Air interface and operating mode

Air Interface	Band (MHz)	Type	ANSI C63.19 Tested	Simultaneous Transmitter	Name of Voice Service	Power Reduction
GSM	850	VO	Yes	BT and Wi-Fi	CMRS Voice*	NA
	1900					
	GPRS/EDGE	VD	Yes		Google Duo**	
WCDMA	850	VO	Yes	BT and Wi-Fi	CMRS Voice*	NA
	1900					
	HSPA	VD	Yes		Google Duo**	
LTE	Band 2/4/5/13/66	VD	Yes	BT and Wi-Fi	VoLTE* Google Duo**	NA
Wi-Fi	2450	VD	Yes	BT, GSM, WCDMA and LTE	Wi-Fi calling** Google Duo**	NA
BT	2450	DT	NA	Wi-Fi, GSM, WCDMA and LTE	NA	NA

VO: Legacy Cellular Voice Service from Table 7.1 in 7.4.2.1 of ANSI C63.19-2011

DT: Digital Transport (no voice)

VD: IP Voice Service over Digital Transport

* Ref Lev in accordance with 7.4.2.1 of ANSI C63.19-2011 and the July 2012 VoLTE interpretation

** Ref Lev −20 dBm0

Wi-Fi calling for T-coil measurement

- **1. Equipment setup**
  - The test setup used for Wi-Fi calling T-coil measurement is shown in next page. The callbox used when performing Wi-Fi calling T-coil measurement is CMW500. The Data Application Unit (DAU) of the CMW500 was used to simulate IP Multimedia Subsystem (IMS) server.

- **2. Audio level settings**
  - According to KDB 285076 D02, the average speech level of −20 dBm0 shall be used. The CMW500 was manually configured to ensure that the settings for speech input and full scale levels resulted in the -20dBm0 speech input level to the DUT for the Wi-Fi calling over IMS connection.

- **3. For the detail of test setup,**
  - Following attached SPEAG document "TN-BK-10032018-C-VoWLAN_T-coil_w_CMW500" to perform Wi-Fi calling T-coil setup and measurement

Wi-Fi calling for T-coil measurement
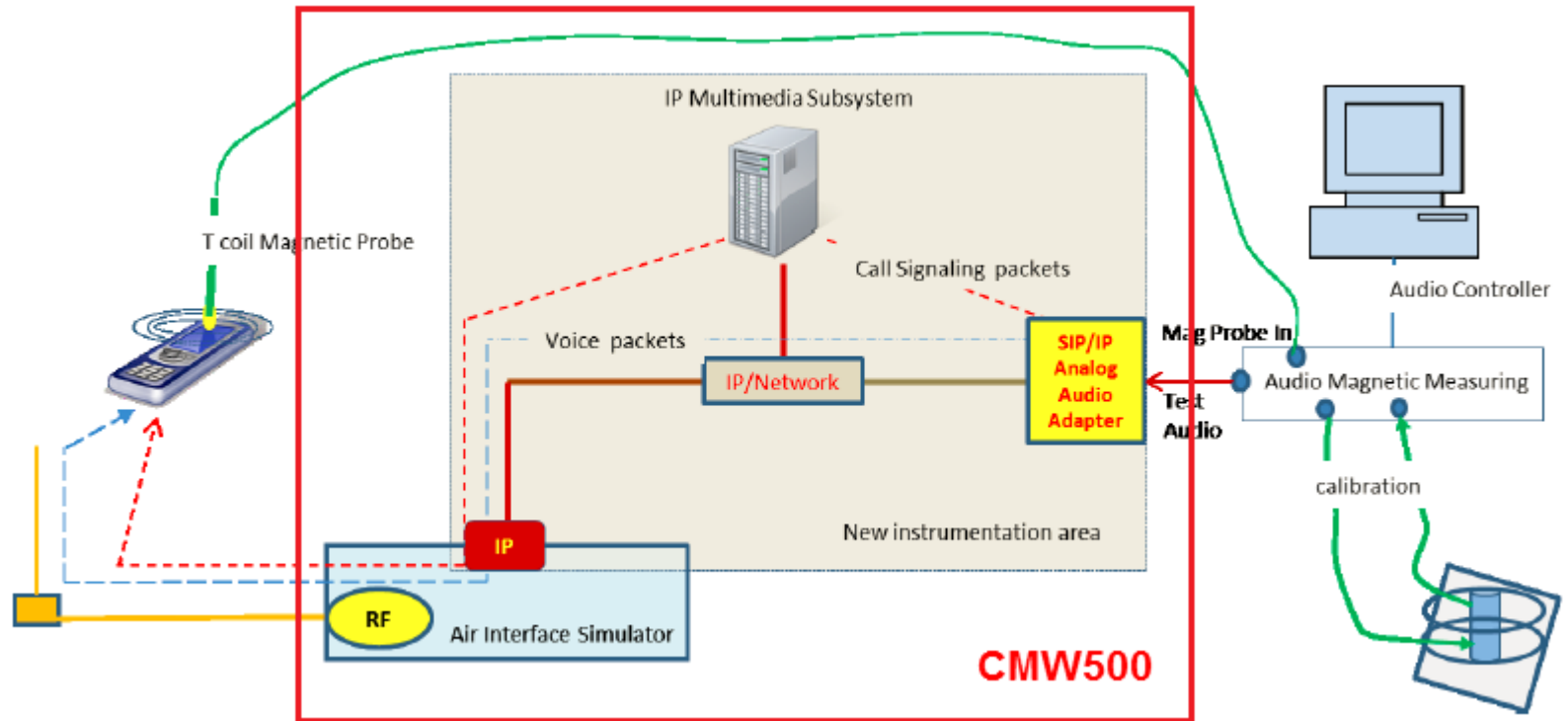
Test setup for Wi-Fi calling T-coil measurement

