19							
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	
Expanded STD Uncertainty						8.1%	12.2%

Uncertainty Budget for HAC T-Coil

7. Information of the Testing Laboratories

We, Huarui 7layers High Technology (Suzhou) Co., Ltd., were founded in 2020 to provide our best service in EMC, Radio, Telecom and Safety consultation.

If you have any comments, please feel free to contact us at the following:

Add: Tower N, Innovation Center, 88 Zuyi Road, High-tech District, Suzhou City, Anhui Province
Tel: +86 (0557) 368 1008

The road map of all our labs can be found in our web site also
Web: http://www.7Layers.com

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Appendix A. Plots of HAC T-Coil Measurement

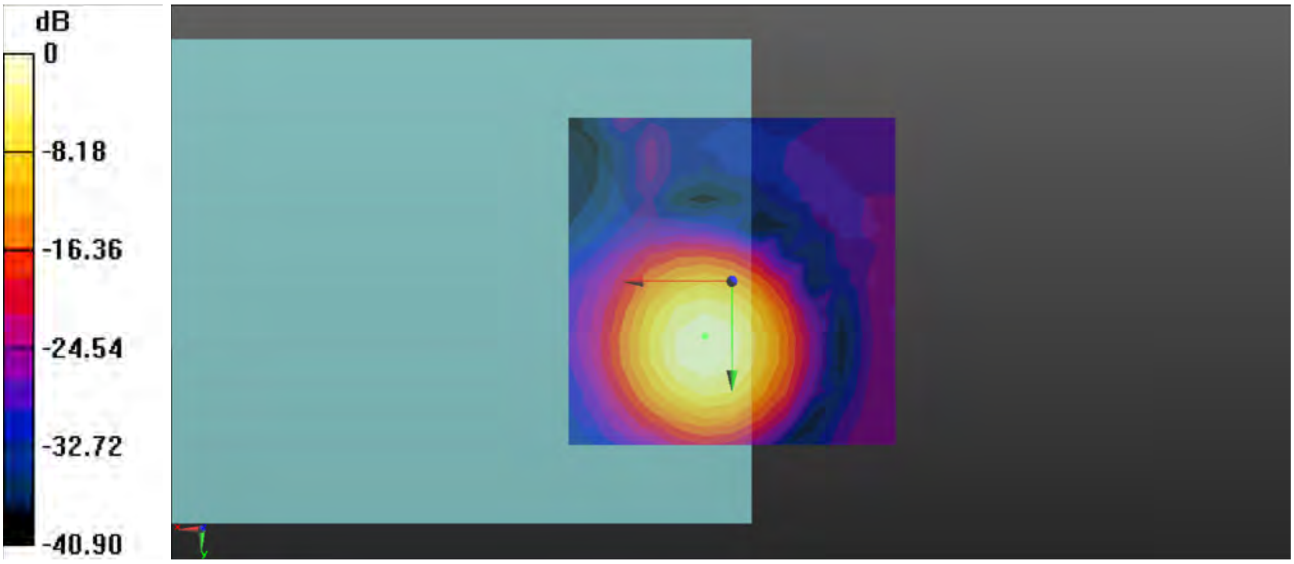
The plots for HAC measurement are shown as follows.

P01 T-Coil_GSM850_Voice_Ch189_FR V1_Axial (Z)

Communication System: GSM; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 33.08 dB
ABM1 comp = 7.06 dBA/m
Location: 4.2, 8.3, 3.7 mm



0 dB = 45.09 = 33.08 dB

Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/05

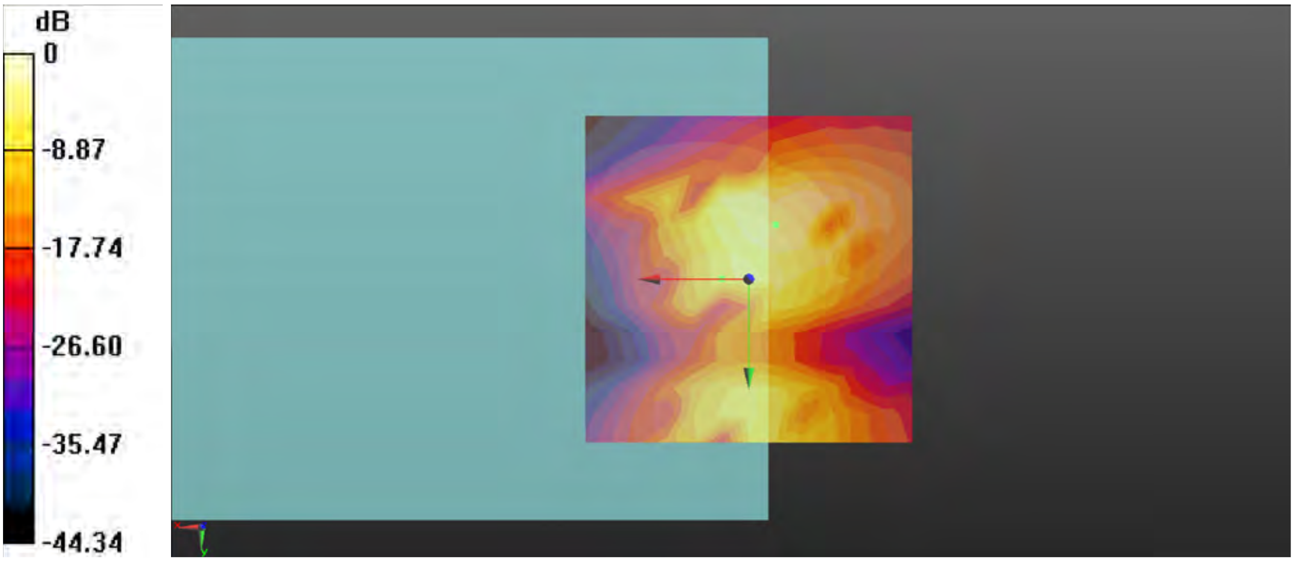
P01 T-Coil_GSM850_Voice_Ch189_FR V1_Transversal (Y)

Communication System: GSM; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):

Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 38.94 dB
ABM1 comp = -10.07 dBA/m
Location: -4.2, -8.3, 3.7 mm



0 dB = 88.51 = 38.94 dB

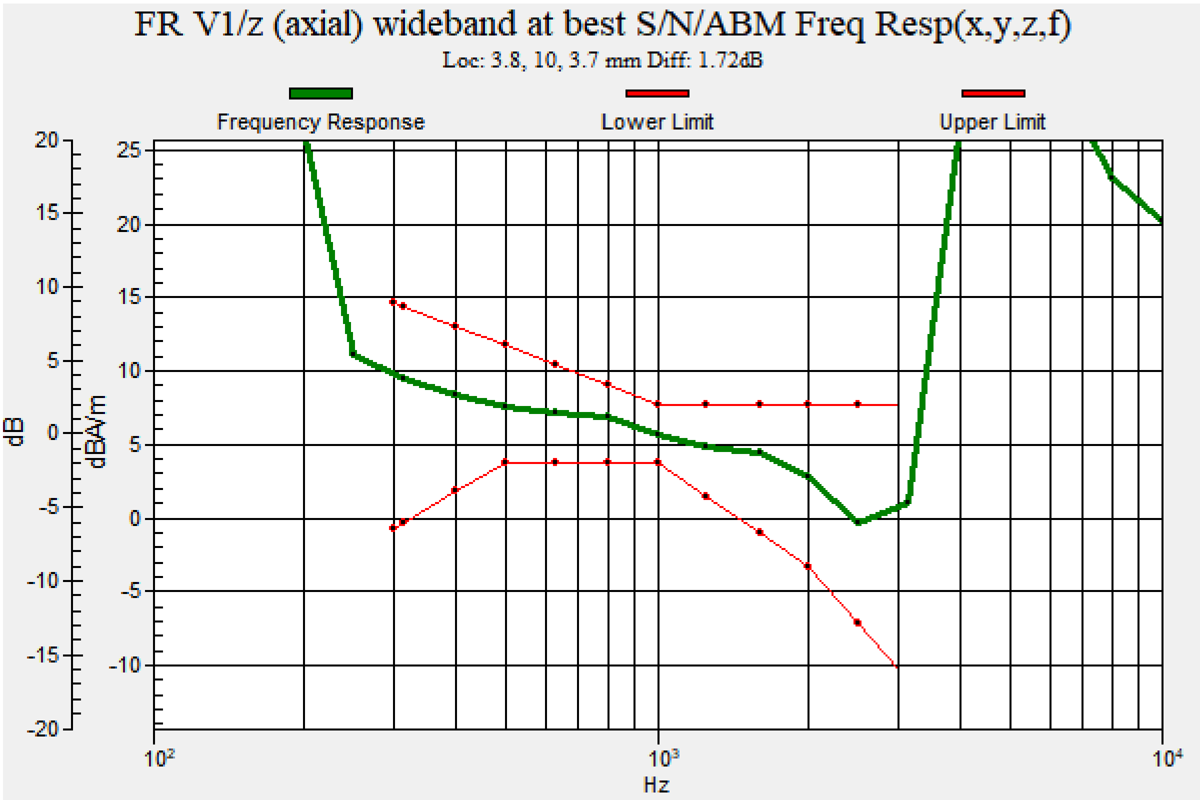
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/05

P01 T-Coil_GSM850_Voice_Ch189_FR V1_Freq Resp

Communication System: GSM; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature : 23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



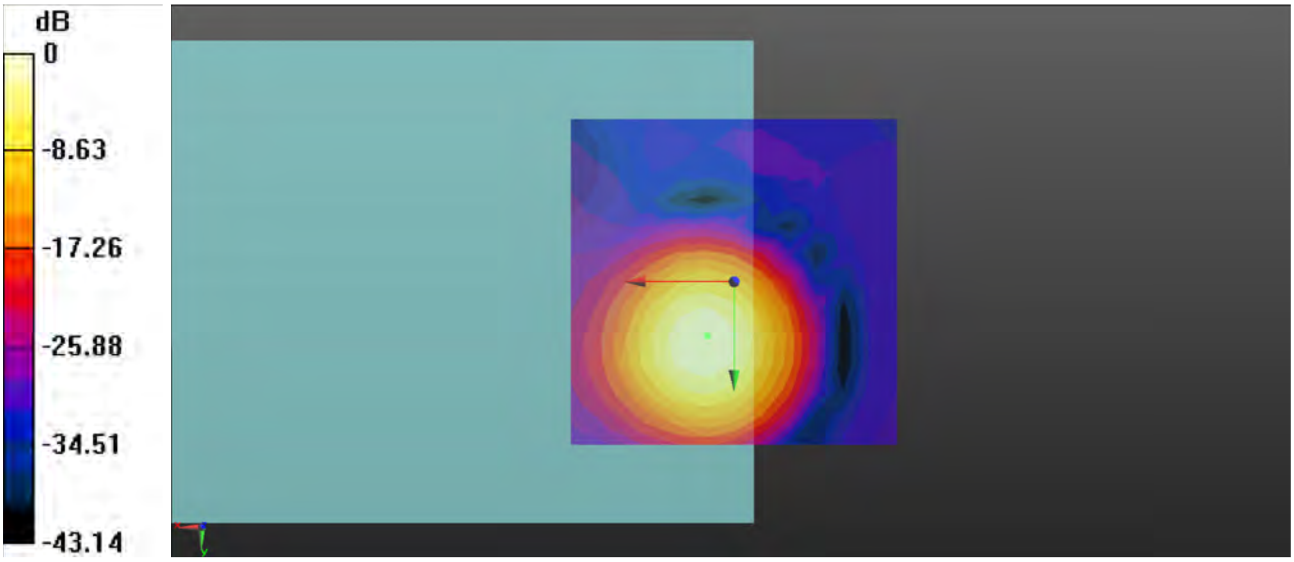
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/05

P02 T-Coil_GSM1900_Voice_Ch661_FR V1_Axial (Z)

Communication System: GSM; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 35.94 dB
ABM1 comp = 5.37 dBA/m
Location: 4.2, 8.3, 3.7 mm



0 dB = 73.72 = 35.94 dB

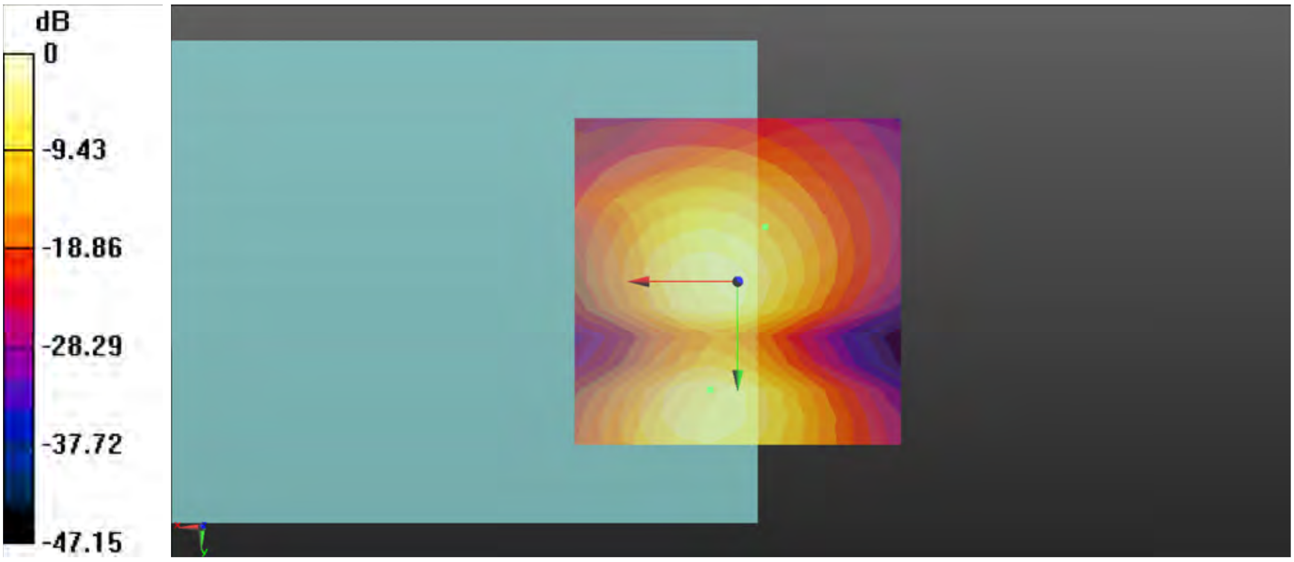
P02 T-Coil_GSM1900_Voice_Ch661_FR V1_Transversal (Y)

Communication System: GSM; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):

Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 40.76 dB
ABM1 comp = -9.90 dBA/m
Location: -4.2, -8.3, 3.7 mm



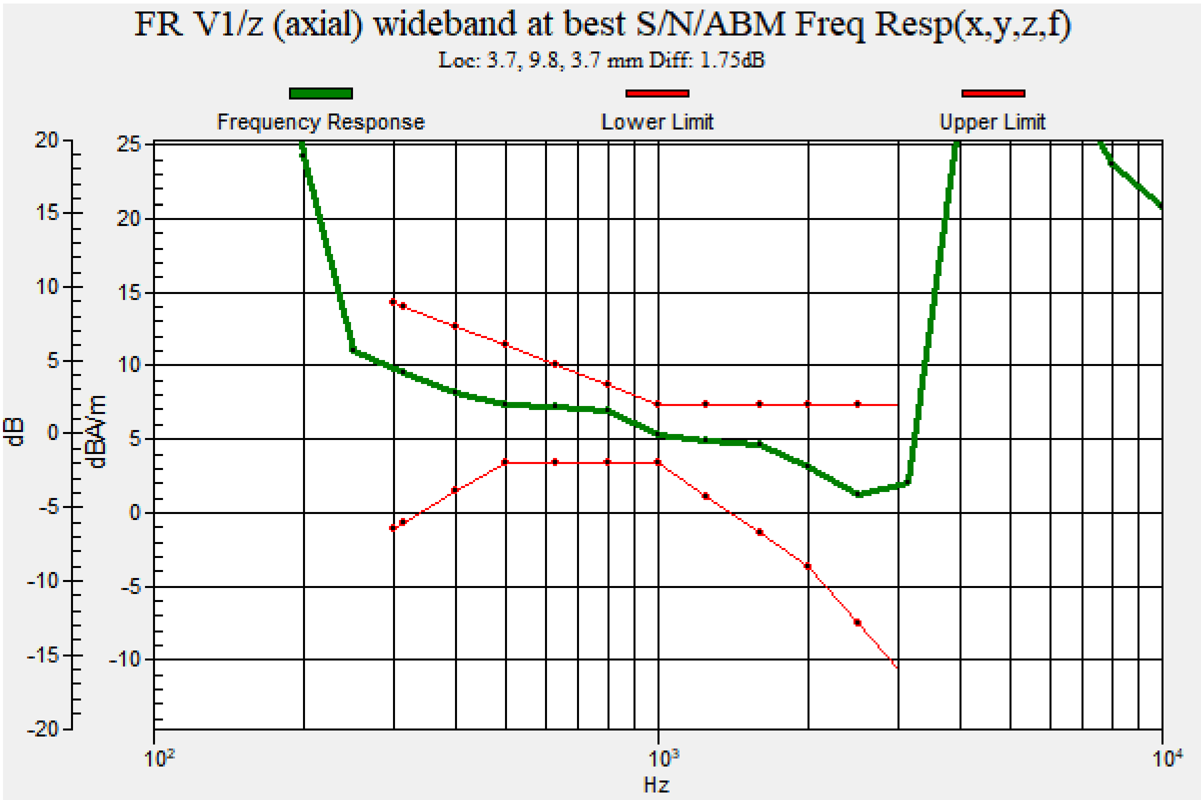
0 dB = 109.1 = 40.76 dB

P02 T-Coil_GSM1900_Voice_Ch661_FR V1_Freq Resp

Communication System: GSM; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Genral Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



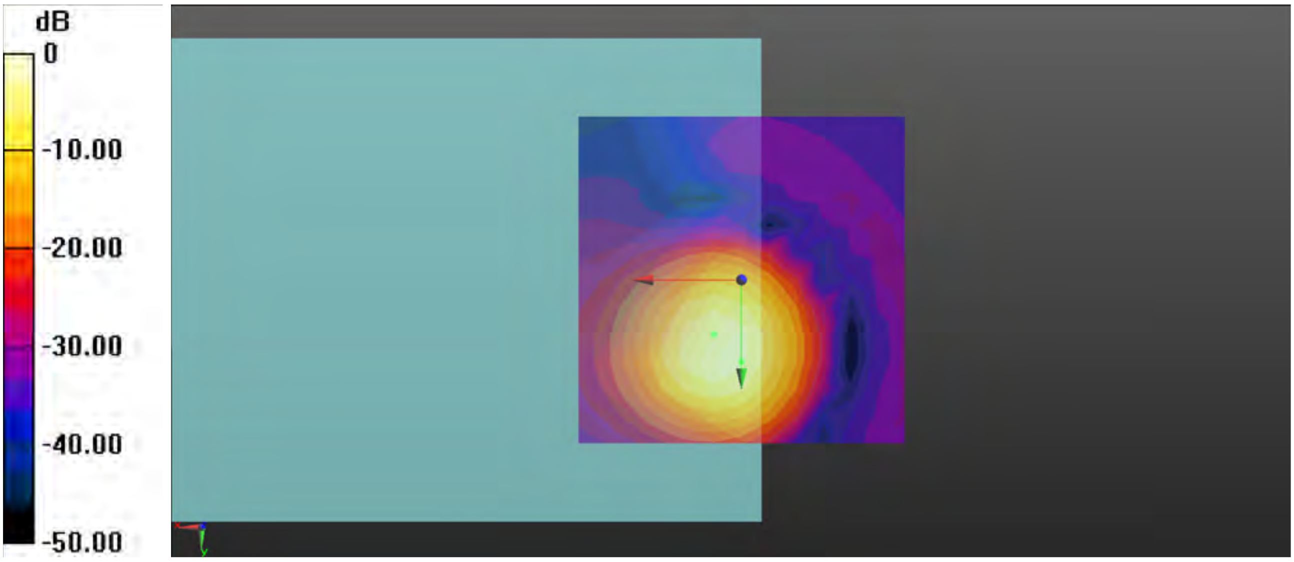
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/05

P03 T-Coil_WCDMA II_Voice_Ch9400_AMR 7.95Kbps_Axial (Z)

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 54.84 dB
ABM1 comp = 5.01 dBA/m
Location: 0, 12.5, 3.7 mm



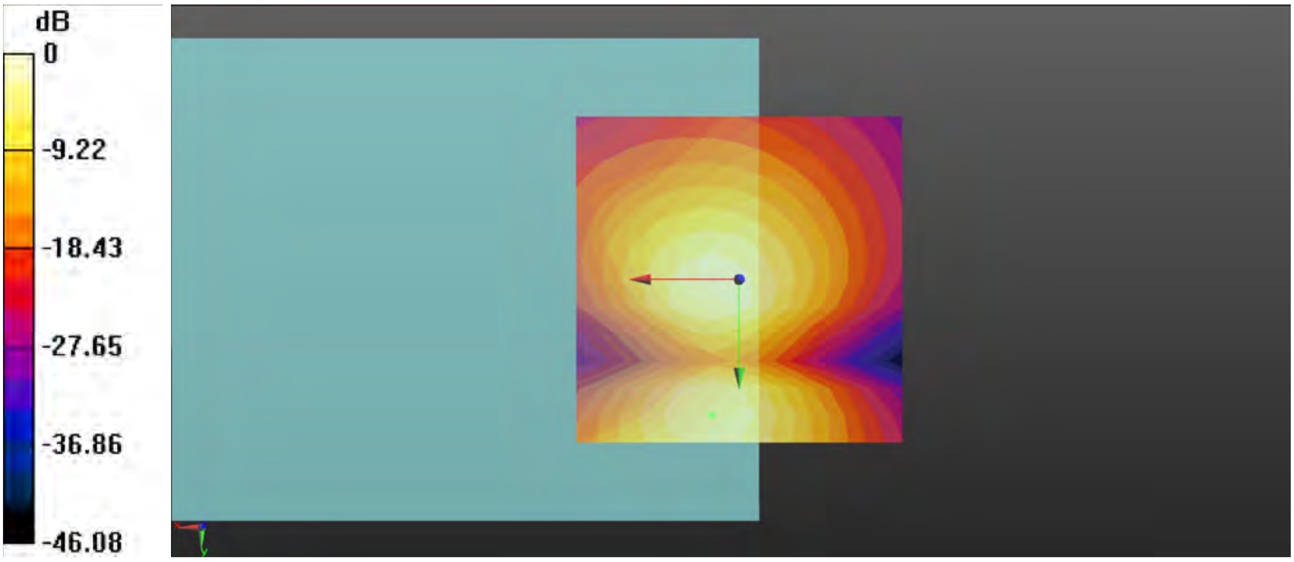
0 dB = 552.2 = 54.84 dB

P03 T-Coil_WCDMA II_Voice_Ch9400_AMR 7.95Kbps_Transversal (Y)

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 46.28 dB
ABM1 comp = -2.97 dBA/m
Location: 0, 0, 3.7 mm



0 dB = 206.0 = 46.28 dB

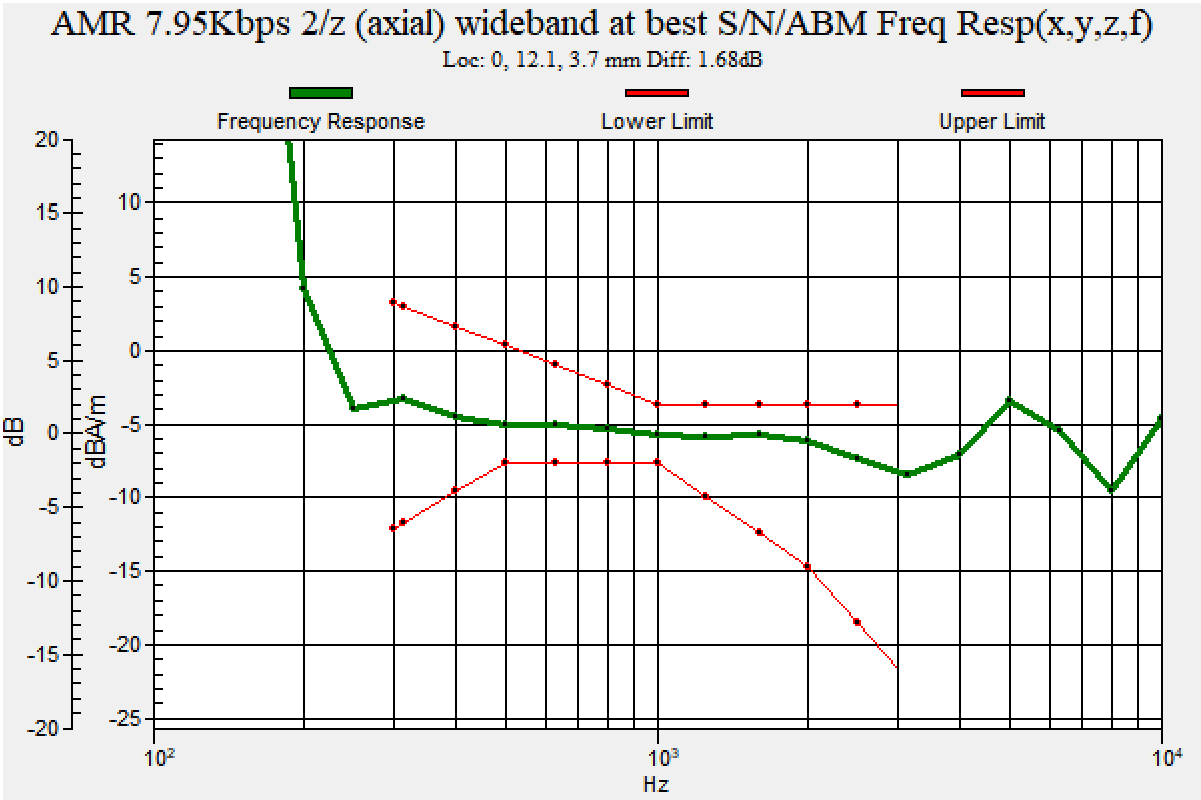
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/05

P03 T-Coil_WCDMA II_Voice_Ch9400_AMR 7.95Kbps_Freq Resp

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm

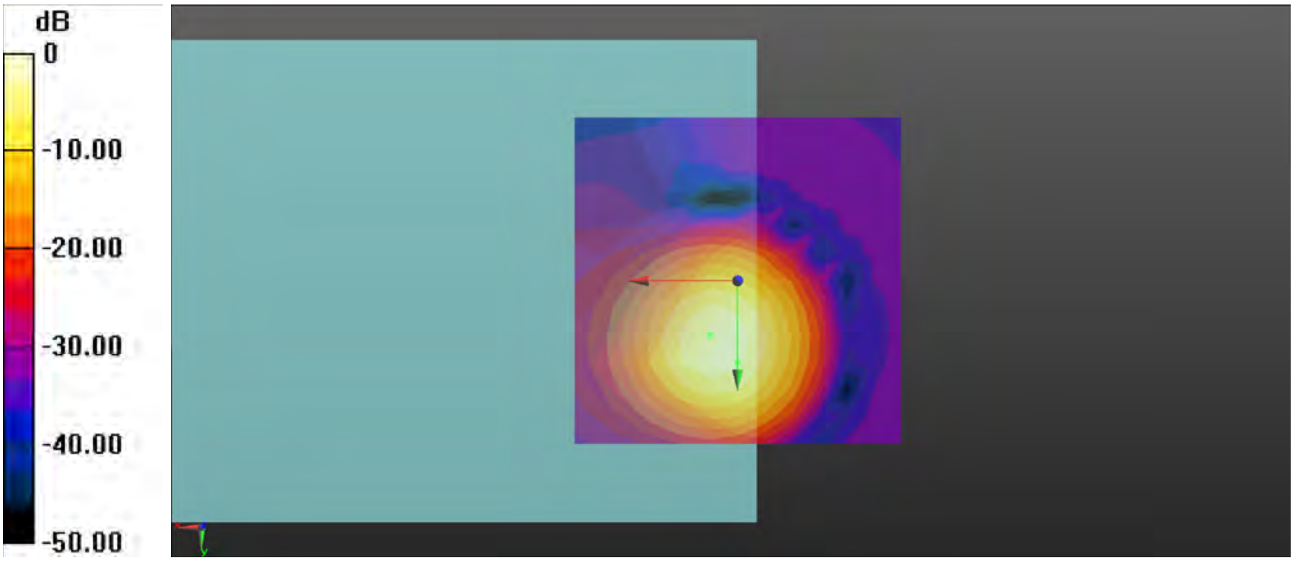


P04 T-Coil_WCDMA IV_Voice_Ch1413_AMR 7.95Kbps_Axial (Z)

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 54.32 dB
ABM1 comp = 5.08 dBA/m
Location: 0, 12.5, 3.7 mm



0 dB = 520.3 = 54.32 dB

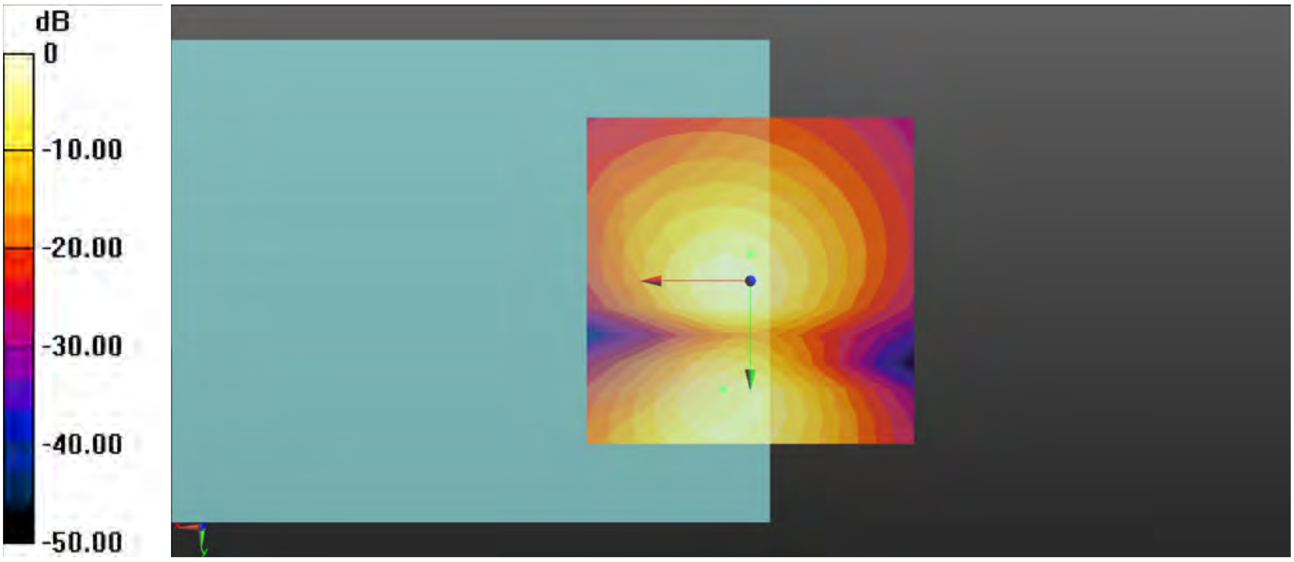
P04 T-Coil_WCDMA IV_Voice_Ch1413_AMR 7.95Kbps_Transversal (Y)

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):

Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 46.67 dB
ABM1 comp = -3.93 dBA/m
Location: 0, -4.2, 3.7 mm



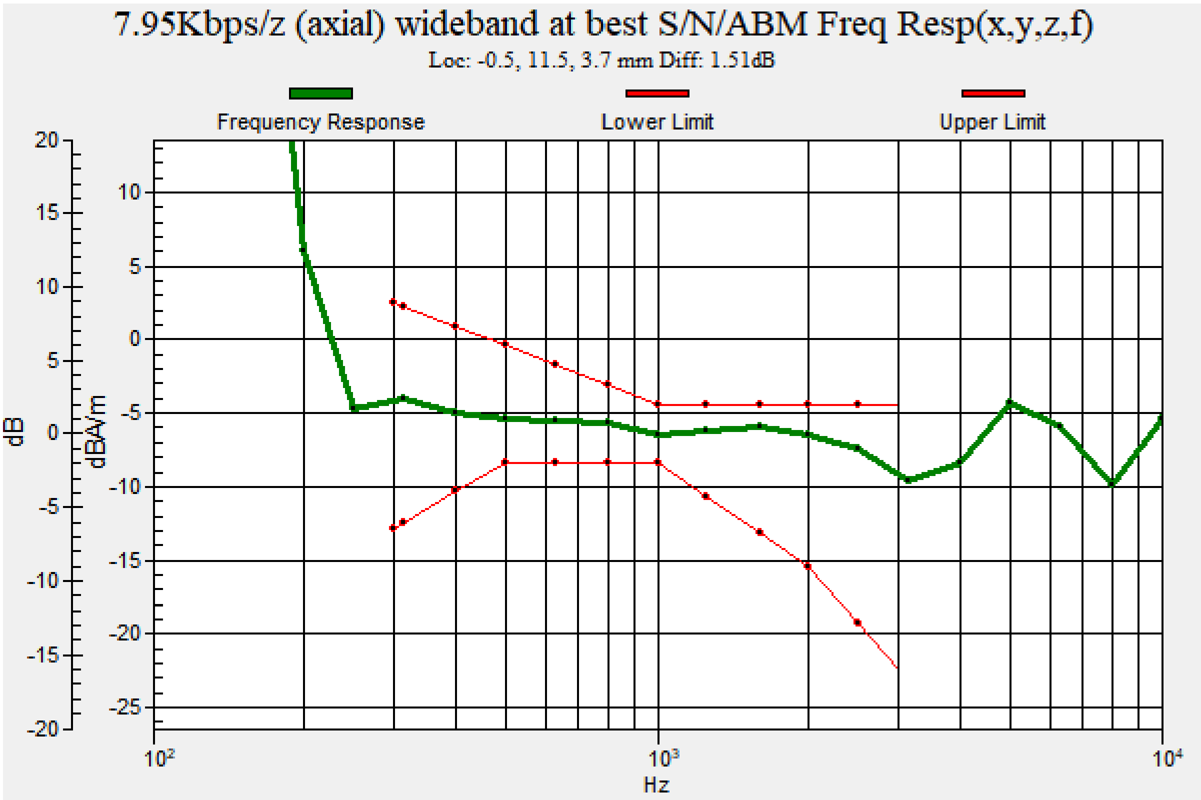
0 dB = 215.5 = 46.67 dB

P04 T-Coil_WCDMA IV_Voice_Ch1413_AMR 7.95Kbps_Freq Resp

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm

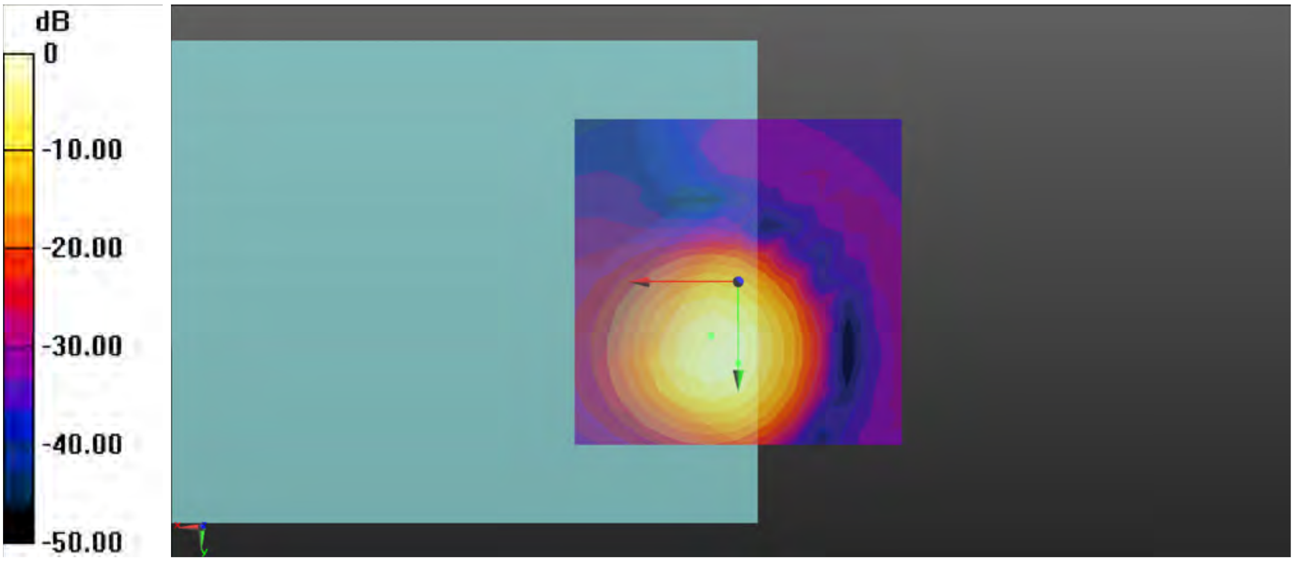


P05 T-Coil_WCDMA V_Voice_Ch4182_AMR 7.95Kbps_Axial (Z)