Follow the test plan to perform Wi-Fi calling T-coil testing

Test plan	
(1) Radio configuration investigation	Investigate the lowest and highest data rates to determine worst radio configuration to be used for testing by SNR comparison.
(2) Codec Investigation	Determine the worst-case codec by SNR comparison.
(3) Air Interface Investigation	Using the worst-case codec, a channel of worst band shall be tested

Follow the test plan to perform Wi-Fi calling
T-coil testing_Radio configuration investigation

802.11b Radio configuration investigation					
Mode	**Channel**	**Data Rate [Mbps]**	**ABM1 [dB(A/m)]**	**ABM2 [dB(A/m)]**	**Signal Quality [dB]**
802.11b	6	1	2.37	-39.21	41.58
802.11b	6	11	2.25	-39.30	41.55

802.11n(20M) Radio configuration investigation					
Mode	**Channel**	**Data Rate [Mbps]**	**ABM1 [dB(A/m)]**	**ABM2 [dB(A/m)]**	**Signal Quality [dB]**
802.11n(20M)	6	MCS0	2.33	-39.39	41.72
802.11n(20M)	6	MCS7	2.40	-40.27	42.67

802.11g Radio configuration investigation					
Mode	**Channel**	**Data Rate [Mbps]**	**ABM1 [dB(A/m)]**	**ABM2 [dB(A/m)]**	**Signal Quality [dB]**
802.11g	6	6	2.22	-46.40	48.62
802.11g	6	54	2.36	-46.76	49.12

802.11n(40M) Radio configuration investigation					
Mode	**Channel**	**Data Rate [Mbps]**	**ABM1 [dB(A/m)]**	**ABM2 [dB(A/m)]**	**Signal Quality [dB]**
802.11n(40M)	6	MCS0	2.30	-41.77	44.07
802.11n(40M)	6	MCS7	2.34	-41.99	44.33

(1) Radio configuration investigation
Investigate the lowest and highest data rates to determine worst radio configuration to be used for testing by SNR comparison.
*Yellow represent the worst radio configuration
*The data is for reference and example only

Follow the test plan to perform Wi-Fi calling T-coil testing_Codec investigation

AMR Codec Investigation - VoWIFI over IMS								
Codec Setting:	WB AMR 23.85kbps	WB AMR 6.60kbps	NB AMR 12.2kbps	NB AMR 4.75kbps	Orientation	Band	Standard	Channel
ABM1 (dBA/m)	2.17	2.25	2.67	2.36	Axial	2.4GHz	802.11b	6
ABM2 (dBA/m)	-41.05	-40.3	-40.51	-40.44				
Frequency Response	Pass	Pass	Pass	Pass				
Signal Quality (dB)	43.22	42.55	43.18	42.8				

EVS Codec Investigation - VoWIFI over IMS								
Codec Setting:	EVS Primary WB 13.2kbps	EVS Primary WB 5.9kbps	EVS Primary NB 13.2kbps	EVS Primary NB 5.9kbps	Orientation	Band	Standard	Channel
ABM1 (dBA/m)	3.41	2.49	3.9	3.98	Axial	2.4GHz	802.11b	6
ABM2 (dBA/m)	-40.73	-40.28	-40.47	-39.62				
Frequency Response	Pass	Pass	Pass	Pass				
Signal Quality (dB)	44.14	42.77	44.37	43.6				

(2) Codec Investigation

In this case, the worst radio configuration is 802.11b, hence, using 802.11b to determine the worst-case codec by SNR comparison. (**WB AMR 6.6kbps** is the worst codec in this case.)

*Yellow represent the worst-case codec

*The data is for reference and example only.

SGS

Following the test plan to perform Wi-Fi calling T-coil testing_Air interface investigation

Air interface investigation for 2.4GHz WIFI									
Mode	Orientation	Bandwidth (MHz)	Channel	ABM1 [dB(A/m)]	ABM2 [dB(A/m)]	Ambient Noise [dB(A/m)]	Frequency Response Variation(dB)	Signal Quality (dB)	C63.19-2011 Rating
WLAN 802.11b	Axial	20	6	2.25	-40.30	-58.34	2.00	42.55	T4
	Radial	20	6	-1.85	-41.94	-58.18	N/A	40.09	T4

(3) Air Interface Investigation

Using the worst-case codec and radio configuration a channel of worst band shall be tested.

The worst case mode for 2.4GHz WLAN in each probe orientation is tested.

*The data is for reference and example only.