Communication System: WCDMA (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：23.3°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 54.85 dB
ABM1 comp = 5.17 dBA/m
Location: 0, 12.5, 3.7 mm



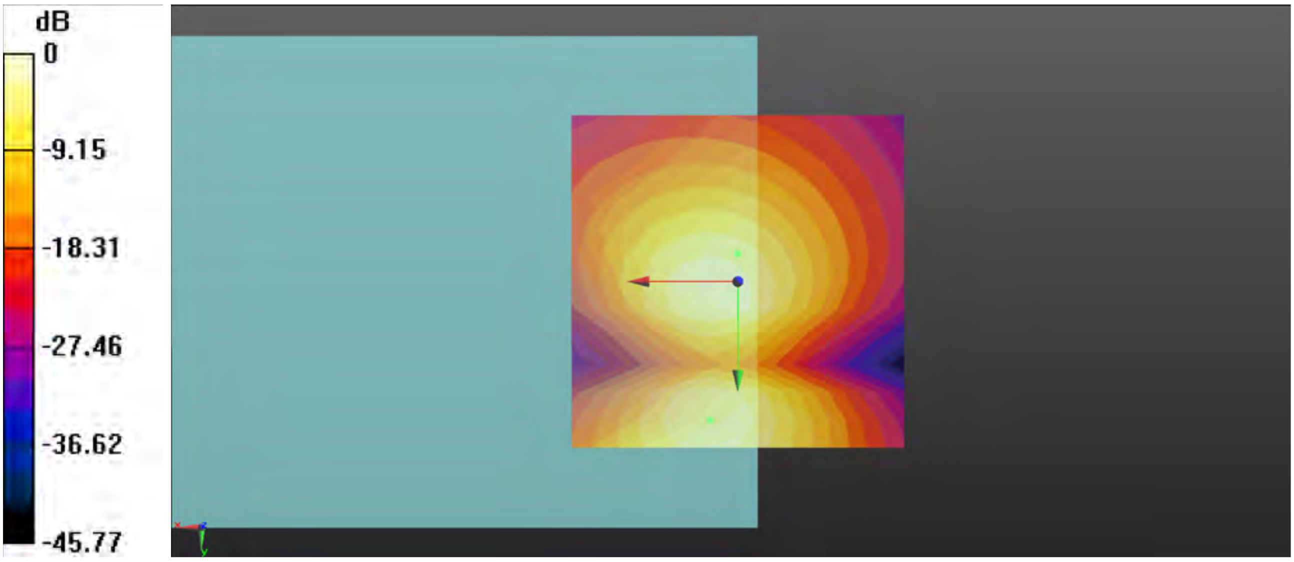
0 dB = 552.8 = 54.85 dB

P05 T-Coil_WCDMA V_Voice_Ch4182_AMR 7.95Kbps_Transversal (Y)

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 45.84 dB
ABM1 comp = -5.15 dBA/m
Location: 0, -4.2, 3.7 mm



0 dB = 195.8 = 45.84 dB

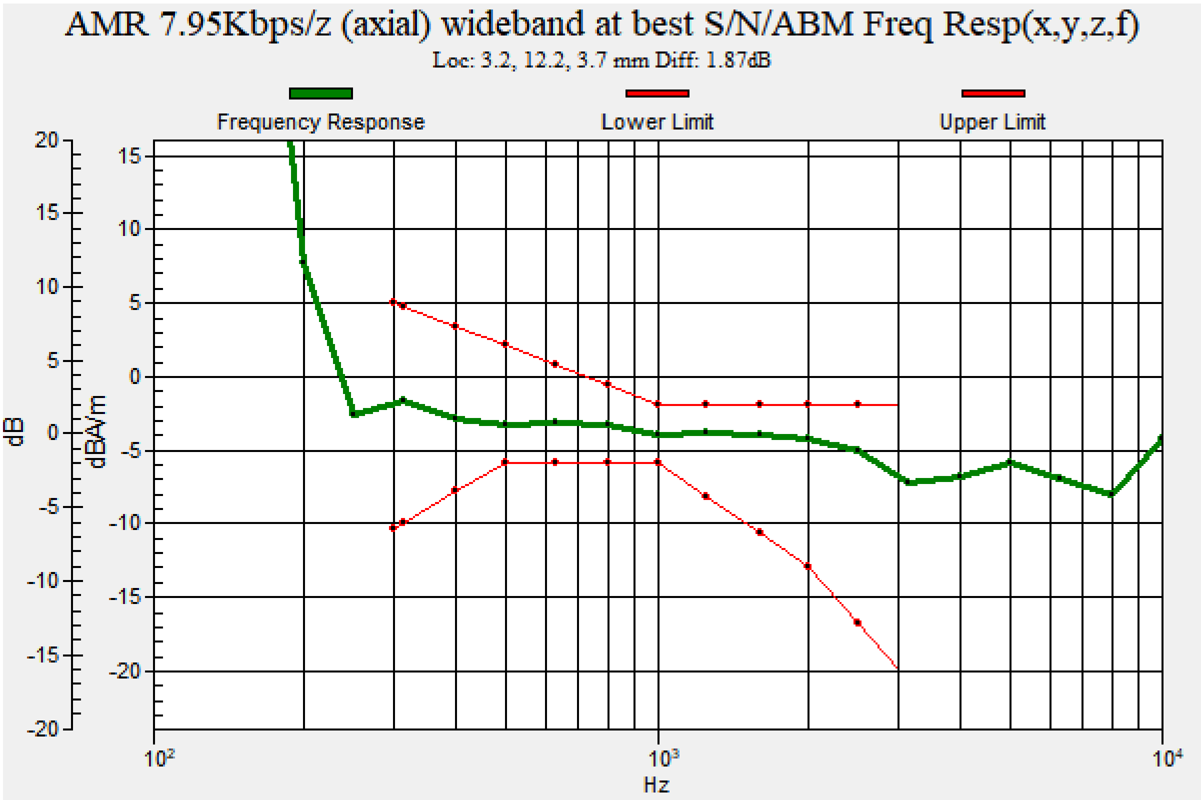
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab   Date: 2023/05/05

P05 T-Coil_WCDMA V_Voice_Ch4182_AMR 7.95Kbps_Freq Resp

Communication System: WCDMA; 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：23.3℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm

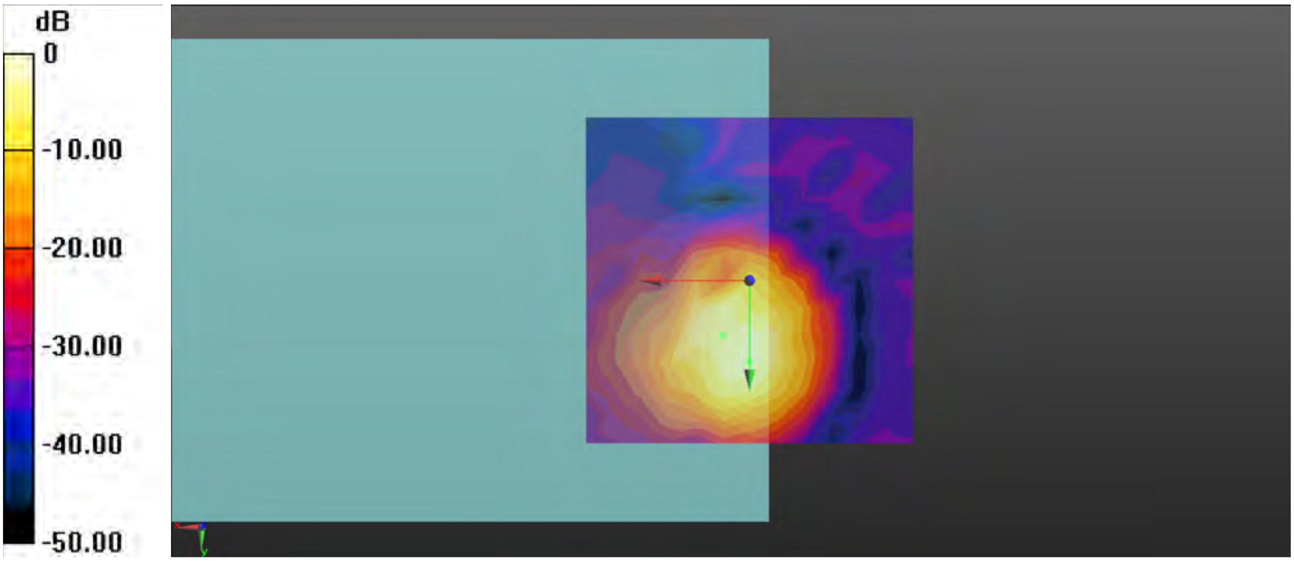


P06 LTE 12_QPSK10M_Ch23095_1RB_OS0_EVS WB 5.9Kbps_Axial (Z)

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 49.20 dB
ABM1 comp = 0.33 dBA/m
Location: 0, 12.5, 3.7 mm



0 dB = 288.4 = 49.20 dB

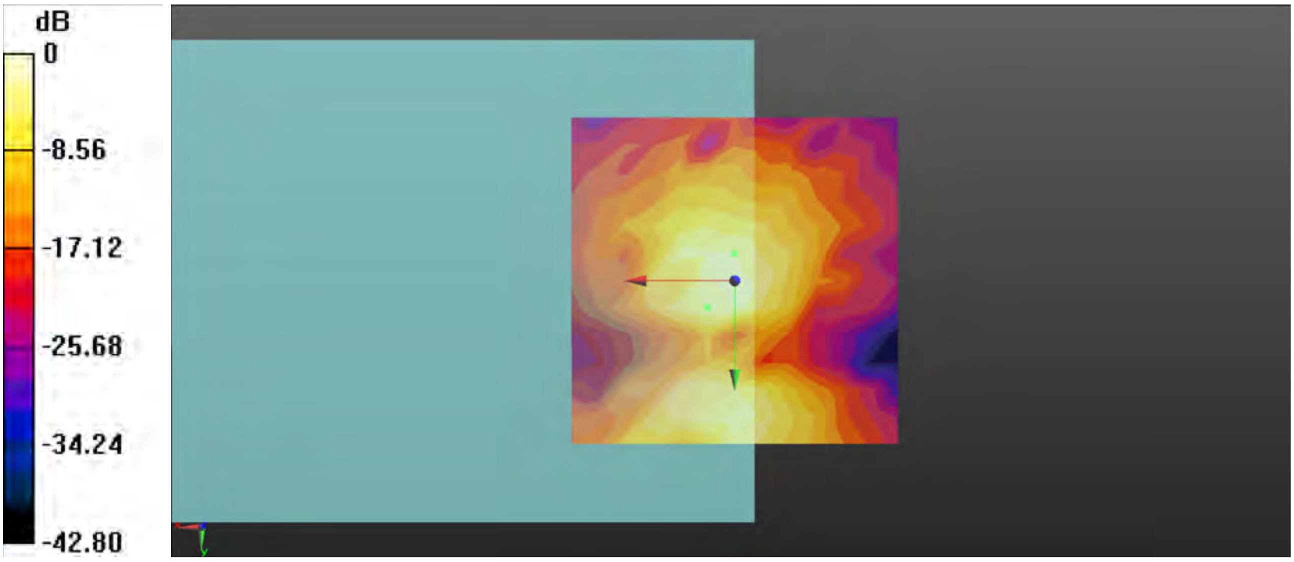
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P06 LTE 12_QPSK10M_Ch23095_1RB_OS0_EVS WB 5.9Kbps_Transversal (Y)

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 40.13 dB
ABM1 comp = -9.38 dBA/m
Location: 0, -4.2, 3.7 mm



0 dB = 101.5 = 40.13 dB

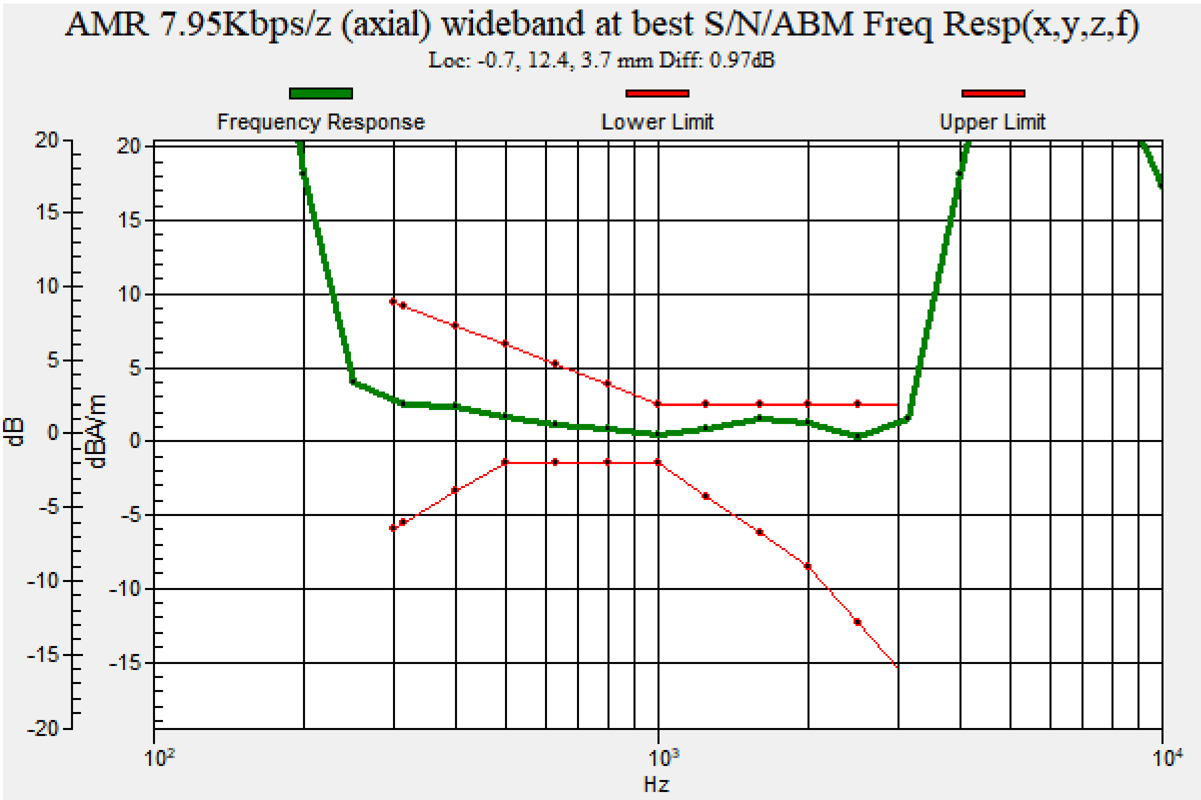
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab   Date: 2023/05/06

P06 LTE 12_QPSK10M_Ch23095_1RB_OS0_EVS WB 5.9Kbps_Freq Resp

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Configuration/AMR 7.95Kbps/z (axial) wideband at best S/N/ABM Freq Resp (x,y,z,f) (1x1x1): Measurement grid: dx=10mm, dy=10mm



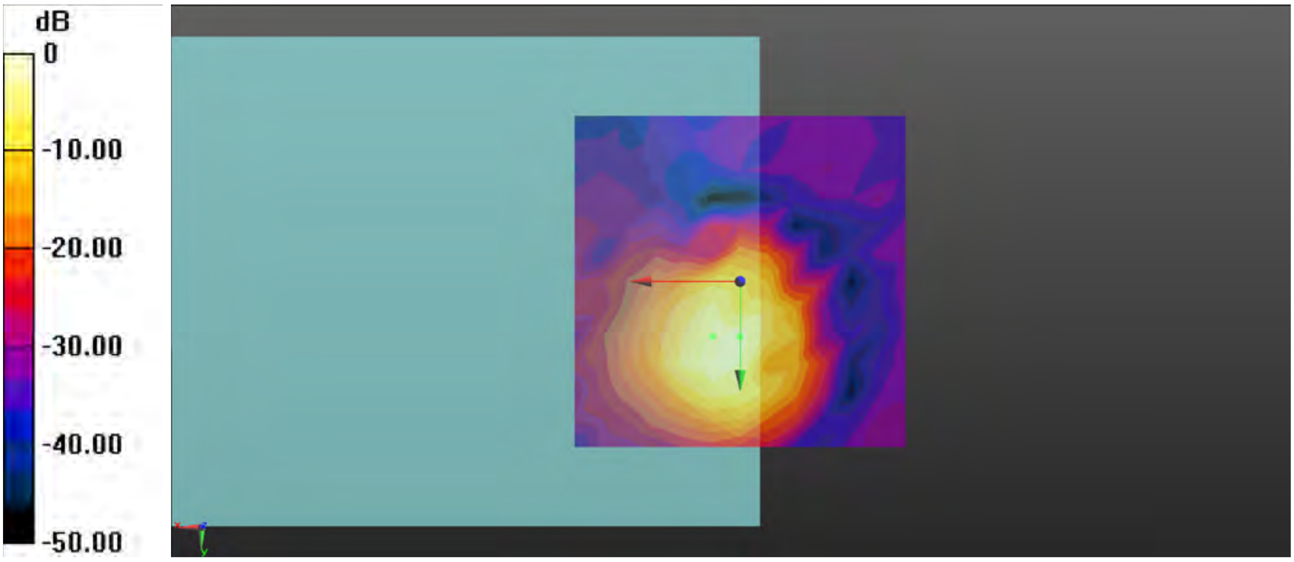
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P07 LTE 25_QPSK20M_Ch26340_1RB_OS0_EVS WB 5.9Kbps_Axial (Z)

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 50.73 dB
ABM1 comp = 3.23 dBA/m
Location: 0, 8.3, 3.7 mm



0 dB = 344.0 = 50.73 dB

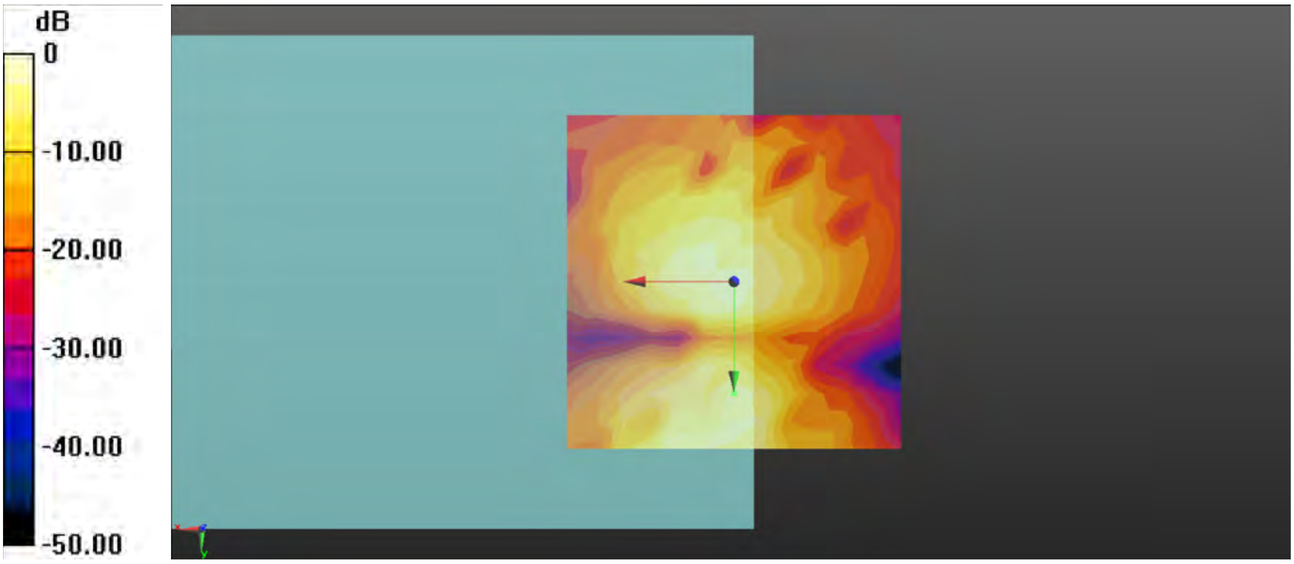
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P07 LTE 25_QPSK20M_Ch26340_1RB_OS0_EVS WB 5.9Kbps_Transversal (Y)

Communication System: LTE_FDD; 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：23.5°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 43.22 dB
ABM1 comp = -4.35 dBA/m
Location: 0, 0, 3.7 mm



0 dB = 144.9 = 43.22 dB

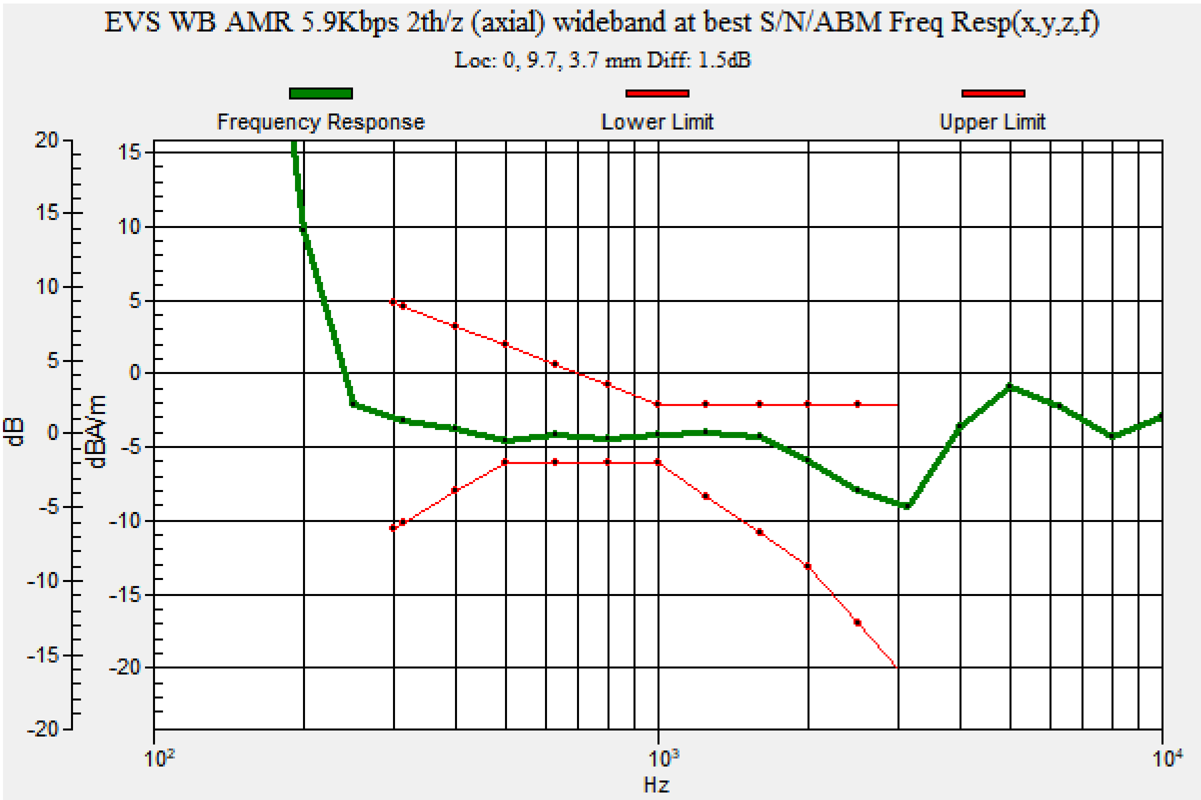
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P07 LTE 25_QPSK20M_Ch26340_1RB_OS0_EVS WB 5.9Kbps_Freq Resp

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



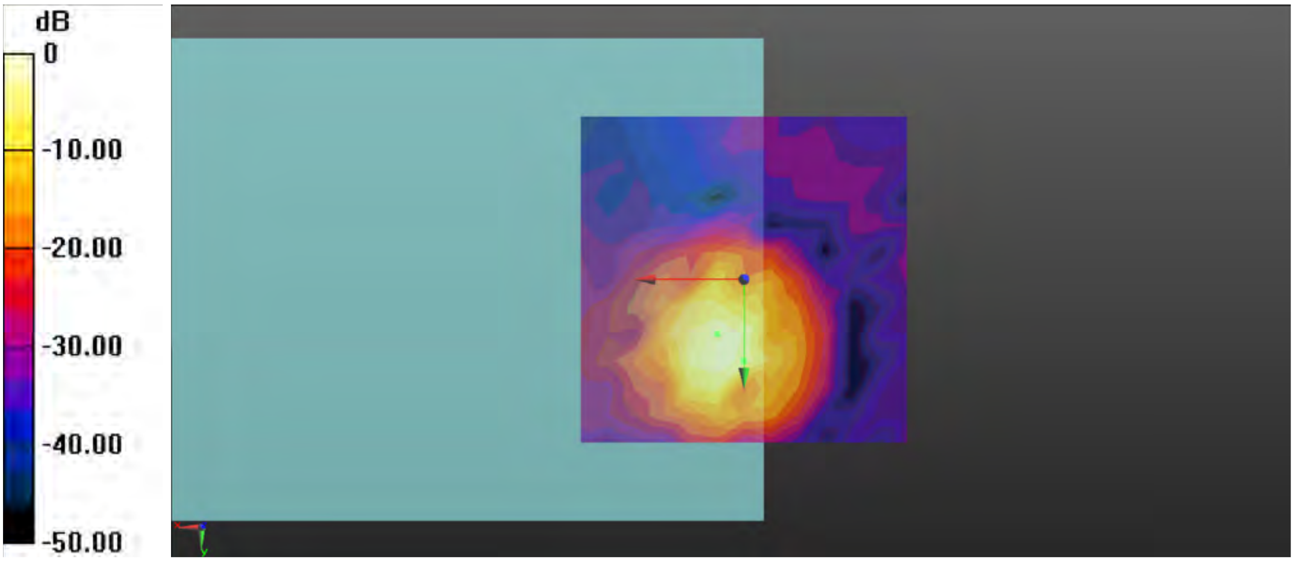
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P08 LTE 26_QPSK15M_Ch26865_1RB_OS0_EVS WB 5.9Kbps_Axial (Z)

Communication System: LTE_FDD; Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: σ = 0 S/m, $\varepsilon_r = 1$; ρ = 0 kg/m^3
Ambient Temperature：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 47.51 dB
ABM1 comp = -1.33 dBA/m
Location: 0, 12.5, 3.7 mm



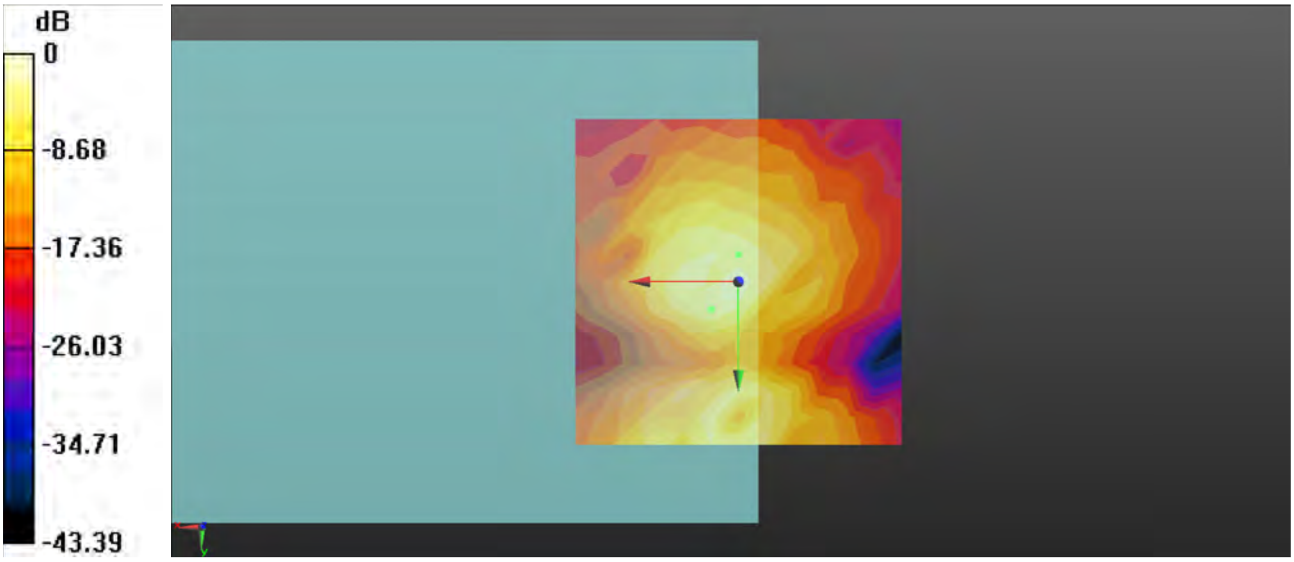
0 dB = 237.4 = 47.51 dB

P08 LTE 26_QPSK15M_Ch26865_1RB_OS0_EVS WB 5.9Kbps_Transversal (Y)

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 39.97 dB
ABM1 comp = -10.37 dBA/m
Location: 0, -4.2, 3.7 mm



0 dB = 99.67 = 39.97 dB

P08 LTE 26_QPSK15M_Ch26865_1RB_OS0_EVS WB 5.9Kbps_Freq Resp

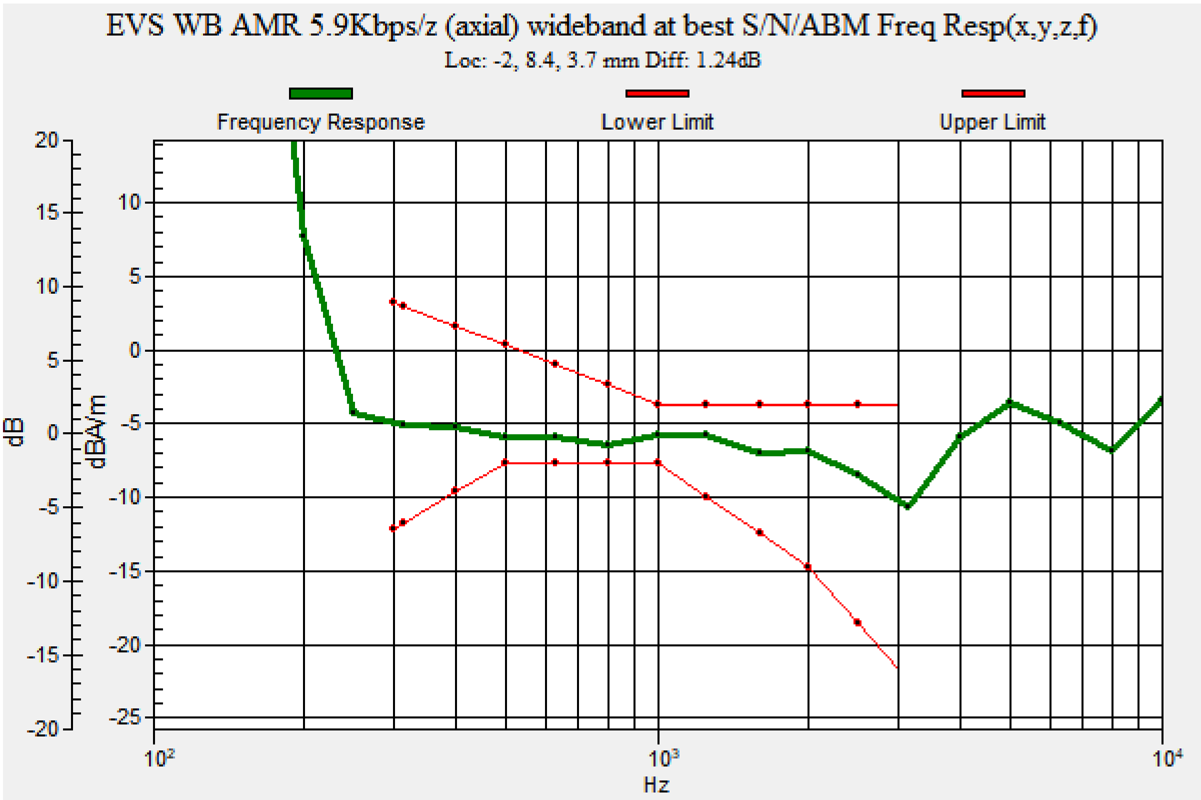
Communication System: LTE_FDD; Frequency: 831.5 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3

Ambient Temperature：23.5°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):

Measurement grid: dx=10mm, dy=10mm



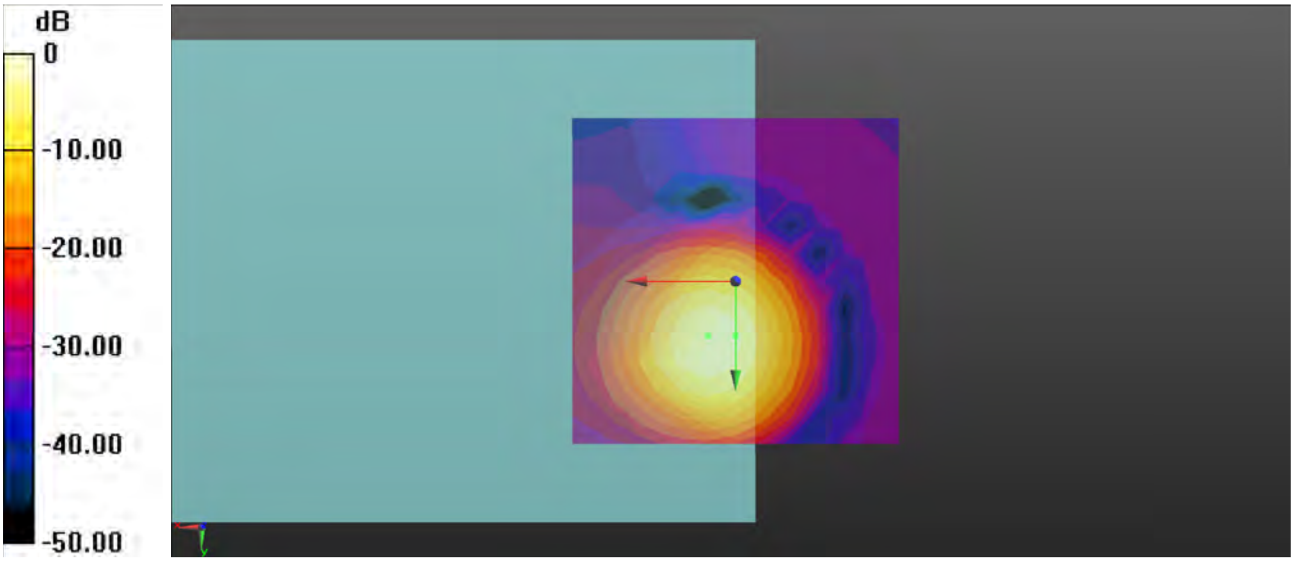
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P09 LTE 41_QPSK20M_Ch40620_1RB_OS0_WB AMR 6.6Kbps_Axial (Z)

Communication System: LTE_TDD; Frequency: 2593 MHz;Duty Cycle: 1:1.59
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 47.93 dB
ABM1 comp = 4.77 dBA/m
Location: 0, 8.3, 3.7 mm



0 dB = 249.1 = 47.93 dB

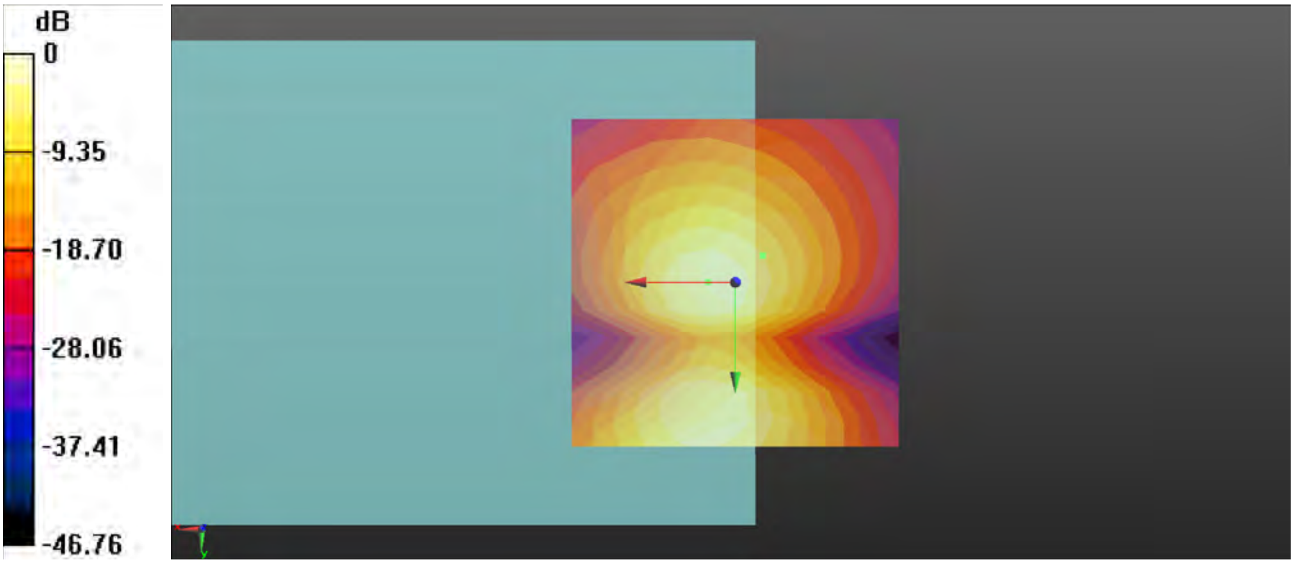
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab   Date: 2023/05/06

P09 LTE 41_QPSK20M_Ch40620_1RB_OS0_WB AMR 6.6Kbps_Transversal (Y)

Communication System: LTE_TDD; Frequency: 2593 MHz;Duty Cycle: 1:1.59
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.5°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 41.19 dB
ABM1 comp = -7.30 dBA/m
Location: -4.2, -4.2, 3.7 mm



0 dB = 114.7 = 41.19 dB

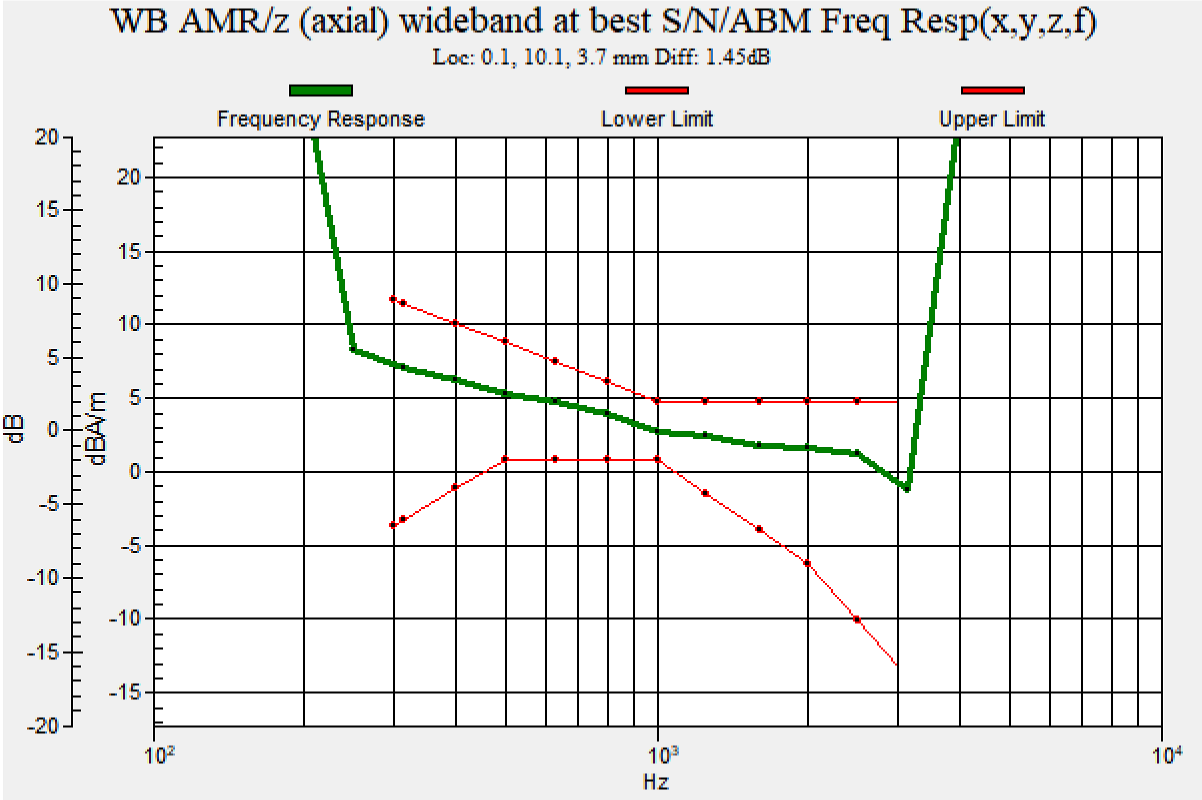
P09 LTE 41_QPSK20M_Ch40620_1RB_OS0_WB AMR 6.6Kbps_Freq Resp

Communication System: LTE_TDD (0); Frequency: 2593 MHz;Duty Cycle: 1:1.59
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3

Ambient Temperature：23.5°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



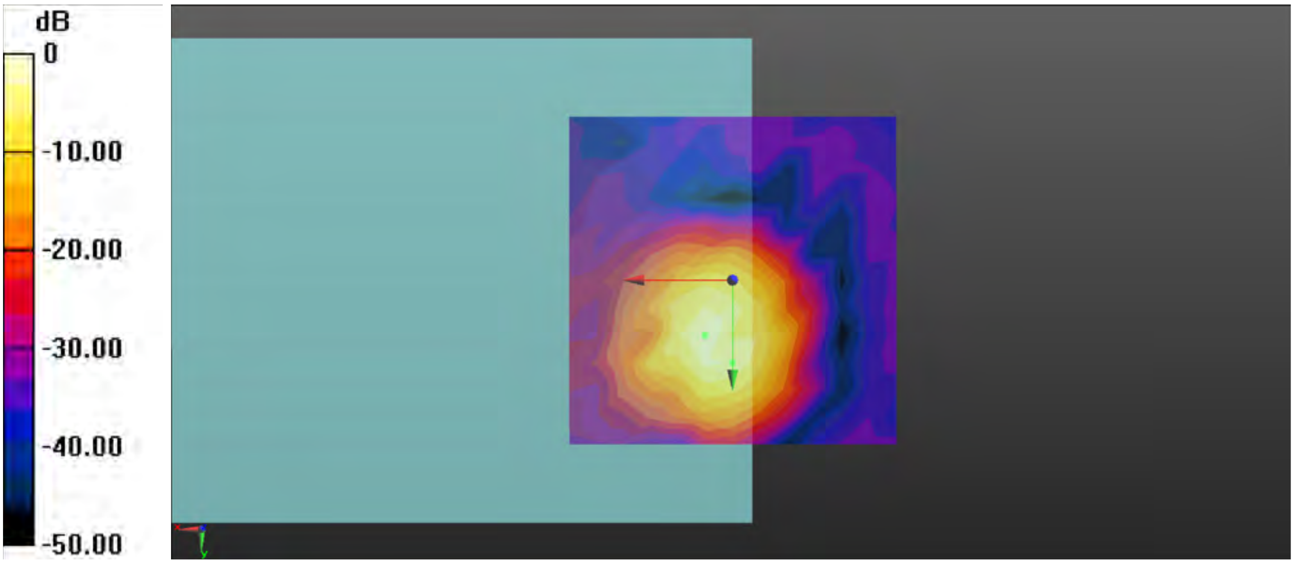
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab   Date: 2023/05/06

P10 LTE 66_QPSK20M_Ch132322_1RB_OS0_EVS WB 5.9Kbps_Axial (Z)

Communication System: LTE_FDD; 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：23.5°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 54.52 dB
ABM1 comp = 2.25 dBA/m
Location: 0, 12.5, 3.7 mm



0 dB = 531.9 = 54.52 dB

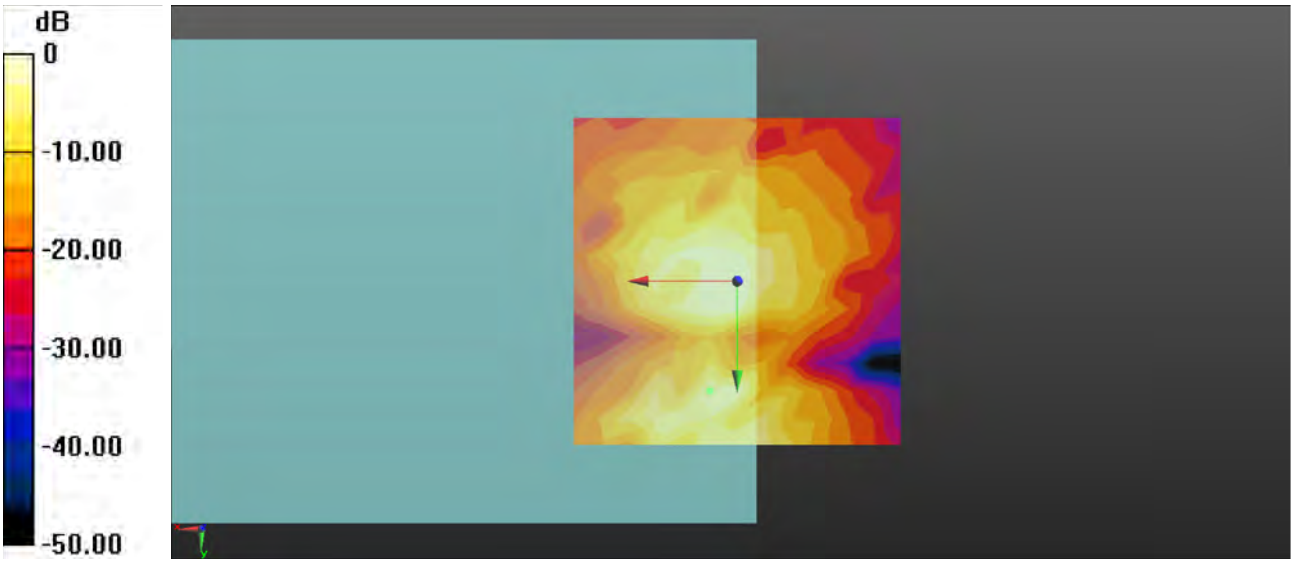
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab   Date: 2023/05/06

P10 LTE 66_QPSK20M_Ch132322_1RB_OS0_EVS WB 5.9Kbps_Transversal (Y)

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 45.88 dB
ABM1 comp = -5.31 dBA/m
Location: 0, 0, 3.7 mm



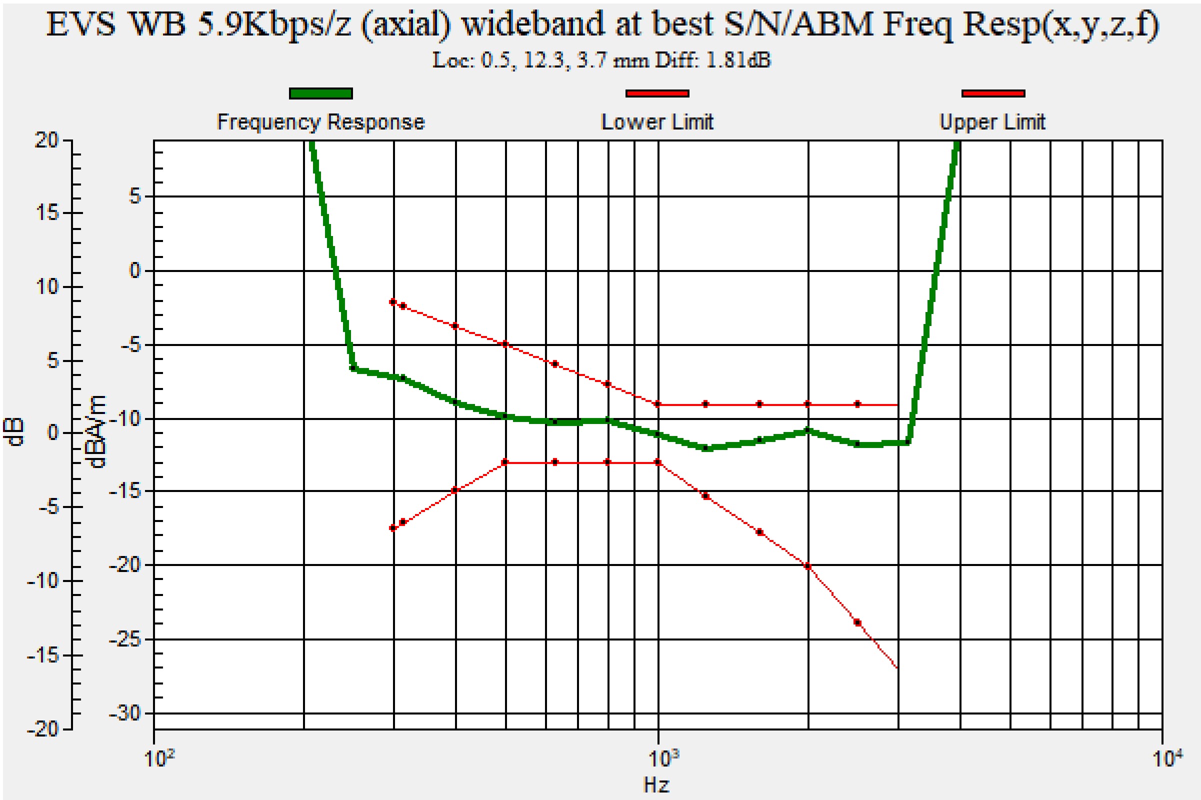
0 dB = 196.8 = 45.88 dB

P10 LTE 66_QPSK20M_Ch132322_1RB_OS0_EVS WB 5.9Kbps_Freq Resp

Communication System: LTE_FDD; 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：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm

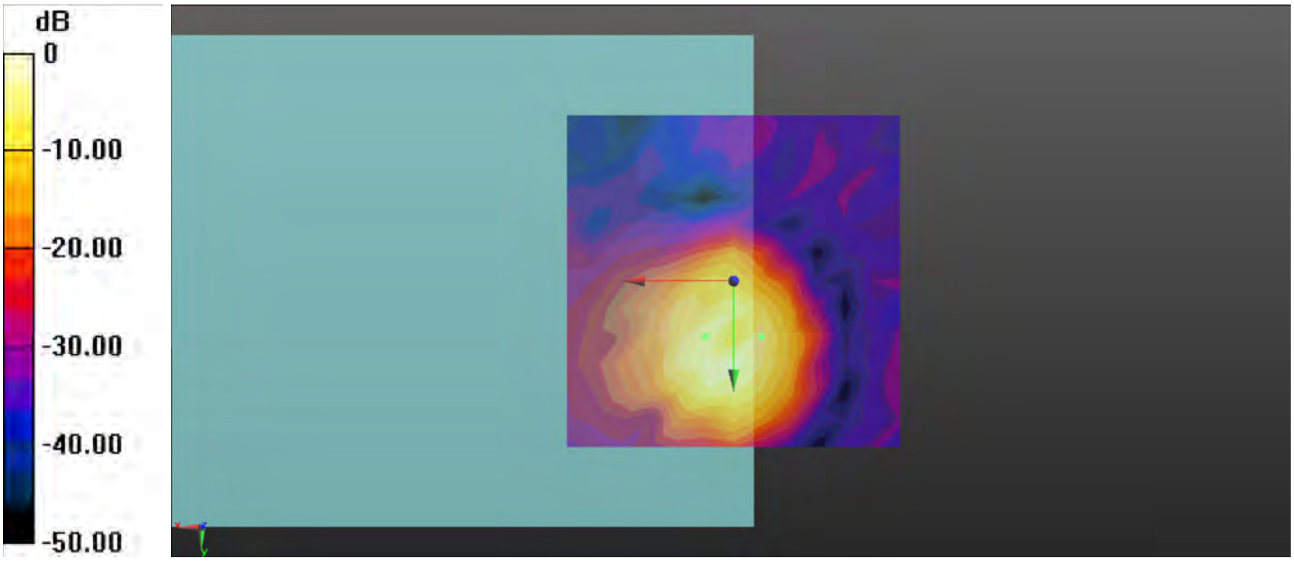


P11 LTE 71_QPSK20M_Ch133322_1RB_OS0_EVS WB 5.9Kbps_Axial (Z)

Communication System: LTE_FDD; Frequency: 683 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 47.19 dB
ABM1 comp = -3.59 dBA/m
Location: -4.2, 8.3, 3.7 mm



0 dB = 228.9 = 47.19 dB

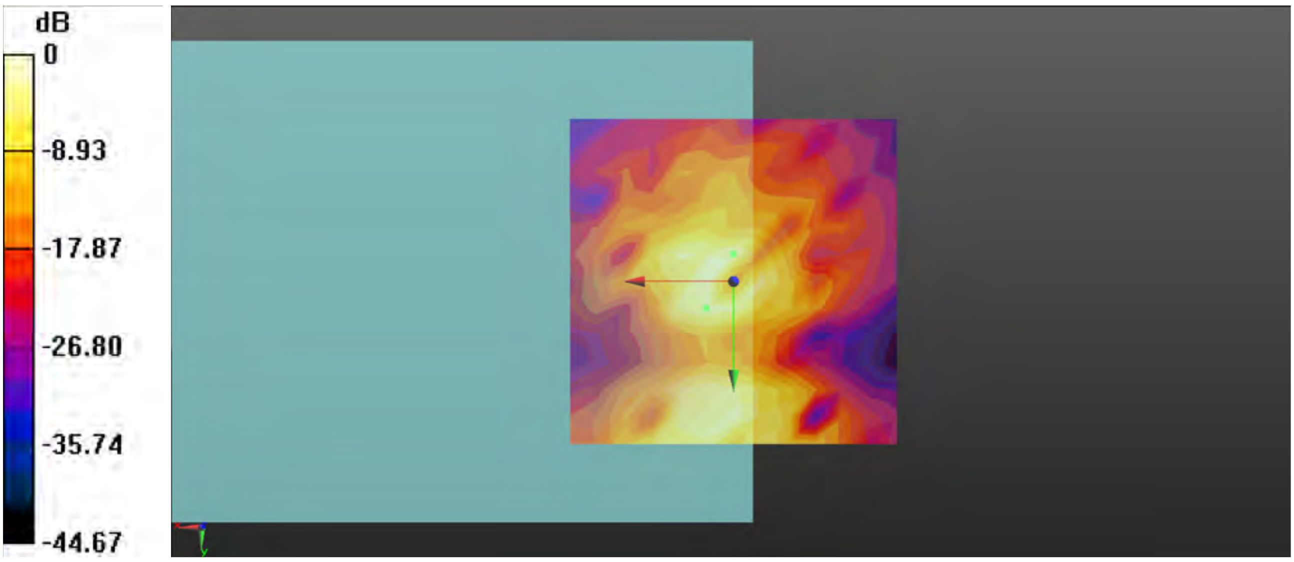
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/06

P11 LTE 71_QPSK20M_Ch133322_1RB_OS0_EVS WB 5.9Kbps_Transversal (Y)

Communication System: LTE_FDD; Frequency: 683 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.5℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 40.20 dB
ABM1 comp = -9.15 dBA/m
Location: 0, -4.2, 3.7 mm



0 dB = 102.4 = 40.20 dB

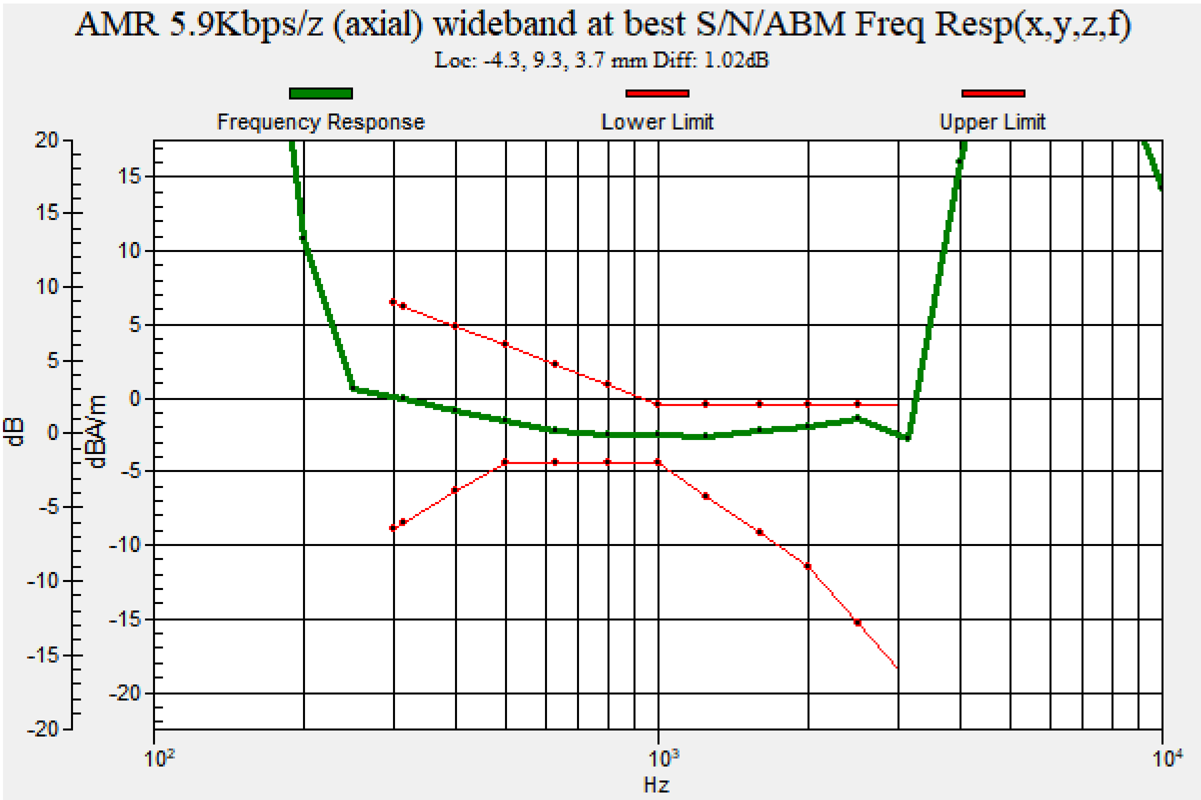
P11 LTE 71_QPSK20M_Ch133322_1RB_OS0_EVS WB 5.9Kbps_Freq Resp

Communication System: LTE_FDD; Frequency: 683 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3

Ambient Temperature：23.5°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm

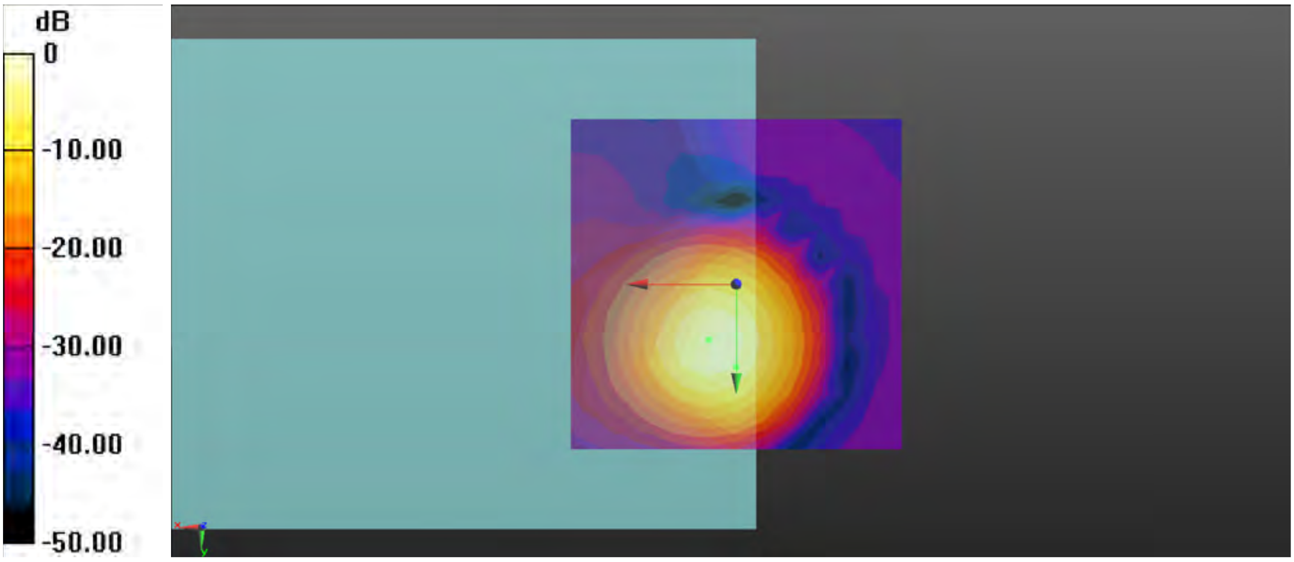


P12 WLAN2.4G_802.11b_Ch6_WB AMR 6.60Kbps_Axial (Z)

Communication System: 802.11b; 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：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 53.73 dB
ABM1 comp = 4.18 dBA/m
Location: 0, 12.5, 3.7 mm



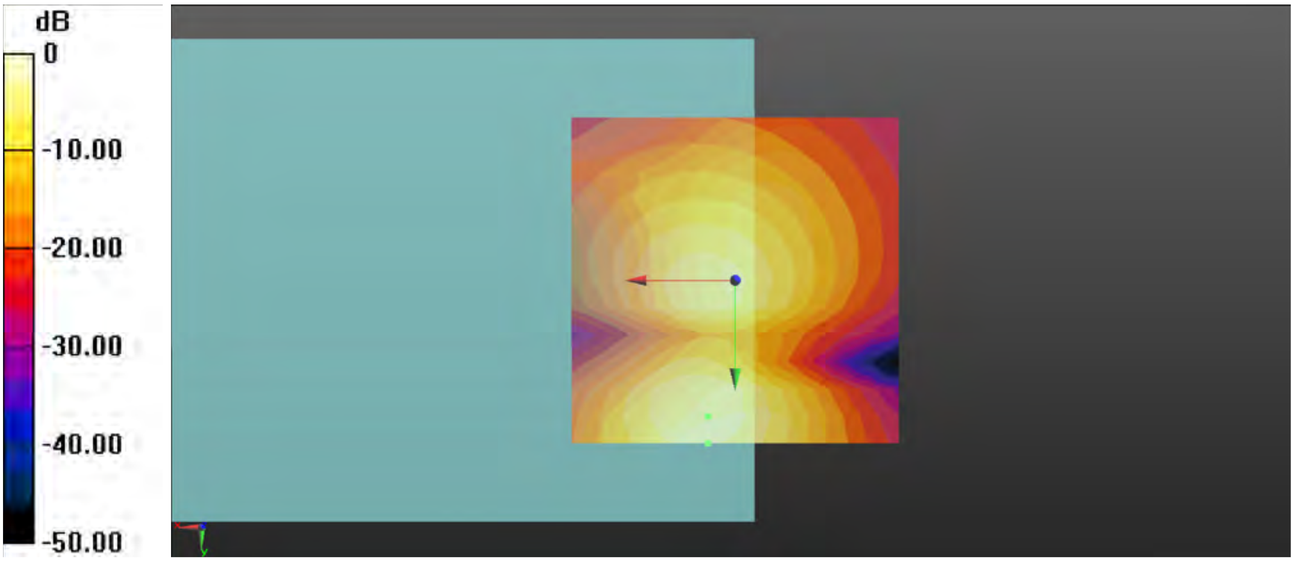
0 dB = 485.8 = 53.73 dB

P12 WLAN2.4G_802.11b_Ch6_WB AMR 6.60Kbps_Transversal (Y)

Communication System: 802.11b; 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：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 43.48 dB
ABM1 comp = -3.94 dBA/m
Location: 4.2, 25, 3.7 mm



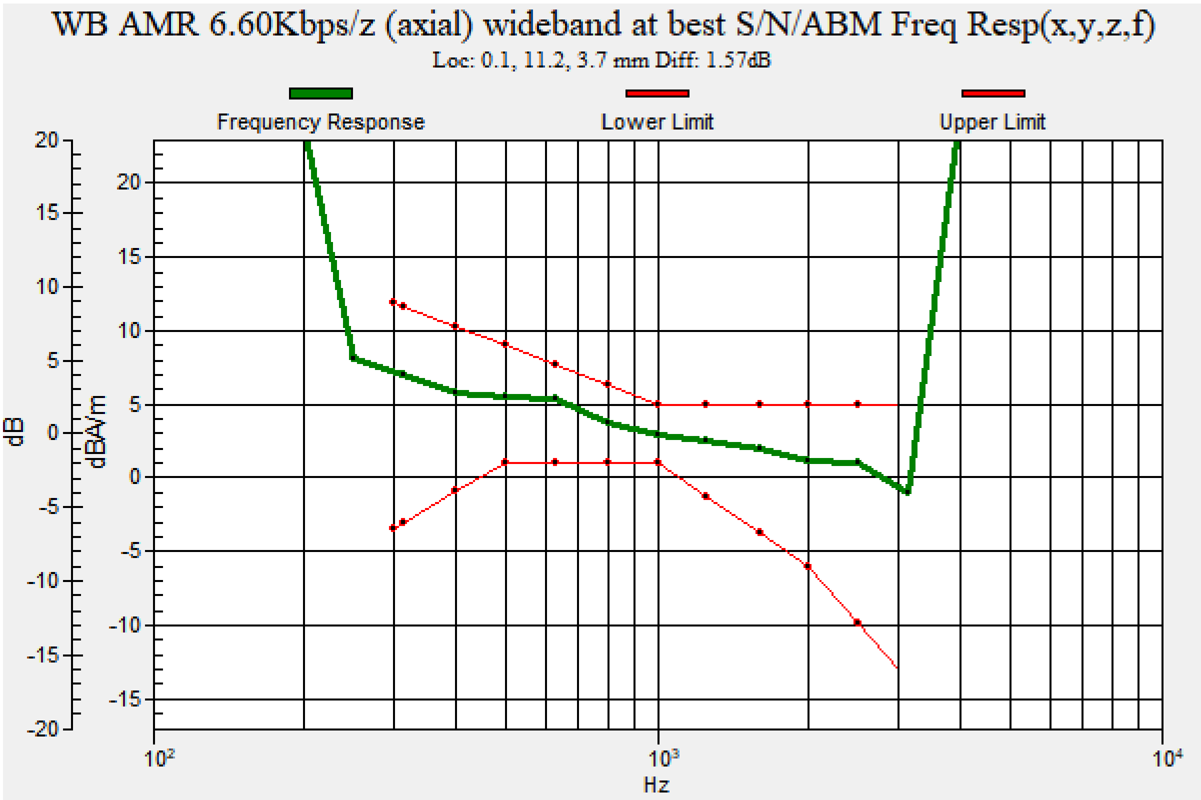
0 dB = 149.3 = 43.48 dB

P12 WLAN2.4G_802.11b_Ch6_WB AMR 6.60Kbps_Freq Resp

Communication System: 802.11b; 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：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



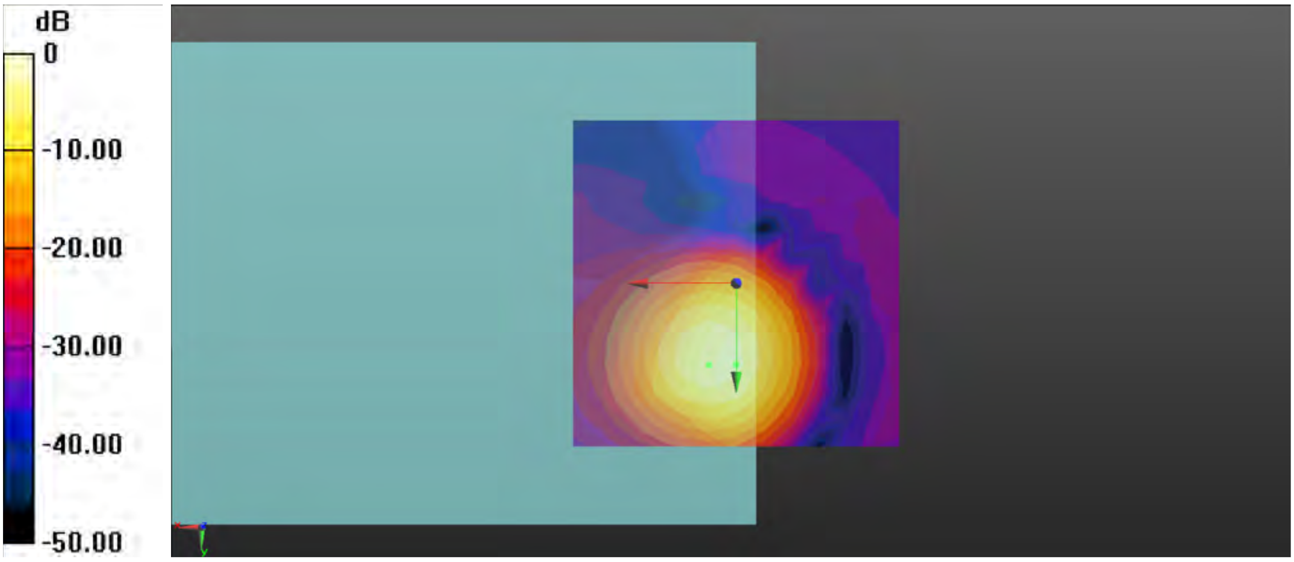
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

P13 WLAN5G_802.11an-HT20_MCS0_Ch40_WB AMR 6.60Kbps_Axial (Z)

Communication System: 802.11an-HT20; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 54.40 dB
ABM1 comp = 5.88 dBA/m
Location: 0, 12.5, 3.7 mm



0 dB = 524.9 = 54.40 dB

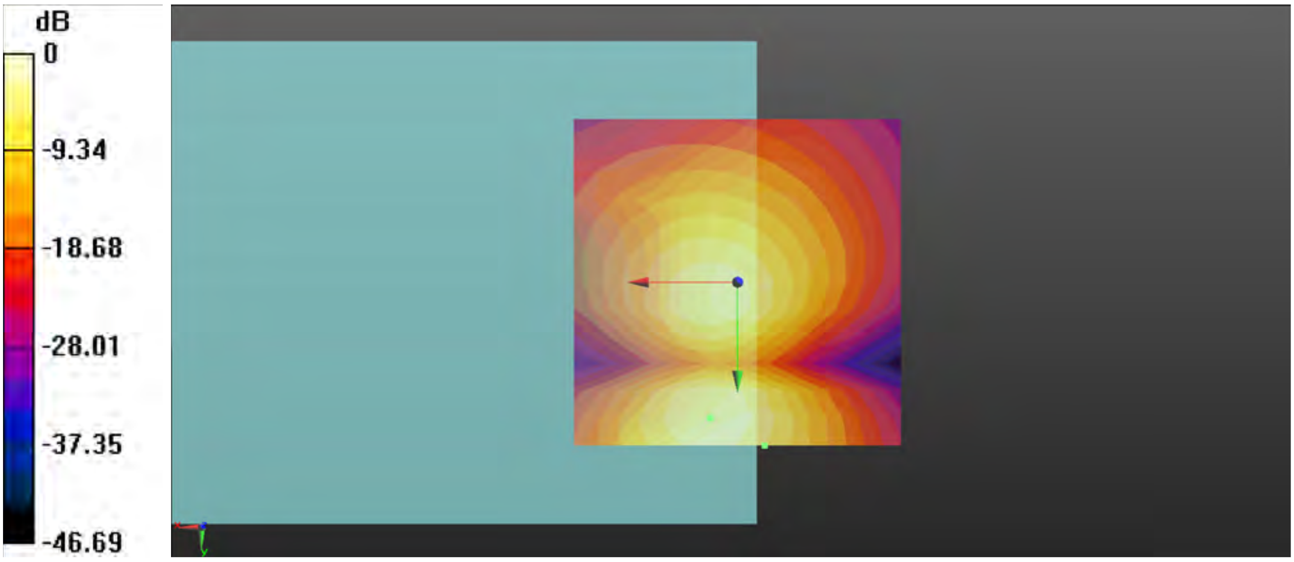
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

P13 WLAN5G_802.11an-HT20_MCS0_Ch40_WB AMR 6.60Kbps_Transversal (Y)

Communication System: 802.11an-HT20; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 44.38 dB
ABM1 comp = -5.65 dBA/m
Location: -4.2, 25, 3.7 mm



0 dB = 165.7 = 44.38 dB

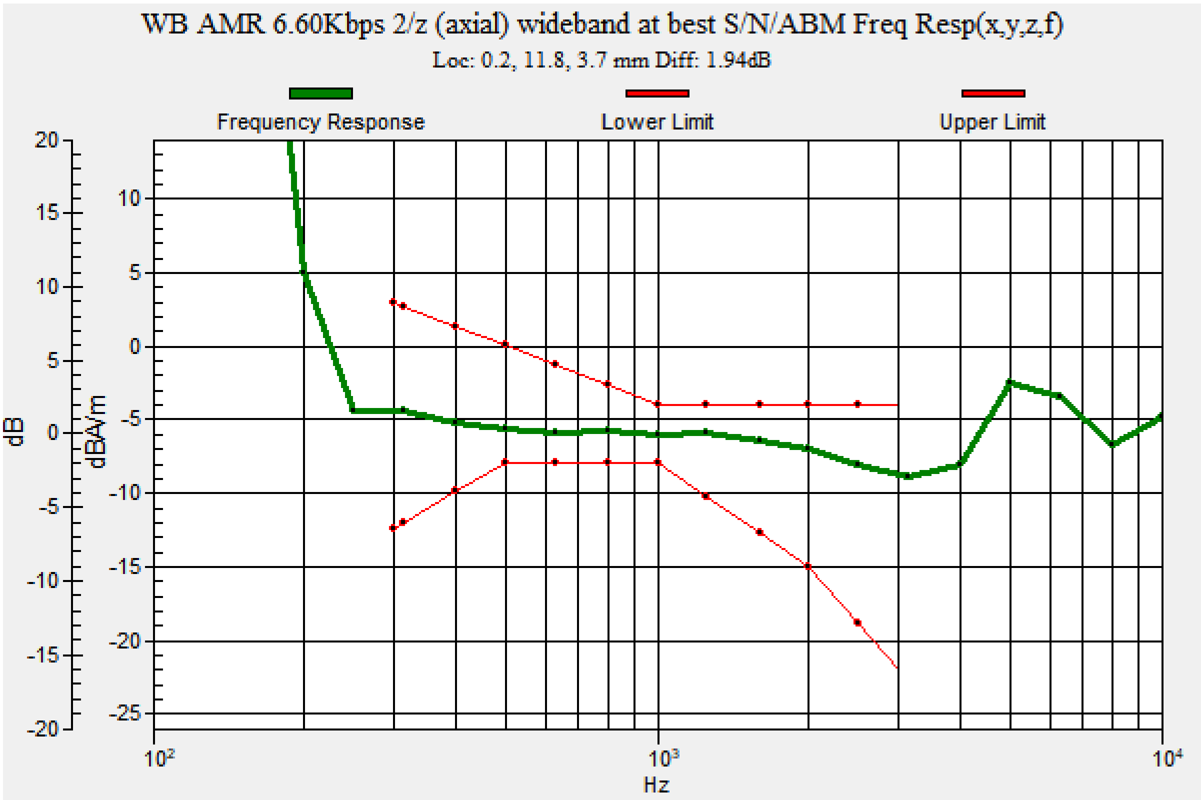
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

P13 WLAN5G_802.11an-HT20_MCS0_Ch40_WB AMR 6.60Kbps_Freq Resp

Communication System: 802.11an-HT20; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



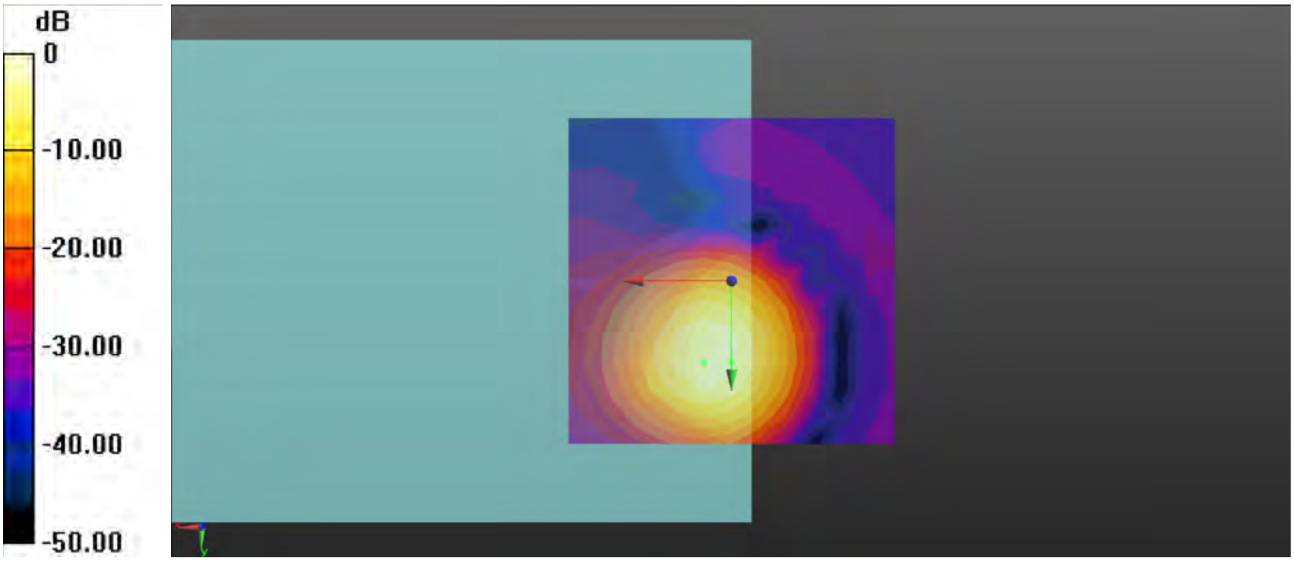
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

P14 WLAN5G_802.11an-HT20_MCS0_Ch60_WB AMR 6.60Kbps_Axial (Z)

Communication System: 802.11an-HT20; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 54.91 dB
ABM1 comp = 5.88 dBA/m
Location: 0, 12.5, 3.7 mm



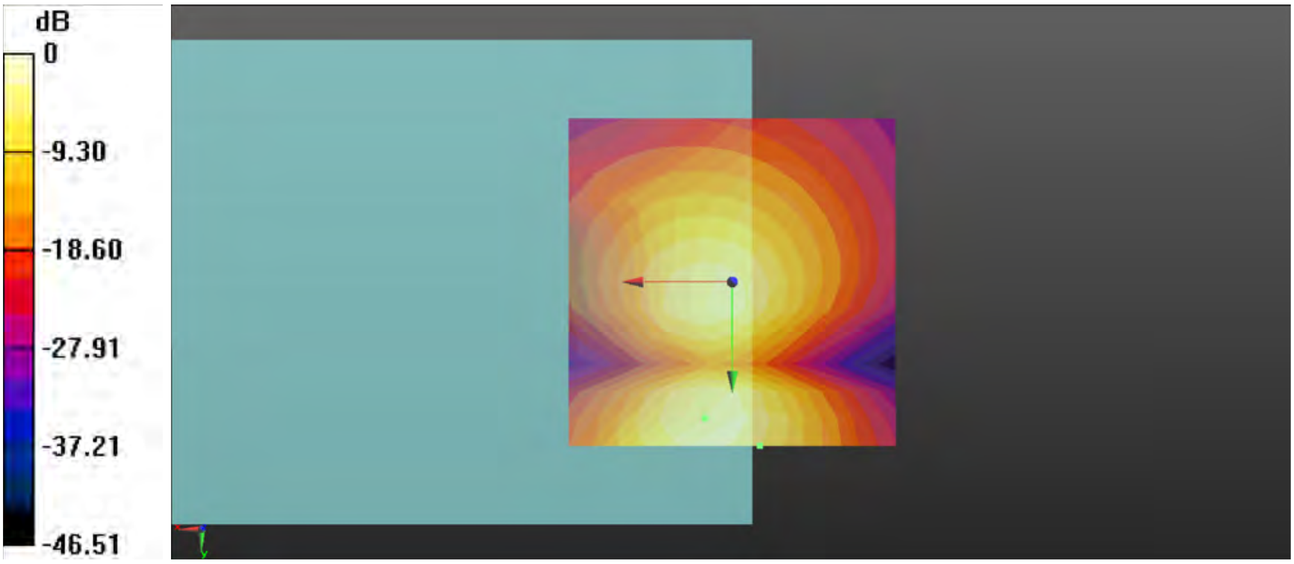
0 dB = 556.4 = 54.91 dB

P14 WLAN5G_802.11an-HT20_MCS0_Ch60_WB AMR 6.60Kbps_Transversal (Y)

Communication System: 802.11an-HT20; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 44.64 dB
ABM1 comp = -5.61 dBA/m
Location: -4.2, 25, 3.7 mm



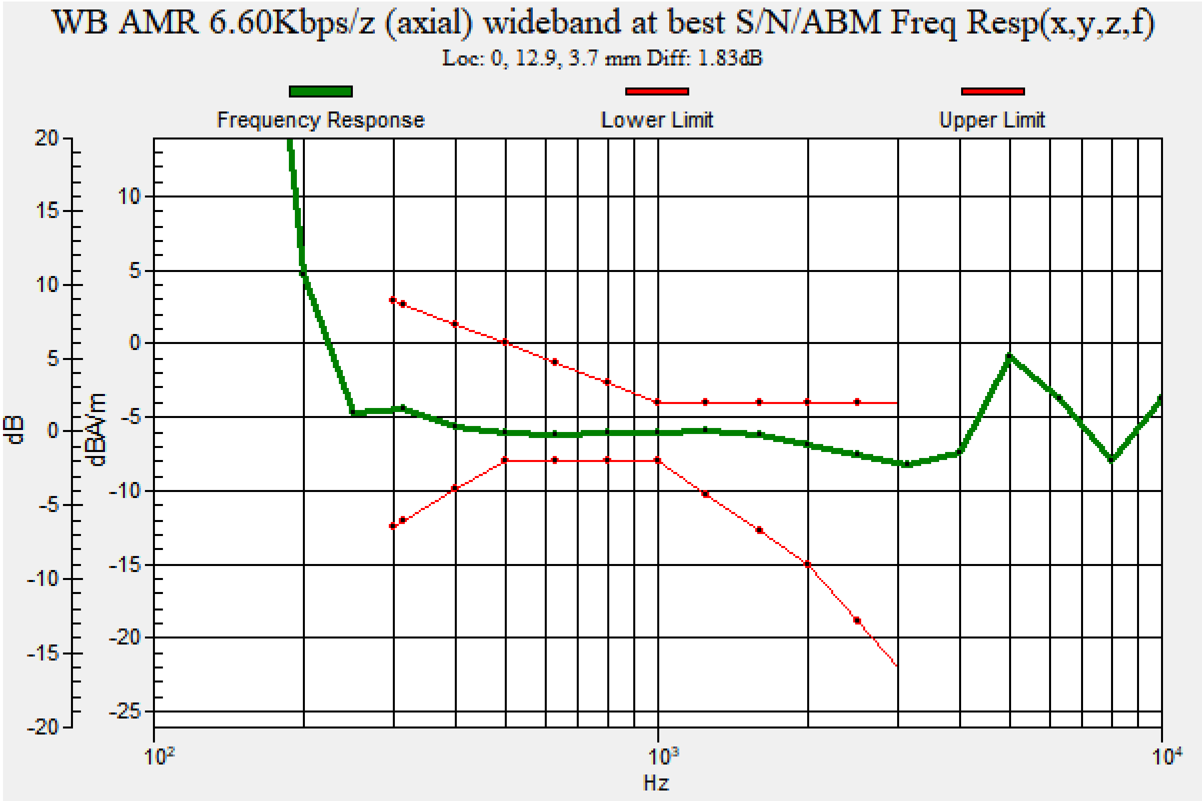
0 dB = 170.7 = 44.64 dB

P14 WLAN5G_802.11an-HT20_MCS0_Ch60_WB AMR 6.60Kbps_Freq Resp

Communication System: 802.11an-HT20; Frequency: 5300 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



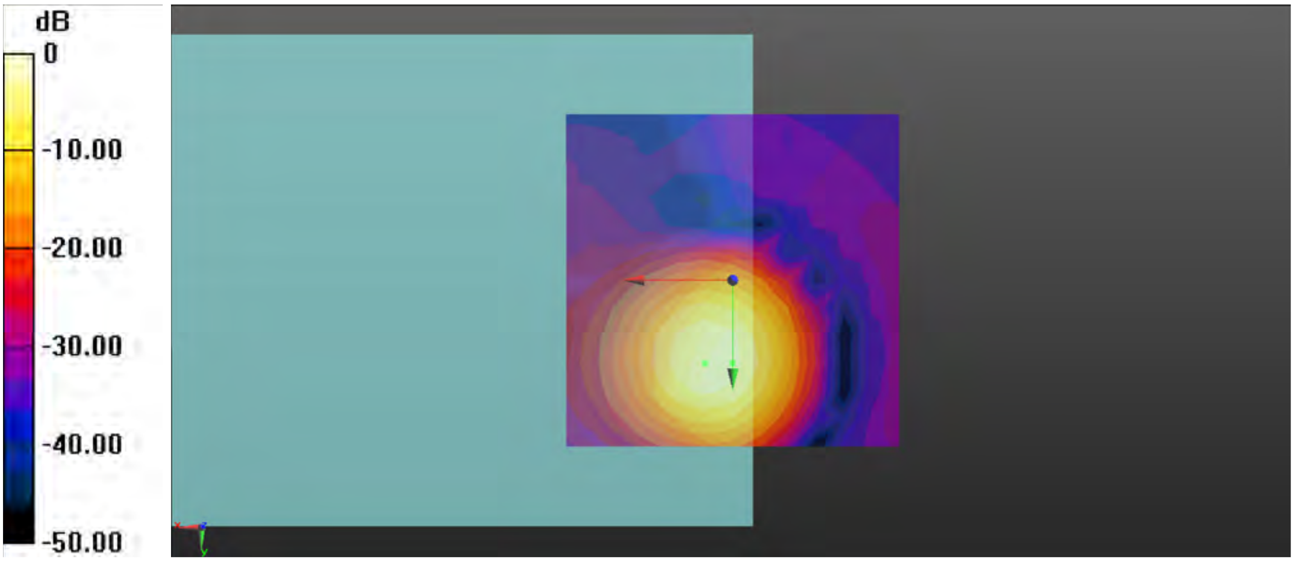
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

P15 WLAN5G_802.11an-HT20_MCS0_Ch124_WB AMR 6.60Kbps_Axial (Z)

Communication System: 802.11an-HT20; Frequency: 5620 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 53.11 dB
ABM1 comp = 5.88 dBA/m
Location: 0, 12.5, 3.7 mm



0 dB = 452.2 = 53.11 dB

Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

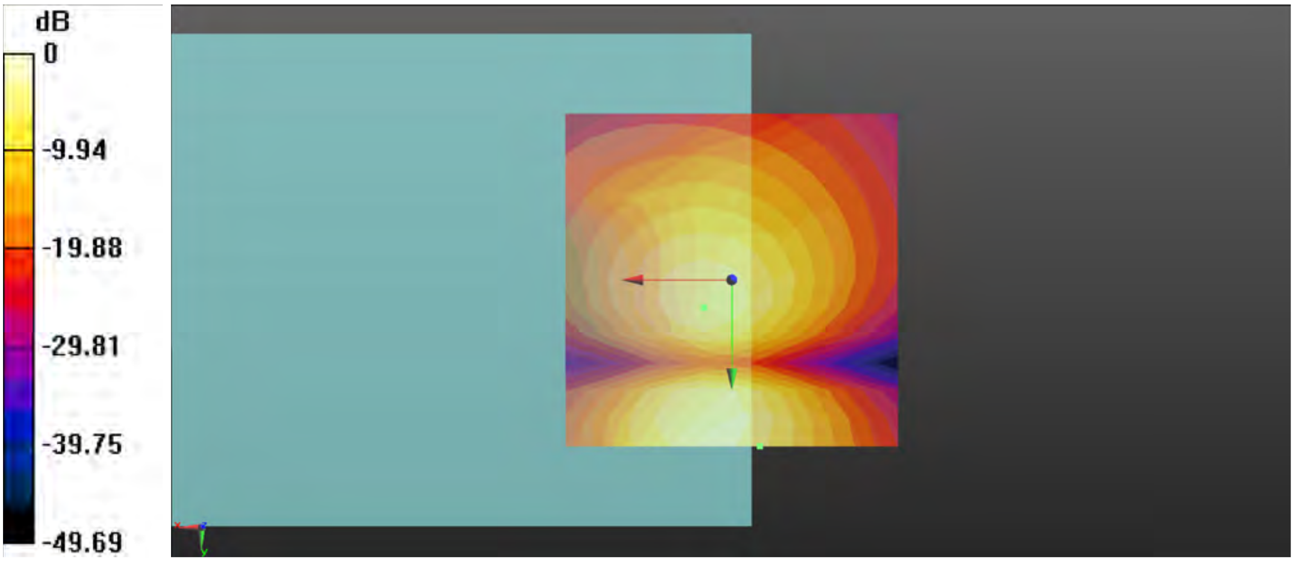
P15 WLAN5G_802.11an-HT20_MCS0_Ch124_WB AMR 6.60Kbps_Transversal (Y)

Communication System: 802.11an-HT20; Frequency: 5620 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):

Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 43.96 dB
ABM1 comp = -5.47 dBA/m
Location: -4.2, 25, 3.7 mm



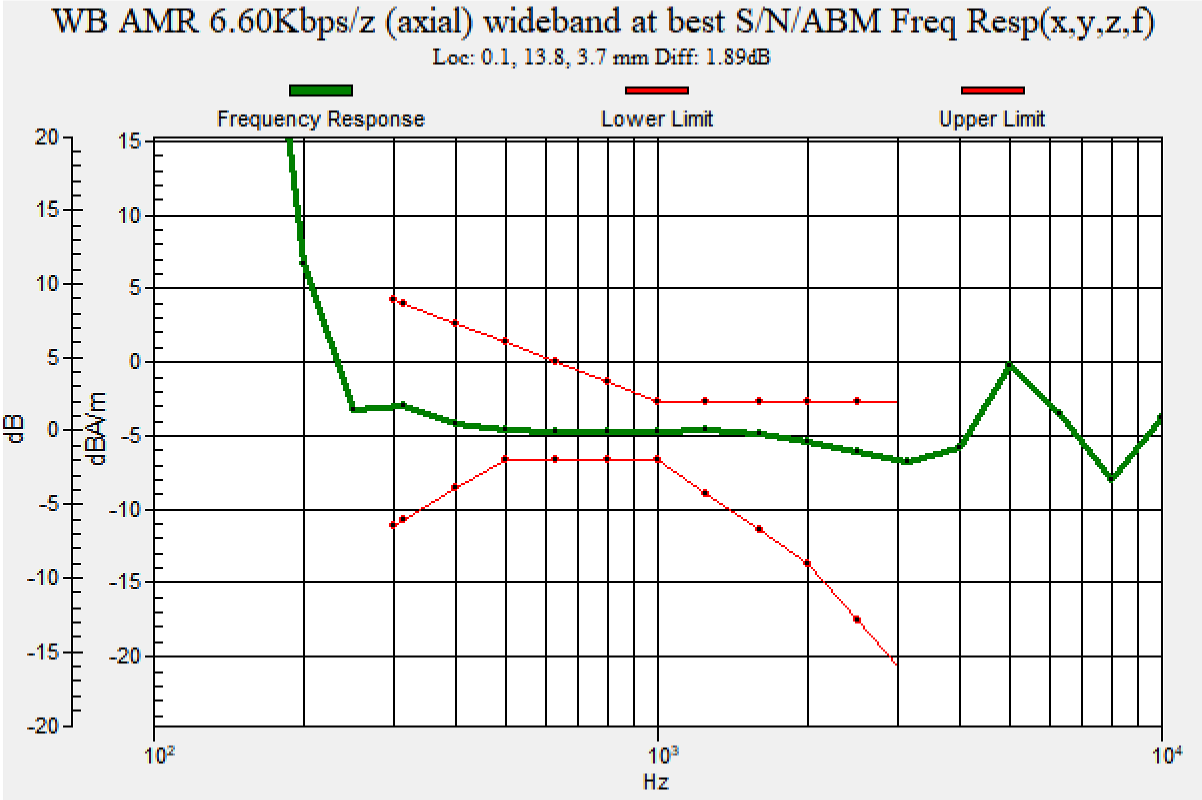
0 dB = 157.8 = 43.96 dB

P15 WLAN5G_802.11an-HT20_MCS0_Ch124_WB AMR 6.60Kbps_Freq Resp

Communication System: 802.11an-HT20; Frequency: 5620 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



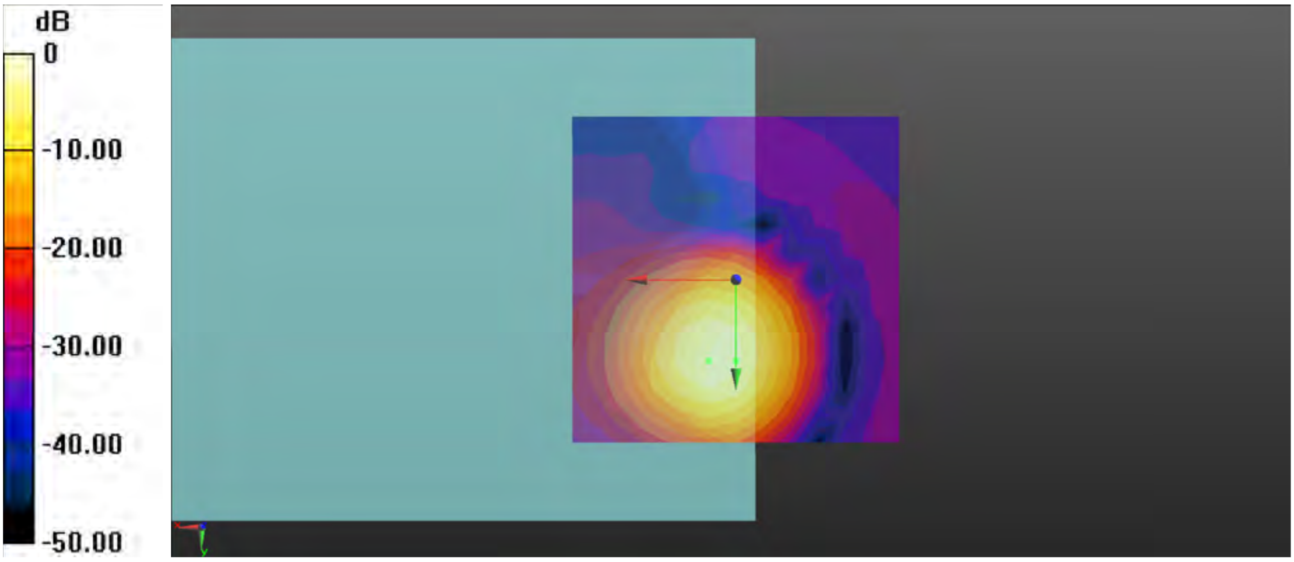
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

P16 WLAN5G_802.11an-HT20_MCS0_Ch157_WB AMR 6.60Kbps_Axial (Z)

Communication System: 802.11an-HT20 (0); Frequency: 5785 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7°C

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 53.72 dB
ABM1 comp = 5.79 dBA/m
Location: 0, 12.5, 3.7 mm



0 dB = 485.1 = 53.72 dB

Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab Date: 2023/05/08

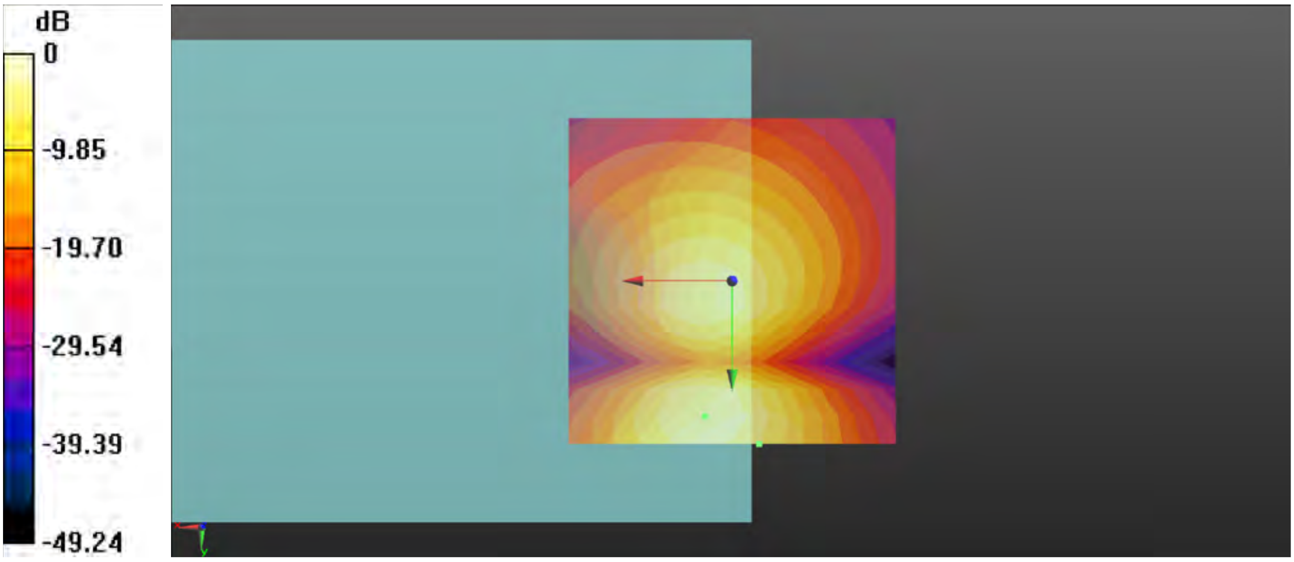
P16 WLAN5G_802.11an-HT20_MCS0_Ch157_WB AMR 6.60Kbps_Transversal (Y)

Communication System: 802.11an-HT20; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3

Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1):
Measurement grid: dx=10mm, dy=10mm
ABM1/ABM2 = 44.50 dB
ABM1 comp = -5.72 dBA/m
Location: -4.2, 25, 3.7 mm



0 dB = 167.8 = 44.50 dB

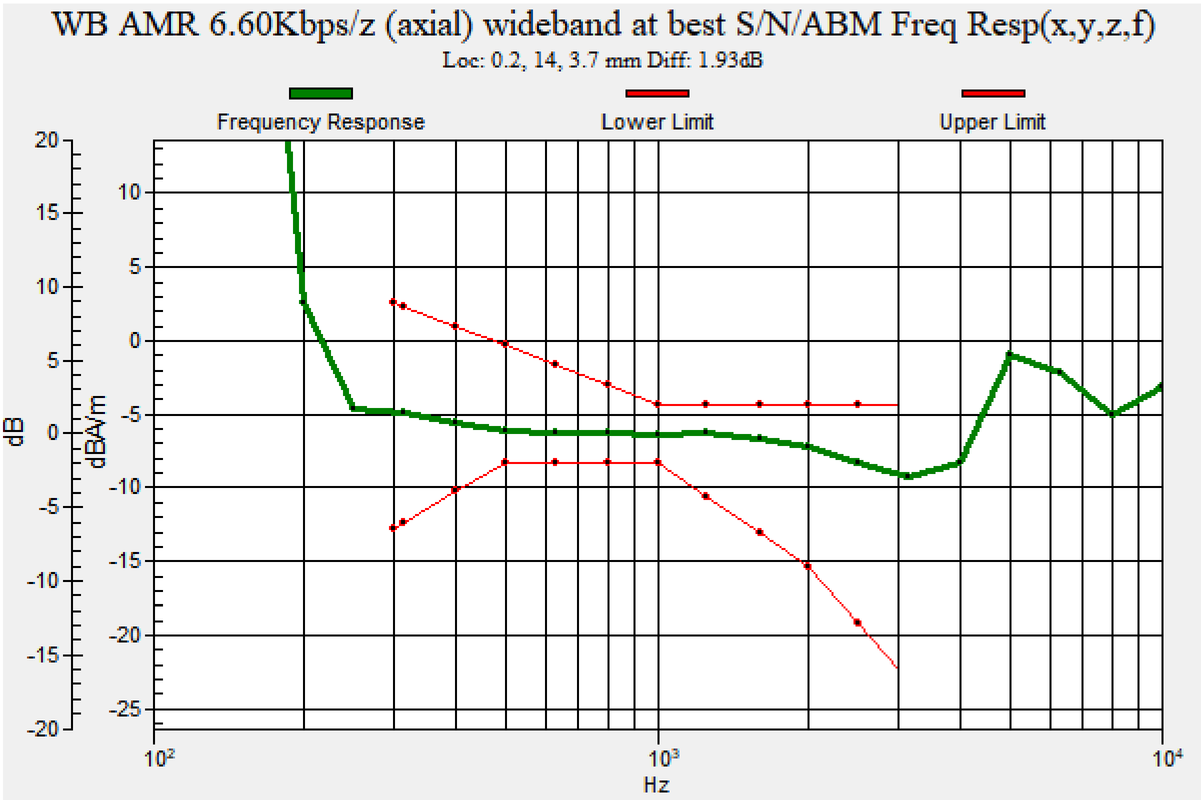
Test Laboratory: ritt 7 Layers SAR/HAC Testing Lab   Date: 2023/05/08

P16 WLAN5G_802.11an-HT20_MCS0_Ch157_WB AMR 6.60Kbps_Freq Resp

Communication System: 802.11an-HT20; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium: Air Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Ambient Temperature：23.7℃

DASY5 Configuration:
- Probe: AM1DV3 - 3144; ; Calibrated: 2023/02/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn1633; Calibrated: 2023/02/08
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

General Scans/z (axial) wideband at best S/N/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm



Appendix B. Calibration Certificate for Probe

The SPEAG calibration certificates are shown as follows.

In Collaboration with
speag
CALIBRATION LABORATORY
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

中国认可
国际互认
校准
CALIBRATION
CNAS L0570

Client : 7layers

Certificate No: Z23-60064

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1633
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	February 08, 2023

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	14-Jun-22 (CTTL, No.J22X04180)	Jun-23

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: February 14, 2023

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Glossary:

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.

- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.

- The report provide only calibration results for DAE, it does not contain other performance test results.

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100…+300 mV

Low Range: 1LSB = 61nV , full range = -1…….+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.258 ± 0.15% (k=2)	405.540 ± 0.15% (k=2)	405.038 ± 0.15% (k=2)
Low Range	4.00096 ± 0.7% (k=2)	4.00014 ± 0.7% (k=2)	4.01156 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	318° ± 1 °

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S **Schweizerischer Kalibrierdienst**
C **Service suisse d'étalonnage**
S **Servizio svizzero di taratura**
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **7Layer**

Certificate No: AM1DV3-3144_Feb23

CALIBRATION CERTIFICATE

Object	AM1DV3 - SN: 3144
Calibration procedure(s)	QA CAL-24.v4 Calibration procedure for AM1D magnetic field probes and TMFS in the audio range
Calibration date:	February 16, 2023

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	29-Aug-22 (No. 34389)	Aug-23
Reference Probe AM1DV2	SN: 1008	20-Dec-22 (No. AM1DV2-1008_Dec22)	Dec-23
DAE4	SN: 781	03-Jan-23 (No. DAE4-781_Jan23)	Jan-24

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
AMCC	SN: 1050	01-Oct-13 (in house check Oct-20)	Oct-23
AMMI Audio Measuring Instrument	SN: 1062	26-Sep-12 (in house check Oct-20)	Oct-23

	Name	Function	Signature
Calibrated by:	Aidonia Georgiadou	Laboratory Technician	
Approved by:	Niels Kuster	Quality Manager	

Issued: February 22, 2023

References

[1] ANSI-C63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

[2] ANSI-C63.19-2019 (ANSI-C63.19-2011)
American National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

[3] DASY System Handbook

Description of the AM1D probe

The AM1D Audio Magnetic Field Probe is a fully shielded magnetic field probe for the frequency range from 100 Hz to 20 kHz. The pickup coil is compliant with the dimensional requirements of [1+2]. The probe includes a symmetric low noise amplifier for the signal available at the shielded 3 pin connector at the side. Power is supplied via the same connector (phantom power supply) and monitored via the LED near the connector. The 7 pin connector at the end of the probe does not carry any signals, but determines the angle of the sensor when mounted on the DAE. The probe supports mechanical detection of the surface.
The single sensor in the probe is arranged in a tilt angle allowing measurement of 3 orthogonal field components when rotating the probe by 120° around its axis. It is aligned with the perpendicular component of the field, if the probe axis is tilted nominally 35.3° above the measurement plane, using the connector rotation and sensor angle stated below.
The probe is fully RF shielded when operated with the matching signal cable (shielded) and allows measurement of audio magnetic fields in the close vicinity of RF emitting wireless devices according to [1+2] without additional shielding.

Handling of the item

The probe is manufactured from stainless steel. In order to maintain the performance and calibration of the probe, it must not be opened. The probe is designed for operation in air and shall not be exposed to humidity or liquids. For proper operation of the surface detection and emergency stop functions in a DASY system, the probe must be operated with the special probe cup provided (larger diameter).

Methods Applied and Interpretation of Parameters

- *Coordinate System:* The AM1D probe is mounted in the DASY system for operation with a HAC Test Arch phantom with AMCC Helmholtz calibration coil according to [3], with the tip pointing to "southwest" orientation.
- *Functional Test:* The functional test preceding calibration includes test of Noise level RF immunity (1kHz AM modulated signal). The shield of the probe cable must be well connected. Frequency response verification from 100 Hz to 10 kHz.
- *Connector Rotation:* The connector at the end of the probe does not carry any signals and is used for fixation to the DAE only. The probe is operated in the center of the AMCC Helmholtz coil using a 1 kHz magnetic field signal. Its angle is determined from the two minima at nominally +120° and –120° rotation, so the sensor in the tip of the probe is aligned to the vertical plane in z-direction, corresponding to the field maximum in the AMCC Helmholtz calibration coil.
- *Sensor Angle:* The sensor tilting in the vertical plane from the ideal vertical direction is determined from the two minima at nominally +120° and –120°. DASY system uses this angle to align the sensor for radial measurements to the x and y axis in the horizontal plane.
- *Sensitivity:* With the probe sensor aligned to the z-field in the AMCC, the output of the probe is compared to the magnetic field in the AMCC at 1 kHz. The field in the AMCC Helmholtz coil is given by the geometry and the current through the coil, which is monitored on the precision shunt resistor of the coil.

AM1D probe identification and configuration data

Item	**AM1DV3** Audio Magnetic 1D Field Probe
Type No	SP AM1 001 BA
Serial No	**3144**

Overall length	296 mm
Tip diameter	6.0 mm (at the tip)
Sensor offset	3.0 mm (centre of sensor from tip)
Internal Amplifier	20 dB

Manufacturer / Origin	Schmid & Partner Engineering AG, Zurich, Switzerland

Calibration data

Connector rotation angle	(in DASY system)	**356.0** °	+/- 3.6 ° (k=2)
Sensor angle	(in DASY system)	**0.61** °	+/- 0.5 ° (k=2)
Sensitivity at 1 kHz	(in DASY system)	**0.00734 V/(A/m)**	+/- 2.2 % (k=2)

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.